Controls on denudation along the East Australian continental margin

A.T. Codilean^{(1,2)*}, R.-H. Fülöp^(1,3), H. Munack^(1,2), K.M. Wilcken⁽³⁾, T.J. Cohen^(1,2), D.H. Rood⁽⁴⁾,
D. Fink⁽³⁾, R. Bartley⁽⁵⁾, J. Croke⁽⁶⁾, L.K. Fifield⁽⁷⁾

(1) School of Earth, Atmospheric and Life Sciences, University of Wollongong, Wollongong, NSW 2522, Australia

(2) ARC Centre of Excellence for Australian Biodiversity and Heritage (CABAH), University of Wollongong, Wollongong, NSW 2522, Australia

(3) Australia's Nuclear Science and Technology Organisation (ANSTO), Lucas Heights, NSW 2234, Australia

10 *(4) Department of Earth Science and Engineering, Imperial College London, London SW7 2AZ, UK*

(5) CSIRO Land and Water, GPO Box 2583, Brisbane, QLD 4001, Australia

(6) School of Geography, University College Dublin, Dublin 4, Ireland

(7) Research School of Physics, The Australian National University, ACT 2601, Australia

* Corresponding author: codilean@uow.edu.au; +61 2 4221 3426

Abstract

We report a comprehensive inventory of ¹⁰Be-based basin-wide denudation rates ($n=160$) and ²⁶Al/¹⁰Be ratios ($n=67$) from 48 drainage basins along a 3,000 km stretch of the East
20 Australian passive continental margin. We provide data from both basins draining east of the continental divide ($n=37$) and discharging into the Tasman and Coral Seas, and from basins draining to the west as part of the larger Murray-Darling and Lake Eyre river systems ($n=11$). ¹⁰Be-derived denudation rates in mainstem samples from east-draining basins range between 7.7 ± 1.9 ($\pm 1\sigma$; Mary) and 54.6 ± 13.7 mm kyr⁻¹ (North Johnstone). Denudation rates in tributary samples range between 3.0 ± 0.7 (Burdekin) and 70.2 ± 18.9 mm kyr⁻¹ (Liverpool). For west-draining basins, denudation rates are overall lower and with a more restricted range of 4.8 ± 1.2 (Barcoo) to 15.4 ± 3.6 mm kyr⁻¹ (Maranoa) in mainstem samples, and between 4.4 ± 1.0 (Murrumbidgee) and 38.5 ± 7.8 mm kyr⁻¹ (Murray) in tributary samples. East Australian denudation rates (median = 14.5 mm kyr⁻¹) are similar to
30 those found in other postorogenic landscapes (global median = 12.4 mm kyr⁻¹) and the medians of the top 10% denudation rates recorded here (46.5 mm kyr⁻¹) and in other passive margin settings are also similar, despite differences in topography and precipitation. These median denudation rate values are close to the 95th percentile denudation rate for all

tectonically passive basins ($\approx 53 \text{ mm kyr}^{-1}$) and are very similar to the global silicate weathering speed limit ($\approx 58 \text{ mm kyr}^{-1}$) calculated as the 95th percentile of global soil weathering rates. The above suggests that in post-orogenic terrain, the overall rates of topographic decay have a ‘speed limit’ that is imposed by the rate at which rock is converted to soil by chemical weathering. Denudation rates along the East Australian margin correlate with topographic metrics at both the mainstem basin scale and at the smaller tributary basin scale suggesting that topography exerts the main control on rates of landscape lowering in this setting. An important link between denudation rate and rainfall is also inferred: the highest mainstem ^{10}Be denudation rates all occur in basins which also have the highest rainfall amounts and there is a strong correlation between the distance knickpoints have travelled upstream from the river mouth and basin area — a proxy for discharge and so to some extent also rainfall. On both sides of the divide, in all but a few of the samples, $^{26}\text{Al}/^{10}\text{Be}$ ratios are consistently lower than what is expected in a setting where sediments experience a simple and continuous exposure history. East of the continental divide, the lowest $^{26}\text{Al}/^{10}\text{Be}$ ratios are found in basins that also experience increased flood variability. We posit that there is a causal link between the hydrological variability that characterises the coastal rivers of eastern Australia and the observed non-steady state $^{26}\text{Al}/^{10}\text{Be}$ ratios: the periodic stripping of vertically accreted floodplains by large floods means that deeper and potentially older material is periodically incorporated into the sediment mix transported by the modern river.

Keywords: Australia; passive continental margin; Great Dividing Range; denudation; cosmogenic ^{10}Be ; cosmogenic $^{26}\text{Al}/^{10}\text{Be}$;

1. Introduction

The uplift and erosion of mountain ranges is thought to regulate global climate over million-year timescales [Raymo & Ruddiman, 1992] while also responding to climate forcing itself [Molnar & England, 1990; Whipple, 2009]. It remains unclear whether mountain uplift drives climate change, or vice versa, and the key role that the erosion of mountains plays in the global climate system is intensely debated [Zhang et al., 2001; Galy et al., 2007; Willenbring & von Blanckenburg, 2010; Finnegan et al., 2014; Herman et al., 2013; Larsen et al., 2014; Schildgen et al., 2018]. While research explicitly on the links between tectonics, climate, and

erosion has largely focused on tectonically active compressional orogens [e.g., Willett, 1999; Montgomery et al., 2001; Willett & Brandon, 2002; Dadson et al., 2003], high-elevation passive continental margins such as those found in southern Africa, western India, eastern North America, and eastern Australia, can provide important insights. First, passive continental margins are major, first-order topographic features of the Earth's surface that, although tectonically quiescent at present, can be clearly related to plate tectonic processes and setting [Bishop, 2007 and references therein]. Second, given their expanse, the formation and long-term evolution of high-elevation passive continental margins has implications on the large-scale spatial and temporal rearrangement of mass at the Earth's surface (via denudation and sediment flux) and so exerts a first-order control on large-scale patterns of tectonic and isostatic uplift [Gilchrist & Summerfield, 1990; Gilchrist et al., 1994; Tucker & Slingerland, 1994]. The latter has implications on timescales of topographic decay [Baldwin et al., 2003; Braun et al., 2014] and therefore on tectonics–topography–erosion couplings. The denudational history of high-elevation passive continental margins also has bearing on the formation of major hydrocarbon fields in these settings [Mann et al., 2003], and so an understanding of post-breakup passive margin evolution is important to the global economy.

The long-term evolution of the East Australian continental margin was the subject of research in the mid-19th century by the luminaries of Charles Darwin (1890) during his visit to Australia on *The Beagle* in 1836, who saw the gorges as the result of the marine erosion of cliffs, and James Dana (1850) who was the first to describe their correct formation as due to intense fluvial activity. It was a landscape seen subsequently, however, largely in Davisian terms as being one of multiple cycles of peneplanation analogous to then current interpretations of North American uplands [e.g., Andrews, 1903]. While a few proposed from various lines of evidence a much older landscape [e.g., Craft, 1932; 1933] their ideas did not prevail and as late as the mid 20th century it was still believed that the uplift of this margin was as late as Miocene-Pliocene with gorge cutting of the plateaus associated with intense episodes of Quaternary fluvial activity [e.g., King, 1959; Browne, 1969]. Much of the current insight into the evolution and antiquity of the East Australian highland belt came in the south-eastern sector with the dating of widespread Cenozoic plateau and valley basalt flows [e.g., Wellman & McDougall, 1974; Wellman, 1979; Bishop & Young, 1980; Ollier,

1982; Young, 1983; Bishop, 1985; Lambeck & Stephenson, 1986; Lister & Etheridge, 1989; Young & McDougall, 1993; Nott et al., 1996; Bishop & Goldrick, 2010]. Data obtained from these studies along with results from surface process models [e.g., Gilchrist & Summerfield, 1994; Kooi & Beaumont, 1994; van der Beek & Braun, 1998, 1999; van der Beek et al., 2001; Braun & van der Beek, 2004; see also Braun, 2018] and those from studies employing low-
100 temperature thermochronometers such as apatite fission track and apatite (U-Th)/He [e.g., Dumitru et al., 1991; Persano et al., 2002; 2005], have permitted the testing of conceptual models proposed for the post-breakup evolution of high-elevation passive continental margins, and have provided important constraints on the rates and style of landscape denudation in these settings. Notwithstanding, rates of landscape denudation obtained from the study of Cenozoic basalts [e.g., Nott et al., 1996] are spatially restricted, and thermochronometric methods lack the sensitivity required to resolve denudation rates over the spatial and temporal scales that are relevant to geomorphology.

Cosmogenic radionuclides – especially in situ produced ^{10}Be – have proven to be the best suited technique for studying the erosion of Earth's continental topography over millennial
110 timescales. Indeed, ^{10}Be -based denudation rates have now been determined in thousands of river basins [Codilean et al., 2018], providing us with a substantial inventory of erosion rate estimates from several high-elevation passive continental margins, including southeast Brazil [e.g., Barreto et al., 2013; Gonzalez et al., 2016; Salgado et al., 2016], south and southeast Africa [Bierman and Caffee 2001; Codilean et al., 2008, 2014; Scharf et al., 2013; Bierman et al., 2014], western India [Mandal et al., 2015], Sri Lanka [e.g., von Blanckenburg et al., 2004; Vanacker et al., 2007], and eastern North America [e.g., Miller et al., 2013; Reusser et al., 2015]. Along the East Australian margin, studies employing ^{10}Be and with an explicit focus on denudation along the Great Escarpment have been spatially restricted to a few basins in the southern sector of the margin (e.g., Bega: Heimsath et al. [2000, 2001,
120 2006], Godard et al. [2019]; Blue Mountains: Tomkins et al. [2007]; Macleay: Weissel & Seidl [1998]). In the northern sector of the East Australian margin – where both elevations and relief are more subdued and the continental divide is farther inland – studies employing ^{10}Be have focused on constraining sediment sources and sediment yields (both contemporary and longer-term) to the Great Barrier Reef, with questions relevant to the

long-term evolution of the margin being secondary [e.g., Nichols et al., 2014; Croke et al., 2015; Mariotti et al., 2020].

Figure 1: Topography of the East Australian margin. Swath profiles were produced over a width of 25 km with red lines showing average and envelopes showing minimum and maximum elevation values. Dotted blue line depicts the 1000 m isobath and is shown here to indicate the width of the continental shelf. CD – Continental Divide; GE – Great Escarpment. Grey band on swath profiles indicates the escarpment zone – note how this zone is narrow in the northern sector of the margin and becomes wider in the southern sector where the escarpment is more sinuous and heavily dissected by rivers. Inset map shows the location of major cities: M – Melbourne, S – Sydney, B – Brisbane.

The morphology of the East Australian passive margin is that of the less common *arch-type* margin [cf. Matmon et al., 2002]: along most of its length the major highland drainage divide is situated inland (i.e., westward) of the crest of the escarpment (Figure 1). Thus, rivers draining the escarpment with headwater plateau regions will have larger drainage areas than their counterparts on the more common *shoulder-type* margins (where the drainage divide coincides with the escarpment lip). Such *arch-type* margin basins are

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inferred to have higher discharges, and greater stream power that will promote knickpoint retreat and faster embayment of the escarpment [e.g., Nott et al., 1996; Weissel & Seidl, 1998]. The latter characteristics make the East Australian margin particularly well-suited to testing conceptual models of the post-breakup evolution of passive margins (i.e., with respect to discriminating between escarpment retreat and excavation in place by downwearing; see: Gallagher et al. [1998]), and also well-suited to exploring transient landscape dynamics and issues related to the protracted decay of topography in post-orogenic terrains.

In this study we provide a comprehensive inventory of ^{10}Be -based denudation rates ($n=160$) and $^{26}\text{Al}/^{10}\text{Be}$ ratios ($n=67$) from rivers draining Australia's Great Dividing Range (Figure 1) between the Mitchell River in southeast Victoria ($\approx 38^\circ$ S latitude) and the Daintree River in north Queensland ($\approx 16^\circ$ S latitude). We compiled published data from the OCTOPUS database [Codilean et al., 2018] and more recent studies [Portenga et al., 2016; Godard et al., 2019; Eccleshall, 2019; Fülöp et al., 2020; Mariotti et al., 2021], and present new ^{10}Be and ^{26}Al data from a further 40 and 47 basins, respectively. Our aim is to identify major first order controls on ^{10}Be -derived denudation rates along the length of the margin, explore east-west differences in rates of denudation, and place these rates in a global context by comparing to other high-elevation passive continental margins. We also explore sediment residence times and the potential influence of the flood variability that characterises the coastal rivers of eastern Australia on the $^{26}\text{Al}/^{10}\text{Be}$ ratios in the sediment.

2. Study area

2.1. Geomorphologic and geologic setting

The East Australian passive continental margin formed by continental extension, rifting and break-up during the fragmentation of Gondwana in the late Mesozoic and early Cenozoic at circa 80 – 65 Ma [Weissel & Hayes, 1977; Falvey & Mutter, 1981; Veevers, 1984; Colwell et al., 1993]. The history of the highlands forming the East Australian margin is still unresolved; however, it is now generally accepted that highland uplift pre-dated the Cenozoic [see discussion in Bishop & Goldrick, 2000]. It has been argued that the whole of the highlands should not be treated as a single morphotectonic unit that shares a common history

[Bishop, 1988; Ollier & Pain, 1996], which is a view that is supported by the marked morphological differences between the southern and northern sectors of the highlands (Figure 1) and the different plate tectonic histories of their respective margins. These morphological differences, however, make the margin interesting from a denudation / surface processes point of view and thus warrant the inclusion of basins from both southern and northern sectors in this study.

Our study area stretches about 3,000 km along the East Australian margin between $\approx 38^{\circ}\text{S}$ and $\approx 16^{\circ}\text{S}$ latitude. In the southern sector, between $\approx 38^{\circ}\text{S}$ and $\approx 26^{\circ}\text{S}$, the Great Dividing Range takes the form of a broad asymmetrical arch located close to the present coastline (Figure 1). Elevations rise gently from the interior to the continental drainage divide, with the latter being an area of generally low relief. The low relief continues east of the divide until the crest of the Great Escarpment, across which east-flowing rivers descend through dissected ranges to a coastal plain with relief decreasing towards the coast (Figure 1). North of 26°S the continental drainage divide moves further inland and the Great Dividing Range takes the form of a broader, more diffuse, and more symmetrical arch (Figure 1). In the northern sector (between $\approx 26^{\circ}\text{S}$ and $\approx 16^{\circ}\text{S}$), east-flowing rivers have generally larger drainage basins with both elevations and relief being more subdued than in the south (Figure 1). The Great Escarpment is more fragmented in the north, but as in the southern sector, follows the present coastline. Interestingly, the distinct morphologies of the two sectors are broadly mirrored by the morphology of the continental shelf – narrow in the south and broad in the north (dotted blue line in Figure 1).

The Great Dividing Range consists of uplifted Palaeozoic basement rocks belonging to the Tasman Orogen, namely granites and metasedimentary sequences of the Lachlan and New England Fold Belts and intervening Late Palaeozoic and Mesozoic sedimentary sequences – such as those of the Permo-Triassic Sydney Basin – that have generally experienced only mild deformation [Coney et al., 1990; Veevers, 2006]. The western and southern edges of the highlands are covered by Mesozoic and Cenozoic sedimentary sequences – such as the Murray and Eromanga-Surat Basin sequences in the west, and the Otway and Gippsland Basin sequences on the Victorian coast [Veevers, 2000; Raymond et al., 2012]. Within the actual highlands there are minor but widespread occurrences of Cenozoic sedimentary

deposits, and more extensive – but still minor – occurrences of Late Mesozoic and Cenozoic basaltic lavas [Wellman & McDougall, 1974; Johnson, 1989; Raymond et al., 2012] (see Figure S1A). Overall, with the exception of the Cenozoic basalts, quartz is abundant throughout the study area.

2.2. Climatic and hydrologic setting

In terms of climate, an essentially present-day climatic regime was in operation in Australia from the beginning of the Pleistocene, however overall precipitation was higher than that of today [Martin, 2006; Fujioka & Chappell, 2010]. Quaternary glaciation was restricted to Tasmania and small parts of the Snowy Mountains in the south of the margin [Barrows et al., 2001; 2002; Augustinus et al., 2017; Kiernan et al., 2017]. Outside these areas, in broad terms, the interglacial periods, but probably excluding the interglacial maxima, were wetter and glacial periods but probably excluding the glacial maxima, were drier, however the general trend through the Pleistocene and Holocene has been that of a gradual decrease in precipitation [Nanson et al., 1992; 2008; Kershaw & Nanson, 1993]. In terms of current conditions, mean annual rainfall varies from 400 mm year⁻¹ in the inland regions of the Fitzroy and Burdekin Rivers to greater than 3,000 mm year⁻¹ in the wetter parts of northern Queensland (Figure 2 and Figure S1B). The southern sector of the margin (south Queensland and New South Wales) typically receives mean annual rainfall of 600 – 1200 mm year⁻¹.

Rainfall decreases away from the coast, and westwards of the continental divide mean annual rainfall decreases to 400 – 800 mm year⁻¹, and in some basins to even below 400 mm year⁻¹ (Figure S1B). Drainage basins north of the Fitzroy River (Figure 2) are dominated by summer rainfall and tropical cyclone activity. In the middle section of the margin (between Fitzroy and Hunter; basins #27 and #14 respectively in Figure 2) a less intense summer precipitation dominance prevails, whereas the southern sector of the margin experiences a relatively uniform seasonal precipitation regime, although the southernmost basins (Genoa – Mitchell; Figure 2) experience peak runoff in the austral winter months [Bureau of Meteorology, 2018].

Figure 2: Distribution of east and west draining basins included in this study. The study area stretches about 3,000 km along the East Australian margin and basins range in area between 35 – 139,000 km² (east) and 3,300 – 150,000 km² (west). See Figure 3 for map of tributary basins and Table S1 for further detail.

Research on comparative global hydrology [Finlayson & McMahon, 1988] indicates that Australia (and southern Africa) are currently hydrologically distinct from the rest of the world. This is shown through a series of metrics: (1) the coefficient of variation of annual runoff and (2) the standard deviation of logarithms to base 10 of peak discharges for all basin areas – both of which are the highest in the world; (3) the ratio of the peak discharge for the 1% annual exceedance probability flood to the mean annual flood is generally higher than elsewhere; and (4) the coefficient of skewness of the log transformed annual floods is more than three times that for the rest of the world [Finlayson & McMahon, 1988]. Such hydrological characteristics demonstrate that Australian rivers are currently generally

characterised by high flood variability and/or steep annual series flood frequency curves.

This is particularly the case for eastern Australia and such rivers have been said to be

230 sensitive to flood-induced channel changes in their alluvial reaches [Abrahams & Cull, 1979; Neller, 1980; Erskine, 1986]. On the east coast, this large inter-annual and overall flood variability is spatially variable [e.g., Rustomji et al., 2009] and is also superimposed on multi-decadal variability (flood and drought dominated periods) modulated by the Interdecadal Pacific Oscillation – IPO [Power et al., 1999; Kiem et al., 2003].

3. Methods

3.1. Sample sites

We report cosmogenic radionuclide data for 48 drainage basins: 37 draining to the east and discharging into the Tasman and Coral Seas, and 11 draining to the west as part of the larger Murray-Darling and Lake Eyre river systems (Table S1, Figure 2). For all 48 basins, samples

240 were collected from the mainstem, and for 19 basins, samples are also available from tributaries, with 11 located east of the continental divide and four to the west (Figure 3). In total, we report ^{10}Be results in 160 samples, and ^{26}Al results in 67 samples. Of the reported data, 40 ^{10}Be and 47 ^{26}Al are previously unpublished data, and the rest have been compiled from the OCTOPUS database [Codilean et al., 2018] and more recent studies, namely, Portenga et al. [2016], Godard et al. [2019], Eccleshall [2019], Fülöp et al. [2020], and Mariotti et al. [2021]. Basin areas for the mainstem samples range between 35 and 139,000 km^2 for Macquarie Rivulet (Illawarra) and Fitzroy River, respectively, draining east, and between 3,300 and 150,000 km^2 for Lachlan River and Thomson River, respectively, draining west. For rivers draining east, basin areas reflect the morphology of the margin and the

250 distance of the continental divide from the coast, i.e., smaller basins in the southern sector and larger basins in the northern sector. For the western rivers, basin areas of samples included in this analysis are dictated by the data available in the literature, however, fortuitously, areas of available basins both east and west of the divide are not dissimilar. In terms of tributary samples, there is a good geographic distribution (and also representation of basin sizes) along the length of the margin on the eastern side of the divide, whereas west of the divide, three of the four tributary basins are in the southern sector of the margin and tributary areas cover a lesser range (Figure 3).

Figure 3: Distribution of sample sites and associated drainage basins. Further detail is provided in Table S1. Inset map shows the location of major cities: M – Melbourne, S – Sydney, B – Brisbane.

3.2. Cosmogenic ^{10}Be and ^{26}Al analyses

Sediment – collected as part of the new samples presented in this study – was sieved in the field to isolate the 250 – 500 μm fraction for analysis, and quartz was purified following procedures described in Kohl and Nishiizumi [1992] using froth flotation to separate feldspars from quartz. For all but two of the samples, Be and Al were separated at the University of Wollongong following procedures described in von Blanckenburg et al. [1996] with the modification that Al was separated from Be and Ti using pH sensitive precipitation before Be cation exchange chromatography [Child et al., 2000]. Samples were spiked with $\approx 300\ \mu\text{g}$ of ^9Be from a low-level beryl carrier solution added prior to complete HF dissolution. For samples FTZ and PIO-UP, beryllium was separated at Imperial College London following procedures described in Corbett et al. [2016]. ^{26}Al measurements of the Co-QTZ-N ($n=13$) [Binnie et al., 2019], and CRONUS-A ($n=5$) and CRONUS-N ($n=6$) [Jull et al., 2015] laboratory intercomparison materials prepared at the University of Wollongong between 2017 and 2020 yield results in agreement with consensus values (Table 1) suggesting that our Al chemistry procedures are robust and there is no systematic loss of ^{27}Al during sample processing.

$^{10}\text{Be}/^9\text{Be}$ and $^{26}\text{Al}/^{27}\text{Al}$ ratios for samples from east-draining basins #1 to #25 (Figure 2) and the two samples prepared at Imperial College, were measured using the 6MV SIRIUS facility at ANSTO [Wilcken et al., 2019]. The native Al concentrations of the samples ranged from 88 to 290 ppm (median = 158 ppm) and were determined via ICP-OES with a precision of 3-4% [Fujioka et al., 2015]. $^{10}\text{Be}/^9\text{Be}$ ratios were normalised to the KN-5-2 and KN-5-3 [Nishiizumi et al., 2007] standards and $^{26}\text{Al}/^{27}\text{Al}$ ratios were normalised to the KN-4-2 [Nishiizumi, 2004] standard. Analytical uncertainties for the final ^{10}Be and ^{26}Al concentrations (atoms g^{-1}) include AMS measurement uncertainties (larger of counting statistics or standard deviation of repeats and blank corrections) in quadrature with 1-2% for ^{10}Be and 2-3% for ^{26}Al standard reproducibility (depending on the individual AMS measurement conditions), 1% uncertainty in the ^9Be carrier concentration and 4% uncertainty in the ICP-OES Al measurements. $^{26}\text{Al}/^{27}\text{Al}$ ratios for samples from the Fitzroy River (basin #27 in Figure 2) that correspond to the ^{10}Be data in Mariotti et al., [2021], were measured using the 14UD accelerator at the Australian National University (ANU) Heavy Ion Accelerator Facility [Fifield

et al., 2010]. The native Al concentrations in these samples ranged from 124 to 687 ppm (median = 190 ppm). $^{26}\text{Al}/^{27}\text{Al}$ ratios were normalised to the KN-4-3 [Nishiizumi, 2004] standard. Results of the ^{26}Al and ^{10}Be analyses, including measurement uncertainties and blank corrections are summarised in Tables S2 and S3.

Material ^(a)	Measured value ^(b)	Consensus value ^(b)	Reference
Co-QTZ-N	$1.57 \pm 0.05 \times 10^7$ ($n=8$) ^(c) $1.68 \pm 0.09 \times 10^7$ ($n=5$) ^(d)	$1.56 \pm 0.08 \times 10^7$ ($n=19$)	Binnie et al. [2019]
CRONUS-A	$1.47 \pm 0.15 \times 10^8$ ($n=5$) ^(c)	$1.43 \pm 0.07 \times 10^8$ ($n=13$)	Jull et al. [2015]
CRONUS-N	$1.02 \pm 0.09 \times 10^6$ ($n=6$) ^(c)	$1.05 \pm 0.11 \times 10^6$ ($n=10$)	Jull et al. [2015]

(a) Samples were prepared at the University of Wollongong between 2017 and 2020 following procedures described in the text.

(b) Values are in atoms g^{-1} with uncertainties reported at 1σ .

(c) Measured using the 6MV SIRIUS facility at ANSTO.

(d) Measured at ANU.

Table 1: Summary of ^{26}Al measurement results in the Co-QTZ-N, CRONUS-A, and CRONUS-N laboratory intercomparison materials.

3.3. Denudation rate and sediment storage duration calculations

Denudation rates were calculated using the open-source program CAIRN v.1 [Mudd et al., 2016]. Basin-averaged nuclide production from neutrons and muons was calculated with the approximation of Braucher et al. [2011] and using a sea-level and high-latitude total production rate of $4.3 \text{ atoms g}^{-1} \text{ yr}^{-1}$ for ^{10}Be and $31.1 \text{ atoms g}^{-1} \text{ yr}^{-1}$ for ^{26}Al [Mudd et al., 2016]. Production rates for catchment-wide denudation rates were calculated at every grid cell of a hydrologically enforced 30 m SRTM DEM [Farr et al., 2007], using the time-independent Lal/Stone scaling scheme [Stone, 2000]. Atmospheric pressure was calculated via interpolation from the NCEP2 reanalysis data [Compo et al., 2011]. Topographic shielding was calculated from the same DEM using the method of Codilean [2006] with $\Delta\theta = 8^\circ$ and $\Delta\phi = 5^\circ$. For consistency, all Australian denudation rate data available in the OCTOPUS database and those from the recent publications not yet available in OCTOPUS, were recalculated using CAIRN and a 30 m SRTM DEM.

We calculate the duration of sediment storage in basins with both ^{26}Al and ^{10}Be data following a simple single exposure – complete burial model. This approach is similar to that used in other studies [e.g., Wittmann et al., 2011; Hippe et al., 2012; Struck et al., 2018b; Fülöp et al., 2020] and involves several simplifying assumptions that cannot be validated

and are likely not met due to spatially variable denudation rates and sediment mixing [cf., Bierman & Steig, 1996]. The two-step model is essentially flawed in a modern fluvial setting, however, inferred values are valuable for comparison with other studies. We perform our calculations in CosmoCalc v.3.0 [Vermeesch, 2007] using the time-independent Lal/Stone scaling factors [Stone, 2000], the neutron and muon production approximation of Braucher et al. [2011], and default values for all other parameters. We reference our $^{26}\text{Al}/^{10}\text{Be}$ ratios to the consensus $^{26}\text{Al}/^{10}\text{Be}$ production rate ratio of 6.75 [Balco et al., 2008]. Recent models and data suggest that the $^{26}\text{Al}/^{10}\text{Be}$ production ratio may be greater than the consensus value and may also be spatially variable as a function of latitude and elevation (see review in Corbett et al. [2017]). In fact, using the latest CRONUS-Earth production rate calibration data [Borchers et al., 2016] and the LSD scaling scheme [Lifton et al., 2014] we calculate $^{26}\text{Al}/^{10}\text{Be}$ spallation production rate ratios for the East Australian continental margin between 6.97 and 7.24 (see below). However, any conclusions arrived at by using the ratio of 6.75 will also hold for larger $^{26}\text{Al}/^{10}\text{Be}$ production ratio values and so using the consensus value is appropriate. Calculated ^{10}Be and ^{26}Al denudation rates and sediment storage durations are reported in Tables S4 and S5.

3.4. Geospatial analyses

We use a 30 m resolution SRTM DEM to calculate a range of topographic metrics including slope, local relief, and normalised channel steepness (k_{sn}). We also extract long profiles for all streams, and in all analyses that involved the extraction of the stream network we use a minimum threshold accumulation area of 1 km² [Jenson & Domingue, 1988; Tarboton et al., 1991]. We calculate slope in ArcGIS, following the algorithm of Horn [1981], and we calculate local relief with the *Focal Statistics* tool in ArcGIS using circular neighbourhoods of 1, 2, and 5 km radii. We calculate normalised channel steepness with the TAK package for MATLAB [Forte & Whipple, 2019] using the *KsnChiBatch* tool with the *output* parameter set to '*ksn*'. The latter produces a stream network with k_{sn} values for each stream segment, as opposed to a continuous raster with interpolated k_{sn} values. We use these raw stream network k_{sn} values as opposed to an interpolated k_{sn} raster to calculate our summary statistics for each basin. Thus, for basins where we compile data from the literature and where k_{sn} values have been reported [e.g., Mandal et al., 2015; Godard et al., 2019], our

recalculated k_{sn} values may be higher due to the fact that interpolated k_{sn} rasters extend to
340 hillslope grid cells where interpolated values will be lower. However, our use of k_{sn} and
other topographic metrics is purely for exploring first order relationships between these and
 ^{10}Be -derived denudation rates, and so values calculated here are appropriate for this
purpose. In instances where we compare our Australian data with denudation rates from
other passive continental margins, for consistency with the OCTOPUS database, and to
avoid recalculating data that is already in this database, we also calculate slope and k_{sn} for
all Australian basins using a 90 m resolution SRTM DEM.

We use modern mean annual rainfall as a proxy for climate across the study area. We
extracted annual rainfall values for each river basin using the WorldClim v.2.1 database [Fick
& Hijmans, 2017]. The rainfall data is based on weather station records for the period 1970
350 – 2000 and was obtained by interpolation at a resolution of ≈ 1 km using thin-plate splines
with covariates including elevation and distance to the coast [Fick & Hijmans, 2017].
Modern rainfall values for east Australia are similar in magnitude and also in spatial
distribution to rainfall values predicted for this area for the Mid-Holocene (≈ 6 ka) and the
Last Glacial Maximum (≈ 22 ka) as part of simulations using global climate models within the
Coupled Model Intercomparison Project Phase 5 (CMIP5) [Meehl et al., 2000; Taylor et al.,
2012] (Figure S2). Annual rainfall values are also similar to those predicted for the last
interglacial [Otto-Bliesner et al., 2006] (Figure S2). Thus, although the WorldClim rainfall
data only covers a period of 30 years, in contrast to the integration timescale for ^{10}Be -
derived denudation rates (10^4 - 10^5 years; Table S4), using these data to explore first-order
360 relationships between millennial-scale denudation rates and rainfall is appropriate.

To explore hydrological variability as a potential control on ^{10}Be and ^{26}Al inventories in
sediment, we aggregated Rustomji et al.'s [2009] flood variability metrics for each east-
draining mainstem basin. Rustomji et al. [2009] considered three flood variability metrics,
namely: (1) the $Q_{50}:Q_2$ flood quantile ratio calculated from a fitted probability density
function, (2) a power law scaling coefficient, and (3) the Flash Flood Magnitude Index
(FFMI). These metrics are based on flow data from 424 unregulated gauging stations with a
median record length of 38 years. Of the three metrics, Rustomji et al. [2009] recommend
(1) and (2), however, for completeness we include all three in our analyses. We also

summarise statistics pertaining to the depth of regolith – as a proxy for the volume of
unconsolidated sediment available in each basin – using the publicly available depth-of-
regolith raster dataset for the Australian continent [Wilford et al., 2015]. The depth-of-
regolith raster is based on a database of over 350,000 drillhole records with information on
the depth of the boundary between regolith and bedrock at each bore location [Wilford et
al., 2016]. We use the flood variability metrics and the depth-of-regolith data to explore
potential causes for the observed spatial pattern in $^{26}\text{Al}/^{10}\text{Be}$ ratios. Lastly, we explore first
order linkages between ^{10}Be -derived denudation rates and lithology by calculating the
predominant rock-type in each basin using the Geoscience Australia 1:2.5 million scale
Surface Geology of Australia digital dataset [Raymond et al., 2012].

Given the distinctive variability in hypsometry that characterises basins draining an arch-
type passive margin (i.e., low relief upland plateau, a steep escapement zone, and a low
relief, low elevation coastal plain), it is important to explore in more detail the quantitative
relationships between topography, rainfall, and denudation rates. We calculate summary
statistics (such as mean, median, standard deviation) for all grid cells of a given metric (e.g.,
slope, relief, k_{sn} , rainfall) in each basin, as well as summary statistics only for those grid cells
(of a metric) that have values greater than the 90th percentile. Given that the escarpment
zone will have the steepest slopes, highest local relief and k_{sn} , and due to orographic effects,
also the highest rainfall values, inspecting these metrics at values above the 90th percentile
effectively allows us to isolate and focus our analysis on the escarpment zone. Results are
summarised in Tables S6 to S11.

