Tidal components variations in the North Atlantic by Independent Component Analysis

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Historical sea level records from tide gauges in the North Atlantic have been analyzed trying to infer the underlying generating process in terms of stochastic, deterministic dynamical systems. Analyzed data were acquired in several sites and relative to the time period from January 1926 to December 2005. We have applied a nonlinear decomposition techniques in time domain, i.e. independent component analysis. Namely, although tides are well described by current numerical tide models incorporating satellite altimetry observations, the performance of such global models is very limited in the coast due to nonlinear shallow water effects and site specific characteristics such as bathymetry, basin configuration and coastal morphology. So a nonlinear dynamic perspective appears appropriate particularly studying the long term sea level change. The decomposition via ICA individuates five nonlinear tidal components which are weakly superimposed (semidiurnals, diurnals, annual component). We have studied the time evolution of the amplitude of each nonlinear component showing how it drives the global observed trend.