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Short-term extrapolation of extreme sea level statistical distributions

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There is nowadays evidence that extreme sea levels have increased in recent decades at rates significantly different from those in mean levels. In this work, a statistical model to short-term predict (to year 2030) the probability density function of extreme sea levels is presented. The model uses a time-dependent generalized extreme value distribution (GEV) to fit monthly maxima series and is applied to a particular time series records covering different areas of Europe. The model allows the identification and estimation of the effects of several time scales – such as seasonality, interdecadal variability and secular trends – on the location, scale and shape parameters of the probability distribution of extreme sea levels. These factors are parameterized as functions of time (linear, quadratic, and cosine functions) or covariates (for instance, NAO index), obtaining automatically the best model that explain data variability sufficiently well. The modelling of the different time scales helps to achieve a better understanding of recent secular trends for the extreme climate events and to predict in the short-term (for example in the next 20 years) the annual or monthly probability of a given extreme sea level, considering the uncertainty.