4. Results

4.1. ^{10}Be -derived denudation rates

Denudation rates* in mainstem samples from east-draining basins range between 7.7 ± 1.9
($\pm 1\sigma$) mm kyr⁻¹ (Mary) and 54.6 ± 13.7 mm kyr⁻¹ (North Johnstone). Denudation rates in

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* In situ-produced cosmogenic nuclides accumulate as material moves towards the surface by the removal of material above and so they record the total (i.e., physical and chemical) rate of mass removal from the Earth's surface. ^{10}Be -derived denudation rates represent averages over timescales that depend on the denudation rates themselves (see von Blanckenburg [2005] for details). For the East Australian continental margin denudation rates presented here, averaging timescales are in the order of $10^4 - 10^5$ years (see Table S4).

tributary samples range between $3.0 \pm 0.7 \text{ mm kyr}^{-1}$ (Burdekin) and $70.2 \pm 18.9 \text{ mm kyr}^{-1}$ (Liverpool). For west-draining basins, denudation rates range between $4.8 \pm 1.2 \text{ mm kyr}^{-1}$ (Barcoo) and $15.4 \pm 3.6 \text{ mm kyr}^{-1}$ (Maranoa) in mainstem samples, and between $4.4 \pm 1.0 \text{ mm kyr}^{-1}$ (Murrumbidgee) and $38.5 \pm 7.8 \text{ mm kyr}^{-1}$ (Murray) in tributary samples. Overall, ^{10}Be -derived denudation rates are higher in basins on the eastern side of the continental divide as compared to those on the western side (Figures 4 and 5) and their interquartile ranges (IQR) do not overlap (Figure 5). In the majority of basins where both mainstem and tributary samples are available, tributary samples yield ^{10}Be -derived denudation rates that are overall higher or the same (within uncertainty) as the denudation rates obtained for the mainstem sample (Figure 6). Notwithstanding, in several basins, namely, Murrumbidgee, Fitzroy, Burdekin, and North Johnstone, tributary samples yield ^{10}Be -derived denudation rates that are overall lower or the same (within uncertainty) as the denudation rates obtained for the mainstem sample (Figure 6). In terms of south – north trends, mainstem denudation rates east of the divide average to 11.6 mm kyr^{-1} for the basins draining the southern coast of Victoria (Mitchell to Genoa; Figure 4A). Denudation rates then increase to an average of 27.3 mm kyr^{-1} for the south-eastern sector of the margin (Bega to Logan; Figure 4A), with rates being similar in most basins ($\approx 20 \text{ mm kyr}^{-1}$) except three with denudation rates of $\approx 40 - 45 \text{ mm kyr}^{-1}$ (Figure 4A). Northern sector rates (Bremer to Daintree) average to 20.5 mm kyr^{-1} , though the range is rather large (between ≈ 8 and $\approx 55 \text{ mm kyr}^{-1}$). West of the continental divide, most mainstem denudation rates hover around 10 mm kyr^{-1} with a minor south to north decrease. Tributary denudation rates show similarly low values apart from the upper Murray averaging to 31.0 mm kyr^{-1} .

Figure 4: ^{10}Be -derived denudation rates, topographic metrics and annual rainfall. (A) Distribution of denudation rates for mainstem (large circles) and tributary (small circles) samples from the eastern (red) and western (blue) sides of the continental divide, ordered from south to north. Basins east of the continental divide record overall higher denudation rates than basins west of the divide (red and blue dashed lines and box plots). (B-D) Slope, normalised channel steepness (k_{sn}), and local relief values for each mainstem basin east of the continental divide, calculated using only values from those grid cells where each metric is greater than the 90th percentile. Topographic metrics were extracted from a 30 m resolution SRTM DEM. (E) Mean annual rainfall values for each mainstem basin east of the continental divide, calculated using all values in each basin. Black circles show median values and coloured boxes represent interquartile ranges. Grey bands indicate the south-eastern and northernmost sections of the margin where ^{10}Be -derived denudation rates are consistently higher than elsewhere. Horizontal dashed lines are to guide the eye. Note the logarithmic scale used in (E).

Figure 5: ^{10}Be -derived denudation rates, mean slope, and mean annual rainfall, east and west of the continental divide. (A-C) Black diamonds and black circles represent the median of denudation rate, mean slope, and mean annual rainfall for basins with the 10% highest (diamonds) and 10% lowest (circles) denudation rates, respectively. Slope was extracted from a 90 m resolution SRTM DEM. See text for more details.

Figure 6: ^{10}Be denudation rate vs. area for basins where tributary samples are available. Blue and red circles show samples from basins located west (blue) and east (red) of the continental divide. Grey band shows ^{10}Be denudation rate range at 1-sigma uncertainty level for the mainstem sample. No mainstem sample is available for the Murray River. For the Barron, diamonds represent basins draining the escarpment zone.

4.2. Links between denudation rates, topographic metrics, and rainfall

The east – west differences in denudation rates recorded in the mainstem basins are also mirrored by differences in their topography and annual rainfall, namely both average slope and average annual rainfall are higher in east-draining basins as compared to those on the western side of the continental divide (Figure 5). East of the divide, topographic metrics (such as slope, k_{sn} , and local relief), are generally lower in the northern sector of the margin (i.e., north of Logan), although there is considerable variability in values throughout (Figure 4B-D). Annual precipitation increases from south to north and decreases from east to west with the Great Escarpment exerting a strong orographic control: larger basins in the northern sector of the margin (e.g., Burnett, Fitzroy, Burdekin) receive less rainfall than basins in the southern sector (e.g., Macquarie Rivulet in the Illawarra and Bellinger), mainly because in the south, the continental divide is closer to the coast making the Great Escarpment a more pronounced and an important orographic barrier (Figure 4E). The strong orographic control is also evident in the northernmost basins (e.g., Tully, Johnstone, Liverpool), where the Great Escarpment is also closer to the coast.

To assess potential controls on denudation rates, in Figure 7 we examine the relationship between ^{10}Be -derived denudation rates and the topographic metrics and annual precipitation for each basin. East of the divide, there is a weak correlation between denudation rate and topographic metrics (slope, k_{sn} , and local relief) for mainstem basins ($R^2 = 0.13 - 0.16$). The correlation between denudation rate and slope, and denudation rate and k_{sn} is stronger ($R^2 = 0.27$ and 0.24 , respectively) when topographic metrics are calculated using only values greater than the 90th percentile, suggesting that the escarpment zone is an important contributor of sediment (and therefore ^{10}Be signal) to the outlet of these basins. R^2 values are, however, strongly influenced by several outliers (symbols with no fill in Figure 7). When these outliers are excluded (red regression lines in Figure 7), R^2 values increase to 0.25, 0.35, and 0.44 (slope, k_{sn} , and local relief) when all metric values are used, and to 0.44, 0.41, and 0.30 when only values greater than the 90th percentile are used (Figure 7A). The correlation between denudation rate and topographic metrics becomes stronger when looking at the smaller tributary basins. To maximise the number and geographic spread of tributary basins that we include in our analysis and at the

same time to minimise topographic heterogeneity within each basin, in Figure 7B we limit our analysis to basins with areas < 150 km². For these basins, the strongest correlation ($R^2 =$ 450 0.43; Figure 7B2) is found between denudation rate and k_{sn} . Basin slope and local relief yield R^2 values of 0.31 and 0.34, respectively. Here too, R^2 values are strongly influenced by several outliers. When these outliers are excluded, R^2 values increase to 0.64, 0.71, and 0.70 for slope, k_{sn} , and local relief, respectively.

Figure 7: ¹⁰Be-derived denudation rate vs. topographic metrics and annual rainfall. (A) Plots for east-draining mainstem basins only. Red circles are mean topographic metrics and mean annual rainfall calculated using all grid cells, whereas orange diamonds were calculated using only values greater than the 90th percentile. (B) Plots for both east- and west-draining basins with areas smaller than 150 km². Topographic metrics were extracted from a 30 m resolution SRTM DEM. Symbols with no fill denote outliers defined as points with residuals > 1.5 σ . Dotted lines show 95% confidence intervals. Regression lines and confidence envelopes were calculated using all datapoints (black) and excluding outliers (red). Numbers in red, orange, and black are values of the coefficient of determination – R^2 (red and orange: all data points; black: outliers excluded).

The correlation between denudation rate and annual rainfall (outliers excluded) is weak: $R^2 = 0.32/0.26$ for mainstem basins and $R^2 = 0.25$ for basins < 150 km². Notwithstanding these low R^2 values, Figure 5 suggests that annual rainfall does exert control on denudation rates

as both the highest and lowest ^{10}Be -derived denudation rates, at least east of the divide, occur in basins that not only record the highest (and lowest) mean slopes but also record the highest (and lowest) annual rainfall values (Figure 5, black diamonds and circles).

460 4.3. $^{26}\text{Al}/^{10}\text{Be}$ ratios and sediment storage durations

We measured both ^{26}Al and ^{10}Be in 67 samples, 52 from east draining and 15 from west draining basins, equally split between mainstem and tributary samples. $^{26}\text{Al}/^{10}\text{Be}$ ratios range between 4.99 ± 0.31 ($\pm 1\sigma$) (Mitchell) and 7.86 ± 0.77 (Don), east of the continental divide, and between 3.96 ± 0.32 (Barcoo) and 6.39 ± 0.40 (Maranoa), west of the continental divide (Table S5). On both sides of the divide, all but a few of the samples plot below the $^{26}\text{Al}/^{10}\text{Be}$ steady-state erosion – continuous exposure envelope (Figure 8 A&B), indicating that those samples have experienced complex exposure histories. East of the continental divide, samples that record $^{26}\text{Al}/^{10}\text{Be}$ ratios statistically lower than the consensus $^{26}\text{Al}/^{10}\text{Be}$ spallation production rate ratio of 6.75, at the 95% confidence level, 470 (Figure 9A) cluster on the south coast of Victoria and in south-east Queensland and are predominantly from basins that also experience increased flood variability (Table S10, Figure 9C). We return to this observation later in the discussion below.

As noted above, we calculate the duration of sediment storage in basins with both ^{26}Al and ^{10}Be data assuming a two-step history: continuous exposure in the source zone followed by deep burial (during which production totally ceases) within the colluvial/fluvial system resulting in a decrease of the $^{26}\text{Al}/^{10}\text{Be}$ ratio from its initial input value, and finally recent re-exposure. This approach is similar to that used in other studies [e.g., Wittmann et al., 2011; Hippe et al., 2012; Struck et al., 2018b; Fülöp et al., 2020] and involves several simplifying assumptions that cannot be validated and are likely not met due to spatially variable 480 denudation rates and sediment mixing [cf., Bierman & Steig, 1996]. Calculated sediment storage durations range between 0 and ≈ 730 ka east of the continental divide and between ≈ 260 and $\approx 1,100$ ka west of the continental divide (Table S5). Calculated values have large uncertainties and only 19 of the 67 calculated values are distinguishable from zero at the 95% confidence level.

Figure 8: $^{26}\text{Al}/^{10}\text{Be}$ ratios. (A) and (B) $^{26}\text{Al}/^{10}\text{Be}$ vs. ^{10}Be concentration plots for samples west (A) and east (B) of the continental divide, respectively. Samples that have experienced continuous exposure to cosmic radiation will plot within the dark-grey simple exposure/erosion history envelope. Samples that have experienced a complex exposure history involving one or more episodes of burial and cessation of nuclide production (i.e., samples undergoing storage) will plot in the light-grey shaded area. The distance between the simple exposure / erosion history envelope and a data point is proportional to the duration of burial, with samples buried for longer plotting further away from the dark-grey envelope. Grey curve shows 1 Myr burial isochron. Uncertainties (ellipses) are shown at 2-sigma level. (C) $^{26}\text{Al}/^{10}\text{Be}$ spallation production rate ratios (red lines) calculated for elevation and latitude values representative for the East Australian continental margin using the CRONUS-Earth production rate calibration data [Borchers et al., 2016] and the LSD scaling scheme [Lifton et al., 2014]. (D) Frequency distribution of measured $^{26}\text{Al}/^{10}\text{Be}$ ratios ($n=67$). Red vertical line indicates the consensus $^{26}\text{Al}/^{10}\text{Be}$ spallation production rate ratio of 6.75 [Balco et al., 2008] and the red vertical band indicates the range of spallation production rate ratios calculated in (C). Note how almost the entire population of $^{26}\text{Al}/^{10}\text{Be}$ ratios plots to the left of the consensus $^{26}\text{Al}/^{10}\text{Be}$ spallation production rate ratio of 6.75.

Figure 9: $^{26}\text{Al}/^{10}\text{Be}$ ratios and flood variability. (A) and (B) $^{26}\text{Al}/^{10}\text{Be}$ ratios (circles) for samples east (A) and west (B) of the continental divide, respectively. Whiskers indicate uncertainties at the 95% confidence level and darker blue boxes indicate uncertainties at the 68% confidence level. Blue circles are $^{26}\text{Al}/^{10}\text{Be}$ ratios that are distinguishable from the consensus $^{26}\text{Al}/^{10}\text{Be}$ spallation production rate ratio of 6.75 (black dashed horizontal line) at the 95% confidence level. Black horizontal band indicates the range of spallation production rate ratios calculated in Figure 8C. Red diamonds represent regolith volume per unit basin area, calculated using Wilford et al.'s [2015] depth-of-regolith data. Ivory vertical bands group samples belonging to the same mainstem basin such that basin names on bottom x-axis are mainstem samples only. Red dashed lines are to guide the eye. (C) Flood variability metrics for basins east of the continental divide calculated using data from Rustomji et al. [2009]. FFMI: mean flash flood magnitude index calculated using the monthly peaks-over-threshold flood series; Alpha: mean power law scaling coefficient; Q2 vs. Q50: mean flood quantile ratio. Alpha and Q2 vs. Q50 are the recommended metrics by Rustomji et al. [2009], and FFMI is shown only for completeness.

5. Discussion

5.1 ^{10}Be -derived denudation rates and their global significance

Short-term erosion rates, inferred from measurements of sediment yields have been shown to vary globally by up to six orders of magnitude between 0.001 and 1,000 mm yr⁻¹, the highest rates resulting from the transient response of the landscape to disturbance by volcanic eruptions, rapid climate change, and modern agriculture and land use change [Koppes & Montgomery, 2009; Korup, 2012]. Likewise, millennial-scale denudation rates calculated using cosmogenic ^{10}Be have been shown to also vary globally by up to five orders of magnitude between 0.1 mm kyr⁻¹ and 10,000 mm kyr⁻¹ (or 0.0001 to 10 mm yr⁻¹) [Codilean et al., 2018]. Knowing these extremes is useful in understanding how landscapes might respond to tectonic and climatic forcings, the timescales necessary to reach a new equilibrium state, and to evaluate the conditions under which steady state is attainable. From a long-term landscape evolution perspective, however, more important than knowing the extremes, is understanding what constitute representative (or 'normal') rates of landscape denudation for a given setting.

Within the Australian context, it was realised very early on [e.g., Young, 1983; Bishop, 1985] that rates of landscape lowering along the eastern margin have been very slow and relatively constant throughout the Tertiary in comparison to rates reported for the more humid Northern Hemisphere settings that were regarded as the 'normal' at the time [e.g., Thornbury, 1969]. The low rates of lowering have since been confirmed by more recent studies, Bishop [2007] summarising representative rates for tectonically quiescent landscapes to be in the order of 5 to 10 mm kyr⁻¹. More importantly, however, these early studies – in particular Young [1983] – have also suggested that the perception that Northern Hemisphere rates of erosion were the 'normal' and that those recorded in Australia were, for example, anomalously low was probably incorrect. In fact, the opposite may be true: denudation rates recorded in non-glaciated, tectonically quiescent settings are the 'normal' and those recorded in tectonically active settings or from areas affected by Quaternary glaciations are anomalously high in comparison. Our understanding of rates of landscape lowering has improved substantially since the early works of Young [1983] and Bishop [1985]. In particular, in the last decade, the availability of global datasets of both short-term

and millennial-scale erosion rates have permitted unprecedented synoptic studies of denudation aiming to infer global-scale trends from these data [e.g., Koppes & Montgomery, 2009; Milliman & Farnsworth, 2011; Portenga & Bierman, 2011; Willenbring et al., 2013; Harel et al., 2016]. The comprehensive dataset of ^{10}Be -derived denudation rates presented in this study, in conjunction with ^{10}Be data from the OCTOPUS database [Codilean et al., 2018] allows us to re-visit the question of what constitute representative rates of landscape denudation, and to place East Australian denudation rates into a global context.

To achieve a meaningful comparison between the East Australian basins and those found in the OCTOPUS database (Figure 10 A&B), we first need to separate the basins that are located in tectonically passive settings from those in tectonically active settings. To do the latter we use Kreemer et al.'s [2014] Global Strain Rate Model (v.2.1) and consider all basins that fall completely within areas classed by the model as rigid plates as being in a tectonically passive setting. Conversely, all basins with non-zero mean values for the model strain rate field – even if partially overlapping areas classed as rigid plates – are considered to belong to the tectonically active group. Given that there is no definitive definition or universally accepted set of metrics to distinguish between tectonically active and passive settings, the above approach, although simplistic, is based on a quantitative framework that allows us to carry out a first-order statistical inter-comparison of the datasets.

Figure 10: East Australian denudation rates in a global context. (A) and (B) ^{10}Be -derived denudation rate vs. mean basin slope (A) and mean annual rainfall (B), comparing data from the East Australian margin with the global denudation rates from the OCTOPUS database. Dashed horizontal lines are median values: light magenta – basins from tectonically passive settings, light green – basins from tectonically active settings, red – this study. Horizontal grey band (W_{limit}) represents the silicate weathering speed limit (i.e., $151 \text{ t km}^{-2} \text{ yr}^{-1}$ or approx. 58 mm kyr^{-1}) from Dixon & von Blanckenburg [2012]). (C) – (F) Box plots showing ^{10}Be -derived denudation rates (C), mean basin slope (D), mean normalised channel steepness (k_{sn}) (E), and mean annual rainfall (F) for basins from this study (AUS) and other passive continental margin settings: Namibia (NAM), South Africa (ZAF), Eastern Brazil (BRA), Sri Lanka (LKA), Western Ghats (IND), and the Appalachian Mountains (USA). Red box plots show data for Australian basins to the east of the continental divide and orange box plot includes data from both sides of the divide. Black diamonds represent the median of denudation rate, mean slope, mean k_{sn} , and mean annual precipitation, respectively, for basins with the 10% highest denudation rates. Red (and orange) horizontal dashed lines represent median values for all Australian datapoints, and black horizontal dashed lines represent median values calculated only for Australian basins with the 10% highest denudation rates. Light magenta horizontal bands in (C) represent median denudation rate values for all tectonically passive basins (lower band) and for those with the 10% highest denudation rates (upper band). Topographic metrics were extracted from a 90 m resolution SRTM DEM. See text for more details.

Using the above approach to split the global denudation rate data, we calculate a median global ^{10}Be -derived denudation rate for tectonically passive regions of 12.4 mm kyr^{-1} ($n = 1025$) and similarly a value of 136 mm kyr^{-1} ($n = 2263$) for tectonically active regions. The majority (95%) of the data sit between 2 and 65 mm kyr^{-1} , a small range when compared with the five orders of magnitude range of the entire global dataset. The distribution of the East Australian data is virtually identical to the global tectonically passive data, with the median denudation rate being 14.5 mm kyr^{-1} ($n = 160$), and 95% of the data siting between 5 and 55 mm kyr^{-1} . In addition, the East Australian denudation rates are also similar to those found in other passive continental margin settings (Figure 10C). The only exceptions to the above are the Namibian (NAM) and South African (ZAF) margins, where the very low denudation rates have been attributed to hyper-arid conditions [Cockburn et al., 2000; Bierman & Caffee, 2001; van der Wateren & Dunai, 2001; Codilean et al., 2008; 2014] and to strong lithological control [Scharf et al., 2013], respectively. The similarities are also present when looking at the extremes. For example, the median of the highest 10% denudation rates in all but the Namibian and South African margins are very similar (Figure 10C, black diamonds and black dashed line) despite substantial differences between the margins in both the topography and the annual rainfall of the basins (Figure 10D-F, black diamonds and black dashed lines).

Young and McDougall [1993], citing evidence on the widespread preservation of basaltic lavas that flowed into river valleys across the uplands of south-eastern Australia, have highlighted the ‘anomalous’ persistence of transience in these landscapes for tens of millions of years. The data compiled in Figure 10, however, show very clearly that there is nothing anomalous about the East Australian margin as far as denudation rates are concerned. In fact, given that tectonically quiescent terrains occupy a large proportion of the Earth’s continental surface[†], we can argue that the relatively low rates at which they are lowering (as compared to those in tectonically active settings), and the protracted timescales of landscape transience that these low rates imply, are the normal globally, rather than the exception. In contrast, tectonically active and / or glacially affected terrains

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[†]Based on the Global Strain Rate Model (GSRM v.2.1) [Kreemer et al., 2014], only $\approx 25\%$ of the Earth’s continental topography (only 18% if Antarctica is included) records non-zero values for the model strain rate field.

such as Taiwan, New Zealand, Alps, Himalaya record ^{10}Be -derived denudation rate above the global 90th percentile ($\approx 1,000 \text{ mm kyr}^{-1}$) for tectonically active regions, and so should be perceived as the anomaly.

Denudation rates in tectonically passive settings are not only substantially lower than those from tectonically active settings (Figure 10A – box plots and dashed horizontal lines) but also there seems to be a limit to how high they can be. This observation is supported by the fact that the medians of the top 10% denudation rates recorded in the various passive margins (Figure 10C, black diamonds) are similar despite differences in topography and precipitation (Figure 10D-F, black diamonds). These median denudation rate values, and in fact the 95th percentile denudation rate for all tectonically passive basins ($\approx 53 \text{ mm kyr}^{-1}$), are very similar to Dixon & von Blanckenburg's [2012] 'silicate weathering speed limit' ($\approx 58 \text{ mm kyr}^{-1}$) calculated as the 95th percentile of global soil weathering rates (Figure 10A&B, grey band labelled W_{limit}). This last observation suggests that in post-orogenic terrain, the overall rates of topographic decay have a speed limit that is imposed by the rate at which rock is converted to soil by chemical weathering.

5.2. Links between denudation rates and lithology

A strong lithological control on denudation rates has been documented in numerous post-orogenic landscapes, more recent salient examples including the Cape Mountains of South Africa [Scharf et al., 2013], the Pyrenees [Bernard et al., 2019], the Kimberley plateau in Western Australia [Cazes et al., 2020], and the Quadrilátero Ferrífero in Brazil [Peifer et al., 2020]. In contrast to the above, and despite well documented instances of a strong (localised) lithological control on escarpment retreat in south-eastern Australia [e.g., Nott et al., 1996], lithology does not seem to exert a first order control on ^{10}Be -derived denudation rates along the East Australian passive margin (Figure 11). Median denudation rates for each major quartz-bearing lithological group vary in a narrow range (between $10\text{-}20 \text{ mm kyr}^{-1}$) as compared to the factor of 10 range in the total dataset, and denudation rate IQRs overlap for all groups. It is unlikely that the lack of a relationship is due to the scale of the drainage basins that are included in this study, as the same statistics are obtained when only including basins $< 150 \text{ km}^2$ (Figure 11, white boxplots). Notwithstanding the above, our data does not preclude the possibility of a strong lithological control at the landform scale,

neither is it suitable to exploring such local scale linkages between lithology and rates of denudation.

Figure 11: ^{10}Be -derived denudation rates grouped by dominant lithology. Dashed vertical lines indicate the median of all denudation rates and the median of denudation rates above the 90th percentile, respectively. White box plots show only data for basins < 150 km². Predominant rock-type in each basin was calculated using the Geoscience Australia 1:2.5 million scale Surface Geology of Australia digital dataset [Raymond et al., 2012].

5.3 Controls on denudation rates: the role of rainfall

^{10}Be -derived denudation rates along the East Australian margin correlate strongly with topographic metrics – especially at the smaller tributary basin scale ($R^2 = 0.64 - 0.71$; Figure 7B), which suggests that topography exerts the main control on rates of landscape lowering in this setting. Denudation rates have been found to strongly correlate with topography globally [e.g., Montgomery & Brandon 2002; Portenga & Bierman, 2011; Willenbring et al., 2013] and topography has also been shown to be an important control on denudation rates in other passive continental margin settings [e.g., Codilean et al., 2008; Scharf et al., 2013; Mandal 2015]. Conversely, although strong correlations between ^{10}Be -derived denudation rates and rainfall have been observed in some settings [e.g., Moon et al., 2011], most studies report a small to non-existent relationship between the two parameters [e.g., Riebe et al., 2001; Mandal et al., 2015], despite water playing a key role in both the production of sediment (via chemical weathering) and its removal.

Despite the low correlation coefficients, links between denudation rate and rainfall may still exist, but be difficult to disentangle. For example, the data presented in this study suggest a weak correlation between denudation rate and rainfall along the East Australian margin (Figure 7 A4&B4; $R^2 = 0.24/0.20$ for mainstem basins and $R^2 = 0.19/0.25$ for tributary basins). Yet, as shown in Figure 4A, most of the highest mainstem ^{10}Be denudation rates are all found in basins that also have the largest rainfall amounts (see also Figure 5, black diamonds), which suggests that in addition to steep slopes and steep channels, rainfall is factor in producing elevated denudation rates. Furthermore, in a recent study, Godard et al. [2019] have compared the regression slopes of ^{10}Be derived denudation rates vs. mean basin slope – taken as a proxy for the efficiency of hillslope denudation – for a range of settings to argue that annual rainfall has an important and non-linear effect on the efficiency of hillslope processes in post-orogenic terrains. Moreover, they used this relationship between regression slope and annual rainfall to suggest that the elevated denudation rates recorded in the Bega section of the East Australian margin (see Figure 4A) are the result of its temperate climate and annual rainfall values falling within a range (1000 – 1500 mm) that is optimal for chemical weathering and hillslope erosion. We note, however, that commensurately high denudation rates are recorded in the northernmost basins (e.g., Liverpool and Johnstone), despite annual rainfall in excess of 3,000 mm, value at which Godard et al. [2019] predict denudational processes to be less sensitive to topographic gradients, and thus denudation rates to be potentially lower.

Another observation that illustrates the complex links between topography, rainfall, and denudation rates, and further bolsters our suggestion that rainfall exerts an important (albeit secondary) control on denudation rates along the East Australian margin, is the strong relationship that is observed between knickpoint recession distance and basin area. The latter is used as a proxy for discharge (and thus to some extent also a proxy for rainfall) in the stream power formulation of bedrock river incision [Whipple & Tucker, 1999; Lague, 2014]. In Figure 12, we show knickpoint distance vs. basin area from five of the largest basins east of the continental divide from the southern sector of the margin. These basins feature prominent embayed escarpments located some distance from the continental divide with large-scale knickpoints located at the head of narrow gorges advancing into the upland plateau surface. The data show a strong correlation ($R^2 = 0.75$) between the distance

knickpoints have travelled upstream from the river mouth (i.e., the confluence with the mainstem river for tributary knickpoints) and basin area, also measured at the river mouth.

640 The scatter in Figure 12 can be explained by differences in lithology between the five basins, and given the large basin areas, also by lag time – i.e., the amount of time it takes for the knickpoint in the mainstem river to travel past one tributary on to the next. Thus, knickpoints in tributaries further upstream have had less time to propagate upstream than a knickpoint in a tributary with a similar area but located further downstream in the drainage network. The relationship in Figure 12 is statistically significant, however, and holds across three orders of magnitude basin area, suggesting that the rate of bedrock channel incision is proportional to stream power, and basin area – as a proxy for discharge – and determines the rate at which knickpoints retreat upstream [Whipple & Tucker, 1999].

Figure 12: Relationship between knickpoint recession distance measured from confluence and basin area at confluence. Data includes both tributary and mainstem rivers east of the continental divide from five basins characterised by embayed escarpments and large-scale knickpoints along both mainstem and tributary rivers. For mainstem rivers both distance and area are calculated from the outlet defined by the present sea level. Knickpoints were identified based on distance-slope (DS) plots [Goldrick & Bishop, 2007] using a 30 m SRTM DEM.

The strong positive relationship between distance of knickpoint retreat and basin area shown in Figure 12 is in direct conflict with the findings of Seidl et al. [1996] and Weissel &

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Seidl [1998] who showed that all of the knickpoints in the Macleay have propagated upstream from the mouth of the mainstem river by about 200 km and therefore conclude that the distance of knickpoint migration upstream does not depend on basin area (i.e., discharge). Instead of basin area, these authors explain knickpoint propagation inland by slope failure mechanisms and the resulting mass wasting events on the steep rock slope in the knickpoint area. However, relating the location of knickpoints to how far they are from the mouth of the mainstem river is not appropriate. Knickpoint propagation distances should be calculated from the tributary confluence, rather than the mainstem river mouth, as tributary knickpoints are triggered when the base-level signal reaches the confluence and they propagate at a rate that depends on the basin area of the tributary and not on that of the mainstem river [Bishop et al., 2005]. Thus, Seidl et al.'s [1996] and Weissel & Seidl's [1998] approach was incorrect and resulted in an erroneous conclusion that discharge does not affect knickpoint recession rates in the Macleay.

To summarise, despite the weak correlation between denudation rate and rainfall that is observed in our data, rainfall (when coupled with other topographic variables) can exert control on the rates and styles of landscape lowering in our study area. The role of rainfall in the East Australian setting as opposed to the lack of such a role in other passive margins with a wetter climate, such as, for example, the Western Ghats and Sri Lanka (Figure 10F, black diamonds), might not necessarily be (entirely) due to the East Australian margin's optimal rainfall regime as suggested by Godard et al. [2019]. Rather, it might also be a characteristic feature of the very architecture of arch-type margins [cf. Matmon et al., 2002]. Here, the presence of a prominent escarpment seaward from the continental divide (Figure 1) means that both orographically enhanced rainfall and stream power will be at their maximum at the escarpment zone, promoting the dissection of the highland mass by gorge extension, and so increasing the areal extent of high relief areas that in turn leads to elevated basin averaged denudation rates.

5.4 Sediment storage and reworking

Various processes have been identified to explain the cause of $^{26}\text{Al}/^{10}\text{Be}$ ratios in river sediment that plot below the range that is normal for samples experiencing a simple and continuous exposure history (for a complete list of these processes, see Wittmann et al.,

[2020]). Rivers may be tapping older sediment – for example previously buried floodplain material or adjacent older Pleistocene terraces [e.g., Wittmann et al., 2011] or dune sands [e.g., Vermeesch et al., 2010; Eccleshall, 2019] – with depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios being the result of deep burial and decay of both ^{26}Al and ^{10}Be . Depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios have also been observed in settings where instead of deep burial, overall sediment fluxes are low and thus rivers continuously rework shallow sediment deposits that are widespread [e.g., Struck et al. 2018a,b, Fülöp et al., 2020]. Here burial is not deep enough to completely stop the production of ^{26}Al and ^{10}Be , but both hillslope and fluvial transit times are long enough that even with (or sometimes even in the absence of) shallow burial there is sufficient decay of ^{26}Al and ^{10}Be to detectably alter the Al/Be signal. Lastly, in landscapes with low erosion rates ($< \approx 1 \text{ mm kyr}^{-1}$), $^{26}\text{Al}/^{10}\text{Be}$ ratios can already be lowered by decay within the bedrock column, and these depressed ratios will then be passed onto river sediment via various erosion pathways [e.g., Struck et al., 2018a; Cazes et al., 2020]. Each of the above processes have been observed in Australian basins and in the case of large systems such as the Lake Eyre and Murray Darling Basins, the depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios observed in their downstream reaches [e.g., Struck et al., 2018b; Eccleshall, 2019] are the result of not one single process, but all of them combined.

As described above, due to the relatively large uncertainties on the measured $^{26}\text{Al}/^{10}\text{Be}$ ratios, only 28 of the 67 samples yield ratios that are lower than the consensus $^{26}\text{Al}/^{10}\text{Be}$ spallation production rate ratio of 6.75 at the 95% confidence level, and 49 of the 67 samples yield ratios that are lower than 6.75 at the 68% confidence level (Figure 9).

Notwithstanding, all but a few of the 67 samples have $^{26}\text{Al}/^{10}\text{Be}$ ratios that plot below the range that is normal for a simple and continuous exposure history (Figure 8D). In summary, despite the large uncertainties, it is important to note that $^{26}\text{Al}/^{10}\text{Be}$ ratios are consistently lower than what is expected in a setting where sediment experiences a simple history of erosion through the rock column followed by a relatively fast passage through the colluvial and fluvial systems. Our ^{10}Be and ^{26}Al dataset lacks the detail of Struck et al.'s [2018a,b] western Lake Eyre data, and so we cannot fully investigate which compartments (i.e., bedrock, hillslope, fluvial) and which processes are contributing to the depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios. Our basins are significantly smaller than the Murray Darling and Lake Eyre Basins, and so sediment residence times in the fluvial domain will be shorter, however, as illustrated by

optically stimulated luminescence (OSL) ages from the Lockyer River (Figure 13D; Croke et al. [2016]; Daley et al. [2017]), residence times may still be substantial (10^3 to 10^5 years). Further, unconsolidated valley floor material cover that rivers can potentially rework is widespread in our study area (see Figure 9 A&B – red diamonds; Figure 13). Hillslope sediment residence times of the order of 200 kyr have also been determined using uranium-series isotopes for the upper Murrumbidgee basin [Suresh et al., 2014], commensurate with the sediment storage durations that we calculate here (Table S5), suggesting that potential sediment storage times in the colluvial domain might alone be sufficient to explain the depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios observed in our basins. Lastly, a number of small upland plateau basins in our study area record average ^{10}Be -derived denudation rates of $\approx 5 \text{ mm kyr}^{-1}$ (Figure 4A), and so we cannot completely rule out the possibility that in some of the basins, depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios might already be inherited from the rock column prior to sediment entering the colluvial and fluvial systems [cf. Struck et al., 2018a].

As noted earlier, the coastal rivers of eastern Australia are hydrologically distinct from the rest of the world, showing a comparatively high flood variability [Finlayson & McMahon, 1988]. In addition – and as opposed to many other parts of the world where lateral (and regular channel migration) dominates the valley floor sediment storage pattern – the floodplains of east Australia’s coastal rivers are dominated by vertical accretion which has occurred since at least the mid Holocene [Nanson & Young, 1981; Fergusson & Brierley, 1999a,b; Cohen & Nanson, 2007]. There is insufficient evidence to state whether this mode of floodplain accumulation in eastern Australia is a function of the narrow and confined settings, the limited sediment supply, the climatic variability, the potential role of Australia’s vegetation, or a combination of all of the above. Notwithstanding, vertical accretion combined with high flood variability leads to a cyclical process of periodic floodplain destruction and rebuilding [Nanson, 1986]. Floodplain stripping can be caused by a single large flood, or a series of more moderate floods, that follow a period of quiescence of a few hundred or thousand years over which overbank deposition gradually builds a floodplain.

