

Background

In the United States of America coastal communities suffer huge yearly losses from flooding. One of the causes of such flooding is storm surges, this is the sea level rise caused by tropical hurricanes and cyclones. Studies have shown that between 1963 and 2012 49% of all deaths from hurricanes in the US were caused by the storm surge(Fig. 1) (Rappaport, 2014). The economic impact has also been huge with estimates showing that with no further improvements to coastal flood defenses by 2050 yearly losses from storm surge flooding could exceed US\$1trillion (Hallegatte et al., 2013). Following this it makes sense to model and simulate these storm surge events to facilitate better planning for flood defence spending. Most storm surge models require finely tuned parameters which either require direct measurement which can be expensive and difficult to carry out or to be inferred from previous data. Inference of these parameters requires huge numbers of time consuming model runs. To address this we investigate the use of various surrogate models that approximate the model outputs in much less time so this inference can be carried out. We focus on the coefficients of friction at varying water depths as our parameters.

Aims and Objectives

- Implement and use the kriging surrogate modelling method to infer friction parameters
- Implement Polynomial Chaos Expansion (PCE) as a surrogate method to infer the friction parameters
- Implement the hybrid Polynomial Chaos Kriging surrogate model as a hybrid to infer the friction parameters.
- Analyse the inferred parameters from each surrogate model and compare the accuracy when used in the full model, as well as the uncertainty in the approximations.

Flood Death and Cost Data

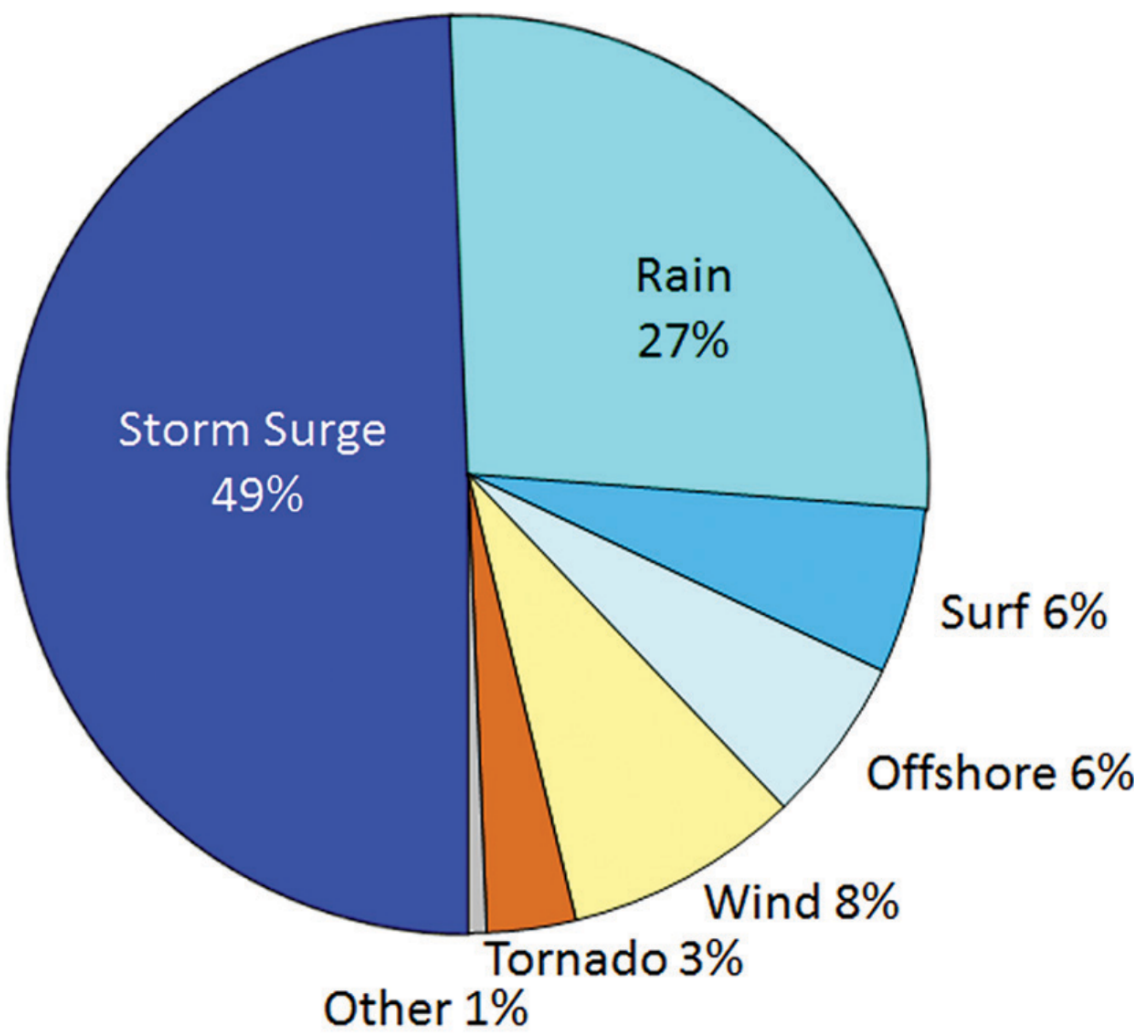


Fig. 1: Deaths in the US caused by hurricanes between 1963-2012 (Rappaport, 2014)

Method

Comparison

Remarks

Acknowledgements

References

Hallegatte, S., Green, C., Nicholls, R. J. and Corfee-Morlot, J. (2013), 'Future flood losses in major coastal cities', *Nature Climate Change* **3**(9), 802–806.
Rappaport, E. N. (2014), 'Fatalities in the united states from atlantic tropical cyclones: New data and interpretation', *Bulletin of the American Meteorological Society* **95**(3), 341–346.