

Project: **PEARL**

Project title: **PEARL: Preparing for Extreme And Rare events in coastal regions**

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Abstract

Coastal floods are one of the most dangerous and harmful natural hazards affecting urban areas adjacent to shorelines. Rapid urbanisation combined with climate change and poor governance means a significant increase in the risk of local surface flooding coinciding with high water levels in rivers and high tide or storm surges from the sea, posing a greater risk of devastation to coastal communities.

The focus of the project is to achieve a better understanding of the coevolution of disasters due to extreme hydro-meteorological events. Methodologies will be developed to assess joint probability of extreme rainfall, storm surges, sea level rise and other hazard events for today's climate and future climate scenarios. For this purpose we will use a model consisting of the formally global ocean model MPIOM with enhanced resolution around Europe. Tides are included by prescribing the full luni-solar ephemeridic tidal potential. Over the northeast Atlantic and Europe a regional atmospheric model REMO will be interactively coupled to this ocean model in order to get a high resolution atmospheric forcing. Beside the standard fluxes of heat, mass (freshwater), momentum and turbulent energy input, the ocean model is also forced with sea level pressure, in order to be able to capture the full variation of sea level. The hydrological budget in the study domain is closed using a hydrological discharge model. This approach has been successfully tested using forcing from an AR4-A1B simulation.

In comparison to traditionally used regional ocean models, this approach has the advantage that also the short term sea level signals travelling into the domain of interest through the boundaries can be captured adequately. This regionally coupled model will be used to perform a dynamical downscaling of anthropogenic climate change simulations for the European coasts with a special focus on sea level and especially extreme sea level events. The forcing for the regional atmosphere model component and for the surface forcing for the ocean outside the atmospheric model domain will be taken from the CMIP5 simulations performed with the Max-Planck-Institute for Meteorology global earth system model. The simulations will be analyzed for three time slices 1971-2000, 2021-2050 and 2071-2100, with a special focus on extreme events over the selected case studies within PEARL project which include: Greve (DK), Liverpool (UK), the Elbe Estuary (Hamburg), Les Bouchoux (F), Genoa (I), Marbella (E) and Rethymno (GR). Extreme sea level and precipitation events for the case study sites will be further downscaled using the very-high resolution models ATHAM-Fluidity (atmosphere model) and Fluidity-ICOM (tidal model) and SWAN (wave model). These data will serve as input for risk assessment and for the development of a mitigation strategy.