A salient example of floodplain stripping is the case of the January 2011 catastrophic floods that affected the Brisbane River system in south-east Queensland. The floods, estimated as a 1-in-1000 year event [Thompson & Croke, 2013], completely removed valley sediment-fills

on a basin-wide scale in the most confined and upstream reaches of some of the tributaries. In the Lockyer River, a tributary of the Brisbane, the 2011 flood resulted in the total destruction of channel units and the removal of in-channel and riparian vegetation. Along steep headwater streams, 1–3 m of coarse-grained sediment was flushed out, revealing extensive reaches of exposed bedrock channels, and bedrock steps [Baggs Sargood et al. 2015].

Figure 13: Depth-of-regolith maps for selected basins. (A) to (C) Maps showing the distribution of regolith thickness in basins from south-east Queensland (A), Illawarra (B), and southern Victoria (C) calculated using Wilford et al.'s [2015] depth-of-regolith data. (D) Box plots showing optically stimulated luminescence (OSL) ages of alluvial units vs. their depth from the Lockyer River. Data from Croke et al. [2016] and Daley et al. [2017]. Location of samples and spatial distribution of ages are shown in (A).

The process of vertical floodplain accretion also promotes rapid and relatively deep burial of sediment, and thus is conducive to loss of cosmogenic radionuclides via decay, and so to lowering of $^{26}\text{Al}/^{10}\text{Be}$ ratios. If storage times are too short for substantial radionuclide decay to occur, at the very least, deep burial within vertically accreted floodplains ensures that the production of ^{10}Be and ^{26}Al ceases and potentially depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios inherited from the bedrock column or hillslope domain are preserved. Moreover, stripping of sediment by large floods, allows rivers to periodically access the deeper, and potentially old, sediment units within floodplains and terraces. For example, as shown in Figure 13, in the upper reaches of the Lockyer River, the median age of alluvial units at depths greater than 5 m is ≈ 10 ka, with the oldest recorded age being ≈ 230 ka [Daley et al., 2017].

Not all east Australian coastal basins have equally high flood variability. However, the basins with the highest flood variability (Figure 9C) broadly correspond to those basins that record the most depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios (Figure 9A – solid blue circles). Given the above we propose that there may be a causal link between the hydrological variability that characterises the rivers draining the eastern seaboard of Australia and the non-steady state $^{26}\text{Al}/^{10}\text{Be}$ ratios that we observe in the sediment from these rivers. We posit that sediment residence times in the hillslope domain and the upper reaches of the fluvial network are responsible for the bulk of cosmogenic radionuclide decay, and the periodic stripping of vertically accreted floodplains by large floods means that deeper and potentially older units are periodically incorporated into the sediment mix transported by the modern river.

5.5 Implications for the long-term evolution of the East Australian margin

Nott et al. [1996] and Weissel & Seidl [1998] have documented high rates of gorge extension in the Shoalhaven and Macleay basins, respectively. Using evidence provided by Cenozoic basalts, Nott et al. [1996] estimated a knickpoint retreat rate for the Shoalhaven mainstem of $\approx 2,500$ mm kyr^{-1} (averaged over 30 Myr), a value 15 times higher than that inferred using the same basalts for major escarpment retreat in the area (≈ 170 mm kyr^{-1}). Likewise, Weissel & Seidl [1998] used cosmogenic ^{10}Be and ^{26}Al to show that river incision rates in a tributary of the Macleay are the highest at the gorge head and immediately downstream: incision rates obtained were consistently > 100 mm kyr^{-1} , in contrast to rates of ≈ 5 mm kyr^{-1} recorded upstream of the knickpoint. Our results – namely, the strong

correlation between denudation rate and topographic metrics – especially channel steepness (k_{sn}) – (Figure 7B) and the strong correlation between knickpoint recession distance and basin area (Figure 12) – lend further support to these early studies and collectively show that the headward erosion of gorges is an important process in the denudation of the highlands mass and the overall downwearing of the escarpment. As noted earlier, gorge extension results in the dissection of the relatively low-gradient upland plateau surface, increasing the areal extent of high relief areas that in turn leads to elevated basin averaged denudation rates.

Notwithstanding the above, our analysis based on the OCTOPUS database (Figure 10) also suggests that despite rivers driving the dissection of the landscape (via the headward erosion of gorges), there is a ‘speed limit’ to the overall rate of landscape lowering that is set by the rate at which rock is converted to sediment by chemical weathering [cf. Dixon & von Blanckenburg, 2012]. Laboratory studies have shown that the sediment load of a bedrock river plays an important role in the fluvial incision process and a decrease in sediment availability will lead to a deficiency in abrasion tools and therefore to a decrease in incision rates [Sklar & Dietrich, 2001; Turowski et al., 2007]. The link between a lack of tools and decreased rates of incision/denudation has been documented in several post-orogenic settings, where despite steep slopes [e.g., Scharf et al., 2013] or elevated stream power [e.g., Jansen et al., 2011; 2014], overall rates of denudation / incision are very low. As mass-wasting is not the dominant erosional process, in post-orogenic terrains the availability of sediment in rivers is ultimately controlled by chemical weathering rates [West et al., 2005]. Thus, in these settings, despite the presence of steep slopes and large knickpoints, rates of lowering are substantially slower than those recorded in similar terrains but in a tectonically active setting. Based on the above, we propose that in the context of the East Australian passive margin, while rivers drive the dissection of the landscape, the overall pace of topographic decay is capped by the rate at which the bedrock column is converted to sediment by chemical weathering. The latter provides a mechanism to explain the persistence of transience over million-year timescales and the protracted decay of topographic relief in tectonically passive settings.

6. Outlook

Our study identifies major first order controls on ^{10}Be -derived denudation rates along the entire length of the East Australian continental margin, explores differences in rates of denudation east and west of the continental divide, and places East Australian denudation rates in a global context by comparing to other high-elevation passive continental margins. We also explore sediment residence times and suggest a link between the flood variability that characterises the coastal rivers of eastern Australia and the $^{26}\text{Al}/^{10}\text{Be}$ ratios recorded in the sediment from these rivers. Our study raises a number of important questions that our data is not suitable to address, however, and we briefly discuss these here.

We posit that while the dissection of the highland mass by gorge extension is a key process in escarpment downwearing along the East Australian margin, overall rates of landscape decay are capped by the rate of chemical weathering occurring on the hillslopes. Testing this assertion, however, requires data on rates of knickpoint retreat. With the exception of a handful of data points from the Shoalhaven River [Nott et al., 1996] and Baker's Creek in the Macleay basin [Weissel & Seidl, 1998], data on knickpoint retreat rates along the East Australian continental margin are lacking. Cosmogenic ^{10}Be exposure dating of strath terraces flanking the incised channel segments downstream of knickpoints have successfully been used in the past to quantify bedrock incision and knickpoint retreat rates in both tectonically active [Burbank et al., 1996; Leland et al., 1997] and passive settings [Reusser et al., 2004, Jansen et al 2011]. Prominent knickpoints are present in several basins in the southeastern sector of the margin (e.g., Shoalhaven, Macleay, Clarence; see Figure 12) and dating of abandoned strath terraces could be combined with a more detailed sampling of the smaller tributary basins – akin to the approach employed by Godard et al. [2019] in the Bega – to obtain information on basin-wide lowering rates both upstream and downstream of the knickpoints.

Understanding the couplings between hillslopes and channels in our study area also requires information on hillslope sediment pathways and residence times. As shown above (Figure 9), on both sides of the continental divide, in most of the sediment samples, $^{26}\text{Al}/^{10}\text{Be}$ ratios are consistently lower than what is expected in a setting where sediment experience a simple and continuous exposure history. Our $^{26}\text{Al}/^{10}\text{Be}$ data inventory lacks the detail necessary to fully investigate which landscape compartments and which processes are

responsible for the depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios. Nevertheless, based on independent data from the upper Murrumbidgee basin [Suresh et al., 2014] we propose that residence times in the hillslope domain may be substantial. As demonstrated by Nichols et al. [2005], Jungers et al. [2009], and more recently by Struck et al. [2018a], quantifying sediment residence times in the hillslope domain is possible via detailed sampling of colluvium along longitudinal transects. Introducing a third cosmogenic radionuclide – namely, in-situ produced ^{14}C with a substantially shorter half-life (5730 years) – also reduces the minimum sediment residence times that can be resolved, as demonstrated by Hippe et al. [2012] in the Bolivian Altiplano and by Fülöp et al. [2020] in Australia’s Murray-Darling Basin.

Lastly, the potential impact of anthropogenic disturbance on ^{10}Be -derived denudation rates and $^{26}\text{Al}/^{10}\text{Be}$ ratios is another important issue that requires future study. Long-lived cosmogenic radionuclides such as ^{26}Al and ^{10}Be are insensitive to short-term changes in erosion rates [von Blanckenburg, 2005], and several studies have used ^{10}Be to quantify pre-anthropogenic denudation rates in landscapes affected by land degradation due to human-induced land use changes [e.g., Vanacker et al., 2007; Reusser et al., 2015]. However, the cosmogenic radionuclide inventory of river sediment stops being unaffected by anthropogenic disturbance when the latter is so grave that it results in the exposure of large quantities of deeply shielded material that subsequently get incorporated in the sediment mix exported by rivers.

European settlement of southeastern Australia circa 200 years ago has resulted in massive changes in land use, with the clearing of forests for agriculture and livestock, the drainage of valley bottoms and the clearing of riparian vegetation causing substantial increases in erosion [Cook 2019 and references therein]. Unlike in other regions where human-induced land degradation was mainly focused along cultivated hillslopes [e.g., Trimble, 1974; Montgomery, 2007], in the southeastern Australian Tablelands (and to some extent in other parts of the continental margin), post-settlement sediment fluxes were dominated by material originating from channel incision and bank erosion [Wasson et al., 1998; Olley & Wasson, 2003; Hughes et al., 2009; Portenga et al., 2017]. For example, in formerly vegetated headwater systems of the Murrumbidgee (Figure 2) extensive gully networks developed shortly after European settlement, incision leading to confinement of the flow

and an increase in sediment transport capacity [Olley & Wasson, 2003]. Channel narrowing and deepening in the upstream reaches was followed by channel widening in the lower reaches, resulting in the widespread deposition of eroded alluvium. This process created a common valley bottom stratigraphy throughout the Tablelands consisting of pre-disturbance sediments overlain by sandy post-settlement alluvium [Rustomji & Pietsch, 2007; Portenga et al., 2016]. At present, this common stratigraphy has been exposed in gully walls by further stream incision, and post-settlement alluvium is continuously reworked by the modern streams.

Post-settlement alluvium that originates from a deeply shielded source will have reduced ^{26}Al and ^{10}Be concentrations and potentially also depressed $^{26}\text{Al}/^{10}\text{Be}$ ratios if pre-disturbance rates of erosion were low (see above). Thus, the incorporation of post-settlement alluvium into the modern sediment flux may result in overestimated ^{10}Be -derived denudation rates and elevated apparent burial ages. Quantifying the effects of post-settlement alluvium reworking on the cosmogenic nuclide inventories exported from basins is possible by comparing ^{26}Al , ^{10}Be , and ^{14}C abundances and ratios between basins with varying degrees of disturbance or by employing sediment fingerprinting techniques based on meteoric ^{10}Be and bulk sediment optically stimulated luminescence (bulk OSL), that allows gully-derived sediment to be traced back to its source location [e.g., Portenga et al., 2017].

7. Conclusions

We studied the cosmogenic ^{10}Be ($n=160$) and ^{26}Al ($n=67$) inventories of sediment from drainage basin along a 3,000 km stretch of Australia's Great Dividing Range between $\approx 38^\circ\text{S}$ and $\approx 16^\circ\text{S}$ latitude. We sampled 48 drainage basins: 37 draining to the east and discharging into the Tasman and Coral Seas, and 11 draining to the west as part of the larger Murray-Darling and Lake Eyre river systems. Our main conclusions are summarised below.

^{10}Be -derived denudation rates are overall higher in basins on the eastern side of the continental divide as compared to those on the western side, reflecting differences in topography and to some extent also rainfall. In terms of absolute values, ^{10}Be -derived denudation rates range between 7.7 ± 1.9 (Mary) and 54.6 ± 13.7 mm kyr $^{-1}$ (North

Johnstone) in mainstem samples and 3.0 ± 0.7 (Burdekin) and 70.2 ± 18.9 mm kyr⁻¹ (Liverpool) in tributary samples to the east of the continental divide. The median denudation rate east of the continental divide is 15.9 mm kyr⁻¹. On the western side of the divide, denudation rates range between 4.8 ± 1.2 (Barcoo) and 15.4 ± 3.6 mm kyr⁻¹ (Maranoa) in mainstem samples, and between 4.4 ± 1.0 (Murrumbidgee) and 38.5 ± 7.8 mm kyr⁻¹ (Murray) in tributary samples. The median denudation rate west of the continental divide is 9.3 mm kyr⁻¹. The median of all (east and west) denudation rates is 14.5 mm kyr⁻¹ and 95% of denudation rates fall between 5 and 55 mm kyr⁻¹. These values are virtually identical with those calculated for a global dataset comprising all tectonically passive regions, namely, median = 12.4 mm kyr⁻¹ and 95% range of 2 to 65 mm kyr⁻¹. The similarities are also present when looking at the extreme denudation rate values: the medians of the top 10% denudation rates recorded here and in other passive margin settings are also similar, despite substantial differences in topography and precipitation between regions.

These median denudation rate values are close to the 95th percentile denudation rate for all tectonically passive basins (≈ 53 mm kyr⁻¹) and are very similar to the global silicate weathering speed limit (≈ 58 mm kyr⁻¹) calculated as the 95th percentile of global soil weathering rates. The above suggests that in post-orogenic terrain, the overall rates of topographic decay have a speed limit that is imposed by the rate of chemical weathering. Furthermore, given that tectonically quiescent terrains occupy a large proportion of the Earth's continental surface, it can be argued that the relatively low rates at which they are lowering (as compared to those in tectonically active settings), and the protracted timescales of landscape transience that these low rates imply, are the norm globally, rather than the exception. In contrast, tectonically active and / or glacially affected terrains such as Taiwan, New Zealand, Alps, Himalaya record ¹⁰Be-derived denudation rate above the global 90th percentile for tectonically active regions ($\approx 1,000$ mm kyr⁻¹), and so should be perceived as the anomaly instead.

Denudation rates along the East Australian margin correlate strongly with topographic metrics – especially at the smaller tributary basin scale – which suggests that topography exerts the main control on rates of landscape lowering in this setting. Despite lower correlation coefficients, an important link between denudation rate and rainfall is also inferred: most of the highest mainstem ¹⁰Be denudation rates all occur in basins which also

have the highest rainfall amounts and there is a strong correlation between the distance knickpoints have travelled upstream from the river mouth and basin area — a proxy for discharge, and so to some extent also a proxy for rainfall. The links between rainfall and denudation rates in the East Australian setting might be a characteristic feature of the very architecture of the continental margin. Here, the presence of a prominent escarpment seaward from the continental divide means that both orographically enhanced rainfall and stream power will be at their maximum at the escarpment zone, which promotes the dissection of the highland mass by gorge extension, and so increases the areal extent of high relief areas that in turn leads to elevated basin averaged denudation rates. To summarise the above, topographic gradient and to some extent rainfall set the pace of denudation along the East Australian margin, however, these rates are capped by the rate at which rock is converted to sediment by chemical weathering.

On both sides of the divide, in all but a few of the samples, $^{26}\text{Al}/^{10}\text{Be}$ ratios are consistently lower than what is expected in a setting where sediment experience a simple and continuous exposure history. Further, east of the continental divide, the lowest $^{26}\text{Al}/^{10}\text{Be}$ ratios are found in basins that also experience increased flood variability, and we propose that there is a causal link between the hydrological variability that characterises the rivers draining the eastern seaboard of Australia and the non-steady state $^{26}\text{Al}/^{10}\text{Be}$ ratios that we observe in the sediment from these rivers. We posit that sediment residence times in the hillslope domain and the upper reaches of the fluvial network are responsible for the bulk of cosmogenic radionuclide decay, and the periodic stripping of vertically accreted floodplains by large floods means that deeper and potentially older material are periodically incorporated into the sediment mix transported by the modern river. Our study adds to a growing body of recent works that document $^{26}\text{Al}/^{10}\text{Be}$ ratios in tectonically quiescent settings inconsistent with a simple and continuous exposure scenario, suggesting that in these settings non-steady state $^{26}\text{Al}/^{10}\text{Be}$ ratios may be the rule rather than the exception, and sediment pathways from source to sink are complex and transit times protracted. The later has important implications on how we interpret signals of source-area geomorphology from sediment deposited on the shelves of passive continental margins.

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Data Availability

Data are archived in the supplementary materials. Cosmogenic radionuclide and geospatial data will also be made available via the OCTOPUS database [Codilean et al., 2018].

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Supplementary Material for:

Controls on denudation along the East Australian continental margin

A.T. Codilean^{(1,2)*}, R.-H. Fülöp^(1,3), H. Munack^(1,2), K.M. Wilcken⁽³⁾, T.J. Cohen^(1,2), D.H. Rood⁽⁴⁾,
D. Fink⁽³⁾, R. Bartley⁽⁵⁾, J. Croke⁽⁶⁾, L.K. Fifield⁽⁷⁾

(1) School of Earth, Atmospheric and Life Sciences, University of Wollongong, Wollongong, NSW 2522, Australia

*(2) ARC Centre of Excellence for Australian Biodiversity and Heritage (CABAH), University of Wollongong,
Wollongong, NSW 2522, Australia*

(3) Australia's Nuclear Science and Technology Organisation (ANSTO), Lucas Heights, NSW 2234, Australia

(4) Department of Earth Science and Engineering, Imperial College London, London SW7 2AZ, UK

(5) CSIRO Land and Water, GPO Box 2583, Brisbane, QLD 4001, Australia

(6) School of Geography, University College Dublin, Dublin 4, Ireland

(7) Research School of Physical Sciences and Engineering, The Australian National University, ACT 0200, Australia

* Corresponding author: codilean@uow.edu.au; +61 2 4221 3426

Figure S1: Maps showing the distribution of major rock types (A) and mean annual rainfall (B) along eastern Australia. Black outlines depict the basins sampled in this study. Geology data is based on the Geoscience Australia 1:2.5 million scale Surface Geology of Australia digital dataset (doi: 10.26186/5c636e559cbe1). Rainfall data is from the Australian Bureau of Meteorology (BOM) and is based on standard 30-year climatology (1961 - 1990).

Figure S2: Mean rainfall values predicted for the mainstem basins analysed in this study for the Mid Holocene, Last Glacial Maximum, and the last inter-glacial, respectively, vs. modern rainfall values from the WorldClim v.2.1 database. Dashed diagonal line represents the 1:1 line. Abbreviations identify the various models and simulations used to produce the data. Raw data from the WorldClim downscaled paleoclimate database (<http://www.worldclim.com/paleo-climate1>; accessed 01 Sept 2020). See main text for details and further references.

Table S1: Sample inventory

#	Sample ID	Original Sample ID	10Be AMS ID	26Al AMS ID	WGS84 Latitude*	WGS84 Longitude*	Drainage direction	Mainstem (Y/N)	Basin Name	River Name	Basin area (km2)	Basin # in Fig. 2	Source of data**
1	MTC	-	BE258	AL526	-37.726926	147.386770	East	Yes	Mitchell	Mitchell River	3890.4	1	<i>This study</i>
2	TMB	-	BE255	AL523	-37.765914	147.844059	East	Yes	Tambo	Tambo River	2777.6	2	<i>This study</i>
3	SNW	-	BE256	AL524	-37.716761	148.404615	East	Yes	Snowy	Snowy River	13602.3	3	<i>This study</i>
4	SNW-CP	<i>SnwCP</i>	B6106	AL471	-36.432217	148.319440	East	No	Snowy	Snowy River	20.7	3	<i>Fulop-etal-2020</i>
5	SNW-GTG	<i>GTG</i>	B5980	AL551	-36.372770	148.367856	East	No	Snowy	Guthega River	5.8	3	<i>Fulop-etal-2020</i>
6	SNW-MK	<i>SnwMK</i>	B6112	A2743	-36.454639	148.270208	East	No	Snowy	Snowy River	0.1	3	<i>Fulop-etal-2020</i>
7	SNW-PPC	<i>PPC</i>	B6113	AL476	-36.392752	148.434798	East	No	Snowy	Pipers Creek	3.7	3	<i>Fulop-etal-2020</i>
8	SNW-SPC	<i>SPC</i>	B6107	AL472	-36.427751	148.355781	East	No	Snowy	Spencers Creek	20.3	3	<i>Fulop-etal-2020</i>
9	CNN	-	BE265	AL530	-37.565770	149.147166	East	Yes	Cann	Cann River	649.3	4	<i>This study</i>
10	GNA	-	BE263	AL528	-37.473869	149.592333	East	Yes	Genoa	Genoa River	933.4	5	<i>This study</i>
11	BGA	-	BE314	AL549	-36.671085	149.858073	East	Yes	Bega	Bega River	1813.5	6	<i>This study</i>
12	BGA-BG05	<i>BG5</i>	-	-	-36.700183	149.815510	East	No	Bega	Spring Creek	14.7	6	<i>Godard-etal-2019</i>
13	BGA-BG08	<i>BG8</i>	-	-	-36.706144	149.733142	East	No	Bega	-	5.0	6	<i>Godard-etal-2019</i>
14	BGA-BG09	<i>BG9</i>	-	-	-36.734431	149.807368	East	No	Bega	Wolumla Creek	131.1	6	<i>Godard-etal-2019</i>
15	BGA-BG10	<i>BG10</i>	-	-	-36.739942	149.765228	East	No	Bega	Tylers Creek	15.1	6	<i>Godard-etal-2019</i>
16	BGA-BG14	<i>BG14</i>	-	-	-36.736836	149.704328	East	No	Bega	Candelo Creek	113.9	6	<i>Godard-etal-2019</i>
17	BGA-BG15	<i>BG15</i>	-	-	-36.735501	149.703089	East	No	Bega	Tantawangato Creek	206.3	6	<i>Godard-etal-2019</i>
18	BGA-BG16	<i>BG16</i>	-	-	-36.709116	149.685899	East	No	Bega	Sandy Creek	92.4	6	<i>Godard-etal-2019</i>
19	BGA-BG17	<i>BG17</i>	-	-	-36.635275	149.577433	East	No	Bega	Colombo Creek	50.7	6	<i>Godard-etal-2019</i>
20	BGA-BG21	<i>BG21</i>	-	-	-36.634789	149.601110	East	No	Bega	Polacks Flat Creek	28.4	6	<i>Godard-etal-2019</i>
21	BGA-BG22	<i>BG22</i>	-	-	-36.642291	149.615126	East	No	Bega	-	11.2	6	<i>Godard-etal-2019</i>
22	BGA-BG23	<i>BG23</i>	-	-	-36.605220	149.579351	East	No	Bega	Brown Mountain Creek	35.0	6	<i>Godard-etal-2019</i>
23	BGA-BG25	<i>BG25</i>	-	-	-36.613343	149.502483	East	No	Bega	Nunnock River	29.1	6	<i>Godard-etal-2019</i>
24	BGA-BG26	<i>BG26</i>	-	-	-36.598503	149.475485	East	No	Bega	Rutherford Creek	25.3	6	<i>Godard-etal-2019</i>
25	BGA-BG27	<i>BG27</i>	-	-	-36.597081	149.477811	East	No	Bega	Bemboka River	52.5	6	<i>Godard-etal-2019</i>
26	TRS	-	BE254	AL522	-36.097887	150.023022	East	Yes	Tuross	Tuross River	1663.0	7	<i>This study</i>
27	MOR	-	BE315	AL550	-35.906751	150.036042	East	Yes	Moruya	Moruya River	1334.3	8	<i>This study</i>
28	CLY	-	BE313	AL548	-35.649292	150.142518	East	Yes	Clyde	Clyde River	1402.5	9	<i>This study</i>
29	SHL	-	BE257	AL525	-34.872128	150.464640	East	Yes	Shoalhaven	Shoalhaven River	6510.6	10	<i>This study</i>
30	MQR	-	BE1132	XAL0097	-34.575179	150.705211	East	Yes	Illawarra	Macquarie Rivulet	35.0	11	<i>This study</i>
31	HWK-001	<i>S040WTS001</i>	-	-	-33.414455	150.162123	East	No	Hawkesbury	Marrangaroo Creek	13.9	-	<i>OCTOPUS [Tomkins-etal-2007]</i>
32	HWK-002	<i>S040WTS002</i>	-	-	-33.416644	150.161890	East	No	Hawkesbury	Marra Creek	1.1	-	<i>OCTOPUS [Tomkins-etal-2007]</i>
33	COL	-	BE1125	XAL0090	-33.413620	150.735696	East	Yes	Colo	Colo River	4344.8	12	<i>This study</i>
34	MCD	-	BE1126	XAL0091	-33.292206	150.969689	East	Yes	Macdonald	Macdonald River	1742.4	13	<i>This study</i>
35	HNT	-	BE1129	XAL0094	-32.684630	151.434497	East	Yes	Hunter	Hunter River	17829.7	14	<i>This study</i>
36	HNT-SNGT	-	BE1128	XAL0093	-32.564397	151.156903	East	No	Hunter	Hunter River	16469.2	14	<i>This study</i>
37	HNT-WLL	-	BE1127	XAL0092	-32.650987	151.021580	East	No	Hunter	Wollombi Brook	1679.8	14	<i>This study</i>
38	MAN	-	BE1130	XAL0095	-31.904934	152.232931	East	Yes	Manning	Manning River	6427.6	15	<i>This study</i>
39	HAS	-	BE1131	XAL0096	-31.435706	152.495767	East	Yes	Hastings	Hastings River	1656.8	16	<i>This study</i>
40	MCL	-	BE1133	XAL0098	-31.059177	152.731275	East	Yes	Macleay	Macleay River	10251.7	17	<i>This study</i>
41	BLG	-	BE1134	XAL0099	-30.449917	152.899999	East	Yes	Bellinger	Bellinger River	666.1	18	<i>This study</i>
42	CLA	-	BE1135	XAL0100	-29.591553	152.783176	East	Yes	Clarence	Clarence River	17361.3	19	<i>This study</i>

#	Sample ID	Original Sample ID			WGS84 Latitude*	WGS84 Longitude*	Drainage direction	Mainstem (Y/N)	Basin Name	River Name	Basin area (km2)	Basin # in Fig. 2	Source of data
43	LGN	-	BE859	AL956	-28.070440	152.927325	East	Yes	Logan	Logan River	1275.6	20	This study
44	BRM	-	BE854	AL951	-27.603340	152.695786	East	Yes	Bremer	Bremer River	639.2	21	This study
45	LOC	-	BE863	AL961	-27.442009	152.510677	East	Yes	Lockyer	Lockyer River	2554.0	22	This study
46	LOC-15MC	-	BE866	AL964	-27.453136	152.099027	East	No	Lockyer	15 Mile Creek	57.7	22	This study
47	LOC-FSC	-	BE870	AL968	-27.618556	152.112158	East	No	Lockyer	Flagstone Creek	130.4	22	This study
48	LOC-LC	-	BE868	AL966	-27.671179	152.370465	East	No	Lockyer	Laidley Creek	209.5	22	This study
49	LOC-MC	-	BE864	AL962	-27.476155	152.091619	East	No	Lockyer	Murphys Creek	163.9	22	This study
50	LOC-PC	-	BE857	AL954	-27.452941	152.104180	East	No	Lockyer	Paradise Creek	26.4	22	This study
51	LOC-SCS	-	BE861	AL959	-27.526645	152.127289	East	No	Lockyer	Sheep Station Creek	10.4	22	This study
52	LOC-TH	-	BE862	AL960	-27.634988	152.214855	East	No	Lockyer	Tenthill Creek	452.9	22	This study
53	BRS	-	BE867	AL965	-27.038857	152.402685	East	Yes	Brisbane	Brisbane River	3913.9	23	This study
54	BRS-CC	-	BE858	AL955	-26.746123	152.216594	East	No	Brisbane	Cooyar Creek	1059.5	23	This study
55	BRS-UP	-	BE856	AL953	-26.737623	152.208995	East	No	Brisbane	Brisbane River	443.7	23	This study
56	STN	-	BE860	AL958	-26.919448	152.776909	East	Yes	Stanley	Stanley River	200.5	24	This study
57	MAR	C_MAR_01 / GBR01	XBE0354	-	-25.732337	152.526789	East	Yes	Mary	Mary River	6941.8	25	Mariotti-etal-2020; 2021
58	MAR-CNDL	-	BE855	AL952	-26.728608	152.713976	East	No	Mary	Mary River	111.7	25	This study
59	MAR-KNW	-	BE869	AL967	-26.599829	152.728587	East	No	Mary	Mary River	524.5	25	This study
60	MAR-OB	-	BE865	AL963	-26.597152	152.740456	East	No	Mary	Obi Obi Creek	197.4	25	This study
61	BUR	C_BUR_OUT / GBR05	XBE0369	-	-24.976151	152.178399	East	Yes	Burnett	Burnett River	32983.7	26	Mariotti-etal-2020; 2021
62	BUR-EID	C_BUR_01 / GBR04	XBE0357	-	-25.377622	151.083955	East	No	Burnett	Burnett River	7103.3	26	Mariotti-etal-2020; 2021
63	BUR-GYD	C_BUR_03 / GBR02	XBE0355	-	-25.537657	151.657451	East	No	Burnett	Burnett River	29553.9	26	Mariotti-etal-2020; 2021
64	BUR-MBR	C_BUR_02 / GBR03	XBE0356	-	-25.595904	151.336898	East	No	Burnett	Burnett River	21916.1	26	Mariotti-etal-2020; 2021
65	FTZ	GBR06	XBE0370	-	-23.387379	150.524986	East	Yes	Fitzroy	Fitzroy River	139282.0	27	This study
66	FTZ-CMT	F_MAC_03	-	-	-23.606396	148.524351	East	No	Fitzroy	Comet River	16438.6	27	Mariotti-etal-2020; 2021 & this study
67	FTZ-CNR	F_ISS_01	-	-	-22.420949	148.982869	East	No	Fitzroy	Connors River	9528.6	27	Mariotti-etal-2020; 2021 & this study
68	FTZ-DON	F_FIT_03	-	-	-24.100007	150.114362	East	No	Fitzroy	Don River	6825.3	27	Mariotti-etal-2020; 2021 & this study
69	FTZ-EBW	F_FIT_OUT	-	-	-23.091483	150.118376	East	No	Fitzroy	Fitzroy River	135775.2	27	Mariotti-etal-2020; 2021 & this study
70	FTZ-ISC-IS	F_ISS_02	-	-	-22.264512	148.456113	East	No	Fitzroy	Isaac River	4245.7	27	Mariotti-etal-2020; 2021 & this study
71	FTZ-ISC-MDR	F_ISS_04	-	-	-22.706985	149.196588	East	No	Fitzroy	Isaac River	21197.5	27	Mariotti-etal-2020; 2021 & this study
72	FTZ-MKZ-B	F_MAC_06	-	-	-23.075621	149.032457	East	No	Fitzroy	Mackenzie River	50767.9	27	Mariotti-etal-2020; 2021 & this study
73	FTZ-MKZ-DS	F_MAC_07	-	-	-23.303437	149.516213	East	No	Fitzroy	Mackenzie River	76711.1	27	Mariotti-etal-2020; 2021 & this study
74	FTZ-NGA	F_MAC_04	-	-	-23.531980	148.167051	East	No	Fitzroy	Nogoa River	16505.7	27	Mariotti-etal-2020; 2021 & this study
75	FTZ-TRS	F_MAC_05	-	-	-23.435131	148.147999	East	No	Fitzroy	Theresa Creek	8405.9	27	Mariotti-etal-2020; 2021 & this study
76	PLA	C_PLA_01 / GBR07	XBE0371	-	-21.286210	149.013281	East	Yes	Plane Creek	Sandy Creek	340.1	28	Mariotti-etal-2020; 2021
77	PIO	C_PIO_03 / GBR11	XBE0375	-	-21.144957	148.952513	East	Yes	Pioneer	Pioneer River	1364.3	29	Mariotti-etal-2020; 2021
78	PIO-BMSF	C_PIO_02 / GBR08	XBE0372	-	-21.309097	148.836884	East	No	Pioneer	Pioneer River	511.1	29	Mariotti-etal-2020; 2021
79	PIO-DWN	C_PIO_01 / GBR09	XBE0373	-	-21.178661	148.744537	East	No	Pioneer	Cattle Creek	331.3	29	Mariotti-etal-2020; 2021
80	PIO-UP	GBR10	XBE0374	-	-21.155959	148.733870	East	No	Pioneer	Cattle Creek	313.8	29	This study
81	OCL	C_CON_03 / GBR13	XBE0377	-	-20.563718	148.612899	East	Yes	O'Connell	O'Connell River	828.0	30	Mariotti-etal-2020; 2021
82	OCL-NRL	C_CON_02 / GBR12	XBE0376	-	-20.652996	148.572063	East	No	O'Connell	O'Connell River	342.8	30	Mariotti-etal-2020; 2021
83	OCL-SCK	C_CON_01 / GBR15	XBE0379	-	-20.572238	148.478294	East	No	O'Connell	Andromache River	246.7	30	Mariotti-etal-2020; 2021
84	BDK	S162WTS022	-	-	-19.900413	147.227308	East	Yes	Burdekin	Burdekin River	132320.0	31	OCTOPUS [Croke-etal-2015]

