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Holocene denudation pattern across the South-Eastern Australian Escarpment and implications for its evolution

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Developing a process based understanding of continental relief evolution requires to quantify rates of denudation and to compare their distribution with the evolution of geomorphic parameters. The analysis of denudation and exhumation spatial patterns based from cosmogenic nuclides and low temperature thermochronology are routinely used to document the processes associated with the geomorphic evolution of continental relief over various timescales. Passive margin escarpments are among some of the most salient continental geomorphic features outside of orogenic areas. Their evolution have been studied intensively over the long-term (several Ma to tens of Ma), using for example low-temperature thermochronology. However, datasets documenting their shorter-term (1-10 ka) dynamics are scarcer, and only a limited number of case studies have used quantitative techniques such as cosmogenic nuclides to document the denudation pattern across such escarpments.
The South Eastern Australian Escarpment is such a place where cosmogenic nuclides have been intensively used over the last two decades to constrain processes of landscape evolution over short wavelength, with, for example the calibration of the soil production function. Such existing data and constraints provide an ideal setting to carry on further long-wavelength exploration of the dynamics of the whole escarpment. We have sampled 17 catchments across the South Eastern Australian Escarpment, starting from the coastal plain and moving westward up to the low relief plateau surface. The observed landscape denudation rates are 10-20 mm/ka in the coastal area and progressively increases up to $\sim$60 mm/ka toward the edge of the escarpment. In the low-relief areas located west of the continental drainage divide denudation rates fall back to 10-20 mm/ka. This nearly four-fold contrast in denudation across the divide is characteristic of a major disequilibrium in the dynamics of the river network associated with a progressive migration of the escarpment edge farther west. A high resolution DEM (5m) was also extracted from stereo-pairs of Pléiades images along a 20 km wide swath across the escarpment. Detailed morphometric characteristics of the catchments were extracted from this DEM for comparison with the spatial distribution of the denudation rates.