Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05468, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05468
EGU General Assembly 2008

A model of aeolian fetch development and beach-to-foredune sand supply on multiple bar-trough (ridge-and-runnel) beaches

E.J. Anthony, M.H. Ruz
Université

anthony@univ-littoral.fr

Beaches exhibiting multiple shore-parallel intertidal bars alternating with troughs (*ridge and runnel beaches*) are, topographically, probably the most complex type of intertidal beach. These beaches are commonly associated with aeolian dunes. Bar-trough topography may vary spatially and temporally in terms of the number, spacing, elevation difference, and proximity to the foredune, of bars and troughs in the 'aeolian-critical' upper beach zone. The intertidal bar-trough couplets, which may number up to ten on certain beaches with large tidal ranges, commonly exhibit strong cross-shore variations in surface moisture contents. Bar crests normally exhibit smooth beds but may also show bedform development during spring tides and storms, which also tend to increase surface moisture content. The troughs are only exceptionally dry, while the bar slip-faces and seaward slopes are generally moist, and, like the upper beach ramp linking the bar-trough systems to the foredune, may carry abundant wave-tidal bedforms, notably ripples. Potential aeolian sand transport across these beaches is considerably influenced by the observed and inferred effects of the undulating bar-trough topography and its attendant cross-shore-segmented pattern of bedform development on air flow, and by the marked variability in surface moisture content.

A simple model of effective fetch development, integrating the effects of the spring-neap tidal range and of gross bar-trough morphological variability over time, is proposed for these bar-trough beaches. Holding wind direction constant, the shore-parallel topography and moisture variations may lead to significant fluctuations in ef-

fective aeolian fetch. As a result, despite large intertidal widths, the effective dry fetch of these beaches is segmented by the moist shore-parallel troughs in the cross-shore direction and, therefore, dry sand sources for the foredune may be highly restricted to a narrow upper beach zone. Neap tides with limited tidal and wave effects on the upper beach bar, and especially on the upper beach slope linking the bar-trough system to the foredune, tend to favour dry and smooth bed fetch conditions conducive to sand supply to the foredune, while spring tides may limit sand supply from the upper beach to the foredune. Variations in (segmented) fetch may be caused by changes in bar-trough morphology and spacing, while each segmented cross-shore fetch may be considerably enlarged by obliquely-incident winds. In this conceptual model, under adequate sand availability, the most favourable conditions for short-term beach-to-dune sand supply on bar-trough beaches are predicted to occur when strong onshore, and especially obliquely onshore (fetch-lengthening) winds, coincide with neap tides, while longer-term optimal aeolian sand supply from beach to dune is hinged on the development of a large upper beach platform associated with trough infill or minimal trough development. Such an optimal fetch can only occur under conditions dominated by wave-induced accretion and infill of the troughs above MSL. Erosion and flattening of the profile by storms may, on the other hand, lead to enhanced beach surface moisture content and bedform development associated with significant cross-shore fetch reduction. The model, thus, highlights an aeolian fetch system characterised by cross-shore segmentation and by cross-shore expansion or contraction of fetch segments essentially controlled by marine processes.