Operational forecasting of storm surges – quantifying uncertainty and risk management

K. Horsburgh

National Oceanography Centre, UK

Million of European coastal properties are currently at risk from coastal flooding. Any increase in flood frequency or severity, due to sea level rise or changes in storminess, would impact on economic and social systems, as well as fragile ecosystems. Storm surges are natural hazards for which improved forecasting procedures can be used to mitigate against their potential destructive capacity. Many nations now possess operational forecasting systems that combine numerical models with real time observations of sea level, in the context of both tropical cyclones and extra-tropical weather systems. Storm surge forecasting systems are a vital component of flood and coastal defence policy. The same models are used to simulate the behaviour of extreme sea level in response to future climate scenarios. The science that underpins the next generation of surge forecasting tools is vitally important and is an international concern. It is equally important that any scientific developments are put to effective use by exporting knowledge (i.e. improved forecasting systems) to a global community which is often at greater risk. This talk will describe the evolution of operational surge forecasting systems. Each component of a tide-surge forecast procedure will be examined critically to reflect its importance to an operational system. The talk will illustrate a practical approach for quantifying the spread of uncertainty through ensemble forecasts at mid-latitudes. Ensemble predictions give confidence to those responsible for emergency response because they provide a measure of uncertainty at all future times in a forecast period. Recent work shows the utility of probability-based forecasts for coastal flood risk management. Ensemble generation of tropical cyclones will also be considered. The role of unstructured grids and of three-dimensional hydrodynamic surge models will be discussed, along with the need for improved and robust metrics for model validation.