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Deterministic vs. stochastic acceleration in sea level rise

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Global mean sea level has been rising since (at least) the 19th century and the rate of rise may be increasing. Several studies have tried to detect an acceleration in the rate of sea level rise during the instrumental record, with widely varying results in the range of ~ 0.01mm/year^2, depending on the particular data set, method and time period considered. All studies share the common assumption that the alleged acceleration, if present, is deterministic in nature and different from random (natural) variations. Here, we show that this apparent acceleration can alternatively be explained as being caused by random variations and hence not having a deterministic origin. Two possibilities are analysed: either natural variations are a stationary random process superimposed on a linear trend or the time series of sea level is integrated and exhibits a stochastic trend. The latter leads to a random walk model with (linear) trend. Both models predict a linear (on average) evolution of sea level of magnitude comparable with previous estimations, deviations from which may be significant and persistent over extended periods of time, but are purely random in nature.