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Sea-level variability in Chesapeake Bay: Nonlinear trends and changing seasonality

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Sea-level is influenced by many different physical processes acting on different spatial and temporal scales. Tide gauges records of relative sea-level heights constitute therefore a precious repository of information on oceanographic and climatic variability. Of particular interest is the determination of long-term trends from tide gauge records and specifically how to extract flexible, non linear trend components for the description of sea-level long-term variability. Furthermore, seasonality, which is an ubiquitous feature in tide gauge records, can also exhibit long-term variability, and the extraction of time-varying seasonal components requires specific methodologies enabling the separation of variability in the seasonal pattern from variability in the mean. