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Residual dune ridges: sedimentary architecture and potential as climate archive (southern North Sea)

Tony Reimann (1) and Sebastian Lindhorst (2)

(1) Wageningen University, Soil Geography and Landscape, Environmental Sciences, Wageningen, Netherlands (tony.reimann@wur.nl), (2) Universität Hamburg, Zentrum für Erdsystemforschung und Nachhaltigkeit CEN, Institut für Geologie, Bundesstr. 55, 20146 Hamburg, Germany

Sedimentary architecture and genesis of residual dune ridges are presented and it is shown that these ridges bear a so far unread archive of changes in precipitation rate and wind-field configuration on to decadal time scales.
Residual dunes are common features of wet aeolian siliciclastic systems. They form sets of shallow ridges in upwind-direction of active dunes, oriented perpendicular to the prevailing wind direction. Residual dune ridges are vegetated and typically elevate 1 to 3 m above the local deflation surface, which is controlled by the long-term mean position of the ground-water table. Ground-penetrating radar data show that they are composed of windward as well leeward dipping sedimentary beds, with the dipping of the latter being comparable to the foreset angles of active dunes. Dating based on optically stimulated luminescence (OSL), however, indicate a complete reworking of sediments during construction of the ridge and, as a consequence, ridges do not contain preserved bottom sets of their parent dunes.
Residual dune ridges develop on the stoss side of active dunes during periods of elevated ground-water table and hence colonization of the foot of the active dune by rapid growing pioneer vegetation. These plants trap sand blown off the parent dune and stabilize the ridge when it detaches from the parent dune in the course of their further downwind migration.
Multi-annual to multi-decadal variability in precipitation leads to the development of sequences composed of tens of ridges, spanning a time period of several centuries, as indicated by OSL ages. Comparison with meteorological data, however, shows that the spacing of individual ridges in these sequences is controlled not by variable precipitation alone, but also reflects changes in the rate of migration of the parental dune due to long-term changes in wind intensity.