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Multiple Equilibria and Abrupt Transitions in Tidal Eco-Morphodynamics

M. Marani (1), A. D'Alpaos (1), S. Lanzoni (1), L. Carniello (1), A. Rinaldo (1)

(1) Dept. IMAGE and International Center for Hydrology, University of Padova
(marani@idra.unipd.it/+390498275446)

Changes in relative sea level, sediment loading, and ecological characteristics expose tidal landforms and ecosystems to responses which may or may not be reversible. Here we present a point model of the joint evolution of tidal landforms and biota, including the dynamics of intertidal vegetation, benthic microbial assemblages, erosional and depositional processes, local and general hydrodynamics, and relative sea-level change. Alternative stable states and abrupt transitions among them emerge, governed by vegetation type, disturbances of the benthic biofilm, sediment availability and marine transgressions or regressions. Multiple equilibria are the result of the interplay of erosion, deposition and biostabilization, highlighting the importance of the coupling between biological and sediment transport processes in determining the evolution of a tidal system as a whole.