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Numerical investigation of salinity fields in River Deltas

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River Deltas are large and complex morphological formations that develop following the discharge of sediments into the sea. Deltaic deposits are highly fertile, leading river deltas to be desirable sites to perform rural and agricultural activities. Worldwide half a billion people are currently dependant on this type of ecosystems. The fragile physical and ecological balance of river deltas may be jeopardised by climate change and sea level rise in the near future. Major concerns are connected to salt intrusion in soil and rivers due to the increased sea level in the ocean. Salinity can have a serious impact on the anthropogenic activities taking place in river deltas and cause ecological degradation. For instance, increased salinity levels damage soil cultivation, decrease the quality and availability of irrigation and drinking water, and can cause harmful algal blooms. In addition, salinity affects the density of the water flow. In case of high stratification, baroclinic effects may alter the water flow by introducing density driven flows. Therefore, the hydrodynamics of salt intrusion in river deltas can have large impacts on coastal communities, and is an important topic for study. This study endeavours to understand the factors that influence the developed salinity fields in river deltas under different hydrodynamic conditions and changing climate. The ultimate goal is to find a way to predict salinity pattern and the controlling hydrodynamics in complex coastal systems, such as the Ganges Brahmaputra Meghna, or Pearl River delta. The work presented here constitutes an idealized numerical model of a typical river delta. The model is configured to investigate the impact of variable river discharge and channel morphology on saline intrusion. The model will then be used to investigate more complex interactions between river discharge, tides, and rising sea level. The conclusions from this study will be widely applicable to river deltas around the world.

Keywords: salinity, salt intrusion, river deltas, numerical modelling, climate change, sea level rise, idealised river delta models