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Statistical Downscaling of daily extreme Sea Level with Random Forest: Examples from South-East Asia and the Baltic Sea

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The coastlines of the Baltic Sea and Indonesia are both relatively complex, so that the estimation of extreme sea levels caused by the atmospheric forcing becomes complex with conventional methods. Here, we explore whether Machine Learning methods can provide a model surrogate to compute more rapidly daily extremes in sea level from large-scale atmosphere-ocean fields. We investigate the connections between the atmospheric and ocean drivers of local extreme sea level in South East Asia and along the Baltic Sea based on statistical analysis by Random Forest Models, driven by large-scale meteorological predictors and daily extreme sea level measured by tide-gauge records over the last few decades.

First results show that in some Indonesian areas extremes are driven by large-scale climate fields; in other areas they are incoherently driven by local processes. An area where random forest predicted extremes show good correspondence to observed extremes is found to be the Malaysian coastline. For the Indonesian coasts, the Random Forest Algorithm was unable to predict extreme sea levels in line with observations. Along the Baltic Sea, in contrast, the Random Forest model is able to produce reasonable estimations of extreme sea levels based on the large-scale atmospheric fields. An analysis of the interrelations of extreme sea levels in the South Asia regions suggests that either the data quality may be compromised in some regions or that other forcing factors, distinct from the large-scale atmospheric fields, may also be involved.