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Late Quaternary dunefield histories in Asia: a new analysis of datasets using the Accumulation Intensity model

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There are 3948 published luminescence age records for dunes in China, India, Arabia and Israel in the INQUA dune atlas database (Lancaster et al. 2016). Accumulation Rate Variability (ARV) analysis (Bailey and Thomas 2013) and the Accumulation Intensity model (Thomas and Bailey 2017) allow published dune age data meeting key criteria, particularly inclusion of multiple ages and sampling depth data, to be assimilated and reanalysed, providing temporally-continuous quantitative assessments of Late Quaternary dunefield histories. These can be used to test hypotheses concerning forcing conditions for aeolian activity and relationships with other proxy records of Quaternary environmental change (Thomas and Bailey 2017). Here we apply the AI method to Asian dunefield age datasets, exploring spatial patterns and differences in the timing of dunefield activity, potential links to regional and global drivers, and gaps in available data.
ARV and the AI derivative were developed for linear dune contexts, since these are both the world's most common dune type and systems that have high preservation potential, but the method can be applied to other preservation-rich contexts including sand sheets and parabolics. Asian records in the INQUA database include 260 ages from Arabia, 132 from linear dunes; 194 from the Negev Desert in Israel (87from linear dunes, 47 from sand sheets}; 337 from Chinese dunefields, (45 from linear dunes, 47 from sandsheets, 21 from parabolics), and 155 from the Thar Desert in India.
Despite the apparent volume of published ages, scrutiny reveals several factors limiting contributions to Quaternary environmental reconstructions. For example, only 128 ages from China meet the criteria for the AI methodology, covering Inner Mongolia but not other areas where ages are either very young, from upper sedimentary units, or comprise 'spot' ages lacking other supporting data. For India, only 59 of 155 ages have depth data allowing AI analysis, limiting a detailed assessment of Late Quaternary Thar Desert dynamics. Records from the linear dune systems of the UAE and Negev are more robust, facilitating detailed analysis of accumulation variability over the last c.30ka and periods back to over 100ka.
Overall, we indicate that for many Asian dunefields, more systematic chronometric investigations are needed for robust reconstructions of Late Quaternary environmental changes to be developed.

Bailey RM, Thomas DSG 2014 Earth Surf. Proc. Landf. 39, 614-631.
Lancaster N et al. 2016 Quat. Int. 410, 3-10.
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