#	Sample ID	Original Sample ID			WGS84 Latitude*	WGS84 Longitude*	Drainage direction	Mainstem (Y/N)	Basin Name	River Name	Basin area (km2)	Basin # in Fig. 2	Source of data
85	BDK-001	S162WTS001	-	-	-19.892866	146.522246	East	No	Burdekin	Weany Creek	3.7	31	OCTOPUS [Croke-etal-2015]
86	BDK-002	S162WTS002	-	-	-19.889613	146.522567	East	No	Burdekin	Weany Creek	5.4	31	OCTOPUS [Croke-etal-2015]
87	BDK-003	S162WTS003	-	-	-19.913134	146.495265	East	No	Burdekin	Weany Creek	13.5	31	OCTOPUS [Croke-etal-2015]
88	BDK-004	S162WTS004	-	-	-19.917922	146.495536	East	No	Burdekin	Weany Creek	28.3	31	OCTOPUS [Croke-etal-2015]
89	BDK-005	S162WTS005	-	-	-19.720985	146.427741	East	No	Burdekin	Stockyard Creek	38.3	31	OCTOPUS [Croke-etal-2015]
90	BDK-006	S162WTS006	-	-	-19.923931	146.484056	East	No	Burdekin	Weany Creek	45.3	31	OCTOPUS [Croke-etal-2015]
91	BDK-007	S162WTS007	-	-	-19.650708	146.495237	East	No	Burdekin	Fanning River (East)	121.0	31	OCTOPUS [Croke-etal-2015]
92	BDK-008	S162WTS008	-	-	-19.901988	146.489573	East	No	Burdekin	Station Creek	152.2	31	OCTOPUS [Croke-etal-2015]
93	BDK-009	S162WTS009	-	-	-19.637048	146.454080	East	No	Burdekin	Fanning River (West)	209.0	31	OCTOPUS [Croke-etal-2015]
94	BDK-010	S162WTS010	-	-	-19.732942	146.429132	East	No	Burdekin	Fanning River	540.3	31	OCTOPUS [Croke-etal-2015]
95	BDK-011	S162WTS011	-	-	-19.903212	146.484701	East	No	Burdekin	Fanning River	765.1	31	OCTOPUS [Croke-etal-2015]
96	BDK-012	S162WTS012	-	-	-19.923255	146.480040	East	No	Burdekin	Fanning River	926.0	31	OCTOPUS [Croke-etal-2015]
97	BDK-013	S162WTS013	-	-	-19.979676	146.450331	East	No	Burdekin	Fanning River	1094.6	31	OCTOPUS [Croke-etal-2015]
98	BDK-014	S162WTS014	-	-	-19.986391	146.429045	East	No	Burdekin	Burdekin River	35087.8	31	OCTOPUS [Croke-etal-2015]
99	BDK-015	S162WTS015	-	-	-20.000517	146.437059	East	No	Burdekin	Burdekin River	36201.3	31	OCTOPUS [Croke-etal-2015]
100	BDK-016	S162WTS016	-	-	-20.265565	146.862421	East	No	Burdekin	Burdekin River	39360.1	31	OCTOPUS [Croke-etal-2015]
101	BDK-017	S162WTS017	-	-	-20.531032	147.557435	East	No	Burdekin	Bowen River	8217.8	31	OCTOPUS [Croke-etal-2015]
102	BDK-018	S162WTS018	-	-	-21.528108	147.044350	East	No	Burdekin	Suttor River	10854.8	31	OCTOPUS [Croke-etal-2015]
103	BDK-019	S162WTS019	-	-	-20.997235	146.421720	East	No	Burdekin	Cape River	16121.2	31	OCTOPUS [Croke-etal-2015]
104	BDK-020	S162WTS020	-	-	-21.523292	146.869674	East	No	Burdekin	Belyando River	38076.9	31	OCTOPUS [Croke-etal-2015]
105	BDK-021	S162WTS021	-	-	-21.236715	146.929772	East	No	Burdekin	Suttor River	52988.0	31	OCTOPUS [Croke-etal-2015]
106	TUL	W_TUL_03	-	-	-18.001844	145.929610	East	Yes	Tully	Tully River	1362.0	32	Mariotti-etal-2020; 2021
107	TUL-DP	W_TUL_02	-	-	-17.895959	145.765826	East	No	Tully	Tully River	667.7	32	Mariotti-etal-2020; 2021
108	TUL-GR	W_TUL_01	-	-	-17.771847	145.650381	East	No	Tully	Tully River	481.9	32	Mariotti-etal-2020; 2021
109	LVP	W_LIV_02	-	-	-17.704058	146.073079	East	Yes	Liverpool	Liverpool Creek	286.4	33	Mariotti-etal-2020; 2021
110	LVP-UP	W_LIV_01	-	-	-17.712532	145.876935	East	No	Liverpool	Liverpool Creek	50.9	33	Mariotti-etal-2020; 2021
111	SJN	W_SJO_02	-	-	-17.547774	146.027951	East	Yes	South Johnstone	South Johnstone River	503.1	34	Mariotti-etal-2020; 2021
112	SJN-UP	W_SJO_01	-	-	-17.588287	145.913807	East	No	South Johnstone	South Johnstone River	331.6	34	Mariotti-etal-2020; 2021
113	NJN	W_NJO_03	-	-	-17.506009	145.992013	East	Yes	North Johnstone	North Johnstone River	959.5	35	Mariotti-etal-2020; 2021
114	NJN-MD	W_NJO_02	-	-	-17.539137	145.949710	East	No	North Johnstone	North Johnstone River	932.8	35	Mariotti-etal-2020; 2021
115	NJN-UP	W_NJO_01	-	-	-17.522643	145.860257	East	No	North Johnstone	North Johnstone River	811.2	35	Mariotti-etal-2020; 2021
116	BRR	S132WTS005	-	-	-16.852750	145.649198	East	Yes	Barron	Barron River	1993.1	36	OCTOPUS [Nichols-etal-2014]
117	BRR-001	S132WTS001	-	-	-16.821484	145.635622	East	No	Barron	Jumrum Creek	6.5	36	OCTOPUS [Nichols-etal-2014]
118	BRR-002	S132WTS002	-	-	-16.821484	145.635622	East	No	Barron	Jumrum Creek	6.5	36	OCTOPUS [Nichols-etal-2014]
119	BRR-007	S132WTS007	-	-	-16.903345	145.556180	East	No	Barron	Clohesy River	83.0	36	OCTOPUS [Nichols-etal-2014]
120	BRR-008	S132WTS008	-	-	-16.901427	145.550856	East	No	Barron	Davies Creek	134.7	36	OCTOPUS [Nichols-etal-2014]
121	BRR-009	S132WTS009	-	-	-16.823569	145.512865	East	No	Barron	Clohesy River	287.7	36	OCTOPUS [Nichols-etal-2014]
122	BRR-010	S132WTS010	-	-	-16.823569	145.512865	East	No	Barron	Clohesy River	287.7	36	OCTOPUS [Nichols-etal-2014]
123	BRR-011	S132WTS011	-	-	-16.801241	145.610432	East	No	Barron	Barron River	1933.2	36	OCTOPUS [Nichols-etal-2014]
124	BRR-012	S132WTS012	-	-	-16.793601	145.643428	East	No	Barron	-	4.1	36	OCTOPUS [Nichols-etal-2014]
125	BRR-013	S132WTS013	-	-	-16.827573	145.653595	East	No	Barron	Streets Creek	1.8	36	OCTOPUS [Nichols-etal-2014]
126	BRR-ESC	S132WTS003	-	-	-16.963277	145.677139	East	Yes	Barron (Escarpment)	Freshwater Creek	55.6	36	OCTOPUS [Nichols-etal-2014]

#	Sample ID	Original Sample ID			WGS84 Latitude*	WGS84 Longitude*	Drainage direction	Mainstem (Y/N)	Basin Name	River Name	Basin area (km2)	Basin # in Fig. 2	Source of data
127	BRR-ESC-004	S132WTS004	-	-	-16.946816	145.688796	East	No	Barron (Escarpment)	-	0.6	36	OCTOPUS [Nichols-etal-2014]
128	BRR-ESC-006	S132WTS006	-	-	-16.872146	145.672432	East	No	Barron (Escarpment)	Stony Creek	11.2	36	OCTOPUS [Nichols-etal-2014]
129	BRR-ESC-014	S132WTS014	-	-	-16.832079	145.681154	East	No	Barron (Escarpment)	-	1.7	36	OCTOPUS [Nichols-etal-2014]
130	BRR-ESC-015	S132WTS015	-	-	-16.816359	145.682155	East	No	Barron (Escarpment)	-	1.4	36	OCTOPUS [Nichols-etal-2014]
131	DAI	W_DAI_01	-	-	-16.220093	145.296918	East	Yes	Daintree	Daintree River	969.0	37	Mariotti-etal-2020; 2021
132	MRY-AW	MryAW	B6111	A2742	-36.488028	148.124730	West	No	Murray	Murray River	989.8	1	Fulop-etal-2020
133	MRY-BGC	BGC	B6048	-	-36.356170	148.203397	West	No	Murray	Bogong Creek	90.5	1	Fulop-etal-2020
134	MRY-SWP	SWP	B6110	AL475	-36.386603	148.181467	West	No	Murray	Swampy Plain	373.2	1	Fulop-etal-2020
135	BGA-BG28	BG28	-	-	-36.487867	149.357789	West	No	Murrumbidgee	-	10.6	2	Godard-etal-2019
136	BGA-BG29	BG29	-	-	-36.398795	149.406254	West	No	Murrumbidgee	Kydra Creek	17.5	2	Godard-etal-2019
137	BGA-BG30	BG30	-	-	-36.362469	149.422174	West	No	Murrumbidgee	Kybeyan River	60.8	2	Godard-etal-2019
138	BGA-BG31	BG31	-	-	-36.459945	149.381051	West	No	Murrumbidgee	Numeralla River	74.5	2	Godard-etal-2019
139	MBG	MbgG	BE316	AL552	-35.075430	148.086243	West	Yes	Murrumbidgee	Murrumbidgee River	22352.3	2	Fulop-etal-2020
140	MBG-LP1	MbgLP-1	B6108	AL473	-35.620119	148.581142	West	No	Murrumbidgee	Murrumbidgee River	20.1	2	Fulop-etal-2020
141	MBG-LP2	MbgLP-2	B6109	AL474	-35.697169	148.550183	West	No	Murrumbidgee	Murrumbidgee River	96.1	2	Fulop-etal-2020
142	MBG-TLB01	TLB-01	-	-	-35.064750	149.210210	West	No	Murrumbidgee	Spring Flat Creek	36.5	2	Portenga-etal-2016
143	MBG-TLB03	TLB-03	-	-	-34.890952	149.452042	West	No	Murrumbidgee	Collector Creek	88.5	2	Portenga-etal-2016
144	MBG-TLB04	TLB-04	-	-	-35.371974	149.255854	West	No	Murrumbidgee	Deep Creek	16.3	2	Portenga-etal-2016
145	MBG-TLB07	TLB-07	-	-	-35.321209	149.561977	West	No	Murrumbidgee	Meehans Creek	11.8	2	Portenga-etal-2016
146	MBG-TLB08	TLB-08	-	-	-35.431627	149.186820	West	No	Murrumbidgee	Four Mile Creek	5.4	2	Portenga-etal-2016
147	MBG-TLB09	TLB-09	-	-	-35.534708	149.299785	West	No	Murrumbidgee	Urialla Creek	37.4	2	Portenga-etal-2016
148	MBG-TLB11	TLB-11	-	-	-35.459997	149.507871	West	No	Murrumbidgee	Yandyguinula Creek	21.9	2	Portenga-etal-2016
149	LCH	LchR	BE1114	XAL0079	-34.210649	149.068484	West	Yes	Lachlan	Lachlan River	3301.5	3	Fulop-etal-2020
150	LCH-TLB05	TLB-05	-	-	-34.638934	149.374244	West	No	Lachlan	Humes Creek	53.1	3	Portenga-etal-2016
151	LCH-TLB10	TLB-10	-	-	-34.453429	149.276241	West	No	Lachlan	Wheeo Creek	79.2	3	Portenga-etal-2016
152	MCQ	McqD	BE1116	XAL0081	-32.205317	148.616071	West	Yes	Macquarie	Macquarie River	19702.9	4	Fulop-etal-2020
153	GWY	GwyB	XBE0516	XAL0139	-29.861823	150.579059	West	Yes	Gwydir	Gwydir River	6431.2	5	Fulop-etal-2020
154	MCN	McnB	BE1115	XAL0080	-28.574358	150.342852	West	Yes	Macintyre	Macintyre River	22779.4	6	Fulop-etal-2020
155	BLN	Blng	BE1106	XAL0075	-27.654310	148.735981	West	Yes	Balonne	Balonne River	55189.1	7	Fulop-etal-2020
156	MRN	MrnM	BE1117	XAL0082	-26.483191	147.978880	West	Yes	Maranoa	Maranoa River	11650.4	8	Fulop-etal-2020
157	WRG	WrgD	BE1123	XAL0088	-26.842581	146.037127	West	Yes	Warrego	Warrego River	39983.4	9	Fulop-etal-2020
158	BCO	BW1	B6017	A2710	-25.178388	143.269531	West	Yes	Barcoo	Barcoo River	52047.6	10	Eccleshall-2019
159	BCO-RC	BR2	B5745	A2592	-24.398897	145.114660	West	No	Barcoo	Ravensbourne Creek	4033.6	10	Eccleshall-2019
160	TMS	WD-FS1	B5757	A2597	-25.651333	142.644851	West	Yes	Thomson	Thomson River	148269.0	11	Eccleshall-2019

* Latitude and longitude as derived from a 30m SRTM DEM and may differ from originally published sample GPS coordinates.

** Mariotti-etal-2020: Mariotti A., Croke J., Bartley R., Kelley S.E., Fifield L.K., Fülöp R.-H., Codilean A.T., Austin J.M., 2020, Controlling variables of denudation across catchments draining to the Great Barrier Reef, AGU Fall Meeting, EP036-0002.

** Mariotti-etal-2021: Mariotti A., Croke J., Bartley R., Kelley S.E., Ward J.A., Fülöp R.-H., Caklais A.H., Road D.H., Codilean A.T., Wilcken K.M., Fifield L.K., 2021, Pre-development erosion rates for the Great Barrier Reef catchments derived using 10Be, Marine Pollution Bulletin, manuscript in review.

Table S2: Summary of ¹⁰Be and ²⁶Al data for samples analysed at ANSTO

#	Sample ID	Total Qtz (g)	Blank corrected 10Be/9Be (1e-15)	Blank corrected d[10Be/9Be]	Blank 10Be/9Be (1e-15)	9Be Spike (µg)	10Be SRM-4325 (atoms.g-1)	d[10Be]	Blank corrected 26Al/27Al (1e-15)	Blank corrected d[26Al/27Al]	Blank 26Al/27Al (1e-15)	27Al native (µg)	26Al KNSTD (atoms.g-1)	d[26Al]	Al/Be
1	MTC	20.175	567.66	14.86	2.591 ± 0.454	236.1	443845	12440	341.08	13.55	0.853 ± 0.603	5869.30	2214680	124870	4.99
2	TMB	20.225	411.81	11.53	2.591 ± 0.454	237.2	322703	9592	285.68	12.49	0.853 ± 0.603	5679.40	1790504	106123	5.55
3	SNW	20.625	682.30	17.10	2.591 ± 0.454	237.1	524107	14140	792.79	21.10	0.853 ± 0.603	3625.56	3110454	149440	5.93
4	CNN	20.400	389.68	10.23	2.591 ± 0.454	236.9	302347	8496	608.69	18.17	0.853 ± 0.603	2679.80	1784650	89073	5.90
5	GNA	20.228	434.15	11.39	2.591 ± 0.454	236.2	338796	9516	591.30	16.43	0.853 ± 0.603	3379.00	2204585	107374	6.51
6	BGA	20.451	216.83	6.82	1.773 ± 0.459	247.2	175165	5783	307.26	12.95	1.036 ± 0.733	3202.41	1073889	62401	6.13
7	TRS	20.092	173.86	5.10	2.591 ± 0.454	236.9	136957	4242	261.03	9.94	0.853 ± 0.603	3249.58	942270	52043	6.88
8	MOR	20.236	206.43	6.46	1.773 ± 0.459	248.0	169037	5557	260.61	12.68	1.036 ± 0.733	3713.87	1067546	67244	6.32
9	CLY	20.181	207.63	6.47	1.773 ± 0.459	248.0	170483	5577	237.41	18.61	1.036 ± 0.733	4495.83	1180483	103905	6.92
10	SHL	20.429	259.83	6.97	2.591 ± 0.454	235.3	199942	5721	256.68	10.11	0.853 ± 0.603	4490.06	1259152	70679	6.30
11	MQR	21.192	99.47	2.70	0.464 ± 0.115	289.7	90845	2625	139.31	8.83	1.650 ± 1.115	3631.67	532849	39946	5.87
12	COL	20.130	184.54	4.35	0.464 ± 0.115	289.2	177141	4532	348.74	18.09	1.650 ± 1.115	3057.75	1182380	77462	6.67
13	MCD	20.013	149.84	3.77	0.464 ± 0.115	288.8	144487	3910	327.47	21.98	1.650 ± 1.115	2410.23	880246	68775	6.09
14	HNT	20.006	172.54	4.91	0.464 ± 0.115	289.4	166775	5027	297.55	14.93	1.650 ± 1.115	3050.74	1012726	64990	6.07
15	HNT-SNGT	22.006	179.84	4.56	0.464 ± 0.115	289.3	157972	4309	291.39	18.95	1.650 ± 1.115	3089.57	913099	69723	5.78
16	HNT-WLL	20.541	150.64	3.80	0.464 ± 0.115	288.7	141489	3837	267.48	14.80	1.650 ± 1.115	2765.22	803707	54878	5.68
17	MAN	20.021	190.84	4.64	0.464 ± 0.115	289.2	184196	4844	495.43	22.55	1.650 ± 1.115	2217.55	1224808	74212	6.65
18	HAS	20.454	176.74	4.46	0.464 ± 0.115	289.3	167036	4535	467.54	27.87	1.650 ± 1.115	2270.81	1158560	83174	6.94
19	MCL	20.052	105.54	2.98	0.464 ± 0.115	289.4	101772	3044	242.81	13.45	1.650 ± 1.115	2345.06	633798	43297	6.23
20	BLG	20.039	78.95	2.26	0.464 ± 0.115	289.4	76181	2306	168.20	10.81	1.650 ± 1.115	2737.40	512832	38815	6.73
21	CLA	20.330	157.94	4.16	0.464 ± 0.115	289.6	150324	4231	293.07	38.07	1.650 ± 1.115	2972.91	956538	130001	6.36
22	LGN	30.127	198.42	5.88	0.483 ± 0.165	264.8	116551	3643	174.65	9.41	4.737 ± 3.295	5048.61	653248	43826	5.60
23	BRM	30.142	464.92	14.75	0.483 ± 0.165	263.3	271423	9029	411.42	12.83	4.737 ± 3.295	4571.28	1392644	70635	5.13
24	LOC	30.217	357.12	10.18	0.483 ± 0.165	266.3	210315	6354	420.86	13.39	4.737 ± 3.295	3617.75	1124658	57484	5.35
25	LOC-15MC	30.189	208.12	6.33	0.483 ± 0.165	269.2	124008	3969	219.32	10.02	4.737 ± 3.295	4796.41	777746	47217	6.27
26	LOC-FSC	30.023	196.12	6.06	0.483 ± 0.165	269.5	117641	3819	203.56	9.59	4.737 ± 3.295	4940.32	747628	46199	6.36
27	LOC-LC	30.217	234.42	7.06	0.483 ± 0.165	269.1	139507	4426	192.12	10.89	4.737 ± 3.295	5261.49	746658	51801	5.35
28	LOC-MC	30.224	369.82	10.78	0.483 ± 0.165	261.9	214130	6600	357.37	12.13	4.737 ± 3.295	4591.34	1211700	63558	5.66
29	LOC-PC	30.338	386.22	11.62	0.483 ± 0.165	261.3	222322	7049	374.34	14.56	4.737 ± 3.295	4706.36	1296147	72310	5.83
30	LOC-SCS	30.330	586.22	17.61	0.483 ± 0.165	263.7	340539	10782	470.07	14.36	4.737 ± 3.295	5438.63	1881346	94697	5.52
31	LOC-TH	30.319	189.62	5.70	0.483 ± 0.165	262.5	109700	3475	118.75	7.91	4.737 ± 3.295	6691.05	584937	45455	5.33
32	BRS	30.497	227.42	6.91	0.483 ± 0.165	268.9	133971	4283	283.36	11.96	4.737 ± 3.295	4078.36	845780	49188	6.31
33	BRS-CC	30.078	342.52	10.32	0.483 ± 0.165	263.4	200424	6363	274.52	12.73	4.737 ± 3.295	5419.18	1103967	67618	5.51
34	BRS-UP	30.102	302.62	9.78	0.483 ± 0.165	262.3	176227	5960	256.14	10.63	4.737 ± 3.295	5733.45	1088903	62774	6.18
35	STN	30.347	245.12	7.76	0.483 ± 0.165	263.9	142460	4732	268.95	12.37	4.737 ± 3.295	4199.18	830636	50624	5.83
36	MAR-CNDL	30.306	244.22	7.99	0.483 ± 0.165	263.0	141616	4843	-	-	-	-	-	-	-
37	MAR-KNW	30.380	179.22	5.72	0.483 ± 0.165	268.2	105736	3537	157.86	9.03	4.737 ± 3.295	5336.54	618925	43215	5.85
38	MAR-OB	30.080	135.92	4.47	0.483 ± 0.165	271.7	82028	2820	77.82	7.65	4.737 ± 3.295	7943.48	458704	48686	5.59
39	FTZ*	10.011	127.30	2.83	1.982 ± 0.331	256.9	218282	4859	-	-	-	-	-	-	-
40	PIO-UP*	10.005	31.00	1.22	1.982 ± 0.331	257.0	53209	2097	-	-	-	-	-	-	-

* Samples prepared at Department of Earth Science and Engineering, Imperial College London.

Table S3: Summary of ²⁶Al data for samples analysed at ANU*

#	Sample ID	Total Qtz (g)	Blank corrected 26Al/27Al (1e-15)	Blank corrected d[26Al/27Al]	Blank 26Al/27Al (1e-15)	27Al native (µg)	26Al KNSTD (atoms.g-1)	d[26Al]
1	FTZ-CMT	20.209	315.18	24.09	5.554 ± 2.117	3638.57	1266561	109248
2	FTZ-CNR	20.155	134.75	12.34	5.554 ± 2.117	13853.48	2067281	206559
3	FTZ-DON	20.159	480.91	32.70	5.554 ± 2.117	3277.37	1745080	137673
4	FTZ-EBW	20.068	387.02	26.92	5.554 ± 2.117	2575.97	1108820	88975
5	FTZ-ISC-IS	20.678	388.26	28.46	5.554 ± 2.117	4202.61	1761224	147090
6	FTZ-ISC-MDR	20.934	246.79	16.85	5.554 ± 2.117	7316.89	1925287	152380
7	FTZ-MKZ-B	20.183	439.43	31.97	5.554 ± 2.117	3833.76	1862994	154667
8	FTZ-MKZ-DS	20.357	310.04	23.47	5.554 ± 2.117	4204.44	1429246	122365
9	FTZ-NGA	20.546	371.76	24.33	5.554 ± 2.117	3652.59	1475155	113142
10	FTZ-TRS	20.132	483.84	30.30	5.554 ± 2.117	3835.62	2057535	152904

* Corresponding ¹⁰Be data in Mariotti et al. (2020; 2021).

Table S4: Recalculated ¹⁰Be and ²⁶Al denudation rates

#	Sample ID	10Be (atoms.g ⁻¹)	d[10Be]	CAIRN Average Scaling	10Be erosion rate (mm.kyr ⁻¹)	d[E. rate]	26Al (atoms.g ⁻¹)	d[26Al]	26Al erosion rate (mm.kyr ⁻¹)	d[E. rate]	Averaging timescale 10Be E. rate (kyr)*	Averaging timescale 26Al E. rate (kyr)*
1	MTC	443845	12440	1.7692	10.92	2.33	2214680	124870	16.25	3.43	55	37
2	TMB	322703	9592	1.5158	13.18	2.89	1790504	106123	17.60	3.80	46	34
3	SNW	524107	14140	1.8940	9.79	2.06	3110454	149440	12.04	2.50	61	50
4	SNW-CP	586608	31437	3.9892	18.17	3.62	3401760	154335	22.85	4.51	33	26
5	SNW-GTG	404619	15609	3.6774	24.57	4.81	2446528	121761	29.70	5.91	24	20
6	SNW-MK	330125	16030	4.4460	36.38	7.08	1971574	273124	44.55	10.53	16	13
7	SNW-PPC	521974	23785	3.4576	17.81	3.55	3165626	156256	21.40	4.28	34	28
8	SNW-SPC	653007	31035	3.6929	15.07	3.00	4258125	205524	16.73	3.35	40	36
9	CNN	302347	8496	1.3927	13.02	2.90	1784650	89073	16.30	3.51	46	37
10	GNA	338796	9516	1.3260	10.99	2.47	2204585	107374	12.35	2.66	55	49
11	BGA	175165	5783	1.2765	21.34	4.88	1073889	62401	25.86	5.76	28	23
12	BGA-BG05	191100	13600	1.0225	15.86	3.98	-	-	-	-	38	-
13	BGA-BG08	224900	10600	1.0237	13.34	3.25	-	-	-	-	45	-
14	BGA-BG09	179200	7800	1.0149	16.87	4.11	-	-	-	-	36	-
15	BGA-BG10	211300	11500	0.9810	13.70	3.40	-	-	-	-	44	-
16	BGA-BG14	163200	11600	1.1767	21.33	5.18	-	-	-	-	28	-
17	BGA-BG15	148300	8300	1.4829	29.14	6.60	-	-	-	-	21	-
18	BGA-BG16	153500	9900	1.1524	22.32	5.40	-	-	-	-	27	-
19	BGA-BG17	145300	12900	1.2794	26.00	6.36	-	-	-	-	23	-
20	BGA-BG21	117800	10200	1.2578	31.84	7.80	-	-	-	-	19	-
21	BGA-BG22	159200	11200	1.2646	23.38	5.58	-	-	-	-	26	-
22	BGA-BG23	131300	13600	1.4174	31.71	7.81	-	-	-	-	19	-
23	BGA-BG25	181300	13000	1.7936	28.23	6.31	-	-	-	-	21	-
24	BGA-BG26	100200	11000	1.9652	56.41	13.32	-	-	-	-	11	-
25	BGA-BG27	121300	9300	2.0218	47.66	10.52	-	-	-	-	13	-
26	TRS	136957	4242	1.3525	29.08	6.56	942270	52043	31.27	6.92	21	19
27	MOR	169037	5557	1.2431	21.62	4.98	1067546	67244	25.41	5.72	28	24
28	CLY	170483	5577	1.0957	19.08	4.53	1180483	103905	20.34	4.84	31	29
29	SHL	199942	5721	1.4691	21.17	4.68	1259152	70679	24.86	5.40	28	24
30	MQR	90845	2625	1.1935	39.76	9.24	532849	39946	50.74	12.02	15	12
31	HWK-001	354450	10425	2.0427	15.93	3.32	-	-	-	-	38	-
32	HWK-002	260625	10425	2.0209	21.71	4.57	-	-	-	-	28	-
33	COL	177141	4532	1.3938	22.88	5.11	1182380	77462	25.32	5.62	26	24
34	MCD	144487	3910	1.0430	21.73	5.22	880246	68775	26.64	6.35	28	23
35	HNT	166775	5027	1.1723	20.78	4.84	1012726	64990	25.48	5.81	29	24
36	HNT-SNGT	157972	4309	1.1921	22.33	5.18	913099	69723	28.87	6.71	27	21
37	HNT-WLL	141489	3837	1.0365	22.09	5.31	803707	54878	29.18	6.89	27	21
38	MAN	184196	4844	1.4015	22.07	4.92	1224808	74212	24.50	5.39	27	24
39	HAS	167036	4535	1.2981	22.78	5.17	1158560	83174	24.23	5.48	26	25
40	MCL	101772	3044	1.6172	46.46	10.09	633798	43297	55.42	12.30	13	11
41	BLG	76181	2306	1.1622	46.56	10.91	512832	38815	51.58	12.31	13	12
42	CLA	150324	4231	1.3792	26.88	6.03	956538	130001	31.33	8.07	22	19
43	LGN	116551	3643	1.0180	26.65	6.46	653248	43826	35.75	8.54	23	17
44	BRM	271423	9029	0.8685	9.30	2.33	1392644	70635	13.71	3.16	65	44
45	LOC	210315	6354	0.9989	14.01	3.39	1124658	57484	19.71	4.50	43	30
46	LOC-15MC	124008	3969	1.1260	27.33	6.46	777746	47217	32.50	7.51	22	18
47	LOC-FSC	117641	3819	1.0797	27.81	6.65	747628	46199	32.65	7.62	22	18
48	LOC-LC	139507	4426	1.0222	22.14	5.36	746658	51801	31.16	7.41	27	19
49	LOC-MC	214130	6600	1.0938	14.95	3.54	1211700	63558	19.75	4.44	40	30
50	LOC-PC	222322	7049	1.1208	14.70	3.46	1296147	72310	18.78	4.22	41	32
51	LOC-SCS	340539	10782	0.9951	8.27	1.99	1881346	94697	11.15	2.50	73	54
52	LOC-TH	109700	3475	1.1446	31.51	7.41	584937	45455	44.42	10.61	19	14
53	BRS	133971	4283	1.0381	23.43	5.65	845780	49188	27.68	6.43	26	22
54	BRS-CC	200424	6363	1.0858	15.94	3.78	1103967	67618	21.69	4.96	38	28
55	BRS-UP	176227	5960	1.0442	17.63	4.24	1088903	62774	21.25	4.87	34	28
56	STN	142460	4732	0.9106	19.51	4.88	830636	50624	25.14	6.00	31	24
57	MAR	332119	6634	0.8983	7.69	1.88	-	-	-	-	78	-
58	MAR-CNDL	141616	4843	1.0100	21.56	5.24	-	-	-	-	28	-
59	MAR-KNW	105736	3537	1.0178	29.50	7.17	618925	43215	37.83	9.10	20	16
60	MAR-OB	82028	2820	0.9680	36.78	9.08	458704	48686	49.57	12.93	16	12
61	BUR	292741	6176	0.9672	9.50	2.29	-	-	-	-	63	-
62	BUR-EID	268134	5354	0.9690	10.47	2.53	-	-	-	-	57	-
63	BUR-GYD	311271	6218	0.9821	9.01	2.16	-	-	-	-	67	-
64	BUR-MBR	299056	4727	0.9830	9.42	2.26	-	-	-	-	64	-
65	FTZ	218282	4859	0.9056	12.28	3.03	-	-	-	-	49	-
66	FTZ-CMT	238260	9466	0.9570	11.76	2.89	1266561	109248	16.65	4.01	51	36
67	FTZ-CNR	304207	12998	0.8528	8.06	2.03	2067281	206559	8.62	2.15	74	70
68	FTZ-DON	222142	12725	0.9204	12.23	3.09	1745080	137673	11.26	2.67	49	53
69	FTZ-EBW	186300	9312	0.9081	14.61	3.69	1108820	88975	18.36	4.43	41	33
70	FTZ-ISC-IS	327123	13500	0.8736	7.61	1.90	1761224	147090	10.60	2.55	79	57
71	FTZ-ISC-MDR	331805	13975	0.8469	7.27	1.83	1925287	152380	9.29	2.23	83	65
72	FTZ-MKZ-B	320325	17218	0.9378	8.35	2.08	1862994	154667	10.65	2.53	72	56
73	FTZ-MKZ-DS	275621	12092	0.9045	9.51	2.37	1429246	122365	13.84	3.34	63	43
74	FTZ-NGA	222845	16061	0.9950	13.11	3.31	1475155	113142	14.61	3.43	46	41
75	FTZ-TRS	332996	16440	0.8997	7.68	1.92	2057535	152904	9.13	2.15	78	66
76	PLA	168461	3570	0.7418	13.54	3.56	-	-	-	-	44	-
77	PIO	95851	2332	0.8669	28.40	7.20	-	-	-	-	21	-
78	PIO-BMSF	70945	3072	0.9390	41.65	10.44	-	-	-	-	14	-
79	PIO-DWN	59390	2147	0.8977	48.18	12.17	-	-	-	-	12	-
80	PIO-UP	53209	2097	0.9166	54.92	13.82	-	-	-	-	11	-
81	OCL	74394	2195	0.7800	33.86	8.90	-	-	-	-	18	-
82	OCL-NRL	63541	1955	0.7982	40.70	10.63	-	-	-	-	15	-
83	OCL-SCK	79531	2784	0.8079	32.52	8.48	-	-	-	-	18	-
84	BDK	263000	12000	0.9060	10.03	2.51	-	-	-	-	60	-
85	BDK-001	266000	18000	0.8340	9.15	2.39	-	-	-	-	66	-
86	BDK-002	209000	10000	0.8333	11.91	3.07	-	-	-	-	50	-
87	BDK-003	202000	25000	0.8281	12.29	3.53	-	-	-	-	49	-
88	BDK-004	245000	11000	0.8286	9.95	2.55	-	-	-	-	60	-
89	BDK-005	387000	31000	0.8505	6.15	1.61	-	-	-	-	98	-
90	BDK-006	190000	10000	0.8273	13.12	3.41	-	-	-	-	46	-
91	BDK-007	203000	12000	0.9415	13.77	3.47	-	-	-	-	44	-
92	BDK-008	180000	16000	0.8378	14.08	3.81	-	-	-	-	43	-
93	BDK-009	269000	22000	0.9526	10.26	2.64	-	-	-	-	58	-
94	BDK-010	240000	15000	0.9143	11.18	2.84	-	-	-	-	54	-
95	BDK-011	219000	11000	0.8907	12.05	3.05	-	-	-	-	50	-

