Geophysical Research Abstracts,
Vol. 11, EGU2009-12693, 2009
EGU General Assembly 2009

Scaling of equilibrium bed profiles in short tidal channels

M. Toffolon (1) and S. Lanzoni (2)

(1) University of Trento, Faculty of Engineering, Department of Civil and Environmental Engineering, Trento, Italy (marco.toffolon@ing.unitn.it, +39 0461 882672), (2) University of Padua, Department IMAGE, Padua, Italy (stefano.lanzoni@unipd.it)

We study the equilibrium bottom profile in short tidal channels using a simplified erosion/deposition relationship. The proposed approach, developed within the framework of a one-dimensional model and valid for the case of fine sediments, exploits some common assumptions: the inertial terms are neglected in the momentum equation, a purely sinusoidal tidal wave is considered; moreover the channel head is assumed to be always wet. The analytical solution is obtained for weakly dissipative channels in the limit of morphological long-term equilibrium by means of a perturbation analysis and is correct up to the second order of the perturbation of the frictional term. No assumption is made about the scale of the tidal amplitude with respect to the depth.

The resulting bed profile is described by a single analytical relationship if expressed in terms of a modified longitudinal coordinate and tends to be flat in the landward part and linearly deepening seaward. The effect of channel convergence is included in the modified coordinate and tends to increase the upward concavity of the profile seaward when rewritten as a function of the physical variable; the possible presence of lateral tidal flats has a similar effect. The adoption of a suitably modified longitudinal coordinate, on the other hand, implies that the mouth of channels with different lengths is simply represented by points moving along the analytical curve describing the equilibrium profile. It is also possible to define a threshold between short flat channels and long linear channels, depending only on the critical velocity for erosion and the convergence length, so that convergent channels or sediment difficult to erode determine the tendency towards an almost horizontal bottom profile.