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Sea level fluctuations in observations and in climate models : Is there a signature of anthropogenic impact ?

Mélanie Becker (1), Mikhail Karpytchev (2), Marta Marcos (3), and Sabine Lennartz-Sassinek (4)

(1) IRD/LEGOS, Toulouse, France (melanie.becker@ird.fr), (2) LIENSs UMR 7266 CNRS, University of La Rochelle, France, (3) IMEDEA(UIB-CSIC), Mallorca, Spain, (4) Institute for Geophysics and Meteorology, University of Cologne, Germany

The sea level fluctuations result from complex interactions between diverse physical processes and, as many other geophysical signals, they exhibit long-term correlations that can be modeled as outcomes of stochastic power-law process with a Hurst exponent, $\alpha > 0.5$. The long-term correlated records manifest a specific long-term persistence behavior: Large events well above the average are more likely to be followed by large events, and small events by small events. In other words, a lower (than average) stand of the sea level is more likely to be followed by a lower level whereas a higher sea level is more probably followed by a high one. In this study, we estimate the Hurst exponent in the longest available tide gauges records and, as well, in the predictions of the global climate models. The first question we address is whether the power law behavior universally observed in the sea level records is correctly modeled by the global models? Then we analyze spatial variations of the Hurst exponents and their links in to the main features of the global ocean circulation. And finally, we apply the Lennartz-Bunde statistics to detect the signatures of anthropogenic effects in the longest tide gauges records. This analysis reveals a significant worldwide impact of the anthropogenic effects on the observed sea level trends although the magnitude of the anthropogenic contribution varies a lot from one region to another.