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Enabling Delta Life

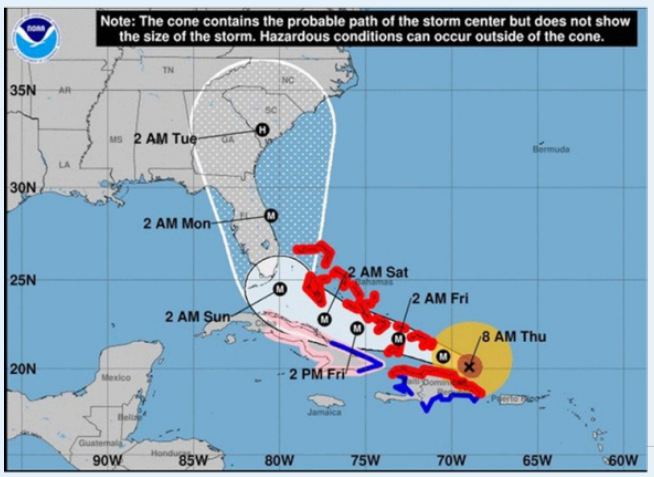
Efficient Modeling of Compound Flooding

Hurricanes have a tremendous impact on coastal communities in terms of damage due to flooding and high wind velocities, as shown by the recent hurricane season of 2017. Coastal flooding during hurricanes can be caused by high offshore water levels, wind-induced waves, surge, precipitation, or combinations of these. **Compound flooding** is often neglected in probabilistic risk analysis, as well as flood forecasting, because both of these need to calculate flooding numerous times, and therefore require fast models. Advanced process-based models that can model compound flood events (e.g. Delft3D-FLOW or XBeach) require a lot of run-time. Simple, static models are fast, but too simplistic to be accurate. There is a deep need for an **intermediate approach** which can r**epresent the physics of compound flood events**, while being **fast enough** to be feasible for risk analysis and forecasting.

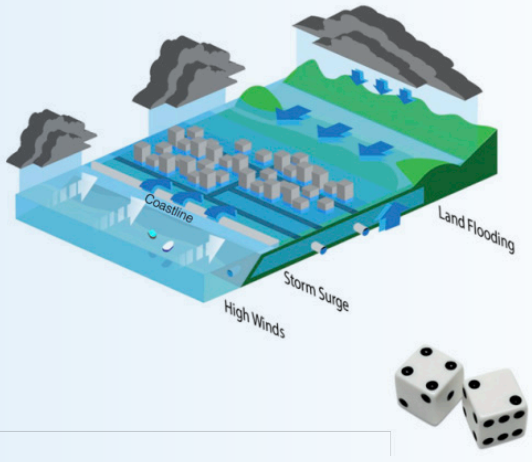
The SFINCS model (Super-Fast INundation of CoastS) was developed as a semi-advanced model which solves all relevant processes in a computationally efficient manner. The model was used to hindcast the compound flooding in Jacksonville, Florida due to Hurricane Irma in 2017. Surge, wind-induced waves, and precipitation combined during Irma, resulting in flooding in Jacksonville up to 1.5 meters, and hundreds of people requiring rescue.

The results of the SFINCS hindcasting for the compound flood event in Jacksonville were tested for accuracy by comparing with the results of an advanced modeling train using Delft3D-FLOW and WAVE models. The SFINCS model accurately predicted maximum water levels, differing from the advanced models by less than 6 cm, but running **100 times faster** than the advanced models.

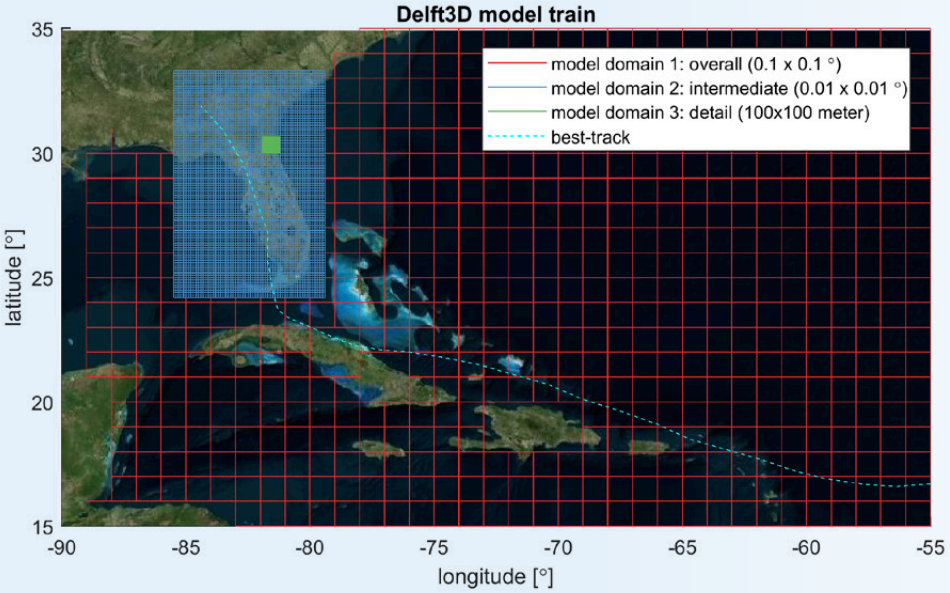
Early Warning Systems



Climate vulnerability assessments



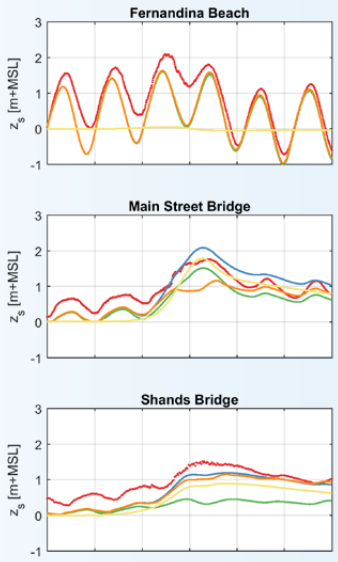
The need for faster models. Accounting for compound flooding in forecasting systems and vulnerability/risk assessments requires fast – but still accurate – flood models.

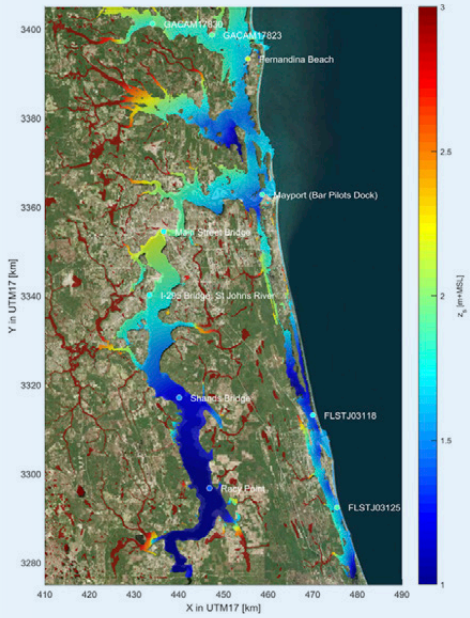


Delft3D model train. SFINCS results were compared with the 100 m detailed model of Jacksonville

observations

Modelled:
All process on
no rainfall
no wind
no offshore WL





Contributions of precipitation, wind, and offshore water levels to compound flooding. Left: water level time-series of SFINCS with and without the contribution of different flooding sources. Right: map of flood extent.

More information

This work was part of a Master's Thesis carried out at Deltares and TU Delft. For more information, please see:

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