

Coastal ocean forecasting: high-resolution downscaling for the German Bight and its estuaries

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Coastal areas in the North Sea and more specifically in the German Bight are subject to continuously developing activities such as wind farming, transportation, river regulations, transport, etc. The resulting environmental changes interplay with the ones caused by the local natural variability and interaction with the open ocean. Coastal areas are also known as typical representatives of most active biogeochemical interactions between land and ocean, sediment dynamics and morphodynamics. The small temporal and spatial scales of processes is challenging for the provision of sufficient and credible high-resolution 4D observations. Therefore the mix between modelling and observations is considered as the most efficient tool to develop up-to-date coastal products, among them predictions and state estimates of coastal and estuarine state, and scientific support of activities and decision making. The role of numerical modelling is a central one. One major research direction is to shorten the gap between regional ocean and coastal/estuarine modelling and ensure a seamless interface between CMEMS and regional operational predictions. This is demonstrated in applications for the German Bight and its estuaries, where we propose a way to develop flexible interfaces beneficial for the CMEMS framework and coastal forecasting systems. This development is transferable to other European coastal areas and contributes to harmonising various similar, and not well inter-linked, activities. The downscaled model is based on the unstructured-grid SCHISM. The German Bight circulation model performance is assessed against in-situ observations and CMEMS regional products. The coastal prediction system is capable of providing accurate near-real-time high-resolution forecasts. Coastal forecasts are needed in sectors as off-shore wind energy, search and rescue operations, coastal risks and protection, aquaculture, fisheries and tourism. The seamless coastal downscaling approach is a step towards solving Global Coastal Ocean Prediction challenges.