# Stochastic properties of the water level time series in the ports of Boulogne, Calais and Dunkerque, France

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We consider here water level time series recorded in the Eastern English Channel and the North sea by the SHOM (Service Hydrographique et Oceanographique de la Marine, France) in the ports of Boulogne-sur-mer, Clais and Dunkerque, every hour from 1956 to 2010. Water level is a complex quantity, influenced by deterministic astronomic forcing (tides, daily cycle, etc.) and also by stochastic forcing: water temperature, atmospheric pressure, turbulence. The deterministic forcing are strong and can be used to reconstruct synthetic water level predictions, also provided hourly by the SHOM. Stochastic forcing exist at all scales from minutes to centuries. Here we use the two datasets to explore the statistical and dynamical properties of both series, deterministic reconstruction and experimental measurements.

We estimate power spectra, and return times statistics for different water level thresholds. We show that the measured time series has some scaling properties (between day and year) that are not shown by the synthetic series, indicating that this is a signature of the stochastic forcing. We also show that, for large thresholds, return time statistics between synthetic series and measured ones, are markedly different. We compare these results for the three different time series. Applications of this study belong to littoral flood risk assessments.