Modelling nearshore waves and overtopping using a stochastic typhoon set

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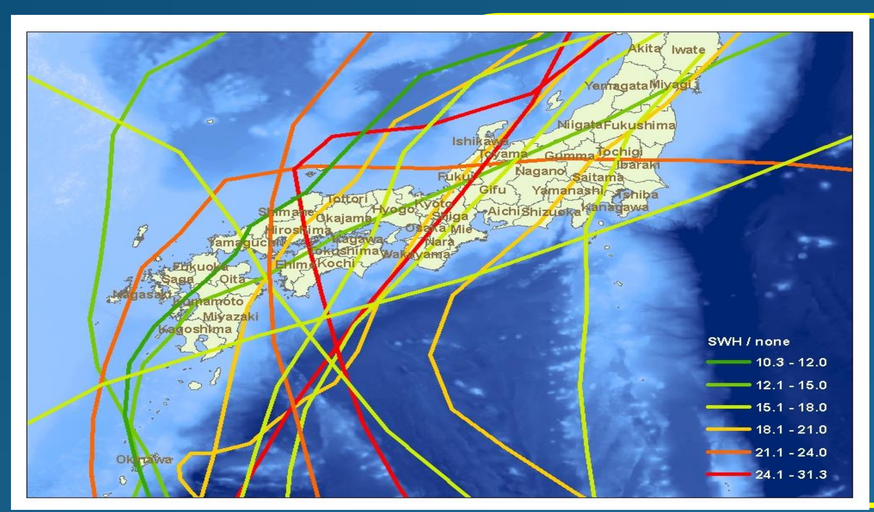
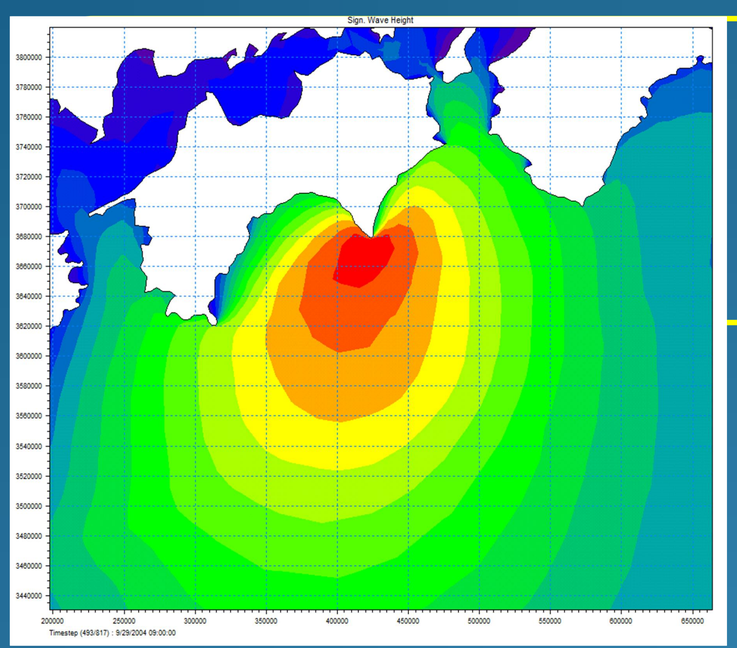
Track Selection

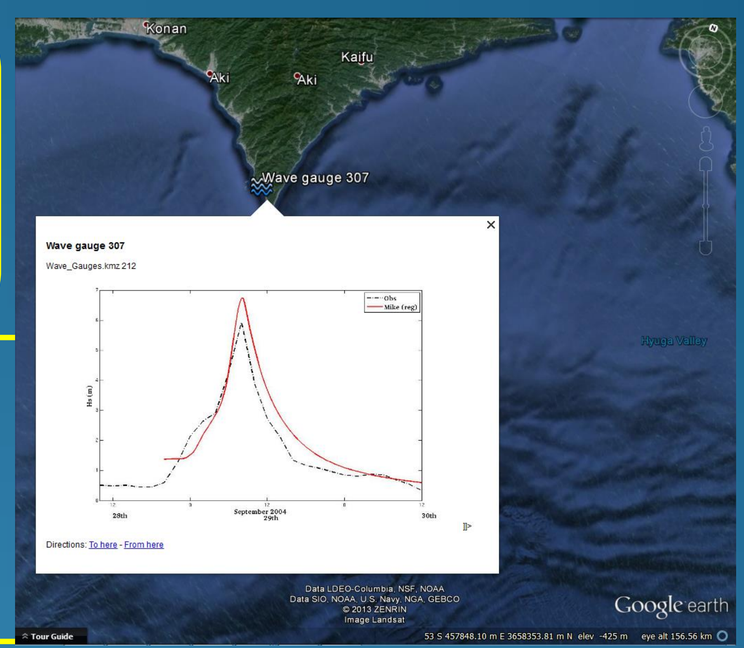


- Too computationally expensive to simulate waves for 100,000 tracks that affect Japan in the stochastic typhoon set.
- Therefore, a subset of tracks has to be selected using a simple method to predict those that may produce the most significant waves.
- Potential for wave generation is calculated using a parametric formula that takes into account the wind speed and direction and also the effective fetch of the typhoon – validated with Mike21SW.
- By-passing tracks are sometimes important for wave generation.

