Geophysical Research Abstracts
Vol. 12, EGU2010-6956-1, 2010
EGU General Assembly 2010

Complexity and multi-scale dynamics of migrating dunes under varying flow conditions

Arvind Singh (1), Stefano Lanzoni (2), and Efi Foufoula-Georgiou (3)

(1) St. Anthony Falls Laboratory and National Center for Earth-surface Dynamics, University of Minnesota (sing0336@umn.edu), (2) Università di Padova, Department IMAGE, PADOVA, ITALY (stefano.lanzoni@unipd.it), (3) St. Anthony Falls Laboratory and National Center for Earth-surface Dynamics, University of Minnesota (efi@umn.edu)

Knowledge of the dynamics of migrating dunes is essential for characterizing sediment transport in alluvial rivers or in channels whose bottom consists of self-organized bedforms of different sizes and geometries. These bedforms exhibit strongly nonlinear dynamics which is affected by the mutual interaction of near-bed turbulence and sediment transport. Here we study the complexity of migrating sand bedforms under varying streamflow conditions. We present a space-time characterization of sand-bed elevation fluctuations obtained in a large-scale laboratory experiment in a 20m long, 2.75m wide flume conducted at St. Anthony Falls Laboratory, University of Minnesota. These bed elevations were sampled using SONAR transducers at a frequency of 0.1 Hz. Using multiscale cross-correlation analysis via wavelets we compute the velocity of migrating dunes at different characteristic length scales. We also quantify the predictability and complexity in sand bedforms using finite size Lyapunov exponents. Our analysis demonstrates the dependence of bedform complexity on bed shear stress.