Modelling pattern formation in tidal wetlands: a simple approach to describe the flow field

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Tidal wetlands, such as mangroves, salt marshes and tidal flats, are intruiging morphodynamical features occuring abundantly along large parts of the world's coastline. In common, these areas are characterised by a flow field which is frictionally dominated and generated by the propagation of a tidal wave. Here, we present a simplified approach to describe the main features of the hydrodynamics, which, coupled with a model for the sediment transport and vegetation growth, is suitable to describe the long-term morphological evolution of the phenomenon. The approach follows from an expansion in small parameters (ϵ and α), which appear once the governing equations are suitably scaled.

Figure 1 presents a comparison between the simplified approach and a numerical model[1]. Fig 1a illustrates the considered domain and Fig 1b shows the spatial distribution of the magnitude of the flow velocity along the transect illustrated by the light blue line in Figure 1a. It appears from the figure that the simplified model reasonably describes the flow field, supporting the introduced approach.

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[1]Carniello et al., *Estuarine, Coastal and Shelf Science* **92** (2011)

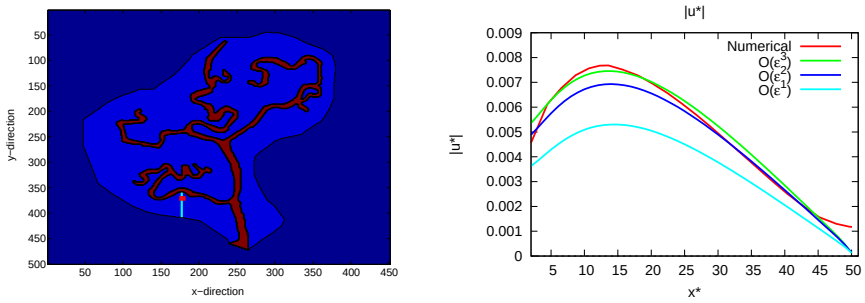

Figure 1: Comparison between the simplified model and a numerical model. (a) Considered domain: blue regions denote the marsh platform, the dark blue area shows the boundary of the marsh and the brown lines are the channels intersecting the marsh platform. The light blue line shows the transect used in Figure 1b. (b) Spatial distribution of the magnitude of the velocity u^* along the transect. A tidal wave with amplitude of 0.75 m is considered within the channels, while the elevation z_b^* of the intertidal platform adjacent to the channel is 0.1 m below the mean sea level. The plots refer to the instant of the flooding phase at which the water level in the channel is 0.3 m.