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Ecohydrological interactions in coastal wetlands and their resilience to future sea-level rise

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Abstract: Predictions of the fate of coastal wetlands under the effects of sea-level rise (SLR) vary widely due to uncertainties on environmental variables, but also due to unavoidable simplifications in the models. Assessment of coastal wetland resilience under rising sea levels using models is challenging due to uncertainties in processes and external drivers. In addition, a number of assumptions and simplifications are required in order to be able to carry out long-term complex simulations that include processes over a wide range of time and spatial scales. Some of those simplifications can have important implications for the assessment of wetland resilience.

In this contribution we look at a number of simplifications typically used in coastal wetland evolution models, and we try to quantify their effects on the results. We include simplifications related to hydrodynamics, sediment transport and vegetation dynamics focusing on issues of process description, process interactions and spatial and temporal discretisation. We pay special attention to the identification of methods that include a level of simplification that allows for efficient computation with acceptable margins of error.

Finally, we present a simplified domain model that includes all relevant hydrodynamic, sedimentation and vegetation dynamics mechanisms that affect wetland evolution, it does not require detailed information and it is efficient enough computationally to allow the simulation of long time periods. We test this framework and apply it in different settings typically found in coastal wetlands around the world, comprising different geomorphic configurations, vegetation types, sediment characteristics and tidal regimes (see figure below). Most of the wetland settings analysed are unable to cope with the high SLR rates expected by the end of the century, in agreement with results using paleo-records during periods of high SLR rates.

Keywords: *Coastal wetlands, ecohydrological modelling, sea-level rise, paleorecords*