Geophysical Research Abstracts
Vol. 15, EGU2013-6234, 2013
EGU General Assembly 2013

Particle tracking and mean residence time in barchan dunes

Deguo Zhang (1), Clement Narteau (2), and Olivier Rozier (2)

(1) Chinese Academy of Sciences) Key Laboratory of Cenozoic Geology and Environment, Institute of Geology and Geophysics, CAS, P.O. Box 9825, Beijing 100029, China., (2) Geological Fluid Dynamics Laboratory, Institut de Physique du Globe de Paris (IPGP, UMR 7154, CNRS, Univ. P7), 1 rue Jussieu, 75238 Paris, Cedex 05, France.

We analyze sediment particles motions in steady-state barchan dunes by tracking individual cells of a 3-D cellular automaton dune model. The overall sediment flux may be decomposed into advective and dispersive fluxes to estimate the relative contribution of the underlying physical processes to the barchan dune shape. The net lateral sediment transport from the center to the horns indicates that dispersion on the stoss slope is more efficient than avalanches on the lee slope. The combined effect of these two antagonistic dispersive processes restricts the lateral mixing of sediment particles in the central region of barchan dunes. Then, for different flow strength and dune size, we find that the mean residence time of sediment particles in barchan dunes is equal to the surface of the central longitudinal dune slices divided by the input sand flux. We infer that this central slice contains most of the relevant information about barchan dune morphodynamics. Finally, we initiate a discussion about sediment transport and memory in presence of bedforms using the advantages of the particle tracking technique.