#	Sample ID	10Be (atoms.g-1)	d[10Be]	CAIRN Average Scaling	10Be erosion rate (mm.kyr-1)	d[E. rate]	26Al (atoms.g-1)	d[26Al]	26Al erosion rate (mm.kyr-1)	d[E. rate]	Averaging timescale 10Be E. rate (kyr)*	Averaging timescale 26Al E. rate (kyr)*
96	BDK-012	256000	15000	0.8813	10.06	2.57	-	-	-	-	60	-
97	BDK-013	247000	11000	0.8729	10.37	2.62	-	-	-	-	58	-
98	BDK-014	289000	15000	0.9838	9.79	2.41	-	-	-	-	61	-
99	BDK-015	282000	22000	0.9802	10.02	2.55	-	-	-	-	60	-
100	BDK-016	276000	14000	0.9685	10.14	2.50	-	-	-	-	59	-
101	BDK-017	149000	78000	0.8951	18.32	14.87	-	-	-	-	33	-
102	BDK-018	731000	27000	0.8611	3.01	0.74	-	-	-	-	199	-
103	BDK-019	352000	15000	0.8862	7.12	1.77	-	-	-	-	84	-
104	BDK-020	514000	19000	0.9167	4.82	1.17	-	-	-	-	125	-
105	BDK-021	634000	25000	0.8982	3.71	0.91	-	-	-	-	162	-
106	TUL	152794	8922	0.9357	18.56	4.69	-	-	-	-	32	-
107	TUL-DP	217425	11132	1.0614	14.30	3.46	-	-	-	-	42	-
108	TUL-GR	172389	9518	1.1470	19.67	4.71	-	-	-	-	31	-
109	LVP	76199	4502	0.8118	34.15	9.05	-	-	-	-	18	-
110	LVP-UP	38749	3199	0.8319	70.19	18.95	-	-	-	-	9	-
111	SJN	90197	5241	0.9010	31.30	8.03	-	-	-	-	19	-
112	SJN-UP	55669	3703	0.9996	56.43	14.21	-	-	-	-	11	-
113	NJN	58871	3971	1.0297	54.64	13.66	-	-	-	-	11	-
114	NJN-MD	104869	5487	1.0393	30.31	7.43	-	-	-	-	20	-
115	NJN-UP	74061	4418	1.0856	45.16	11.04	-	-	-	-	13	-
116	BRR	231000	8000	1.0182	12.89	3.11	-	-	-	-	47	-
117	BRR-001	184000	3000	0.8766	14.33	3.58	-	-	-	-	42	-
118	BRR-002	172000	5000	0.8766	15.41	3.87	-	-	-	-	39	-
119	BRR-007	181000	3000	0.9486	15.68	3.83	-	-	-	-	38	-
120	BRR-008	197000	3000	1.0217	15.34	3.67	-	-	-	-	39	-
121	BRR-009	251000	3000	0.9703	11.26	2.71	-	-	-	-	53	-
122	BRR-010	248000	4000	0.9703	11.41	2.75	-	-	-	-	53	-
123	BRR-011	256000	6000	1.0229	11.59	2.77	-	-	-	-	52	-
124	BRR-012	189000	3000	0.8930	14.16	3.52	-	-	-	-	42	-
125	BRR-013	131000	2000	0.9119	21.36	5.30	-	-	-	-	28	-
126	BRR-ESC	102000	3000	0.9952	30.03	7.33	-	-	-	-	20	-
127	BRR-ESC-004	231000	1000	0.7868	10.11	2.58	-	-	-	-	59	-
128	BRR-ESC-006	499000	8000	0.8921	4.84	1.17	-	-	-	-	124	-
129	BRR-ESC-014	61000	2000	0.8252	43.66	11.30	-	-	-	-	14	-
130	BRR-ESC-015	66000	2000	0.8085	39.54	10.29	-	-	-	-	15	-
131	DAI	151302	8592	0.9301	18.65	4.72	-	-	-	-	32	-
132	MRY-AW	305277	15649	2.3072	20.92	4.38	1600624	169869	29.49	6.69	29	20
133	MRY-BGC	178878	5572	2.4576	38.47	7.80	-	-	-	-	16	-
134	MRY-SWP	234645	12124	2.8668	33.74	6.86	1453174	88463	40.02	8.15	18	15
135	BGA-BG28	312700	17100	2.2314	19.76	4.18	-	-	-	-	30	-
136	BGA-BG29	874400	27300	2.1358	6.39	1.33	-	-	-	-	94	-
137	BGA-BG30	693800	30700	2.1439	8.22	1.73	-	-	-	-	73	-
138	BGA-BG31	510000	20700	2.1695	11.53	2.41	-	-	-	-	52	-
139	MBG	362247	12444	1.7159	13.14	2.83	2126327	132186	16.48	3.52	46	36
140	MBG-LP1	732641	41975	2.6582	9.63	2.01	4391955	257306	11.64	2.40	62	52
141	MBG-LP2	762299	36493	2.6549	9.22	1.90	4578277	287496	11.12	2.31	65	54
142	MBG-TLB01	795000	31000	1.4791	4.85	1.08	-	-	-	-	124	-
143	MBG-TLB03	938000	34000	1.5895	4.36	0.96	-	-	-	-	138	-
144	MBG-TLB04	432000	25000	1.6917	10.76	2.38	-	-	-	-	56	-
145	MBG-TLB07	791000	35000	1.9259	6.41	1.37	-	-	-	-	94	-
146	MBG-TLB08	411000	10000	1.7010	11.40	2.44	-	-	-	-	53	-
147	MBG-TLB09	561000	13000	1.8858	9.07	1.91	-	-	-	-	66	-
148	MBG-TLB11	560000	13000	1.9518	9.40	1.97	-	-	-	-	64	-
149	LCH	559309	15570	1.5158	7.31	1.60	3377947	177945	8.79	1.89	82	68
150	LCH-TLB05	620000	14000	1.7454	7.54	1.61	-	-	-	-	80	-
151	LCH-TLB10	667000	20000	1.7526	7.00	1.50	-	-	-	-	86	-
152	MCQ	478260	13349	1.4607	8.35	1.84	2691030	154541	10.90	2.35	72	55
153	GWY	455854	16565	1.5747	9.47	2.07	2803844	138451	11.23	2.38	63	53
154	MCN	386969	10136	1.2893	9.27	2.09	2280572	125793	11.58	2.52	65	52
155	BLN	268755	7234	1.0308	11.08	2.64	1524021	324759	14.57	4.78	54	41
156	MRN	215750	5809	1.1372	15.38	3.60	1379699	77516	17.80	3.98	39	34
157	WRG	309473	8327	1.0499	9.67	2.29	1674166	151024	13.36	3.18	62	45
158	BCO	520000	17000	0.9332	4.84	1.17	2060000	150000	9.46	2.21	124	63
159	BCO-RC	480000	10000	0.9525	5.41	1.29	2250000	400000	8.72	2.64	111	69
160	TMS	430000	6000	0.8917	5.73	1.39	2390000	610000	7.62	2.94	105	79

* Averaging timescale is calculated as the amount of time necessary to erode 60 cm of rock (see: von Blanckenburg, 2005).

Table S5: Al/Be ratios and minimum sediment storage durations.

#	Sample ID	Mainstem	Drainage Basin	Riv Name	Al/Be	d[Al/Be]	Sediment storage duration (ka)	d[ka] -1s	d[ka] +1s	d[ka] -2s	d[ka] +2s	Regolith vol. / unit area (km3)
<i>East of the continental divide</i>												
1	MTC	Yes	Mitchell	Mitchell River	4.99	0.31	726.6	222.5	232.1	326.9	358.5	0.0023
2	TMB	Yes	Tambo	Tambo River	5.55	0.37	530.0	227.1	243.1	351.6	395.3	0.0028
3	SNW	Yes	Snowy	Snowy River	5.93	0.33	368.1	187.9	200.5	292.7	316.0	0.0031
4	SNW-CP	No	Snowy	Snowy River	5.80	0.41	438.1	279.4	266.6	429.0	397.2	0.0043
5	SNW-GTG	No	Snowy	Guthega River	6.05	0.38	366.1	325.2	324.6	364.3	396.0	0.0014
6	SNW-MK	No	Snowy	Snowy River	5.97	0.88	385.2	383.1	547.2	387.0	757.9	0.0034
7	SNW-PPC	No	Snowy	Pipers Creek	6.06	0.41	347.1	346.3	344.7	347.7	402.5	0.0031
8	SNW-SPC	No	Snowy	Spencers Creek	6.52	0.44	190.4	192.6	209.7	187.9	334.4	0.0031
9	CNN	Yes	Cann	Cann River	5.90	0.34	407.4	198.8	210.0	328.4	349.5	0.0035
10	GNA	Yes	Genoa	Genoa River	6.51	0.37	201.0	200.4	220.2	201.4	311.5	0.0032
11	BGA	Yes	Bega	Bega River	6.13	0.41	355.3	351.8	379.7	356.2	435.9	0.0023
12	TRS	Yes	Turross	Turross River	6.88	0.44	129.6	128.4	186.6	130.7	313.9	0.0019
13	MOR	Yes	Moruya	Moruya River	6.32	0.45	299.7	300.1	335.5	299.1	424.9	0.0016
14	CLY	Yes	Clyde	Clyde River	6.92	0.65	115.5	116.7	233.9	114.1	411.8	0.0020
15	SHL	Yes	Shoalhaven	Shoalhaven River	6.30	0.40	301.3	302.6	313.5	299.7	397.3	0.0045
16	MQR	Yes	Illawarra	Mcquarie Rivulet	5.87	0.47	475.3	299.6	333.1	476.2	543.9	0.0038
17	COL	Yes	Colo	Colo River	6.67	0.47	185.3	182.6	251.6	187.8	373.3	0.0023
18	MCD	Yes	Macdonald	Macdonald River	6.09	0.50	378.2	378.1	447.3	378.2	550.2	0.0023
19	HNT	Yes	Hunter	Hunter River	6.07	0.43	377.7	375.6	392.2	376.4	463.0	0.0043
20	HNT-SNGT	No	Hunter	Hunter River	5.78	0.47	487.7	489.5	572.5	485.7	570.3	0.0042
21	HNT-WLL	No	Hunter	Wollombi Brook	5.68	0.42	522.5	249.5	271.6	388.8	453.5	0.0035
22	MAN	Yes	Manning	Manning River	6.65	0.44	197.3	200.5	242.1	193.8	329.5	0.0030
23	HAS	Yes	Hastings	Hastings River	6.94	0.53	112.8	109.2	208.3	116.3	336.9	0.0041
24	MCL	Yes	Macleay	Macleay River	6.23	0.46	343.1	341.6	385.4	344.5	488.5	0.0040
25	BLG	Yes	Bellinger	Bellinger River	6.73	0.55	194.6	192.0	269.5	197.0	398.8	0.0031
26	CLA	Yes	Clarence	Clarence River	6.36	0.88	298.3	305.5	440.9	291.0	737.9	0.0036
27	LGN	Yes	Logan	Logan River	5.60	0.41	558.3	254.8	281.0	408.1	457.8	0.0038
28	BRM	Yes	Bremer	Bremer River	5.13	0.31	674.0	209.7	212.7	313.8	338.7	0.0081
29	LOC	Yes	Lockyer	Lockyer River	5.35	0.32	621.9	204.8	212.9	316.1	338.7	0.0062
30	LOC-15MC	No	Lockyer	15 Mile Creek	6.27	0.43	323.6	321.2	369.3	325.9	440.8	0.0042
31	LOC-FSC	No	Lockyer	Flagstone Creek	6.36	0.44	301.3	303.3	324.8	299.2	413.9	0.0039
32	LOC-LC	No	Lockyer	Laidley Creek	5.35	0.41	643.9	264.0	281.6	392.3	449.5	0.0041
33	LOC-MC	No	Lockyer	Murphys Creek	5.66	0.34	510.2	215.5	224.2	325.2	340.7	0.0044
34	LOC-PC	No	Lockyer	Paradise Creek	5.83	0.37	449.2	229.5	231.5	360.0	391.2	0.0044
35	LOC-SCS	No	Lockyer	Sheep Station Creek	5.52	0.33	513.3	197.3	206.4	315.0	334.6	0.0074
36	LOC-TH	No	Lockyer	Tenthill Creek	5.33	0.45	663.3	283.1	312.4	437.3	495.4	0.0030
37	BRS	Yes	Brisbane	Brisbane River	6.31	0.42	311.0	311.8	331.9	310.0	401.6	0.0039
38	BRS-CC	No	Brisbane	Cooyar Creek	5.51	0.38	565.7	227.9	250.6	364.5	404.5	0.0047
39	BRS-UP	No	Brisbane	Brisbane River	6.18	0.41	337.6	337.6	356.4	337.5	421.8	0.0025
40	STN	Yes	Stanley	Stanley River	5.83	0.40	468.3	246.3	261.0	382.9	416.9	0.0073
41	MAR-KNW	No	Mary	Mary River	5.85	0.45	472.5	278.9	311.0	474.5	529.1	0.0037
42	MAR-OB	No	Mary	Obi Obi Creek	5.59	0.62	576.2	495.5	592.9	573.5	772.9	0.0053
43	FTZ-CMT	No	Fitzroy	Comet River	5.32	0.50	624.4	314.8	344.1	507.6	585.3	0.0153
44	FTZ-CNR	No	Fitzroy	Connors River	6.80	0.74	105.9	102.1	247.8	109.4	499.2	0.0105
45	FTZ-DON	No	Fitzroy	Don River	7.86	0.77	0.1	0.0	122.5	0.0	296.1	0.0095
46	FTZ-EBW	No	Fitzroy	Fitzroy River	5.95	0.56	411.9	412.2	471.2	411.4	602.2	0.0128
47	FTZ-ISC-IS	No	Fitzroy	Isaac River	5.38	0.50	563.0	566.3	640.0	559.2	623.1	0.0157
48	FTZ-ISC-MDR	No	Fitzroy	Isaac River	5.80	0.52	407.3	313.6	346.8	408.9	516.7	0.0164
49	FTZ-MKZ-B	No	Fitzroy	Mackenzie River	5.82	0.58	411.7	412.3	445.9	410.9	589.3	0.0129
50	FTZ-MKZ-DS	No	Fitzroy	Mackenzie River	5.19	0.50	648.8	316.0	360.3	484.1	566.3	0.0142
51	FTZ-NGA	No	Fitzroy	Nogoa River	6.62	0.70	186.4	186.7	278.6	186.0	461.7	0.0081
52	FTZ-TRS	No	Fitzroy	Theresa Creek	6.18	0.55	291.2	294.3	343.7	287.8	470.7	0.0110
<i>West of the continental divide</i>												
53	MRY-AW	No	Murray	Murray River	5.24	0.62	660.7	444.9	501.0	660.6	819.4	0.0027
54	MRY-SWP	No	Murray	Swampy Plain River	6.19	0.49	334.2	334.1	358.5	334.1	450.1	0.0021
55	MBG	Yes	Murrumbidgee	Murrumbidgee River	5.87	0.42	414.0	265.7	283.1	413.9	470.5	0.0044
56	MBG-LP1	No	Murrumbidgee	Murrumbidgee River	5.99	0.49	337.6	337.5	349.7	337.5	465.1	0.0050
57	MBG-LP2	No	Murrumbidgee	Murrumbidgee River	6.01	0.47	335.0	334.9	357.6	334.9	431.0	0.0038
58	LCH	Yes	Lachlan	Lachlan River	6.04	0.36	313.7	229.8	244.4	313.5	341.2	0.0056
59	MCQ	Yes	Macquarie	Macquarie River	5.63	0.36	465.7	209.9	228.7	334.9	362.6	0.0048
60	GWY	Yes	Gwydir	Gwydir River	6.15	0.38	300.5	300.4	289.0	300.4	317.0	0.0038
61	MCN	Yes	Macintyre	Macintyre River	5.89	0.36	389.3	207.7	219.7	389.2	410.1	0.0072
62	BLN	Yes	Balonne	Balonne River	5.67	1.22	473.3	473.2	829.0	473.2	1253.6	0.0264
63	MRN	Yes	Maranoa	Maranoa River	6.39	0.40	257.7	257.6	292.3	257.6	368.0	0.0086
64	WRG	Yes	Warrego	Warrego River	5.41	0.51	570.1	316.9	353.2	570.0	698.6	0.0276
65	BCO	Yes	Barcoo	Barcoo River	3.96	0.32	1082.6	251.6	270.9	387.8	440.6	0.0255
66	BCO-RC	No	Barcoo	Ravensbourne Creek	4.69	0.84	785.0	585.9	805.2	784.9	1305.6	0.0187
67	TMS	Yes	Thomson	Thomson River	5.56	1.42	475.7	475.6	871.6	475.6	1586.0	0.0318

Table S6: Topographic metrics for east-draining basins derived from 30m SRTM DEM

#	Sample ID	Mainstem	Drainage Basin	Area (km2)	Slope (m.km-1)			ksn (m0.9)		Local Relief (m) - 1km radius			Local Relief (m) - 2km radius			Local Relief (m) - 5km radius			Annual Rainfall (mm)			
					Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.
1	MTC	Yes	Mitchell	3890.63	363.45	362.28	189.32	154.03	136.49	95.82	406.89	405.99	146.96	589.34	593.08	186.22	858.83	900.71	217.53	950.94	918.09	219.12
2	TMB	Yes	Tambo	2781.44	252.65	227.36	157.05	111.71	92.47	86.13	283.59	274.49	125.28	428.88	435.07	161.82	675.90	679.87	202.54	774.33	749.73	116.51
3	SNW	Yes	Snowy	13551.32	185.32	137.98	152.40	103.59	70.76	115.65	222.97	187.10	136.79	343.07	302.92	188.02	557.45	521.98	260.10	813.71	740.81	257.89
4	SNW-CP	No	Snowy	20.67	155.44	135.06	101.03	87.65	68.72	64.68	210.70	218.39	57.89	358.27	358.01	52.17	906.32	909.37	93.20	1944.06	1946.10	29.43
5	SNW-GTG	No	Snowy	5.80	298.74	303.88	116.85	103.52	102.13	20.12	343.98	360.90	51.89	525.99	532.07	67.02	964.78	963.32	84.62	1865.55	1868.61	29.68
6	SNW-MKC	No	Snowy	0.10	236.60	230.79	79.34	-	-	-	255.29	255.45	5.65	329.74	322.57	16.83	1036.75	1034.33	68.89	2017.19	2017.19	0.00
7	SNW-PPC	No	Snowy	3.63	143.79	137.17	78.74	66.16	66.16	0.00	178.05	179.66	24.75	371.67	332.97	117.38	947.59	947.70	10.03	1744.15	1739.83	20.12
8	SNW-SPC	No	Snowy	20.31	177.97	168.45	106.27	41.25	19.89	41.74	221.39	220.32	64.12	434.01	384.80	127.76	935.78	929.68	27.56	1829.08	1821.22	40.29
9	CNN	Yes	Cann	645.78	239.33	217.59	150.94	102.34	90.28	64.76	283.95	288.45	107.71	436.51	444.81	130.91	693.76	712.94	119.86	904.83	903.19	67.31
10	GNA	Yes	Genoa	934.27	169.25	129.62	128.61	76.10	57.96	69.34	204.38	177.25	104.73	320.39	303.42	133.78	535.69	562.07	139.14	879.60	886.33	58.80
11	BGA	Yes	Bega	1813.66	227.27	159.07	185.36	91.47	65.40	99.02	256.19	204.23	165.86	388.48	346.08	215.46	640.82	679.53	239.37	836.61	830.20	71.62
12	BGA-BG05	No	Bega	14.68	151.49	134.87	89.33	50.73	41.87	34.94	147.50	145.27	32.49	222.58	222.35	33.43	359.07	372.56	34.67	829.79	827.86	6.90
13	BGA-BG08	No	Bega	5.02	146.36	136.49	71.43	35.40	30.25	7.83	151.90	152.77	19.33	228.47	222.97	23.95	367.69	369.13	9.23	811.54	811.61	6.94
14	BGA-BG09	No	Bega	130.97	130.91	84.33	124.64	38.18	30.94	21.41	146.78	97.41	108.89	232.60	200.00	146.44	420.92	343.58	173.46	837.61	834.17	21.34
15	BGA-BG10	No	Bega	15.11	83.45	80.14	37.96	28.44	26.63	6.40	78.46	76.77	9.66	115.54	118.29	12.07	196.53	197.88	10.33	806.58	806.11	6.38
16	BGA-BG14	No	Bega	113.57	173.57	132.04	125.63	63.56	47.13	49.30	196.68	183.46	105.64	303.20	310.90	136.11	528.67	609.03	150.35	814.75	799.62	38.46
17	BGA-BG15	No	Bega	206.49	163.26	131.35	118.59	113.91	69.42	125.31	204.52	188.82	102.30	334.20	326.89	140.55	600.13	654.73	158.81	853.94	843.67	77.98
18	BGA-BG16	No	Bega	91.39	138.95	98.77	117.95	63.24	45.75	46.25	175.60	110.10	134.06	286.83	168.20	191.32	545.82	669.37	232.92	764.83	752.61	39.13
19	BGA-BG17	No	Bega	50.69	174.43	108.39	151.29	88.51	70.26	58.55	242.05	174.05	179.83	408.80	401.37	248.91	741.35	832.20	191.79	755.58	728.80	59.63
20	BGA-BG21	No	Bega	28.34	290.01	226.69	234.52	77.39	68.28	41.82	365.36	398.75	194.26	589.17	660.29	175.64	854.49	857.79	27.93	793.44	776.31	51.27
21	BGA-BG22	No	Bega	11.10	382.50	401.56	184.38	82.50	88.62	27.39	404.54	374.23	134.40	597.94	649.94	127.18	849.02	846.59	16.19	817.48	800.29	44.77
22	BGA-BG23	No	Bega	35.12	248.99	207.63	182.23	121.78	131.62	59.46	362.87	379.40	159.63	584.09	644.80	171.71	910.02	922.20	52.07	802.78	761.04	86.01
23	BGA-BG25	No	Bega	27.69	178.87	140.16	134.30	193.26	86.31	225.45	259.58	182.43	151.60	453.36	402.05	196.94	872.73	897.07	92.56	873.83	914.66	102.85
24	BGA-BG26	No	Bega	25.27	180.17	149.52	127.84	233.87	127.37	230.98	243.47	200.50	116.90	424.05	341.91	155.85	827.87	917.99	179.92	932.62	932.15	88.54
25	BGA-BG27	No	Bega	52.54	170.57	134.64	127.91	188.97	95.11	262.08	213.81	168.16	126.55	354.22	259.12	190.82	746.84	774.02	177.57	960.88	987.31	84.77
26	TRS	Yes	Tuross	1659.67	266.99	237.85	183.44	99.32	66.71	132.75	297.17	277.30	156.42	444.39	426.16	205.39	698.34	723.06	236.56	893.58	896.09	64.08
27	MOR	Yes	Moruya	1319.92	335.86	323.19	200.44	92.80	78.90	72.17	362.27	369.14	152.81	519.22	542.26	176.87	755.67	808.71	171.33	879.33	873.50	60.54
28	CLY	Yes	Clyde	1400.83	234.69	185.17	184.96	65.69	46.95	71.07	246.82	211.42	156.33	363.56	327.39	200.58	563.13	552.81	230.83	1007.31	1015.22	87.71
29	SHL	Yes	Shoalhaven	6522.75	139.07	79.90	159.01	83.75	37.78	134.84	167.16	121.12	124.53	258.36	217.54	161.11	431.66	441.83	202.64	876.75	807.17	184.66
30	MQR	Yes	Illawarra	33.63	255.87	213.46	198.98	157.16	179.04	84.33	371.17	381.93	105.27	577.36	590.91	82.14	743.67	745.58	11.62	1388.89	1377.79	69.79
31	HWK-001	No	Hawkesbury	13.94	147.27	110.28	107.57	66.44	65.56	17.03	143.84	152.07	31.52	202.56	208.50	25.18	275.69	273.26	9.74	1067.90	1073.75	39.60
32	HWK-002	No	Hawkesbury	1.08	120.37	103.17	68.55	123.71	123.71	0.00	179.01	176.49	8.75	238.35	239.52	4.82	286.67	284.71	3.28	1019.98	1013.36	34.69
33	COL	Yes	Colo	4344.24	264.51	227.08	210.00	98.44	68.96	100.01	242.94	226.69	114.21	341.63	333.63	129.87	520.40	524.82	131.08	932.66	926.09	157.00
34	MCD	Yes	Macdonald	1741.20	267.18	259.45	138.70	50.21	41.16	36.80	187.17	176.89	54.00	242.52	229.54	66.20	345.44	322.89	86.67	886.23	883.26	37.96
35	HNT	Yes	Hunter	17835.58	181.89	130.62	160.01	63.75	49.36	103.04	193.71	174.20	117.84	285.22	260.43	155.84	438.21	417.68	203.64	797.46	759.99	135.35
36	HNT-SNGT	No	Hunter	16463.03	188.82	140.77	161.44	66.41	51.75	104.63	200.18	180.64	117.01	294.14	267.90	154.31	449.82	422.20	202.10	794.35	750.59	136.84
37	HNT-WLL	No	Hunter	1673.67	237.06	237.09	148.63	48.85	34.90	70.40	197.80	195.00	74.94	271.66	275.50	80.83	380.92	397.14	72.39	895.32	888.77	92.89
38	MAN	Yes	Manning	6425.75	266.44	247.59	168.76	118.42	95.96	103.61	309.97	306.88	131.63	458.21	463.40	153.95	681.33	700.00	151.51	1118.19	1093.36	118.01
39	HAS	Yes	Hastings	1656.52	266.18	235.86	179.03	117.44	83.24	120.49	305.25	294.91	141.01	451.47	442.68	164.74	681.65	659.85	156.48	1421.90	1413.55	125.39
40	MCL	Yes	Macleay	10246.08	206.64	111.18	212.32	116.48	56.61	198.15	241.89	156.36	189.54	357.24	266.71	240.77	548.99	574.19	290.06	1029.05	978.29	197.80
41	BLG	Yes	Bellinger	667.91	363.98	365.99	218.34	120.49	101.13	113.94	403.85	419.74	181.64	599.77	623.16	231.13	919.26	904.15	227.55	1601.02	1573.51	182.37
42	CLA	Yes	Clarence	17382.81	194.34	139.14	166.89	98.20	61.73	126.54	226.49	195.60	138.11	343.86	317.62	176.52	546.34	531.97	208.91	1090.43	1048.73	187.00
43	LGN	Yes	Logan	1273.63	205.09	157.77	172.35	65.89	46.74	62.85	250.04	208.85	158.97	391.37	336.21	215.56	632.27	636.49	270.			

#	Sample ID	Mainstem	Drainage Basin	Area (km2)	Slope (m.km-1)			ksn (m0.9)			Local Relief (m) - 1km radius			Local Relief (m) - 2km radius			Local Relief (m) - 5km radius			Annual Rainfall (mm)		
					Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.
66	FTZ-CMT	No	Fitzroy	16438.58	64.35	23.27	109.66	27.55	16.56	37.86	79.16	37.51	96.02	125.99	69.67	134.01	214.25	170.41	178.92	644.86	646.28	25.37
67	FTZ-CNR	No	Fitzroy	9447.99	92.92	36.53	122.15	26.41	17.77	32.51	108.87	68.53	104.82	172.46	147.81	141.27	295.68	297.88	188.30	916.28	813.84	242.71
68	FTZ-DON	No	Fitzroy	6825.51	98.96	53.85	113.88	34.17	27.58	34.09	109.88	90.52	84.24	168.30	146.68	110.03	277.63	272.29	143.41	706.85	702.43	43.89
69	FTZ-EBW	No	Fitzroy	135799.92	55.22	26.88	85.05	23.65	16.42	40.57	65.26	40.16	69.75	102.61	68.31	96.68	177.35	135.72	136.36	666.96	645.97	102.43
70	FTZ-ISC-IS	No	Fitzroy	4195.53	39.79	20.38	60.15	22.23	13.53	70.78	50.87	33.01	47.92	82.97	61.55	65.14	150.15	129.39	86.46	623.08	616.15	37.59
71	FTZ-ISC-MDR	No	Fitzroy	21391.58	59.33	20.97	96.62	21.63	13.25	43.17	71.08	32.27	84.99	113.46	61.80	118.57	200.12	145.26	169.32	765.93	681.73	213.82
72	FTZ-MKZ-B	No	Fitzroy	50761.75	53.22	23.91	90.55	23.59	15.22	44.99	64.05	34.58	76.15	101.01	58.97	105.22	174.36	121.31	145.55	629.30	629.14	25.45
73	FTZ-MKZ-DS	No	Fitzroy	76763.31	54.22	22.65	91.39	22.79	14.52	44.47	65.25	33.75	78.02	103.35	59.20	108.25	179.89	124.88	151.89	669.96	635.39	130.07
74	FTZ-NGA	No	Fitzroy	16506.63	66.76	33.74	97.36	25.92	18.79	30.22	76.69	47.05	72.86	117.51	78.97	94.35	198.52	163.21	124.03	619.05	621.67	22.89
75	FTZ-TRS	No	Fitzroy	8403.12	36.52	21.97	57.25	17.58	13.11	17.56	44.99	29.29	48.37	73.37	47.78	69.04	133.25	96.00	103.38	622.95	625.43	20.52
76	PLA	Yes	Plane Creek	326.97	86.15	17.90	138.99	14.83	7.44	22.80	116.84	46.41	141.45	200.78	133.36	189.39	405.31	375.44	197.58	1525.71	1528.05	115.24
77	PIO	Yes	Pioneer	1363.69	165.02	102.31	161.21	64.97	40.37	77.22	206.57	176.59	144.77	332.73	290.19	184.34	553.83	547.84	218.80	1551.16	1533.28	156.75
78	PIO-BMSF	No	Pioneer	511.55	189.93	147.46	146.38	78.12	59.34	69.22	214.84	193.07	104.81	334.82	327.80	126.01	574.36	604.42	157.53	1442.04	1453.43	129.03
79	PIO-DWN	No	Pioneer	330.65	219.14	177.06	194.72	92.50	48.29	105.20	298.90	296.84	191.27	483.48	502.73	229.13	761.82	809.59	228.50	1672.70	1664.28	106.59
80	PIO-UP	No	Pioneer	290.17	237.54	210.85	195.82	98.63	52.17	101.34	324.00	332.32	187.35	520.82	546.53	214.32	803.59	825.48	207.57	1678.29	1668.20	108.33
81	OCL	Yes	Oconnell	836.60	153.67	63.71	179.94	39.15	20.96	51.84	214.64	147.71	185.48	351.48	291.93	234.31	577.51	638.41	257.77	1441.91	1454.72	149.15
82	OCL-NRL	No	Oconnell	342.36	180.73	88.59	192.29	48.39	28.51	58.84	252.15	202.35	194.05	404.68	398.17	234.90	643.36	698.46	231.15	1467.63	1473.59	131.35
83	OCL-SCK	No	Oconnell	244.19	191.55	108.79	194.52	48.16	31.36	54.38	272.55	263.89	187.30	445.73	479.52	212.30	723.61	740.37	129.92	1486.10	1514.79	159.69
84	BDK	Yes	Burdekin	129441.86	40.10	18.73	68.68	20.95	13.27	57.19	48.97	29.15	60.03	79.42	50.63	85.58	143.45	104.27	127.32	664.35	625.11	144.66
85	BDK-001	No	Burdekin	3.69	24.57	23.79	11.16	9.15	6.41	3.09	28.01	28.04	3.21	45.16	44.32	4.13	81.16	81.53	4.26	673.11	674.33	6.82
86	BDK-002	No	Burdekin	5.15	22.69	22.38	9.86	9.68	8.42	2.10	26.16	25.82	2.19	42.23	42.54	3.38	77.05	77.27	3.54	674.19	678.60	7.73
87	BDK-003	No	Burdekin	13.45	23.63	23.17	10.83	11.59	11.16	4.81	26.31	25.97	2.78	42.79	42.31	3.63	78.79	79.91	4.78	671.33	671.45	8.19
88	BDK-004	No	Burdekin	28.25	23.94	23.23	11.33	12.89	12.27	4.66	27.83	27.62	3.94	45.04	44.75	3.81	81.15	83.40	5.97	665.26	660.87	13.68
89	BDK-005	No	Burdekin	38.19	44.81	30.83	43.82	16.20	15.42	9.59	52.80	45.63	24.46	90.00	85.71	33.02	172.12	187.85	34.07	722.34	719.02	34.17
90	BDK-006	No	Burdekin	45.34	24.24	23.45	11.61	13.41	11.82	6.56	27.62	27.27	3.86	44.69	44.10	4.59	79.86	81.53	6.25	665.42	663.93	13.69
91	BDK-007	No	Burdekin	119.04	141.08	111.29	111.98	45.00	34.73	35.69	162.44	157.93	64.10	250.78	251.11	74.08	384.52	340.87	103.47	853.69	771.48	156.08
92	BDK-008	No	Burdekin	151.23	29.03	24.17	32.69	13.06	11.99	6.50	38.15	28.28	31.83	71.85	44.40	57.22	167.18	186.37	93.14	695.90	694.14	23.02
93	BDK-009	No	Burdekin	208.98	103.24	71.01	92.29	34.78	21.95	41.85	111.46	101.43	53.59	183.07	171.45	71.39	329.63	295.69	110.63	868.79	783.08	165.68
94	BDK-010	No	Burdekin	541.24	95.80	59.36	97.67	31.41	22.65	33.20	109.77	99.35	66.68	178.37	166.63	85.03	307.17	290.42	114.13	802.72	741.68	148.75
95	BDK-011	No	Burdekin	766.33	77.30	40.56	89.32	27.23	18.54	29.27	89.97	70.78	65.83	146.79	132.59	89.45	256.52	241.49	127.68	764.50	715.89	138.58
96	BDK-012	No	Burdekin	925.71	69.04	34.99	84.32	24.79	16.78	27.42	81.02	56.41	64.33	133.67	119.04	89.39	240.26	233.42	127.54	752.43	708.44	129.32
97	BDK-013	No	Burdekin	1094.36	62.35	32.06	79.31	23.30	15.75	25.62	73.20	39.83	62.01	120.52	86.30	87.90	216.74	219.01	129.81	738.30	697.57	124.07
98	BDK-014	No	Burdekin	34895.90	48.82	27.41	67.11	27.23	17.81	36.71	57.45	40.26	52.19	91.59	68.84	72.17	163.02	136.09	108.83	767.17	703.87	180.33
99	BDK-015	No	Burdekin	36033.55	49.20	27.58	67.52	27.11	17.74	36.44	57.89	40.21	52.57	92.41	69.06	72.84	164.55	136.78	109.90	766.13	703.56	178.88
100	BDK-016	No	Burdekin	39186.11	48.56	27.66	66.48	27.15	17.58	52.30	57.37	39.59	51.75	91.94	68.41	71.84	165.23	137.54	108.35	759.33	700.44	173.23
101	BDK-017	No	Burdekin	8218.07	112.28	55.72	129.03	46.47	31.18	50.93	132.58	101.34	108.04	209.89	187.81	146.67	349.21	325.99	195.85	798.44	728.00	206.45
102	BDK-018	No	Burdekin	10927.93	14.96	8.86	21.91	10.69	7.82	12.24	20.68	15.71	21.12	35.20	27.98	32.06	70.50	57.87	54.61	597.63	595.15	29.89
103	BDK-019	No	Burdekin	16114.17	23.56	10.61	47.96	15.36	10.29	19.79	30.01	15.79	42.15	50.56	29.27	61.45	96.72	72.03	93.30	610.95	610.53	34.48
104	BDK-020	No	Burdekin	35369.23	20.86	11.70	33.88	13.23	10.09	14.66	27.15	19.70	29.74	45.49	34.59	43.71	87.29	71.28	69.13	567.29	566.62	24.58
105	BDK-021	No	Burdekin	50283.68	20.24	11.43	31.91	12.77	9.58	19.17	26.46	19.28	28.10	44.31	33.93	41.39	85.16	69.43	65.60	576.73	575.92	30.24
106	TUL	Yes	Tully	1362.0	178.32	123.58	173.20	92.84	29.98	154.96	240.27	197.48	183.31	406.16	381.78	258.21	717.14	813.14	280.05	3139.72	2997.31	779.98
107	TUL-DP	No	Tully	667.7	182.18	125.28	168.33	111.10	47.14	195.75	234.45	172.71	173.88	393.04	347.37	252.47	703.64	821.45	288.56	2888.93	2651.47	804.57
108	TUL-GR	No	Tully	481.9	161.78	107.65	158.03	112.67	31.73	225.41	192.06	128.39	149.80	321.34	227.18	219.16	624.87	720.53	292.65	2816.86	2621.27	794.99
109	LVP	Yes	Liverpool	286.4	217.64	196.88	174.77	71.57	30.88	86.13	283.32	290.20	159.13	444.96	426.90	206.24	716.45	721.36	266.96	3350.76</		

