A coastal hazards prediction system in the Estuary and Gulf of St. Lawrence, Eastern Canada

In the last decades, several coastal communities in the province of Quebec, Canada, have faced repeated storms associated with flooding/overtopping and erosion events which resulted in severe damages to housings and public infrastructures. The ongoing reduction of seasonal sea ice and rise of the sea level in the EGSL imposes a major threat to these communities in the near future. Reliable predictions of the total water level (TWL) at the coast combined with early warning systems are therefore crucial for local communities and stakeholders in order to enhance preparedness, reduce risks and support the development of mitigation strategies. In 2020, a prototype of a short-term prediction system for coastal hazards has been developed in a collaboration between Université du Québec à Rimouski and the Quebec provincial government. The system produces 48-h forecasts of TWL at a spatial resolution of 50 m on all the coasts of Quebec. It integrates high resolution regional storm surge predictions provided by Environment and Climate Change Canada (ECCC), astronomical tides and waves, and also includes a web-based visualization tool to display forecasts. The impact of waves at the coast is simulated using empirical relationships extensively calibrated using high-resolution UAV and LIDAR-derived digital elevation models and time stacks from video camera deployed during consecutive years across the EGSL coastline. The offshore wave component of the system is based on a validated 1 km-resolution WAVEWATCH IIITM regional configuration forced by atmospheric, ocean and sea ice forecasts and includes a state-of-the-art parametrization of wave propagation and attenuation in sea ice (Dumont et al. 2020). This configuration as proven excellent capabilities compared to lower resolution wave models especially in fetch limited areas. Prediction capabilities of the system have been assessed using observations of the TWL over two years in the EGSL in both operational forecasting mode and in hindcast mode during historical storms.

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