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Storm tide assessment with climate variability -Tropical Cyclone Debbie case study

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Queensland coastline is particularly vulnerable to storm surge as a result of extreme winds, usually associated with Tropical Cyclones (TC). Storm surge could be very destructive and it is a threat to human life and properties along the coast. Tropical cyclone are really difficult to forecast and storm surge is highly non-linear with many factors influencing its peak magnitude and spatial variability.
Griffith Centre for Coastal Management (GCCM) has developed real-time inundation forecasting tool system to support evacuation procedure, in Queensland, Australia. This tool generates visual, spatially continuous inundation mapping of storm tide for the Queensland coast to provide support to the current disaster management system. The model was constructed using the MIKE 21 Hydrodynamic (HD) Flexible Mesh (FM) module for high performance computing (HPC) and was implemented on Griffith University and QCIF's HPC facilities. The model has been calibrated and validated with 20 tide gauges along the coast and the inundation model has been tested with some extremes events such as Tropical Cyclone Debbie that made landfall on the north of Queensland coast between Bowen and Proserpine on March 28, 2017. Validation of storm surge inundation modelling strategies is often hindered by a lack of accurate measurements describing storm surge extent. To remedy this gap a team from Griffith University went to five keys locations to assess debris lines and water marks on the buildings captured from a drone and ground truth with a GPS. The information from the field work has been used to verify the Centre's storm surge decision tool and validate the projected surge and inundation across the land with the case study of Tropical Cyclone Debbie.
The aim of the research is to support the current disaster management system, optimising storm tide forecasting methods and developing future strategies for storm tide hazard assessment for the Queensland coast. Projected sea level rise due to climate change over the course of this century suggests that the impact of Storm Tide events will be more significant in the future as higher sea levels expose a wider area to inundation. This storm tide support tool could be used to project the inundation under future scenarios of climate variability such as sea level rise on decadal timescales. This paper presents the results of a storm tide inundation model of Cyclone Debbie run over varying water levels to simulate sea level rise to examine the effect of sea level rise on Storm Tide inundation on decadal timescales.
Our study provides insight into the future behavior of Storm Surge events as sea levels rise that can inform climate change adaptation planning and vulnerability assessments. This field work has been elaborated in partnership with the Department of Science, Information Technology and Innovation.