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Statistical modelling of sea level response to the changes in climate forcing

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Geophysical studies are plagued by short and noisy time series. These time series are typically nonstationary, contain various quasi-periodic components, and have rather low signal-to-noise ratios and poor spatial sampling. Classic examples of these time series are tide gauge records.
We employ a delayed response statistical model to relate the past 1000 years of sea level variability to climate forcing. We use a 2 000 000 member ensemble Monte Carlo inversion, calibrated by the 300 year long sea level reconstruction based on tide gauge records, to determine the probability density functions of the four unknown model parameters. Use of a Monte Carlo inversion ensures that our statistical model is consistent with the long term picture of sea level response to the climate forcing. Monte Carlo inversion takes a random walk in the parameters space sampling the space according to the likelihood density. The likelihood density function is defined so that the parameter set with the highest likelihood minimizes the misfit when taking the autocorrelation of errors into account. From the Monte Carlo ensemble of parameter values we derive confidence intervals.
We estimate predictive power of the model and examine potential response in sea level to the changes in climate forcing by 2100.