Table S7: Topographic metrics for east-draining mainstem basins derived from 30m SRTM DEM (values > 90th percentile)

#	Sample ID	Mainstem	Drainage Basin	Area (km2)	Slope (m.km-1)			ksn (m0.9)			Local Relief (m) - 1km radius			Local Relief (m) - 2km radius			Local Relief (m) - 5km radius			Annual Rainfall (mm)		
					Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean	Median	St. Dev.
1	MTC	Yes	Mitchell	3890.63	697.32	675.03	83.23	357.89	327.74	95.49	665.21	650.71	54.94	904.57	889.35	56.55	1171.88	1163.15	46.44	1367.30	1348.29	76.40
2	TMB	Yes	Tambo	2781.44	564.20	544.52	75.77	303.25	271.21	121.14	521.74	505.77	61.75	726.14	698.83	82.61	1020.43	992.15	71.15	1059.02	1041.25	79.04
3	SNW	Yes	Snowy	13551.32	522.29	498.28	95.38	357.70	297.50	199.90	507.48	493.55	63.93	714.82	694.03	77.90	1024.94	1004.93	87.25	1464.02	1422.56	213.51
4	CNN	Yes	Cann	645.78	534.67	516.05	71.95	237.16	224.50	57.97	474.03	459.39	51.33	653.44	635.35	65.41	865.13	860.88	18.72	1007.58	1004.63	11.91
5	GNA	Yes	Genoa	934.27	459.17	431.24	98.76	235.55	206.71	105.16	419.74	409.40	49.03	572.00	553.61	51.78	746.19	745.88	33.60	963.60	961.09	13.70
6	BGA	Yes	Bega	1813.66	622.21	599.71	91.44	299.34	233.60	185.09	569.07	559.24	46.02	750.77	741.11	41.70	974.93	964.62	32.22	991.09	987.31	40.73
7	TRS	Yes	Tuross	1659.67	634.46	605.01	107.94	371.68	273.83	281.60	600.96	586.79	63.91	814.17	805.66	50.41	1040.91	1039.69	35.22	996.61	983.58	30.89
8	MOR	Yes	Moruya	1319.92	699.56	678.82	84.31	260.30	232.65	94.70	620.07	607.36	49.19	784.10	774.27	40.80	952.37	954.87	19.54	980.04	977.01	11.02
9	CLY	Yes	Clyde	1400.83	633.58	589.30	153.91	236.94	199.15	102.67	578.12	568.68	62.17	739.60	726.32	55.82	939.32	933.13	36.80	1147.12	1144.74	15.81
10	SHL	Yes	Shoalhaven	6522.75	528.84	475.34	178.25	395.49	323.90	239.02	439.45	429.57	56.54	564.90	556.30	46.28	755.87	730.75	83.42	1317.92	1324.01	131.00
11	MQR	Yes	Illawarra	33.63	701.83	630.25	206.34	396.16	396.16	0.00	519.81	520.11	10.97	669.73	668.59	8.32	760.35	759.17	2.50	1529.12	1519.91	17.95
12	COL	Yes	Colo	4344.24	711.84	628.76	246.66	327.13	288.75	135.13	466.23	460.05	42.33	568.69	557.73	46.18	731.58	710.87	45.36	1221.67	1210.23	54.01
13	MCD	Yes	Macdonald	1741.20	531.04	510.57	72.25	130.87	119.57	46.53	296.11	283.67	37.20	378.53	361.78	50.91	539.12	532.23	40.94	952.55	949.88	10.71
14	HNT	Yes	Hunter	17835.58	524.96	490.72	123.30	203.72	157.42	85.43	437.43	420.18	67.53	603.33	582.53	83.23	848.55	835.28	87.42	1083.16	1065.18	81.26
15	MAN	Yes	Manning	6425.75	589.69	567.99	80.77	338.66	294.96	175.45	550.45	538.09	51.46	717.88	710.25	45.21	922.75	903.75	68.68	1351.03	1339.49	64.58
16	HAS	Yes	Hastings	1656.52	626.89	598.35	104.52	378.58	311.01	209.32	580.70	570.26	60.86	758.69	750.93	48.95	932.33	933.94	20.76	1656.32	1603.44	110.52
17	MCL	Yes	Macleay	10246.08	687.55	657.02	124.02	518.81	376.57	429.45	611.06	598.37	54.12	774.85	762.02	57.65	988.08	970.03	70.30	1397.17	1381.71	64.07
18	BLG	Yes	Bellinger	667.91	756.64	719.46	127.08	344.64	290.23	204.24	698.45	685.61	53.79	965.08	955.43	66.97	1285.66	1281.61	27.64	1933.35	1942.03	62.20
19	CLA	Yes	Clarence	17382.81	570.01	542.66	109.74	362.59	291.84	244.35	518.50	503.00	67.93	690.92	671.73	73.93	915.15	899.19	59.91	1544.54	1497.37	192.60
20	LGN	Yes	Logan	1273.63	584.11	533.89	162.39	219.33	196.85	77.01	584.87	560.22	86.59	822.18	790.69	111.00	1118.45	1100.30	42.84	1557.70	1569.14	119.91
21	BRM	Yes	Bremer	636.51	343.18	300.98	137.77	70.65	57.05	33.85	343.35	323.89	78.93	484.97	468.74	79.26	701.23	643.24	121.96	930.02	927.28	10.30
22	LOC	Yes	Lockyer	2552.77	518.79	480.09	134.04	138.99	124.04	45.65	479.82	465.69	69.96	624.41	603.11	69.36	802.90	787.20	75.52	944.55	928.28	47.42
23	BRS	Yes	Brisbane	3915.86	397.41	380.18	72.81	144.04	122.34	67.63	265.38	258.19	27.12	332.08	323.49	31.11	458.51	450.60	40.59	1031.34	1027.32	31.58
24	STN	Yes	Stanley	196.90	421.66	392.16	104.48	112.44	86.14	82.25	352.58	356.55	22.67	411.51	410.55	10.17	493.63	484.89	17.69	1660.06	1681.90	65.06
25	MAR	Yes	Mary	6843.54	448.85	427.73	85.17	145.04	114.39	138.95	351.72	341.41	42.18	447.79	442.10	37.86	574.42	557.67	44.83	1453.55	1429.78	92.45
26	BUR	Yes	Burnett	32911.88	256.24	228.11	92.95	93.00	65.45	125.92	200.67	180.36	58.51	278.95	251.34	75.02	414.66	387.22	91.81	903.39	893.96	42.41
27	FTZ	Yes	Fitzroy	139049.16	271.45	237.31	123.07	93.01	68.33	109.99	237.18	215.89	74.57	335.65	308.80	90.72	490.52	464.31	103.89	944.52	862.70	203.88
28	PLA	Yes	Plane Creek	326.97	436.52	421.55	84.03	68.06	40.57	40.76	430.82	414.28	75.12	588.08	575.13	51.85	700.14	699.94	2.43	1747.13	1725.51	60.82
29	PIO	Yes	Pioneer	1363.69	513.57	488.82	94.24	252.02	226.68	93.60	509.12	493.46	72.58	712.97	704.84	77.34	970.13	944.91	110.02	1822.67	1827.47	57.99
30	OCL	Yes	O'Connell	836.77	562.51	535.91	112.59	170.75	147.37	65.61	584.78	571.93	61.25	773.03	775.24	44.51	914.72	916.93	18.79	1680.84	1669.18	54.33
31	BDK	Yes	Burdekin	129441.86	207.64	167.90	116.57	101.65	74.87	188.60	198.41	176.75	75.82	290.75	264.21	94.42	444.69	403.78	126.41	1005.71	905.00	211.72
32	TUL	Yes	Tully	1362.0	556.95	519.41	131.71	399.80	297.28	306.96	576.29	563.80	52.35	823.35	811.28	50.67	1057.51	1042.63	37.39	4413.44	4385.79	138.35
33	LVP	Yes	Liverpool	286.4	559.37	533.33	91.18	272.72	249.60	69.07	563.52	547.06	59.14	806.93	796.86	56.59	1119.65	1124.89	11.92	4403.70	4325.67	191.94
34	SJN	Yes	South Johnstone	503.1	497.87	467.86	103.99	258.57	205.12	134.74	420.45	403.69	59.47	582.80	565.00	78.52	822.87	818.83	26.22	4516.00	4484.89	242.70
35	NJN	Yes	North Johnstone	959.5	500.81	460.64	140.40	365.69	317.12	165.32	420.84	408.36	55.03	559.77	547.12	51.99	725.68	721.94	41.13	4415.94	4392.55	264.71
36	BRR	Yes	Barron	1992.94	390.70	367.88	93.60	295.88	170.15	644.12	372.74	362.74	53.94	557.46	542.40	71.01	894.94	866.23	115.25	2515.13	2461.08	202.59
37	BRR-ESC	Yes	Barron (Escp.)	55.52	632.81	596.24	115.18	638.70	827.72	202.38	622.90	616.68	40.33	925.71	917.15	39.39	1271.15	1271.04	4.22	3933.92	4012.78	163.04
38	DAI	Yes	Daintree	968.95	517.10	485.78	104.34	372.79	276.05	268.93	541.38	504.83	119.74	811.00	749.19	158.50	1199.71	1225.83	112.90	3163.45	3090.55	255.68

Table S8: Topographic metrics for west-draining basins derived from 30m SRTM DEM

#	Sample ID	Mainstem	Drainage Basin	Area (km2)	Slope (m.km-1)		ksn (m0.9)		Local Relief (m) - 1km		Annual Rainfall (mm)	
					Mean	Median	Mean	Median	Mean	Median	Mean	Median
1	MRY-AW	No	Murray	989.90	280.28	256.42	169.50	153.67	360.90	353.10	1185.20	1160.00
2	MRY-BGC	No	Murray	90.49	340.43	326.43	232.28	220.25	449.37	432.01	1428.57	1497.00
3	MRY-SWP	No	Murray	373.23	327.11	298.35	246.74	195.24	419.44	409.07	1553.76	1695.50
4	BGA-BG28	No	Murrumbidgee	10.62	85.86	74.61	19.63	20.27	90.97	88.95	969.58	961.78
5	BGA-BG29	No	Murrumbidgee	17.32	72.73	63.38	30.46	33.64	104.67	100.92	907.64	903.07
6	BGA-BG30	No	Murrumbidgee	60.88	86.64	73.87	23.35	23.61	113.37	103.26	956.17	958.74
7	BGA-BG31	No	Murrumbidgee	74.49	87.25	76.39	32.29	24.62	103.23	95.42	973.45	979.31
8	MBG-LP1	No	Murrumbidgee	20.00	111.01	96.14	19.25	5.90	153.15	159.88	1159.22	1153.00
9	MBG-LP2	No	Murrumbidgee	95.97	113.49	103.04	28.67	27.27	142.52	132.07	1176.40	1170.00
10	MBG-TLB01	No	Murrumbidgee	48.96	75.40	63.65	20.08	18.24	72.66	74.73	705.40	703.00
11	MBG-TLB03	No	Murrumbidgee	106.33	59.67	51.63	13.86	13.76	54.20	51.16	726.22	724.00
12	MBG-TLB04	No	Murrumbidgee	16.32	124.05	104.80	82.89	56.38	133.94	122.64	736.24	740.00
13	MBG-TLB07	No	Murrumbidgee	11.82	162.45	152.70	59.70	61.90	193.99	206.20	825.29	823.00
14	MBG-TLB08	No	Murrumbidgee	5.41	118.88	108.83	52.05	48.31	133.72	133.13	771.14	773.00
15	MBG-TLB09	No	Murrumbidgee	37.41	173.66	149.36	90.26	94.39	206.08	207.95	770.87	766.50
16	MBG-TLB11	No	Murrumbidgee	21.81	168.90	157.74	70.86	59.18	203.11	214.80	835.09	824.00
17	LCH-TLB05	No	Lachlan	52.72	78.84	69.34	35.04	30.74	73.15	72.09	760.60	759.50
18	LCH-TLB10	No	Lachlan	79.42	76.54	67.41	33.34	27.42	67.75	65.00	784.91	784.00

Table S9: Topographic metrics for east- and west-draining basins derived from 90m SRTM DEM

#	Sample ID	Mainstem	Drainage Basin	Slope (m.km-1)			Annual Rainfall (mm)		
				Mean	Median	St. Dev.	Mean	Median	St. Dev.
1	MTC	Yes	Mitchell	322.31	318.12	168.27	950.94	918.09	219.12
2	TMB	Yes	Tambo	220.48	194.95	137.64	774.33	749.73	116.51
3	SNW	Yes	Snowy	164.51	122.64	134.25	813.71	740.81	257.89
4	SNW-CP	No	Snowy	144.12	126.09	90.24	1944.06	1946.10	29.43
5	SNW-GTG	No	Snowy	280.80	292.61	110.12	1865.55	1868.61	29.68
6	SNW-MK	No	Snowy	226.00	229.92	61.85	2017.19	2017.19	0.00
7	SNW-PPC	No	Snowy	127.71	119.07	68.32	1744.15	1739.83	20.12
8	SNW-SPC	No	Snowy	162.55	151.29	96.43	1829.08	1821.22	40.29
9	CNN	Yes	Cann	212.88	190.60	134.16	904.83	903.19	67.31
10	GNA	Yes	Genoa	149.27	114.67	111.75	879.60	886.33	58.80
11	BGA	Yes	Bega	198.07	134.90	164.20	836.61	830.20	71.62
12	BGA-BG05	No	Bega	127.12	113.87	74.33	829.79	827.86	6.90
13	BGA-BG08	No	Bega	119.85	113.39	55.55	811.54	811.61	6.94
14	BGA-BG09	No	Bega	112.55	70.54	108.44	837.61	834.17	21.34
15	BGA-BG10	No	Bega	68.73	67.06	29.51	806.58	806.11	6.38
16	BGA-BG14	No	Bega	149.93	112.43	111.12	814.75	799.62	38.46
17	BGA-BG15	No	Bega	143.48	116.22	104.32	853.94	843.67	77.98
18	BGA-BG16	No	Bega	120.87	83.25	107.62	764.83	752.61	39.13
19	BGA-BG17	No	Bega	155.10	90.57	138.10	755.58	728.80	59.63
20	BGA-BG21	No	Bega	261.51	204.90	208.07	793.44	776.31	51.27
21	BGA-BG22	No	Bega	333.40	345.17	162.69	817.48	800.29	44.77
22	BGA-BG23	No	Bega	225.79	183.93	164.51	802.78	761.04	86.01
23	BGA-BG25	No	Bega	159.16	125.32	118.44	873.83	914.66	102.85
24	BGA-BG26	No	Bega	160.00	134.24	109.92	932.62	932.15	88.54
25	BGA-BG27	No	Bega	151.74	121.87	111.29	960.88	987.31	84.77
26	TRS	Yes	Tuross	232.18	200.33	161.73	893.58	896.09	64.08
27	MOR	Yes	Moruya	294.31	274.82	180.80	879.33	873.50	60.54
28	CLY	Yes	Clyde	201.33	152.75	160.71	1007.31	1015.22	87.71
29	SHL	Yes	Shoalhaven	123.22	72.31	137.98	876.75	807.17	184.66
30	MQR	Yes	Illawarra	232.68	200.06	164.26	1388.89	1377.79	69.79
31	HWK-001	No	Hawkesbury	124.80	99.31	82.10	1067.90	1073.75	39.60
32	HWK-002	No	Hawkesbury	105.23	97.94	51.98	1019.98	1013.36	34.69
33	COL	Yes	Colo	224.31	188.72	173.72	932.66	926.09	157.00
34	MCD	Yes	Macdonald	219.49	209.35	115.90	886.23	883.26	37.96
35	HNT	Yes	Hunter	156.83	115.31	133.95	797.46	759.99	135.35
36	HNT-SNGT	No	Hunter	162.79	123.40	134.93	794.35	750.59	136.84
37	HNT-WLL	No	Hunter	197.35	192.94	123.79	895.32	888.77	92.89
38	MAN	Yes	Manning	234.17	212.59	149.40	1118.19	1093.36	118.01
39	HAS	Yes	Hastings	232.47	199.31	158.82	1421.90	1413.55	125.39
40	MCL	Yes	Macleay	182.77	99.14	188.00	1029.05	978.29	197.80
41	BLG	Yes	Bellinger	318.52	316.06	195.26	1601.02	1573.51	182.37
42	CLA	Yes	Clarence	170.54	121.59	146.49	1090.43	1048.73	187.00
43	LGN	Yes	Logan	179.93	135.68	151.21	1089.10	1006.01	196.78
44	BRM	Yes	Bremer	73.02	43.05	91.59	888.63	886.96	22.95
45	LOC	Yes	Lockyer	140.93	96.06	139.72	833.81	828.19	53.57
46	LOC-15MC	No	Lockyer	125.40	114.54	67.91	864.89	857.54	43.86
47	LOC-FSC	No	Lockyer	178.95	158.87	111.16	782.31	780.68	15.39
48	LOC-LC	No	Lockyer	213.84	165.59	183.38	891.42	877.42	45.34
49	LOC-MC	No	Lockyer	131.17	113.76	83.55	840.92	830.76	52.27
50	LOC-PC	No	Lockyer	169.35	150.54	101.86	894.68	888.91	52.90
51	LOC-SCS	No	Lockyer	113.26	101.31	66.03	810.69	799.98	29.86
52	LOC-TH	No	Lockyer	264.89	240.39	166.60	842.88	822.46	63.99
53	BRS	Yes	Brisbane	120.13	92.78	92.13	892.05	892.31	77.55
54	BRS-CC	No	Brisbane	94.04	76.69	67.18	837.20	843.22	46.91
55	BRS-UP	No	Brisbane	158.59	135.35	99.78	936.28	934.76	36.33
56	STN	Yes	Stanley	105.37	63.98	111.85	1531.90	1545.01	102.80
57	MAR	Yes	Mary	118.25	73.38	114.20	1098.51	1063.77	169.89
58	MAR-CNDL	No	Mary	171.37	141.20	124.52	1381.95	1379.63	88.94
59	MAR-KNW	No	Mary	177.30	144.77	132.46	1296.48	1290.79	112.89
60	MAR-OB	No	Mary	150.66	110.59	124.68	1519.21	1533.22	114.86
61	BUR	Yes	Burnett	63.36	46.97	60.90	735.82	714.61	80.91
62	BUR-EID	No	Burnett	74.85	56.85	65.37	719.26	706.67	63.44
63	BUR-GYD	No	Burnett	60.76	46.21	55.98	721.70	703.12	70.17
64	BUR-MBR	No	Burnett	54.27	42.59	49.34	694.34	680.61	49.29
65	FTZ	Yes	Fitzroy	48.20	24.04	71.97	674.47	647.07	114.58
66	FTZ-CMT	No	Fitzroy	56.48	20.83	93.64	644.86	646.28	25.37
67	FTZ-CNR	No	Fitzroy	79.70	32.21	104.09	916.28	813.84	242.71
68	FTZ-DON	No	Fitzroy	85.11	49.29	95.32	706.85	702.43	43.89
69	FTZ-EBW	No	Fitzroy	48.06	24.08	71.63	666.96	645.97	102.43
70	FTZ-ISC-IS	No	Fitzroy	35.42	18.01	51.40	623.08	616.15	37.59
71	FTZ-ISC-MDR	No	Fitzroy	51.30	18.26	82.17	765.93	681.73	213.82
72	FTZ-MKZ-B	No	Fitzroy	46.47	21.26	76.89	629.30	629.14	25.45
73	FTZ-MKZ-DS	No	Fitzroy	47.21	20.05	77.65	669.96	635.39	130.07
74	FTZ-NGA	No	Fitzroy	58.15	30.48	81.88	619.05	621.67	22.89
75	FTZ-TRS	No	Fitzroy	31.60	19.36	48.35	622.95	625.43	20.52
76	PLA	Yes	Plane Creek	76.02	15.78	122.79	1525.71	1528.05	115.24
77	PIO	Yes	Pioneer	143.28	90.06	140.50	1551.16	1533.28	156.75
78	PIO-BMSF	No	Pioneer	161.57	124.52	125.07	1442.04	1453.43	129.03
79	PIO-DWN	No	Pioneer	196.23	157.56	173.54	1672.70	1664.28	106.59

#	Sample ID	Mainstem	Drainage Basin	Slope (m.km-1)			Annual Rainfall (mm)		
				Mean	Median	St. Dev.	Mean	Median	St. Dev.
80	PIO-UP	No	Pioneer	212.89	186.76	174.68	1678.29	1668.20	108.33
81	OCL	Yes	Oconnell	137.85	56.49	162.33	1441.91	1454.72	149.15
82	OCL-NRL	No	Oconnell	163.50	80.06	174.34	1467.63	1473.59	131.35
83	OCL-SCK	No	Oconnell	173.11	100.76	175.26	1486.10	1514.79	159.69
84	BDK	Yes	Burdekin	34.62	16.47	57.95	664.35	625.11	144.66
85	BDK-001	No	Burdekin	21.61	21.54	8.50	673.11	674.33	6.82
86	BDK-002	No	Burdekin	19.91	20.59	7.09	674.19	678.60	7.73
87	BDK-003	No	Burdekin	20.62	21.03	8.24	671.33	671.45	8.19
88	BDK-004	No	Burdekin	20.78	20.88	8.75	665.26	660.87	13.68
89	BDK-005	No	Burdekin	38.90	26.98	35.32	722.34	719.02	34.17
90	BDK-006	No	Burdekin	21.07	21.13	8.97	665.42	663.93	13.69
91	BDK-007	No	Burdekin	120.62	98.53	92.95	853.69	771.48	156.08
92	BDK-008	No	Burdekin	24.94	21.16	26.26	695.90	694.14	23.02
93	BDK-009	No	Burdekin	87.95	62.88	76.29	868.79	783.08	165.68
94	BDK-010	No	Burdekin	82.02	53.01	81.30	802.72	741.68	148.75
95	BDK-011	No	Burdekin	66.31	35.23	74.46	764.50	715.89	138.58
96	BDK-012	No	Burdekin	59.23	29.92	70.33	752.43	708.44	129.32
97	BDK-013	No	Burdekin	53.52	27.44	66.19	738.30	697.57	124.07
98	BDK-014	No	Burdekin	42.02	24.05	55.87	767.17	703.87	180.33
99	BDK-015	No	Burdekin	42.35	24.18	56.22	766.13	703.56	178.88
100	BDK-016	No	Burdekin	41.81	24.27	55.32	759.33	700.44	173.23
101	BDK-017	No	Burdekin	96.36	50.07	109.36	798.44	728.00	206.45
102	BDK-018	No	Burdekin	13.13	7.88	18.92	597.63	595.15	29.89
103	BDK-019	No	Burdekin	20.19	9.28	39.84	610.95	610.53	34.48
104	BDK-020	No	Burdekin	18.20	10.34	28.73	567.29	566.62	24.58
105	BDK-021	No	Burdekin	17.66	10.08	27.07	576.73	575.92	30.24
106	TUL	Yes	Tully	155.31	109.60	144.87	3139.72	2997.31	779.98
107	TUL-DP	No	Tully	157.34	109.18	138.86	2888.93	2651.47	804.57
108	TUL-GR	No	Tully	137.53	92.72	127.24	2816.86	2621.27	794.99
109	LVP	Yes	Liverpool	187.84	172.59	145.71	3350.76	3265.96	540.25
110	LVP-UP	No	Liverpool	269.21	244.57	148.25	3434.92	3208.29	739.14
111	SJN	Yes	South Johnstone	149.52	120.53	118.43	3547.09	3515.66	459.51
112	SJN-UP	No	South Johnstone	179.65	157.47	115.07	3550.83	3516.45	529.76
113	NJN	Yes	North Johnstone	132.58	94.52	115.90	3352.91	3334.27	618.93
114	NJN-MD	No	North Johnstone	134.59	96.32	116.60	3330.12	3302.74	610.38
115	NJN-UP	No	North Johnstone	141.04	102.02	119.54	3288.28	3215.22	624.35
116	BRR	Yes	Barron	92.26	54.62	100.43	1688.06	1647.57	435.41
117	BRR-001	No	Barron	112.26	71.56	99.63	1901.86	1918.61	171.77
118	BRR-002	No	Barron	112.26	71.56	99.63	1901.86	1918.61	171.77
119	BRR-007	No	Barron	131.28	88.39	116.96	1764.16	1754.36	180.74
120	BRR-008	No	Barron	155.29	120.24	124.86	1633.56	1600.22	235.42
121	BRR-009	No	Barron	133.86	94.39	117.03	1700.29	1678.73	218.38
122	BRR-010	No	Barron	133.86	94.39	117.03	1700.29	1678.73	218.38
123	BRR-011	No	Barron	91.37	53.90	99.31	1674.80	1628.96	434.09
124	BRR-012	No	Barron	85.43	73.93	50.48	2177.00	2072.06	174.49
125	BRR-013	No	Barron	210.53	209.22	111.02	2441.58	2441.58	83.83
126	BRR-ESC	Yes	Barron (Escarpment)	248.25	225.25	154.93	2408.36	2129.45	652.07
127	BRR-ESC-004	No	Barron (Escarpment)	377.52	364.28	154.99	2528.58	2472.16	114.98
128	BRR-ESC-006	No	Barron (Escarpment)	311.09	290.17	172.20	2047.90	2032.39	145.67
129	BRR-ESC-014	No	Barron (Escarpment)	350.37	362.13	131.51	2566.52	2566.52	72.99
130	BRR-ESC-015	No	Barron (Escarpment)	415.14	409.35	148.74	2556.43	2540.80	137.82
131	DAI	Yes	Daintree	171.95	141.65	123.11	1997.88	1851.49	556.47
132	MRY-AW	No	Murray	253.04	232.46	138.09	1185.2	1160.0	233.4
133	MRY-BGC	No	Murray	305.49	293.22	144.93	1428.6	1497.0	281.2
134	MRY-SWP	No	Murray	293.60	269.46	174.54	1553.8	1695.5	334.4
135	BGA-BG28	No	Murrumbidgee	75.05	67.79	44.18	969.6	961.8	32.0
136	BGA-BG29	No	Murrumbidgee	66.32	59.74	36.08	907.6	903.1	34.7
137	BGA-BG30	No	Murrumbidgee	76.49	66.78	47.21	956.2	958.7	40.6
138	BGA-BG31	No	Murrumbidgee	77.45	70.15	45.19	973.5	979.3	44.1
139	MBG	Yes	Murrumbidgee	129.81	92.59	113.58	846.1	770.0	215.8
140	MBG-LP1	No	Murrumbidgee	97.29	84.17	69.89	1159.2	1153.0	19.3
141	MBG-LP2	No	Murrumbidgee	96.79	86.37	60.71	1176.4	1170.0	33.2
142	MBG-TLB01	No	Murrumbidgee	52.62	43.05	38.69	705.4	703.0	15.7
143	MBG-TLB03	No	Murrumbidgee	41.14	35.44	28.97	726.2	724.0	10.1
144	MBG-TLB04	No	Murrumbidgee	95.44	78.94	65.68	736.2	740.0	30.8
145	MBG-TLB07	No	Murrumbidgee	144.81	137.16	90.33	825.3	823.0	46.3
146	MBG-TLB08	No	Murrumbidgee	100.00	90.89	49.13	771.1	773.0	12.3
147	MBG-TLB09	No	Murrumbidgee	150.92	127.52	97.26	770.9	766.5	25.2
148	MBG-TLB11	No	Murrumbidgee	149.82	138.17	76.26	835.1	824.0	39.8
149	LCH	Yes	Lachlan	73.11	61.94	50.81	737.0	733.0	40.4
150	LCH-TLB05	No	Lachlan	56.97	50.80	34.43	760.6	759.5	20.3
151	LCH-TLB10	No	Lachlan	55.80	49.09	34.16	784.9	784.0	14.0
152	MCQ	Yes	Macquarie	100.28	70.66	90.41	757.1	745.0	78.0
153	GWY	Yes	Gwydir	83.76	59.59	74.61	821.3	810.0	56.5
154	MCN	Yes	Macintyre	71.19	46.51	75.31	767.3	765.0	82.3
155	BLN	Yes	Balonne	27.11	16.10	42.59	626.1	613.0	71.6
156	MRN	Yes	Maranoa	44.55	32.23	47.97	602.0	594.0	29.7
157	WRG	Yes	Warrego	20.95	14.59	25.94	513.3	508.0	58.6
158	BCO	No	Barcoo	15.66	11.65	18.87	498.0	497.0	16.6
159	BCO-RC	Yes	Barcoo	17.18	11.37	23.16	467.7	476.0	51.1
160	TMS	Yes	Thomson	13.52	9.89	17.21	450.7	448.0	59.4

Table S10: Flood variability metrics based on Rustomji et al. (2009)

Drainage Basin	Alpha		FFMI		Q2 vs. Q50	
	Mean	Median	Mean	Median	Mean	Median
Mitchell	0.476	0.432	0.509	0.477	5.669	4.272
Tambo	0.512	0.512	0.665	0.665	6.365	6.365
Snowy	0.607	0.584	0.583	0.614	8.310	8.283
Cann	0.385	0.385	0.700	0.700	4.067	4.067
Genoa	0.279	0.279	0.793	0.793	3.522	3.522
Bega	0.418	0.399	0.688	0.666	4.821	4.599
Tuross	0.345	0.385	0.707	0.731	4.734	4.506
Moruya	0.346	0.346	0.761	0.761	4.141	4.141
Clyde	0.380	0.380	0.683	0.683	5.361	5.361
Shoalhaven	0.412	0.350	0.674	0.712	4.887	4.921
Colo	0.325	0.325	0.759	0.759	6.227	6.227
Macdonald	0.613	0.613	0.613	0.613	8.329	8.329
Hunter	0.573	0.577	0.633	0.633	8.583	8.101
Manning	0.359	0.373	0.486	0.488	4.303	4.252
Hastings	0.403	0.349	0.547	0.539	4.142	3.535
Macleay	0.400	0.425	0.551	0.576	4.941	5.287
Bellinger	0.278	0.278	0.497	0.497	2.984	2.984
Clarence	0.438	0.413	0.601	0.590	5.726	5.656
Logan	0.405	0.368	0.642	0.678	5.983	5.545
Bremer	0.216	0.253	0.702	0.713	2.726	3.105
Lockyer	0.366	0.416	0.747	0.757	5.795	5.113
Brisbane	0.641	0.765	0.802	0.817	9.454	10.629
Mary	0.475	0.435	0.706	0.701	6.879	6.779
Fitzroy	0.456	0.453	0.694	0.687	6.554	5.758

