Global To Local Predictions Of Sea Level, Surges and Waves

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Storm surges and oceanic waves are the major cause of extreme sea levels and devastating coastal impacts along many coastlines around the world. Impacts of storm surges are realised though significant human tolls and economic impacts. Recent examples include the storm surge from Typhoon Nargis in Myanmar in 2008, which killed 138000 people (IPCC, 2012) and Hurricane Sandy in 2012 for which the US death toll was 106 people and damage estimates exceeded $60 Billion.

The coastal impact of storm surges and waves will continue to increase under rising sea levels, while projected changes in global atmospheric circulation and weather patterns on interannual to climate change time scales may further influence likelihoods of severe storm surges and waves through changes to the frequency, intensity and location of severe weather events. Understanding such changes at the regional to coastal scale is essential for robust coastal planning and adaptation.

Despite the significant potential impacts of these events, recent scientific assessments of future projections of storm surges and waves have low confidence due to (1) the relatively small number of assessments, (2) the different methods and models used to investigate future changes and (3) the limited regional coverage of these assessments (see for example IPCC, 2012; Church et al, 2013). The ocean wind-wave climate community has started to address these challenges through the collaborative project COWCLIP (Coordinated Ocean Wave Climate Project), which has seen an international effort emerge to coordinate both global and regional scale wave model simulations to investigate the role of anthropogenic climate change on future wave climate. Many of the challenges faced through COWCLIP are common to developing 21st Century projections of storm surges.

Combining the contributions of storm surge and wave-induced sea level extremes at scales that are meaningful for coastal planners poses additional challenges in terms of data and computational requirements. In this talk we present progress towards understanding wave and storm surge climates globally and their combined contribution to extreme sea levels in the context of a changing climate through numerical modelling and statistical analysis. We contrast the specific issues for coastal planning along small island coastlines compared to large continental coastlines and summarise key research priorities to advance coastal adaptation more broadly.

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Keywords: waves, storm surge, modelling, coastal impacts