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New records of southern hemisphere Quaternary dune system development derived from Accumulation Intensity analysis

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Sand seas and dunefields accumulate through storing sediment derived from fluvial, aeolian, marine and local weathering sources. Dunefields develop morphologies and patterns that reflect temporally varying interactions between sediment and atmospheric processes that ultimately construct dune form patterns of variable stability. Sediment within dunefields can record the history of changing phases of activity/inactivity through time, with the potential to interrogate dunefield sedimentary bodies to generate chronometrically-controlled records of long term environmental (and climatic) change.

Southern Africa and Australia have some of the most extensive continental dunefields in the world, which in turn have been subject over two decades to the production of hundreds of sediment luminescence (mainly OSL) ages [1,2]. These attest to the spatial and temporal complexity of dunefield accumulation during the Late Quaternary. The interpretation of this chronometric archive as a proxy for past aeolian activity driven by aridity and windiness can pose problems, however [3,4]. This is due not only to difficulties of associating activity with specific climatic parameters, but because of issues of sediment preservation, sampling bias, and age statistical errors that progressively filter the relationship of chronologies to initial forcing conditions.

Recent studies suggest that measures of sediment accumulation may be a better means of assessing past dune system reactions to climate change than raw ages alone [5]. A new data treatment method Accumulation Rate Variability (ARV) [6], is used to develop a quantitative dunefield *Accumulation Intensity* model. We apply this to reanalysed dune system chronometric data assimilated from published sources and the INQUA dune atlas database, using model outputs to 1) test hypotheses about the forcing mechanisms of dunefield dynamics at hemispheric, regional and local scales in the late Quaternary, and 2) to compare model outputs against previously published 'standard' interpretations of dunefield age data from southern Africa and Australia.

References:

[1] Thomas DSG, Burrough SL 2014 Luminescence-based dune chronologies in southern Africa: analysis and interpretation of dune database records across the subcontinent. *Quaternary International.* doi.org/10.1016/j.quaint.2013.09.008

[2] Hesse PP (2014) How do longitudinal dunes respond to climate forcing? Insights from 25 years of luminescence dating of the Australian desert dunefields. Quaternary International doi.org/10.1016/j.quaint.2014.02.020

[3] Chase B (2009) Evaluating the use of dune sediments as a proxy for palaeo-aridity: A southern African case study. Earth-Science Reviews 93: 31-45.

[4] Thomas DSG, Burrough, SL (2012) Interpreting geoproxies of late quaternary climate change in African drylands: Implications for understanding environmental change and early human behaviour. Quaternary International 253: 5-17.

[5] Leighton CL, Bailey RM. Thomas DSG (2014) Reproducibility and utility of dune luminescence chronologies. Earth-Science Reviews 129: 24-39.

[6] Bailey RM, Thomas, DSG (2014) A quantitative approach to understanding dated dune stratigraphies. Earth Surface Processes and Landforms 39: 614-631.