Table S11: Topographic metrics for OCTOPUS basins derived from 90m SRTM DEM (mean values)

#	Sample ID	Author	Pub Year	Group	10Be E (mm.kyr-1)	d[E]	Basin Slope (m.km-1)	ksn (m0.9)	Annual Rainfall (mm)
1	S008WTS001	Bierman	2001	NAM	3.99	0.82	39.00	22.07	276.10
2	S008WTS002	Bierman	2001	NAM	12.54	2.57	197.77	107.00	244.20
3	S008WTS003	Bierman	2001	NAM	7.03	1.47	132.64	71.18	227.20
4	S008WTS004	Bierman	2001	NAM	6.42	1.40	132.90	-	196.10
5	S008WTS005	Bierman	2001	NAM	5.53	1.18	40.73	31.81	278.60
6	S008WTS006	Bierman	2001	NAM	1.32	0.31	44.23	48.11	233.50
7	S008WTS007	Bierman	2001	NAM	5.65	1.24	48.45	40.42	279.00
8	S015WTS001	Matmon	2003	USA	19.75	3.93	293.87	127.10	1788.30
9	S015WTS002	Matmon	2003	USA	22.24	4.51	298.03	132.70	1687.00
10	S015WTS003	Matmon	2003	USA	16.31	3.30	328.79	117.00	1697.00
11	S015WTS004	Matmon	2003	USA	22.72	4.62	307.47	-	1643.00
12	S015WTS005	Matmon	2003	USA	23.95	4.80	363.75	194.10	1740.30
13	S015WTS006	Matmon	2003	USA	19.57	3.98	317.84	185.10	1673.90
14	S015WTS007	Matmon	2003	USA	26.28	5.31	386.65	205.40	1685.30
15	S015WTS008	Matmon	2003	USA	26.60	5.42	357.84	207.00	1670.00
16	S015WTS009	Matmon	2003	USA	23.46	4.75	420.78	191.50	1695.30
17	S015WTS010	Matmon	2003	USA	18.18	3.64	338.26	173.60	1771.60
18	S015WTS011	Matmon	2003	USA	23.81	4.84	324.58	182.90	1683.20
19	S015WTS012	Matmon	2003	USA	27.01	5.56	227.28	181.50	1661.90
20	S015WTS013	Matmon	2003	USA	26.81	5.47	227.28	181.50	1661.90
21	S015WTS014	Matmon	2003	USA	43.72	8.90	227.28	181.50	1661.90
22	S015WTS015	Matmon	2003	USA	24.09	4.93	227.28	181.50	1661.90
23	S015WTS016	Matmon	2003	USA	24.35	5.00	227.28	181.50	1661.90
24	S015WTS017	Matmon	2003	USA	27.23	5.59	227.28	181.50	1661.90
25	S015WTS018	Matmon	2003	USA	38.06	7.79	227.28	181.50	1661.90
26	S015WTS019	Matmon	2003	USA	29.17	6.01	336.72	184.30	1640.80
27	S015WTS020	Matmon	2003	USA	19.55	4.09	319.83	163.70	1583.20
28	S015WTS021	Matmon	2003	USA	35.45	7.26	372.63	185.50	1655.80
29	S015WTS022	Matmon	2003	USA	21.30	4.38	335.06	212.60	1672.00
30	S015WTS023	Matmon	2003	USA	19.62	4.03	312.12	205.80	1702.30
31	S015WTS024	Matmon	2003	USA	29.71	5.93	341.21	130.10	1779.50
32	S015WTS025	Matmon	2003	USA	29.71	5.93	341.21	130.10	1779.50
33	S015WTS026	Matmon	2003	USA	27.02	5.40	341.21	130.10	1779.50
34	S015WTS027	Matmon	2003	USA	32.37	6.54	343.29	246.20	1635.70
35	S015WTS028	Matmon	2003	USA	31.46	6.37	371.23	230.70	1663.30
36	S015WTS029	Matmon	2003	USA	35.33	7.28	398.00	241.90	1549.70
37	S015WTS030	Matmon	2003	USA	30.65	6.31	355.35	246.60	1607.10
38	S015WTS031	Matmon	2003	USA	24.12	5.01	255.65	175.50	1609.60
39	S015WTS032	Matmon	2003	USA	21.51	4.55	283.39	179.80	1570.90
40	S015WTS033	Matmon	2003	USA	29.74	6.05	366.11	236.00	1677.10
41	S015WTS034	Matmon	2003	USA	20.78	4.29	324.80	178.00	1659.40
42	S015WTS035	Matmon	2003	USA	13.87	3.01	211.97	113.30	1523.10
43	S015WTS036	Matmon	2003	USA	17.61	3.84	292.75	149.80	1561.70
44	S015WTS037	Matmon	2003	USA	19.00	4.01	284.08	247.60	1636.50
45	S015WTS038	Matmon	2003	USA	18.59	3.84	334.88	199.70	1708.20
46	S015WTS039	Matmon	2003	USA	18.46	3.78	292.20	158.70	1604.70
47	S015WTS040	Matmon	2003	USA	24.00	4.92	321.90	202.80	1686.90
48	S015WTS041	Matmon	2003	USA	18.87	3.89	324.50	226.50	1708.50
49	S015WTS042	Matmon	2003	USA	20.28	4.22	304.71	169.80	1682.30
50	S015WTS043	Matmon	2003	USA	18.07	3.79	302.63	187.90	1660.70
51	S015WTS044	Matmon	2003	USA	32.20	6.46	343.75	225.30	1802.20
52	S015WTS045	Matmon	2003	USA	35.92	7.23	343.75	225.30	1802.20
53	S015WTS046	Matmon	2003	USA	50.39	10.14	343.75	225.30	1802.20
54	S015WTS047	Matmon	2003	USA	57.45	11.53	343.75	225.30	1802.20
55	S015WTS048	Matmon	2003	USA	47.42	9.50	354.64	194.90	1814.00
56	S015WTS049	Matmon	2003	USA	41.69	8.45	354.64	194.90	1814.00
57	S015WTS050	Matmon	2003	USA	57.59	11.53	354.64	194.90	1814.00
58	S015WTS051	Matmon	2003	USA	58.39	11.77	354.64	194.90	1814.00
59	S015WTS052	Matmon	2003	USA	32.92	6.71	324.22	190.90	1722.20
60	S015WTS053	Matmon	2003	USA	24.67	5.02	295.18	164.60	1736.80
61	S015WTS054	Matmon	2003	USA	22.98	4.79	285.83	219.90	1638.20
62	S015WTS055	Matmon	2003	USA	29.53	6.06	290.81	188.90	1687.20
63	S015WTS056	Matmon	2003	USA	28.91	5.93	290.81	188.90	1687.20
64	S015WTS057	Matmon	2003	USA	43.33	8.87	290.81	188.90	1687.20
65	S015WTS058	Matmon	2003	USA	54.38	11.12	290.81	188.90	1687.20
66	S020WTS001	Hewawasam	2003	LKA	11.41	2.51	241.74	190.50	2455.00
67	S020WTS002	Hewawasam	2003	LKA	8.76	1.96	241.74	190.50	2455.00
68	S020WTS003	Hewawasam	2003	LKA	6.96	1.52	241.74	190.50	2455.00
69	S020WTS004	Hewawasam	2003	LKA	7.51	1.67	241.74	190.50	2455.00
70	S020WTS005	Hewawasam	2003	LKA	6.25	1.38	241.74	190.50	2455.00
71	S020WTS006	Hewawasam	2003	LKA	9.88	2.17	221.53	159.20	2649.30
72	S020WTS007	Hewawasam	2003	LKA	9.57	2.14	221.53	159.20	2649.30
73	S020WTS008	Hewawasam	2003	LKA	12.58	2.87	221.53	159.20	2649.30
74	S020WTS009	Hewawasam	2003	LKA	14.70	3.33	221.53	159.20	2649.30

#	Sample ID	Author	Pub Year	Group	10Be E (mm.kyr-1)	d[E]	Basin Slope (m.km-1)	ksn (m0.9)	Annual Rainfall (mm)
75	S021WTS001	vonBlanckenburg	2004	LKA	13.93	3.20	231.66	195.10	2554.40
76	S021WTS002	vonBlanckenburg	2004	LKA	13.72	3.73	241.74	190.50	2455.00
77	S021WTS003	vonBlanckenburg	2004	LKA	14.39	3.41	229.13	131.60	2529.90
78	S021WTS004	vonBlanckenburg	2004	LKA	16.82	3.84	249.95	221.90	2488.10
79	S021WTS005	vonBlanckenburg	2004	LKA	15.35	3.60	271.32	197.70	2240.60
80	S021WTS006	vonBlanckenburg	2004	LKA	21.71	5.86	289.70	228.00	2256.70
81	S021WTS007	vonBlanckenburg	2004	LKA	18.04	4.34	238.53	198.20	2295.10
82	S021WTS008	vonBlanckenburg	2004	LKA	5.01	1.07	260.59	253.40	2168.00
83	S021WTS009	vonBlanckenburg	2004	LKA	22.93	4.99	322.61	257.70	2289.10
84	S021WTS010	vonBlanckenburg	2004	LKA	36.25	8.80	285.02	340.70	2094.40
85	S021WTS011	vonBlanckenburg	2004	LKA	24.75	5.53	359.75	354.30	2085.20
86	S021WTS012	vonBlanckenburg	2004	LKA	18.39	4.46	250.15	188.90	1986.00
87	S021WTS013	vonBlanckenburg	2004	LKA	14.95	4.44	187.85	167.10	1996.00
88	S021WTS014	vonBlanckenburg	2004	LKA	27.10	6.64	221.62	208.00	1923.60
89	S021WTS015	vonBlanckenburg	2004	LKA	11.94	2.66	221.53	159.20	2649.30
90	S021WTS016	vonBlanckenburg	2004	LKA	20.36	4.75	144.91	129.40	2582.00
91	S021WTS017	vonBlanckenburg	2004	LKA	42.31	10.40	219.71	134.80	2489.10
92	S021WTS018	vonBlanckenburg	2004	LKA	20.92	4.84	294.44	163.30	2300.50
93	S026WTS001	Reuter	2005	USA	21.06	4.99	74.45	24.80	1097.90
94	S026WTS002	Reuter	2005	USA	14.31	3.39	51.39	19.00	1075.60
95	S026WTS003	Reuter	2005	USA	19.61	4.59	81.27	33.50	1075.90
96	S026WTS004	Reuter	2005	USA	35.06	7.98	104.25	53.00	1018.50
97	S026WTS005	Reuter	2005	USA	11.03	2.53	138.05	38.40	1054.00
98	S026WTS006	Reuter	2005	USA	7.55	1.77	111.28	24.60	1040.70
99	S026WTS007	Reuter	2005	USA	19.06	4.38	136.11	42.80	1001.80
100	S026WTS008	Reuter	2005	USA	13.21	2.99	80.59	34.30	1019.60
101	S026WTS009	Reuter	2005	USA	16.46	3.72	149.58	49.50	1019.60
102	S026WTS010	Reuter	2005	USA	19.31	4.28	105.38	35.00	1102.70
103	S026WTS011	Reuter	2005	USA	9.05	2.02	128.81	41.80	978.80
104	S026WTS012	Reuter	2005	USA	8.81	1.95	125.00	44.90	1001.30
105	S026WTS013	Reuter	2005	USA	13.88	3.25	87.42	27.20	1109.20
106	S026WTS014	Reuter	2005	USA	18.81	4.52	54.94	16.10	1089.30
107	S026WTS015	Reuter	2005	USA	11.04	2.64	34.90	12.30	1085.70
108	S026WTS016	Reuter	2005	USA	9.68	2.28	58.10	24.40	1152.90
109	S026WTS017	Reuter	2005	USA	20.09	4.82	55.97	17.70	1100.00
110	S026WTS018	Reuter	2005	USA	17.73	3.97	113.77	51.90	1002.90
111	S026WTS019	Reuter	2005	USA	28.68	6.43	146.33	67.10	1032.90
112	S026WTS020	Reuter	2005	USA	69.21	15.94	115.95	55.60	892.90
113	S026WTS021	Reuter	2005	USA	60.21	15.42	134.21	58.10	901.40
114	S026WTS022	Reuter	2005	USA	40.24	9.39	116.92	58.00	904.40
115	S026WTS023	Reuter	2005	USA	72.27	22.14	118.07	40.80	908.70
116	S026WTS024	Reuter	2005	USA	70.62	18.39	123.59	45.00	915.20
117	S026WTS025	Reuter	2005	USA	92.20	23.08	106.23	49.60	989.10
118	S026WTS026	Reuter	2005	USA	76.78	17.63	109.06	51.20	1041.40
119	S026WTS027	Reuter	2005	USA	26.88	6.18	306.63	108.00	1065.50
120	S026WTS028	Reuter	2005	USA	21.73	4.84	200.34	68.10	1075.30
121	S026WTS029	Reuter	2005	USA	55.54	12.59	298.83	97.30	1068.40
122	S026WTS030	Reuter	2005	USA	33.57	7.56	261.65	64.30	1057.80
123	S026WTS031	Reuter	2005	USA	31.41	6.92	129.59	45.10	1033.30
124	S026WTS032	Reuter	2005	USA	18.50	4.03	60.78	36.00	1103.80
125	S026WTS033	Reuter	2005	USA	22.27	4.91	175.45	42.00	1094.20
126	S026WTS034	Reuter	2005	USA	35.59	7.93	196.93	54.80	1090.30
127	S026WTS035	Reuter	2005	USA	14.45	3.15	115.62	60.50	1099.70
128	S026WTS036	Reuter	2005	USA	40.43	9.13	275.95	61.10	1060.50
129	S026WTS037	Reuter	2005	USA	8.76	1.90	46.42	-	1054.20
130	S026WTS038	Reuter	2005	USA	13.80	3.03	129.00	126.80	1050.70
131	S026WTS039	Reuter	2005	USA	39.17	8.91	214.55	64.80	1045.20
132	S026WTS040	Reuter	2005	USA	18.74	4.14	167.37	31.00	1050.60
133	S026WTS041	Reuter	2005	USA	10.84	2.35	41.84	30.80	1090.90
134	S026WTS042	Reuter	2005	USA	14.42	3.14	89.09	103.30	1083.60
135	S026WTS043	Reuter	2005	USA	12.60	2.77	70.59	57.10	1060.90
136	S026WTS044	Reuter	2005	USA	12.23	2.71	60.27	56.90	1052.30
137	S026WTS045	Reuter	2005	USA	21.29	4.70	213.28	135.10	1048.30
138	S026WTS046	Reuter	2005	USA	33.54	7.47	288.55	77.30	1045.60
139	S026WTS047	Reuter	2005	USA	20.47	4.51	161.56	149.90	1058.60
140	S026WTS048	Reuter	2005	USA	6.32	1.37	21.32	-	1068.90
141	S026WTS049	Reuter	2005	USA	9.68	2.09	81.11	35.50	1061.30
142	S026WTS050	Reuter	2005	USA	10.00	2.34	125.04	41.70	1020.00
143	S026WTS051	Reuter	2005	USA	23.70	5.27	87.01	83.40	1071.10
144	S026WTS052	Reuter	2005	USA	16.99	3.73	51.83	34.30	1076.70
145	S026WTS053	Reuter	2005	USA	8.75	1.91	59.72	20.40	1075.50
146	S026WTS054	Reuter	2005	USA	13.85	3.05	132.89	39.00	1082.20
147	S026WTS055	Reuter	2005	USA	6.43	1.39	59.18	30.40	1109.30
148	S026WTS056	Reuter	2005	USA	11.55	2.72	43.67	13.80	1017.80
149	S026WTS057	Reuter	2005	USA	15.47	3.65	108.46	28.10	1032.70
150	S026WTS058	Reuter	2005	USA	6.47	1.51	60.70	7.80	1058.20

#	Sample ID	Author	Pub Year	Group	10Be E (mm.kyr-1)	d[E]	Basin Slope (m.km-1)	ksn (m0.9)	Annual Rainfall (mm)
151	S026WTS059	Reuter	2005	USA	8.33	1.84	58.59	56.10	1152.20
152	S026WTS060	Reuter	2005	USA	15.90	3.79	79.87	24.30	1071.80
153	S026WTS061	Reuter	2005	USA	19.25	4.54	107.09	25.30	1074.70
154	S026WTS062	Reuter	2005	USA	3.66	0.83	83.46	34.90	1023.70
155	S026WTS063	Reuter	2005	USA	11.14	2.49	207.70	64.80	1050.70
156	S026WTS064	Reuter	2005	USA	14.74	3.32	210.19	95.20	1051.50
157	S026WTS065	Reuter	2005	USA	23.28	5.19	249.41	122.70	1045.00
158	S026WTS066	Reuter	2005	USA	7.35	1.63	54.34	52.50	988.40
159	S026WTS067	Reuter	2005	USA	9.54	2.11	83.88	65.90	994.60
160	S026WTS068	Reuter	2005	USA	9.19	2.09	99.28	27.90	967.50
161	S026WTS069	Reuter	2005	USA	5.11	1.11	143.05	97.90	1052.30
162	S026WTS070	Reuter	2005	USA	6.72	1.45	186.74	58.10	1070.30
163	S026WTS071	Reuter	2005	USA	17.06	3.81	193.81	57.00	1092.40
164	S026WTS072	Reuter	2005	USA	14.15	3.10	90.28	15.50	1088.00
165	S026WTS073	Reuter	2005	USA	31.05	6.89	222.65	63.80	1070.50
166	S026WTS074	Reuter	2005	USA	21.37	4.71	227.68	99.10	1076.40
167	S026WTS075	Reuter	2005	USA	20.88	4.86	181.71	54.90	1024.00
168	S026WTS076	Reuter	2005	USA	8.92	2.11	65.74	68.30	1067.00
169	S026WTS077	Reuter	2005	USA	5.25	1.23	68.57	39.20	1069.40
170	S026WTS078	Reuter	2005	USA	5.41	1.28	49.80	34.90	1071.50
171	S026WTS079	Reuter	2005	USA	11.54	2.73	49.49	20.60	1104.20
172	S026WTS080	Reuter	2005	USA	8.33	1.94	95.74	58.50	1081.90
173	S026WTS081	Reuter	2005	USA	8.63	2.02	82.11	28.70	1073.60
174	S026WTS082	Reuter	2005	USA	9.69	2.26	68.79	22.40	1092.80
175	S026WTS083	Reuter	2005	USA	12.27	2.90	47.39	16.80	1093.00
176	S026WTS084	Reuter	2005	USA	9.11	2.13	53.95	27.10	1096.20
177	S026WTS085	Reuter	2005	USA	8.39	1.94	62.12	20.50	1120.50
178	S026WTS086	Reuter	2005	USA	9.60	2.23	64.26	21.70	1113.70
179	S026WTS087	Reuter	2005	USA	8.36	1.96	72.08	34.30	1068.50
180	S026WTS088	Reuter	2005	USA	9.65	2.31	32.55	6.70	1047.30
181	S030WTS001	Vanacker	2007	LKA	2.33	0.49	80.71	14.60	2036.30
182	S030WTS002	Vanacker	2007	LKA	2.72	0.57	61.43	-	2036.00
183	S030WTS003	Vanacker	2007	LKA	2.28	0.49	88.42	16.40	2050.00
184	S030WTS004	Vanacker	2007	LKA	1.70	0.37	135.54	-	2049.50
185	S030WTS005	Vanacker	2007	LKA	1.98	0.42	234.25	-	2048.30
186	S030WTS006	Vanacker	2007	LKA	3.32	0.70	130.75	104.80	2087.40
187	S030WTS007	Vanacker	2007	LKA	2.55	0.54	178.72	0.00	2063.00
188	S030WTS008	Vanacker	2007	LKA	4.19	0.87	139.13	-	2089.00
189	S030WTS009	Vanacker	2007	LKA	3.12	0.70	116.83	36.50	2051.80
190	S030WTS010	Vanacker	2007	LKA	52.71	14.55	478.18	333.50	2149.90
191	S030WTS011	Vanacker	2007	LKA	40.81	9.45	616.90	333.50	2178.70
192	S030WTS012	Vanacker	2007	LKA	69.43	15.79	926.57	-	2165.70
193	S030WTS013	Vanacker	2007	LKA	19.87	4.44	532.42	294.70	2207.90
194	S030WTS014	Vanacker	2007	LKA	27.13	6.82	655.49	-	2381.80
195	S030WTS015	Vanacker	2007	LKA	30.78	7.19	512.17	400.40	2421.70
196	S030WTS016	Vanacker	2007	LKA	30.91	8.30	449.13	444.10	2674.60
197	S030WTS017	Vanacker	2007	LKA	26.70	6.14	516.13	325.10	2289.10
198	S030WTS018	Vanacker	2007	LKA	26.24	6.34	536.81	200.90	2280.00
199	S030WTS019	Vanacker	2007	LKA	10.17	2.16	204.82	238.70	2083.20
200	S033WTS001	Salgado	2007	BRA	7.39	2.47	179.74	-	1507.50
201	S033WTS002	Salgado	2007	BRA	11.15	5.77	146.72	72.40	1520.30
202	S033WTS003	Salgado	2007	BRA	10.94	2.90	141.89	19.70	1480.60
203	S033WTS004	Salgado	2007	BRA	3.46	1.75	156.51	68.70	1507.10
204	S038WTS001	Bierman	2007	NAM	5.12	1.06	20.90	-	230.00
205	S038WTS002	Bierman	2007	NAM	4.89	1.06	221.50	-	143.80
206	S038WTS003	Bierman	2007	NAM	3.54	0.74	26.60	-	212.30
207	S038WTS004	Bierman	2007	NAM	3.84	0.80	25.50	-	212.00
208	S038WTS005	Bierman	2007	NAM	4.73	1.02	14.10	140.63	129.00
209	S038WTS006	Bierman	2007	NAM	6.38	1.34	238.50	-	164.70
210	S038WTS007	Bierman	2007	NAM	4.48	0.93	173.60	51.24	192.50
211	S038WTS008	Bierman	2007	NAM	5.48	1.13	147.00	-	188.50
212	S038WTS009	Bierman	2007	NAM	8.87	1.85	304.90	39.83	168.80
213	S038WTS010	Bierman	2007	NAM	8.45	1.73	438.90	-	188.40
214	S038WTS011	Bierman	2007	NAM	5.15	1.09	225.60	-	149.40
215	S038WTS012	Bierman	2007	NAM	4.27	0.91	64.10	48.45	156.40
216	S038WTS013	Bierman	2007	NAM	10.81	2.27	171.70	85.10	150.50
217	S038WTS014	Bierman	2007	NAM	8.03	1.70	49.20	39.54	279.10
218	S038WTS015	Bierman	2007	NAM	6.89	1.51	23.40	31.20	209.50
219	S038WTS016	Bierman	2007	NAM	8.17	1.73	50.30	37.79	287.90
220	S038WTS017	Bierman	2007	NAM	8.38	1.77	52.90	36.51	299.00
221	S038WTS018	Bierman	2007	NAM	8.76	1.84	57.60	36.10	323.30
222	S038WTS019	Bierman	2007	NAM	7.26	1.50	52.40	29.51	370.60
223	S038WTS020	Bierman	2007	NAM	9.40	1.95	65.20	31.70	356.40
224	S038WTS021	Bierman	2007	NAM	7.01	1.45	63.50	31.54	386.20
225	S038WTS022	Bierman	2007	NAM	7.47	1.55	59.30	20.65	377.20
226	S038WTS023	Bierman	2007	NAM	10.12	2.14	99.20	51.94	197.70

#	Sample ID	Author	Pub Year	Group	10Be E (mm.kyr-1)	d[E]	Basin Slope (m.km-1)	ksn (m0.9)	Annual Rainfall (mm)
227	S038WTS024	Bierman	2007	NAM	9.13	1.90	78.10	53.68	309.30
228	S038WTS025	Bierman	2007	NAM	10.80	2.23	80.30	52.69	330.00
229	S038WTS026	Bierman	2007	NAM	7.67	1.66	61.50	40.21	225.00
230	S038WTS027	Bierman	2007	NAM	8.53	1.78	69.50	46.65	351.80
231	S038WTS028	Bierman	2007	NAM	9.03	1.90	24.50	31.12	304.30
232	S038WTS029	Bierman	2007	NAM	8.26	1.67	129.70	73.51	393.40
233	S038WTS030	Bierman	2007	NAM	7.28	1.51	43.90	33.12	389.40
234	S038WTS031	Bierman	2007	NAM	6.83	2.00	24.20	26.33	358.30
235	S038WTS032	Bierman	2007	NAM	9.65	2.00	47.00	34.55	399.20
236	S038WTS033	Bierman	2007	NAM	5.47	1.13	26.60	25.57	417.70
237	S038WTS034	Bierman	2007	NAM	8.14	1.66	50.80	36.61	418.00
238	S038WTS035	Bierman	2007	NAM	8.30	1.76	71.60	57.90	241.30
239	S038WTS036	Bierman	2007	NAM	5.22	1.11	45.00	33.54	263.40
240	S038WTS037	Bierman	2007	NAM	7.38	1.52	372.50	-	187.00
241	S038WTS038	Bierman	2007	NAM	12.01	2.41	104.60	-	221.30
242	S038WTS039	Bierman	2007	NAM	7.62	1.62	227.00	22.39	155.30
243	S039WTS001	Sullivan	2007	USA	8.30	1.76	73.20	23.20	1165.00
244	S039WTS002	Sullivan	2007	USA	7.41	1.58	73.20	23.20	1165.00
245	S039WTS003	Sullivan	2007	USA	7.90	1.68	73.20	23.20	1165.00
246	S039WTS004	Sullivan	2007	USA	4.58	0.98	73.20	23.20	1165.00
247	S039WTS005	Sullivan	2007	USA	7.78	1.75	102.10	29.00	1177.50
248	S039WTS006	Sullivan	2007	USA	7.96	1.79	102.10	29.00	1177.50
249	S039WTS007	Sullivan	2007	USA	8.71	1.96	102.10	29.00	1177.50
250	S039WTS008	Sullivan	2007	USA	6.23	1.40	102.10	29.00	1177.50
251	S039WTS009	Sullivan	2007	USA	11.67	2.60	157.70	64.30	1163.60
252	S039WTS010	Sullivan	2007	USA	11.84	2.64	157.70	64.30	1163.60
253	S039WTS011	Sullivan	2007	USA	13.56	3.03	157.70	64.30	1163.60
254	S039WTS012	Sullivan	2007	USA	9.88	2.19	157.70	64.30	1163.60
255	S039WTS013	Sullivan	2007	USA	12.66	2.86	233.10	29.40	1178.00
256	S039WTS014	Sullivan	2007	USA	12.11	2.73	233.10	29.40	1178.00
257	S039WTS015	Sullivan	2007	USA	13.96	3.15	233.10	29.40	1178.00
258	S039WTS016	Sullivan	2007	USA	13.53	3.05	233.10	29.40	1178.00
259	S039WTS017	Sullivan	2007	USA	8.32	1.88	138.90	29.80	1168.20
260	S039WTS018	Sullivan	2007	USA	19.45	4.30	291.40	-	1151.30
261	S039WTS019	Sullivan	2007	USA	21.21	4.71	291.40	-	1151.30
262	S039WTS020	Sullivan	2007	USA	20.71	4.59	291.40	-	1151.30
263	S039WTS021	Sullivan	2007	USA	17.38	3.85	291.40	-	1151.30
264	S039WTS022	Sullivan	2007	USA	10.57	2.28	325.90	107.10	1175.00
265	S039WTS023	Sullivan	2007	USA	14.57	3.15	325.90	107.10	1175.00
266	S039WTS024	Sullivan	2007	USA	18.22	3.95	325.90	107.10	1175.00
267	S039WTS025	Sullivan	2007	USA	21.22	4.57	325.90	107.10	1175.00
268	S039WTS026	Sullivan	2007	USA	7.76	1.66	74.60	22.60	1165.80
269	S039WTS027	Sullivan	2007	USA	11.20	2.45	47.60	10.90	1421.80
270	S039WTS028	Sullivan	2007	USA	12.62	2.76	124.00	-	1419.80
271	S039WTS029	Sullivan	2007	USA	10.95	2.55	121.90	16.30	1345.30
272	S039WTS030	Sullivan	2007	USA	35.90	8.17	323.10	64.60	1416.20
273	S039WTS031	Sullivan	2007	USA	12.40	2.82	163.10	59.80	1340.60
274	S039WTS032	Sullivan	2007	USA	12.91	2.75	233.40	51.40	1386.40
275	S039WTS033	Sullivan	2007	USA	9.89	2.13	185.30	23.90	1316.80
276	S039WTS034	Sullivan	2007	USA	26.34	5.78	275.10	85.70	1315.10
277	S039WTS035	Sullivan	2007	USA	23.23	5.13	211.00	104.80	1316.00
278	S039WTS036	Sullivan	2007	USA	17.90	3.99	180.00	46.90	1311.80
279	S039WTS037	Sullivan	2007	USA	25.14	5.53	254.70	102.30	1335.00
280	S039WTS038	Sullivan	2007	USA	22.32	5.03	233.10	227.70	1357.40
281	S039WTS039	Sullivan	2007	USA	27.80	5.81	283.30	165.60	1483.10
282	S039WTS040	Sullivan	2007	USA	7.14	1.53	88.90	13.50	1175.90
283	S039WTS041	Sullivan	2007	USA	8.68	1.84	175.90	29.50	1154.90
284	S039WTS042	Sullivan	2007	USA	8.37	1.77	91.30	23.70	1180.60
285	S039WTS043	Sullivan	2007	USA	13.93	3.08	245.00	56.70	1197.60
286	S039WTS044	Sullivan	2007	USA	5.89	1.30	186.10	51.70	1258.90
287	S039WTS045	Sullivan	2007	USA	7.96	1.85	82.40	19.10	1261.60
288	S039WTS046	Sullivan	2007	USA	30.22	6.50	275.50	324.50	1216.60
289	S039WTS047	Sullivan	2007	USA	20.03	4.30	151.10	86.30	1190.00
290	S043WTS001	Codilean	2008	NAM	14.76	3.05	212.65	169.99	207.10
291	S043WTS002	Codilean	2008	NAM	12.78	2.63	204.55	157.06	228.40
292	S043WTS003	Codilean	2008	NAM	5.28	1.08	43.19	28.81	272.10
293	S043WTS004	Codilean	2008	NAM	7.94	1.61	90.25	26.23	263.50
294	S046WTS001	Duxbury	2008	USA	24.61	5.32	272.20	186.50	1151.20
295	S046WTS002	Duxbury	2008	USA	25.10	5.46	272.20	186.50	1151.20
296	S046WTS003	Duxbury	2008	USA	28.17	6.19	272.20	186.50	1151.20
297	S046WTS004	Duxbury	2008	USA	38.24	8.26	272.20	186.50	1151.20
298	S046WTS005	Duxbury	2008	USA	6.19	1.35	186.80	100.70	1107.80
299	S046WTS006	Duxbury	2008	USA	7.35	1.61	186.80	100.70	1107.80
300	S046WTS007	Duxbury	2008	USA	8.19	1.79	186.80	100.70	1107.80
301	S046WTS008	Duxbury	2008	USA	8.20	1.80	186.80	100.70	1107.80
302	S046WTS009	Duxbury	2008	USA	7.27	1.88	235.60	54.50	1075.60

