



Nonlinear dynamics of aeolian sand ripples

H. Yizhaq (1), **N. Balmforth** (2) and A. Provenzale (3)

(1) ISI Foundation (Turin, Italy), (2) University of British Columbia, (3) ISAC-CNR (Italy)

A nonlinear continuum model is considered that describes the dynamics of two-dimensional aeolian sand ripples. This integro-differential model is based on a phenomenological approach due to Anderson. Linear stability analysis using this model shows that a flat sand bed exposed to the action of wind is linearly unstable to long-wavelength perturbations. As the ripples grow, nonlinear effects become important, ripples become asymmetric and the wavelength increases due to merging events. A long-wavelength approximation to the full integral model is then derived. The ripple field produced by the long-wave theory undergoes coarsening, drifts downwind and displays bifurcations and defects which move from one ripple to another, similar to what is observed for sand ripples in the desert.