ANALYZING THE EFFECT OF BEACH WIDTH CHANGES ON COASTAL DUNE DEVELOPMENT USING A CELLULAR AUTOMATA MODEL

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The cellular automata model DUBEVEG [1] is used to evaluate the effect of beach width changes on the development of coastal dune systems. The model simulates the effects of Aeolian transport, hydrodynamic erosion and accretion, groundwater and vegetation growth. Twenty different beach profiles were constructed, with beach width ranging from 50 to 1000 meters, based on topographic measurements of real beach-dune systems. Simulations were carried out for a 90-year period for both unlimited and limited sediment supply conditions which were regulated by groundwater depth. The final topographies were compared based on morphological characteristics such as dunefoot position and volume increase. Results show that the distance between dunefoot and the waterline varies according to the supply condition, being closer to the waterline for unlimited supply cases (Figure 1). Furthermore, the position of the seaward most dunerow stabilizes after the first 15-30 years of simulation, suggesting not only an initial horizontal expansion before a vertical growth dominance, but also the delimitation of space on which dunes can actually develop. Regarding dune volume, values increased proportionally with the beach width for an unlimited supply scenario. However, for a limited supply condition, the effect of beach width on dune volume only appears for beach widths larger than 300 meters, suggesting that limitation in supply due to local conditions can dominate dune growth over beach width. These results suggest that for a decadal scale, beach width controls the space available for dune formation, thus the position of the most seaward dune, but the effect of beach width on dune volume can be overruled by other supply limiting conditions such as groundwater depth.

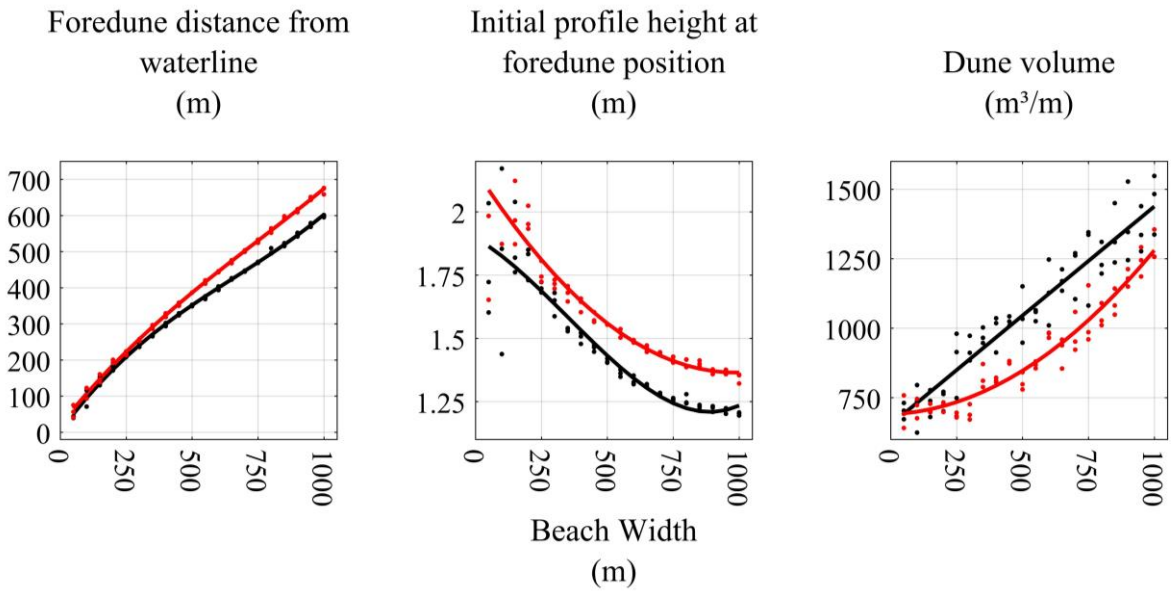

Figure 1. Beach-dune morphological characteristics after 90-year simulations. Black curves represent unlimited supply scenarios, whereas red curves represent limited supply scenarios.

References

[1] Keijsers, J. G. S., A. V. De Groot, and M. J. P. M. Riksen, 2016. Modeling the biogeomorphic evolution of coastal dunes in response to climate change, J. Geophys. Res. Earth Surf., 121, 1161–1181, doi:10.1002/2015JF003815