#	Sample ID	Author	Pub Year	Group	10Be E (mm.kyr-1)	d[E]	Basin Slope (m.km-1)	ksn (m0.9)	Annual Rainfall (mm)
303	S046WTS010	Duxburry	2008	USA	5.55	1.49	235.60	54.50	1075.60
304	S046WTS011	Duxburry	2008	USA	4.69	1.24	235.60	54.50	1075.60
305	S046WTS012	Duxburry	2008	USA	5.63	1.47	235.60	54.50	1075.60
306	S046WTS013	Duxburry	2008	USA	3.56	0.94	330.00	69.90	1131.80
307	S046WTS014	Duxburry	2008	USA	3.20	0.84	330.00	69.90	1131.80
308	S046WTS015	Duxburry	2008	USA	3.63	0.96	330.00	69.90	1131.80
309	S046WTS016	Duxburry	2008	USA	5.16	1.36	330.00	69.90	1131.80
310	S046WTS017	Duxburry	2008	USA	3.50	0.74	143.10	119.90	1177.00
311	S046WTS018	Duxburry	2008	USA	5.04	1.12	244.20	41.80	1038.70
312	S046WTS019	Duxburry	2008	USA	10.92	2.31	347.70	158.00	1169.40
313	S046WTS020	Duxburry	2008	USA	16.63	3.54	288.30	129.60	1146.30
314	S046WTS021	Duxburry	2008	USA	5.88	1.25	259.70	-	1142.10
315	S046WTS022	Duxburry	2008	USA	13.50	2.92	267.20	151.60	1122.90
316	S046WTS023	Duxburry	2008	USA	12.68	2.79	254.00	146.10	1100.10
317	S046WTS024	Duxburry	2008	USA	11.85	2.55	228.00	140.30	1148.50
318	S046WTS025	Duxburry	2008	USA	8.79	1.97	175.90	14.80	1078.00
319	S046WTS026	Duxburry	2008	USA	12.50	2.84	242.30	114.30	1100.20
320	S046WTS027	Duxburry	2008	USA	9.51	2.13	250.00	93.20	1094.40
321	S046WTS028	Duxburry	2008	USA	17.64	3.70	223.30	258.70	1215.10
322	S046WTS029	Duxburry	2008	USA	3.70	0.82	220.10	113.70	1049.90
323	S046WTS030	Duxburry	2008	USA	3.88	0.85	185.90	100.70	1094.80
324	S046WTS031	Duxburry	2008	USA	10.26	2.17	253.90	159.80	1183.70
325	S046WTS032	Duxburry	2008	USA	5.26	1.14	253.50	94.00	1066.00
326	S046WTS033	Duxburry	2008	USA	11.01	2.36	302.50	114.10	1144.00
327	S046WTS034	Duxburry	2008	USA	6.69	1.46	231.10	73.10	1067.20
328	S046WTS035	Duxburry	2008	USA	13.08	2.91	197.30	90.90	1072.40
329	S046WTS036	Duxburry	2008	USA	9.64	2.07	286.20	186.80	1166.20
330	S046WTS037	Duxburry	2008	USA	6.59	1.45	269.60	128.20	1154.70
331	S046WTS038	Duxburry	2008	USA	8.41	1.78	222.30	109.40	1187.20
332	S046WTS039	Duxburry	2008	USA	4.37	0.95	253.10	58.40	1142.60
333	S046WTS040	Duxburry	2008	USA	4.74	1.03	252.40	57.70	1142.60
334	S046WTS041	Duxburry	2008	USA	3.36	0.73	209.00	-	1119.30
335	S046WTS042	Duxburry	2008	USA	5.32	1.13	230.80	-	1154.60
336	S046WTS043	Duxburry	2008	USA	5.90	1.26	269.50	116.80	1151.20
337	S046WTS044	Duxburry	2008	USA	3.77	0.83	172.90	87.30	1047.00
338	S046WTS045	Duxburry	2008	USA	3.88	0.85	168.30	48.80	1047.00
339	S046WTS046	Duxburry	2008	USA	11.15	2.47	269.10	-	1111.30
340	S046WTS047	Duxburry	2008	USA	7.15	1.57	307.90	-	1105.70
341	S046WTS048	Duxburry	2008	USA	6.52	1.41	296.40	70.10	1089.30
342	S046WTS049	Duxburry	2008	USA	6.84	1.48	293.10	78.60	1116.20
343	S046WTS050	Duxburry	2008	USA	7.11	1.57	377.50	87.80	1132.00
344	S046WTS051	Duxburry	2008	USA	6.32	1.34	248.00	188.90	1177.20
345	S046WTS052	Duxburry	2008	USA	6.04	1.32	310.80	-	1104.80
346	S046WTS053	Duxburry	2008	USA	11.60	2.48	281.10	-	1178.70
347	S046WTS054	Duxburry	2008	USA	11.17	2.43	201.70	125.80	1128.30
348	S046WTS055	Duxburry	2008	USA	6.67	1.55	60.30	100.50	1070.50
349	S046WTS056	Duxburry	2008	USA	7.06	1.63	157.10	16.70	1061.00
350	S046WTS057	Duxburry	2008	USA	15.04	3.40	251.80	96.00	1088.50
351	S046WTS058	Duxburry	2008	USA	9.26	2.13	151.40	47.80	1050.90
352	S046WTS059	Duxburry	2008	USA	10.50	2.37	165.80	84.80	1057.40
353	S046WTS060	Duxburry	2008	USA	2.50	0.58	111.40	41.30	1014.90
354	S046WTS061	Duxburry	2008	USA	5.31	1.19	232.10	20.20	1071.60
355	S046WTS062	Duxburry	2008	USA	8.61	1.88	233.20	128.60	1085.70
356	S046WTS063	Duxburry	2008	USA	9.29	2.03	230.50	105.20	1091.90
357	S046WTS064	Duxburry	2008	USA	11.62	2.52	343.20	68.20	1112.70
358	S046WTS065	Duxburry	2008	USA	5.11	1.12	118.60	50.00	1028.00
359	S077WTS001	Codilean	2014	NAM	13.33	2.81	191.85	106.38	193.40
360	S077WTS002	Codilean	2014	NAM	13.58	2.87	195.80	114.68	177.90
361	S077WTS003	Codilean	2014	NAM	13.41	2.89	216.12	105.94	188.00
362	S077WTS004	Codilean	2014	NAM	12.79	2.62	230.21	148.05	219.10
363	S077WTS005	Codilean	2014	NAM	3.27	0.68	27.58	16.61	261.20
364	S077WTS006	Codilean	2014	NAM	5.03	1.04	31.47	27.67	251.20
365	S077WTS007	Codilean	2014	NAM	5.44	1.12	39.26	24.12	273.00
366	S080WTS001	Cherem	2012	BRA	4.71	1.04	105.50	19.20	1440.50
367	S080WTS002	Cherem	2012	BRA	8.75	1.93	141.90	24.50	1441.30
368	S080WTS003	Cherem	2012	BRA	6.54	1.44	155.50	14.80	1457.00
369	S080WTS004	Cherem	2012	BRA	12.97	2.94	197.10	80.30	1420.80
370	S080WTS005	Cherem	2012	BRA	11.37	2.62	228.30	44.10	1418.00
371	S080WTS006	Cherem	2012	BRA	5.44	1.20	128.50	11.80	1450.60
372	S080WTS007	Cherem	2012	BRA	15.34	3.47	240.30	82.30	1425.00
373	S080WTS008	Cherem	2012	BRA	7.42	1.64	170.40	4.40	1462.00
374	S080WTS009	Cherem	2012	BRA	10.13	2.32	166.20	19.00	1331.50
375	S080WTS010	Cherem	2012	BRA	8.49	1.95	163.10	14.20	1294.00
376	S080WTS011	Cherem	2012	BRA	12.36	2.85	184.10	14.50	1286.30
377	S080WTS012	Cherem	2012	BRA	17.26	3.98	197.20	8.50	1295.70
378	S080WTS013	Cherem	2012	BRA	8.19	1.88	185.20	20.90	1319.80

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379	S080WTS014	Cherem	2012	BRA	18.42	4.36	224.50	182.40	1298.70
380	S080WTS015	Cherem	2012	BRA	20.71	5.24	235.50	172.80	1272.30
381	S080WTS016	Cherem	2012	BRA	15.05	3.78	248.70	65.20	1257.30
382	S080WTS017	Cherem	2012	BRA	12.51	3.01	280.60	88.40	1273.60
383	S080WTS018	Cherem	2012	BRA	13.84	3.39	304.20	114.90	1282.30
384	S080WTS019	Cherem	2012	BRA	11.54	2.73	179.10	33.20	1323.30
385	S087WTS001	Scharf	2013	ZAF	5.19	1.12	467.31	361.60	416.30
386	S087WTS002	Scharf	2013	ZAF	3.99	0.88	220.94	116.70	361.90
387	S087WTS003	Scharf	2013	ZAF	3.24	0.69	393.10	171.30	329.40
388	S087WTS004	Scharf	2013	ZAF	2.04	0.47	266.80	142.90	430.10
389	S087WTS005	Scharf	2013	ZAF	2.84	0.63	369.26	211.30	407.50
390	S087WTS006	Scharf	2013	ZAF	5.41	1.16	439.72	282.90	406.80
391	S087WTS007	Scharf	2013	ZAF	6.53	1.39	645.49	373.50	430.40
392	S087WTS008	Scharf	2013	ZAF	6.20	1.28	558.92	299.80	357.80
393	S087WTS009	Scharf	2013	ZAF	2.91	0.61	436.10	317.80	414.20
394	S087WTS010	Scharf	2013	ZAF	4.79	0.99	462.92	256.30	374.80
395	S090WTS001	Salgado	2014	BRA	6.91	1.49	251.14	55.40	1913.30
396	S090WTS002	Salgado	2014	BRA	6.59	1.42	307.03	121.10	1918.40
397	S090WTS003	Salgado	2014	BRA	10.80	2.37	177.52	46.30	1853.50
398	S090WTS004	Salgado	2014	BRA	10.11	2.22	169.11	29.00	1851.30
399	S090WTS005	Salgado	2014	BRA	11.01	2.38	244.03	94.20	1847.20
400	S090WTS006	Salgado	2014	BRA	25.23	5.80	510.06	204.60	1894.30
401	S090WTS007	Salgado	2014	BRA	14.14	3.20	369.17	223.90	1915.30
402	S090WTS008	Salgado	2014	BRA	41.21	10.98	274.91	217.60	1881.60
403	S090WTS009	Salgado	2014	BRA	14.83	3.72	254.90	125.90	1892.80
404	S090WTS010	Salgado	2014	BRA	17.92	4.05	383.59	265.00	1908.90
405	S092WTS001	Barreto	2013	BRA	4.64	1.01	235.57	176.70	1577.30
406	S092WTS002	Barreto	2013	BRA	3.04	0.68	277.69	180.00	1563.10
407	S092WTS003	Barreto	2013	BRA	3.83	0.84	224.80	190.60	1597.60
408	S092WTS004	Barreto	2013	BRA	4.52	1.01	242.99	139.00	1512.50
409	S092WTS005	Barreto	2013	BRA	3.52	0.78	198.23	155.00	1540.10
410	S092WTS006	Barreto	2013	BRA	3.72	0.82	229.73	181.40	1567.00
411	S092WTS007	Barreto	2013	BRA	5.36	1.20	211.86	111.40	1524.10
412	S092WTS008	Barreto	2013	BRA	5.27	1.17	205.56	88.20	1485.80
413	S092WTS009	Barreto	2013	BRA	4.34	0.96	154.95	60.90	1428.20
414	S092WTS010	Barreto	2013	BRA	2.66	0.58	133.29	20.30	1434.90
415	S092WTS011	Barreto	2013	BRA	4.17	0.92	162.03	90.50	1392.40
416	S092WTS012	Barreto	2013	BRA	3.00	0.66	91.02	69.90	1411.10
417	S092WTS013	Barreto	2013	BRA	4.79	1.05	98.20	55.00	1325.60
418	S092WTS014	Barreto	2013	BRA	4.37	0.95	210.44	264.50	1533.20
419	S092WTS015	Barreto	2013	BRA	2.23	0.49	155.53	133.50	1587.40
420	S092WTS016	Barreto	2013	BRA	2.89	0.63	167.25	146.60	1575.40
421	S092WTS017	Barreto	2013	BRA	3.10	0.68	180.71	168.60	1555.30
422	S092WTS018	Barreto	2013	BRA	3.36	0.73	192.05	157.30	1539.70
423	S092WTS019	Barreto	2013	BRA	4.69	1.02	178.85	137.20	1532.40
424	S092WTS020	Barreto	2013	BRA	1.53	0.36	142.71	92.70	1527.40
425	S092WTS021	Barreto	2013	BRA	2.03	0.45	102.76	49.50	1583.90
426	S092WTS022	Barreto	2013	BRA	4.18	0.92	133.25	48.60	1515.70
427	S092WTS023	Barreto	2013	BRA	3.55	0.78	117.70	46.20	1476.00
428	S092WTS024	Barreto	2013	BRA	2.23	0.50	112.49	44.30	1391.60
429	S092WTS025	Barreto	2013	BRA	3.14	0.68	91.33	47.30	1409.40
430	S092WTS026	Barreto	2013	BRA	4.31	0.94	96.92	29.10	1309.30
431	S092WTS027	Barreto	2013	BRA	3.79	0.83	119.75	60.50	1276.40
432	S116WTS001	Bierman	2014	ZAF	3.78	0.80	206.37	98.60	473.40
433	S116WTS002	Bierman	2014	ZAF	2.92	0.63	122.41	78.20	436.80
434	S116WTS003	Bierman	2014	ZAF	4.07	0.87	56.02	39.20	319.00
435	S116WTS004	Bierman	2014	ZAF	3.25	0.72	272.47	123.60	639.50
436	S116WTS005	Bierman	2014	ZAF	3.21	0.72	272.43	123.60	639.70
437	S116WTS006	Bierman	2014	ZAF	2.94	0.66	229.62	90.50	686.50
438	S116WTS007	Bierman	2014	ZAF	4.61	0.98	64.31	40.90	314.80
439	S116WTS008	Bierman	2014	ZAF	4.93	1.06	260.93	127.20	567.40
440	S133WTS001	Gonzalez	2016	BRA	40.09	9.56	427.51	198.00	1616.90
441	S133WTS002	Gonzalez	2016	BRA	98.24	24.72	427.51	198.00	1616.90
442	S133WTS003	Gonzalez	2016	BRA	46.17	9.63	536.49	530.70	1803.90
443	S133WTS004	Gonzalez	2016	BRA	249.39	61.31	536.49	530.70	1803.90
444	S133WTS005	Gonzalez	2016	BRA	70.74	14.80	541.05	535.50	1781.00
445	S133WTS006	Gonzalez	2016	BRA	99.67	20.89	541.05	535.50	1781.00
446	S133WTS007	Gonzalez	2016	BRA	15.89	3.86	187.61	48.00	1343.50
447	S133WTS008	Gonzalez	2016	BRA	11.86	2.84	221.65	64.40	1281.10
448	S133WTS009	Gonzalez	2016	BRA	9.98	2.53	222.45	24.60	1217.40
449	S133WTS010	Gonzalez	2016	BRA	9.75	2.49	205.09	6.60	1195.00
450	S133WTS011	Gonzalez	2016	BRA	39.75	9.85	263.89	163.40	1704.20
451	S133WTS012	Gonzalez	2016	BRA	21.70	5.24	269.13	96.90	1701.00
452	S133WTS013	Gonzalez	2016	BRA	21.59	5.18	270.47	80.80	1701.00
453	S133WTS014	Gonzalez	2016	BRA	18.26	4.20	178.92	86.80	1602.50
454	S133WTS015	Gonzalez	2016	BRA	15.73	3.61	184.48	87.00	1562.00

#	Sample ID	Author	Pub Year	Group	10Be E (mm.kyr-1)	d[E]	Basin Slope (m.km-1)	ksn (m0.9)	Annual Rainfall (mm)
455	S133WTS016	Gonzalez	2016	BRA	17.17	3.91	166.52	82.40	1616.70
456	S133WTS017	Gonzalez	2016	BRA	16.10	3.62	180.32	103.80	1621.40
457	S154WTS001	Linari	2016	USA	7.46	1.58	62.92	23.20	1165.00
458	S154WTS002	Linari	2016	USA	6.65	1.41	62.92	23.20	1165.00
459	S154WTS003	Linari	2016	USA	7.09	1.50	62.92	23.20	1165.00
460	S154WTS004	Linari	2016	USA	4.12	0.88	62.92	23.20	1165.00
461	S154WTS005	Linari	2016	USA	6.91	1.55	91.36	28.80	1177.30
462	S154WTS006	Linari	2016	USA	7.09	1.58	91.36	28.80	1177.30
463	S154WTS007	Linari	2016	USA	7.78	1.74	91.36	28.80	1177.30
464	S154WTS008	Linari	2016	USA	5.55	1.24	91.36	28.80	1177.30
465	S154WTS009	Linari	2016	USA	10.48	2.32	142.96	63.10	1164.40
466	S154WTS010	Linari	2016	USA	10.64	2.36	142.96	63.10	1164.40
467	S154WTS011	Linari	2016	USA	12.18	2.71	142.96	63.10	1164.40
468	S154WTS012	Linari	2016	USA	8.86	1.96	142.96	63.10	1164.40
469	S154WTS013	Linari	2016	USA	11.41	2.56	210.64	29.40	1178.00
470	S154WTS014	Linari	2016	USA	10.92	2.45	210.64	29.40	1178.00
471	S154WTS015	Linari	2016	USA	12.59	2.83	210.64	29.40	1178.00
472	S154WTS016	Linari	2016	USA	12.20	2.73	210.64	29.40	1178.00
473	S154WTS017	Linari	2016	USA	7.46	1.67	124.27	29.30	1168.20
474	S154WTS018	Linari	2016	USA	17.45	3.84	244.28	84.70	1159.00
475	S154WTS019	Linari	2016	USA	19.03	4.20	244.28	84.70	1159.00
476	S154WTS020	Linari	2016	USA	18.59	4.10	244.28	84.70	1159.00
477	S154WTS021	Linari	2016	USA	15.59	3.43	244.28	84.70	1159.00
478	S154WTS022	Linari	2016	USA	9.46	2.03	370.58	161.30	1190.00
479	S154WTS023	Linari	2016	USA	13.06	2.81	370.58	161.30	1190.00
480	S154WTS024	Linari	2016	USA	16.34	3.52	370.58	161.30	1190.00
481	S154WTS025	Linari	2016	USA	19.04	4.08	370.58	161.30	1190.00
482	S154WTS026	Linari	2016	USA	6.95	1.48	69.39	23.60	1165.00
483	S154WTS027	Linari	2016	USA	10.06	2.19	37.93	10.90	1421.40
484	S154WTS028	Linari	2016	USA	11.34	2.47	106.83	-	1415.50
485	S154WTS029	Linari	2016	USA	12.97	2.79	165.98	65.50	1475.40
486	S154WTS030	Linari	2016	USA	16.36	3.64	249.70	166.60	1444.50
487	S154WTS031	Linari	2016	USA	9.84	2.28	105.42	16.30	1344.20
488	S154WTS032	Linari	2016	USA	36.27	8.01	326.08	117.90	1472.00
489	S154WTS033	Linari	2016	USA	35.36	7.82	326.08	117.90	1472.00
490	S154WTS034	Linari	2016	USA	11.15	2.52	151.08	58.60	1346.80
491	S154WTS035	Linari	2016	USA	11.60	2.46	213.60	55.10	1414.30
492	S154WTS036	Linari	2016	USA	15.34	3.22	214.01	81.70	1443.60
493	S154WTS037	Linari	2016	USA	8.89	1.90	172.95	23.90	1307.30
494	S154WTS038	Linari	2016	USA	23.69	5.18	246.68	84.00	1314.80
495	S154WTS039	Linari	2016	USA	21.08	4.62	188.66	100.90	1320.40
496	S154WTS040	Linari	2016	USA	16.08	3.57	163.86	46.50	1313.00
497	S154WTS041	Linari	2016	USA	22.62	4.95	232.60	101.90	1337.40
498	S154WTS042	Linari	2016	USA	20.14	4.51	221.07	221.20	1352.80
499	S154WTS043	Linari	2016	USA	25.02	5.22	268.14	157.60	1483.10
500	S154WTS044	Linari	2016	USA	21.99	4.59	268.14	157.60	1483.10
501	S154WTS045	Linari	2016	USA	6.40	1.37	80.37	15.20	1175.60
502	S154WTS046	Linari	2016	USA	7.79	1.64	164.82	27.80	1158.50
503	S154WTS047	Linari	2016	USA	7.50	1.58	81.40	23.70	1180.80
504	S154WTS048	Linari	2016	USA	12.51	2.76	230.47	56.70	1197.60
505	S154WTS049	Linari	2016	USA	5.30	1.17	172.26	52.00	1257.90
506	S154WTS050	Linari	2016	USA	7.13	1.65	75.91	19.20	1261.10
507	S154WTS051	Linari	2016	USA	7.53	1.75	75.91	19.20	1261.10
508	S154WTS052	Linari	2016	USA	27.26	5.85	121.92	108.70	1201.70
509	S154WTS053	Linari	2016	USA	14.79	3.29	230.03	48.00	1206.00
510	S156WTS001	Reusser	2015	USA	5.01	1.15	89.25	33.10	1090.00
511	S156WTS002	Reusser	2015	USA	5.52	1.28	70.44	28.40	1172.20
512	S156WTS003	Reusser	2015	USA	3.22	0.76	35.78	14.40	1143.30
513	S156WTS004	Reusser	2015	USA	5.55	1.28	61.31	25.40	1182.80
514	S156WTS005	Reusser	2015	USA	4.95	1.14	68.78	28.40	1219.50
515	S156WTS006	Reusser	2015	USA	4.97	1.17	46.94	18.60	1269.70
516	S156WTS007	Reusser	2015	USA	11.46	2.71	60.69	24.90	1360.50
517	S156WTS008	Reusser	2015	USA	7.44	1.77	39.60	15.30	1248.90
518	S156WTS009	Reusser	2015	USA	8.70	2.07	39.84	16.30	1271.70
519	S156WTS010	Reusser	2015	USA	9.15	2.15	60.96	20.70	1414.20
520	S156WTS011	Reusser	2015	USA	5.20	1.18	109.15	38.10	1090.10
521	S156WTS012	Reusser	2015	USA	2.59	0.61	32.80	11.70	1131.20
522	S156WTS013	Reusser	2015	USA	8.93	2.06	92.29	36.60	1443.40
523	S156WTS014	Reusser	2015	USA	12.73	2.90	102.06	43.50	1565.00
524	S156WTS015	Reusser	2015	USA	5.94	1.39	44.91	17.00	1315.90
525	S156WTS016	Reusser	2015	USA	10.05	2.32	67.53	22.90	1431.70
526	S156WTS017	Reusser	2015	USA	7.63	1.67	174.55	68.60	1045.80
527	S156WTS018	Reusser	2015	USA	9.85	2.21	144.77	53.30	1201.00
528	S156WTS019	Reusser	2015	USA	8.62	1.93	156.53	58.00	1271.10
529	S156WTS020	Reusser	2015	USA	20.29	4.46	195.23	90.70	1275.60
530	S156WTS021	Reusser	2015	USA	14.68	3.34	153.86	56.00	1565.50

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531	S156WTS022	Reusser	2015	USA	13.54	2.92	201.45	72.80	1797.20
532	S156WTS023	Reusser	2015	USA	7.96	1.77	144.05	44.20	1594.60
533	S156WTS024	Reusser	2015	USA	14.71	3.15	232.14	116.90	1730.90
534	S164WTS001	Mandal	2015	IND	23.89	6.46	97.99	51.70	2047.80
535	S164WTS002	Mandal	2015	IND	59.06	16.43	427.70	303.70	2510.40
536	S164WTS003	Mandal	2015	IND	72.06	18.70	413.17	232.10	2406.80
537	S164WTS004	Mandal	2015	IND	20.54	5.36	91.17	61.30	1473.50
538	S164WTS005	Mandal	2015	IND	26.82	7.62	102.24	43.30	2416.40
539	S164WTS006	Mandal	2015	IND	46.88	11.27	279.75	235.20	2866.60
540	S164WTS007	Mandal	2015	IND	33.82	8.74	185.54	125.90	3050.60
541	S164WTS008	Mandal	2015	IND	51.37	12.71	342.84	339.70	2529.90
542	S164WTS009	Mandal	2015	IND	42.14	10.52	227.27	207.00	3360.30
543	S164WTS010	Mandal	2015	IND	32.62	7.83	208.08	177.00	2566.60
544	S164WTS011	Mandal	2015	IND	41.44	10.75	230.99	148.90	3623.20
545	S164WTS012	Mandal	2015	IND	49.83	13.02	350.17	259.70	3776.20
546	S164WTS013	Mandal	2015	IND	34.46	8.74	339.34	198.20	3048.30
547	S164WTS014	Mandal	2015	IND	41.35	11.59	451.70	176.80	4010.30
548	S164WTS015	Mandal	2015	IND	23.90	6.19	379.61	218.40	4092.80
549	S164WTS016	Mandal	2015	IND	28.30	7.29	379.07	245.10	4032.30
550	S164WTS017	Mandal	2015	IND	25.71	6.99	282.61	153.30	3986.80
551	S164WTS018	Mandal	2015	IND	18.52	8.00	42.27	4.20	3923.00
552	S164WTS019	Mandal	2015	IND	26.45	6.70	331.10	189.60	4079.50
553	S164WTS020	Mandal	2015	IND	12.26	3.40	230.40	244.80	3684.60
554	S164WTS021	Mandal	2015	IND	31.00	7.41	211.01	91.50	3278.00
555	S164WTS022	Mandal	2015	IND	22.73	6.11	169.60	67.70	4287.10
556	S164WTS023	Mandal	2015	IND	30.35	7.39	270.26	244.90	3263.40
557	S164WTS024	Mandal	2015	IND	13.34	3.11	141.07	27.80	2853.90
558	S164WTS025	Mandal	2015	IND	29.20	7.42	283.13	150.50	5012.60
559	S164WTS026	Mandal	2015	IND	22.87	5.92	275.82	122.30	5154.10
560	S164WTS027	Mandal	2015	IND	47.63	11.86	263.34	200.90	4129.40
561	S164WTS028	Mandal	2015	IND	24.32	6.52	192.02	40.80	4353.80
562	S164WTS029	Mandal	2015	IND	34.96	8.53	286.31	243.80	5283.40
563	S164WTS030	Mandal	2015	IND	30.47	8.24	141.41	77.50	4113.70
564	S164WTS031	Mandal	2015	IND	31.13	8.13	183.48	96.00	3851.90
565	S164WTS032	Mandal	2015	IND	38.69	9.72	170.52	114.00	3802.90
566	S164WTS033	Mandal	2015	IND	46.20	12.65	154.09	82.20	4370.60
567	S164WTS034	Mandal	2015	IND	41.07	10.94	244.40	117.20	4157.70
568	S164WTS035	Mandal	2015	IND	37.66	10.71	244.40	117.20	4157.70
569	S164WTS036	Mandal	2015	IND	41.68	10.74	196.61	113.50	4223.10
570	S164WTS037	Mandal	2015	IND	35.19	9.45	210.05	129.60	4612.70
571	S164WTS038	Mandal	2015	IND	45.64	11.28	231.22	162.30	5752.20
572	S164WTS039	Mandal	2015	IND	20.25	5.35	134.62	81.40	6041.80
573	S164WTS040	Mandal	2015	IND	13.67	3.63	223.72	148.80	6490.70
574	S164WTS041	Mandal	2015	IND	18.57	4.98	193.80	87.90	6487.00
575	S164WTS042	Mandal	2015	IND	29.11	7.65	190.83	116.10	5801.00
576	S164WTS043	Mandal	2015	IND	27.96	7.08	254.59	167.10	6440.80
577	S164WTS044	Mandal	2015	IND	19.88	5.74	33.39	15.50	5303.20
578	S164WTS045	Mandal	2015	IND	14.03	3.67	183.68	89.60	6099.90
579	S164WTS046	Mandal	2015	IND	18.60	4.62	86.50	52.60	3707.50
580	S164WTS047	Mandal	2015	IND	9.43	2.32	74.33	47.70	2159.80
581	S164WTS048	Mandal	2015	IND	7.28	1.76	36.30	20.00	1313.90
582	S164WTS049	Mandal	2015	IND	15.95	3.41	152.46	121.80	1801.00
583	S164WTS050	Mandal	2015	IND	9.81	2.24	71.55	26.70	1666.50
584	S164WTS051	Mandal	2015	IND	11.17	2.26	191.24	247.10	1283.40
585	S164WTS052	Mandal	2015	IND	18.31	4.08	234.00	173.70	1703.60
586	S164WTS053	Mandal	2015	IND	6.14	1.25	200.39	111.50	1513.00
587	S164WTS054	Mandal	2015	IND	6.93	1.46	305.87	346.80	1047.80
588	S164WTS055	Mandal	2015	IND	46.25	10.93	258.17	81.30	2291.40
589	S164WTS056	Mandal	2015	IND	19.24	4.08	261.46	296.70	1185.70
590	S164WTS057	Mandal	2015	IND	28.32	6.09	265.91	231.00	2407.80
591	S164WTS058	Mandal	2015	IND	12.60	2.98	116.24	34.50	3178.90
592	S164WTS059	Mandal	2015	IND	16.64	3.93	174.96	69.90	3897.50
593	S164WTS060	Mandal	2015	IND	10.02	2.62	136.43	30.30	3724.80
594	S164WTS061	Mandal	2015	IND	9.88	2.32	142.04	36.00	2597.20
595	S164WTS062	Mandal	2015	IND	19.08	4.36	163.55	57.60	3318.00
596	S164WTS063	Mandal	2015	IND	18.91	4.32	142.28	46.90	3423.30
597	S164WTS064	Mandal	2015	IND	14.91	3.37	84.09	10.30	3245.10
598	S164WTS065	Mandal	2015	IND	20.92	4.83	179.03	37.30	5041.80
599	S164WTS066	Mandal	2015	IND	12.77	2.93	87.03	19.90	3222.50
600	S164WTS067	Mandal	2015	IND	24.04	5.81	52.85	36.90	760.00
601	S164WTS068	Mandal	2015	IND	25.61	6.28	101.99	69.70	794.50
602	S164WTS069	Mandal	2015	IND	17.87	4.34	204.24	99.70	682.60
603	S164WTS070	Mandal	2015	IND	39.10	10.11	257.20	88.80	1907.50
604	S164WTS071	Mandal	2015	IND	7.64	1.72	173.60	46.50	7041.40
605	S164WTS072	Mandal	2015	IND	10.99	2.48	206.28	82.70	6640.30
606	S164WTS073	Mandal	2015	IND	14.07	3.29	164.73	48.00	6703.30

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607	S164WTS074	Mandal	2015	IND	15.23	3.55	104.87	29.30	3221.20
608	S164WTS075	Mandal	2015	IND	10.58	2.49	50.93	28.30	1123.70
609	S164WTS076	Mandal	2015	IND	9.27	2.15	57.56	26.60	1388.20
610	S164WTS077	Mandal	2015	IND	13.71	3.26	58.35	33.90	1087.80
611	S164WTS078	Mandal	2015	IND	14.47	3.41	58.35	33.90	1087.80
612	S164WTS079	Mandal	2015	IND	13.69	3.30	71.54	45.80	981.20
613	S174WTS001	Barreto	2014	BRA	19.64	-	153.33	93.90	1302.10
614	S174WTS002	Barreto	2014	BRA	17.59	-	153.33	93.90	1302.10
615	S174WTS003	Barreto	2014	BRA	17.16	-	153.33	93.90	1302.10
616	S174WTS004	Barreto	2014	BRA	17.52	-	153.33	93.90	1302.10
617	S174WTS005	Barreto	2014	BRA	5.51	-	77.74	34.00	1314.70
618	S174WTS006	Barreto	2014	BRA	8.53	-	77.74	34.00	1314.70
619	S174WTS007	Barreto	2014	BRA	7.95	-	77.74	34.00	1314.70
620	S174WTS008	Barreto	2014	BRA	9.46	-	77.74	34.00	1314.70
621	S174WTS009	Barreto	2014	BRA	9.48	-	156.10	119.00	1322.00
622	S174WTS010	Barreto	2014	BRA	12.54	-	156.10	119.00	1322.00
623	S174WTS011	Barreto	2014	BRA	6.87	-	156.10	119.00	1322.00
624	S175WTS001	Rezende	2013	BRA	12.87	2.60	225.56	178.50	2032.50
625	S175WTS002	Rezende	2013	BRA	6.64	1.35	249.06	254.80	2013.00
626	S175WTS003	Rezende	2013	BRA	13.48	2.75	285.16	177.70	1900.10
627	S175WTS004	Rezende	2013	BRA	8.61	1.75	291.65	201.10	1945.60
628	S175WTS005	Rezende	2013	BRA	13.30	2.75	321.97	201.20	1857.60
629	S175WTS006	Rezende	2013	BRA	23.57	4.79	297.50	247.70	1937.50
630	S175WTS007	Rezende	2013	BRA	11.47	2.34	321.41	235.80	1891.20
631	S175WTS008	Rezende	2013	BRA	16.03	3.30	351.63	257.20	1846.60
632	S175WTS009	Rezende	2013	BRA	11.25	2.36	309.25	174.30	1710.20
633	S185WTS001	Salgado	2016	BRA	19.24	4.46	309.89	341.20	1699.70
634	S185WTS002	Salgado	2016	BRA	31.03	7.14	360.04	331.30	1755.30
635	S185WTS003	Salgado	2016	BRA	35.86	8.76	382.70	326.90	1739.20
636	S185WTS004	Salgado	2016	BRA	44.07	13.01	340.70	268.80	1683.70
637	S185WTS005	Salgado	2016	BRA	35.99	24.37	316.97	364.70	1660.80
638	S185WTS006	Salgado	2016	BRA	6.85	1.41	205.96	35.70	1831.00
639	S185WTS007	Salgado	2016	BRA	5.90	1.22	193.03	46.30	1827.60
640	S185WTS008	Salgado	2016	BRA	10.81	2.29	242.40	121.20	1598.40
641	S185WTS009	Salgado	2016	BRA	7.67	1.61	215.41	123.90	1688.00
642	S185WTS010	Salgado	2016	BRA	9.57	2.07	224.72	57.50	1507.80
643	S185WTS011	Salgado	2016	BRA	24.78	5.54	369.55	268.50	1619.30
644	S185WTS012	Salgado	2016	BRA	20.25	4.53	381.41	287.50	1645.50
645	S185WTS013	Salgado	2016	BRA	20.37	4.51	381.25	257.50	1632.30
646	S185WTS014	Salgado	2016	BRA	21.69	5.33	342.83	317.40	1628.70
647	S185WTS015	Salgado	2016	BRA	19.97	4.57	299.77	138.70	1544.00
648	S185WTS016	Salgado	2016	BRA	23.77	4.83	294.76	248.20	1943.40
649	S185WTS017	Salgado	2016	BRA	11.47	2.34	322.83	235.30	1928.60
650	S185WTS018	Salgado	2016	BRA	15.57	3.25	302.25	237.20	1890.20
651	S185WTS019	Salgado	2016	BRA	15.98	3.29	347.66	257.20	1846.60
652	S185WTS020	Salgado	2016	BRA	11.23	2.35	312.22	174.30	1722.10
653	S185WTS021	Salgado	2016	BRA	17.20	3.86	254.50	90.20	1625.50
654	S185WTS022	Salgado	2016	BRA	16.38	3.66	290.46	162.30	1714.10
655	S185WTS023	Salgado	2016	BRA	12.87	2.60	223.28	175.90	2029.60
656	S185WTS024	Salgado	2016	BRA	6.66	1.36	246.54	249.60	2013.00
657	S185WTS025	Salgado	2016	BRA	12.55	2.55	237.57	207.00	1977.00
658	S185WTS026	Salgado	2016	BRA	8.72	1.77	274.33	218.50	1971.60
659	S185WTS027	Salgado	2016	BRA	12.81	2.62	322.10	204.80	1890.50
660	S185WTS028	Salgado	2016	BRA	8.62	1.76	291.98	201.10	1952.80
661	S185WTS029	Salgado	2016	BRA	13.29	2.74	321.98	201.20	1868.30
662	S185WTS030	Salgado	2016	BRA	13.50	2.75	286.31	177.70	1900.10