Mike 21 Spectral Wave Model

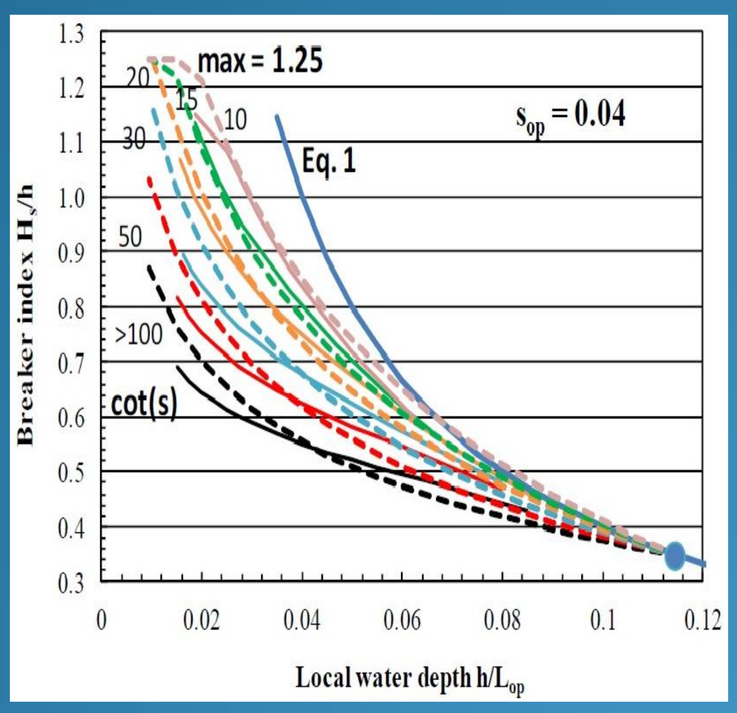


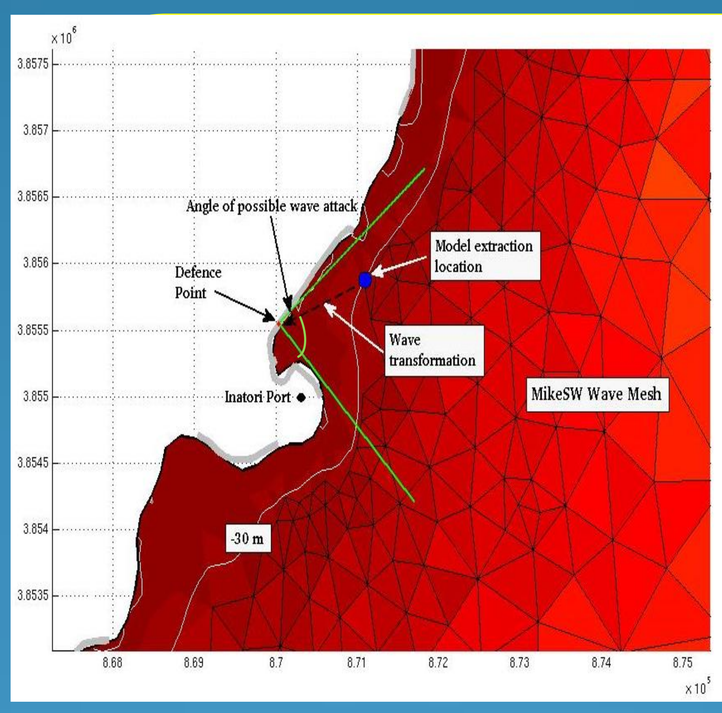
- Selected tracks are used to force a spectral wave model (Mike 21SW)
- Model is calibrated to reproduce sig. wave height, period and wave direction in space and time.



- When the wave signal is strong and driven by the typhoon the model reproduces the observed offshore waves to a reasonable degree of accuracy.

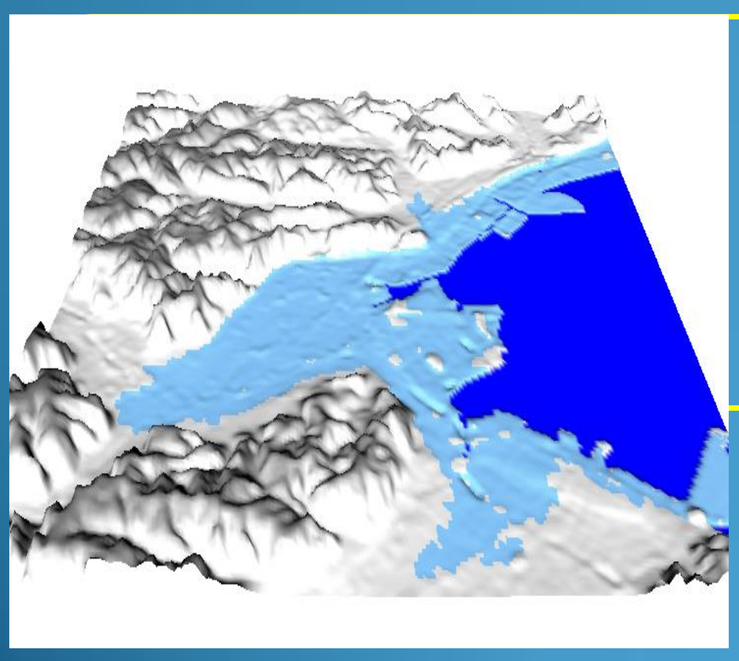
Nearshore Wave and Defence Model





- Wave heights at the defences due to the water depth and bed slope are determined from curve fitting equations from a model study.
- The sig. wave height, peak period and mean wave direction are extracted from the regional model at the 30 m isobath to calculate the wave transformation.
- Shadowing effects due to coastal geometry and wave damping due to offshore tetrapods are taken into account.

Inundation Model



- Overtopping discharges can be calculated at all the defences using equations in the EurOtop manual.
- Used as boundary conditions for a 2D inundation model run on GPUs for enhanced speed.

- A “tail” event in the stochastic set causes significant inundation due to waves and surge at Yokohama.