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Flooding hazards from sea extremes and subsidence

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If we do not understand the effects of climate change and sea level rise (SLR) we cannot live in low-lying coastal areas in the future. Permanent inundation may become a prevalent issue but more often floods related to extreme events have the largest damage potential, and the management of flooding hazards needs to integrate the water loading from various sources. Furthermore, local subsidence must be accounted for in order to evaluate current and future flooding hazards and management options.

We present the methodology (Figure) and preliminary results from the research project "Coastal Flooding Hazards due to Storm Surges and Subsidence" (2014-2017) with the objective to develop and test a practice oriented methodology for combining extreme water level statistics and land movement in coastal flooding hazard mapping and in climate change adaptation schemes in Denmark. From extreme value analysis of tide gauge records, statistics that allow also for projections of SLR, meteorological variability, and extremes with a very low probability of occurrence are provided. Land movement is researched with a focus on short term surface height variability in the groundwater-ocean interface that, together with longer term processes, may cause substantial subsidence and impact future water management and adaptation strategies in flood prone coastal areas. Field studies' results from repeated precise levelling, GPS setups, and ocean and groundwater level monitoring in Thyborøn and Aarhus are integrated into geological and geophysical data and modelling work to explore the nature and causes of the subsidence encountered, and to explore new ways of utilizing data in relation to coastal flooding hazard mapping. Here, preliminary results from the study sites show local subsidence in the order of up to 5-10 mm/y; rates that thus currently exceed SLR by far. The combined effects of storm surges and subsidence may then e.g. be projected in a Digital Elevation Model (DEM) to give more realistic future surface and flooding level representations.

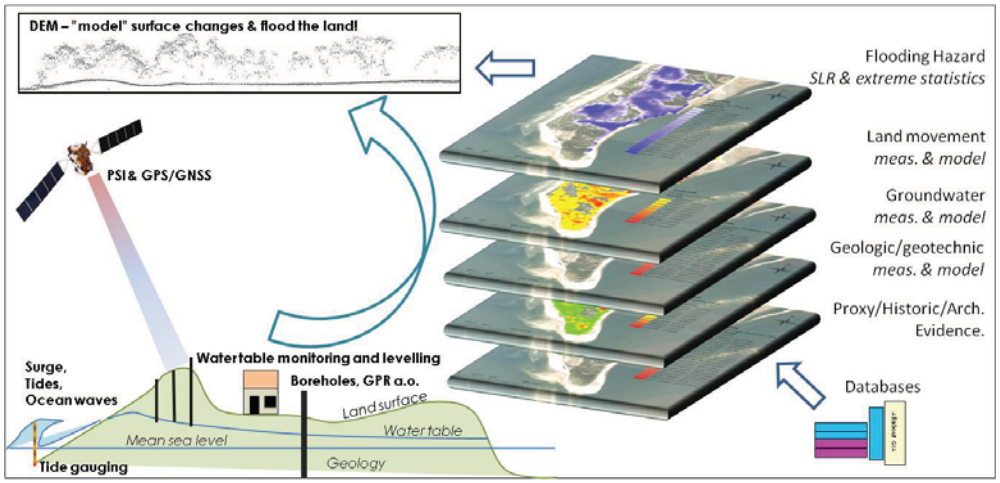

Figure. Sketch of the research setup. Field studies, statistics and existing measurement and modelling efforts are combined to yield more detailed information on land subsidence and to improve flooding hazard assessments.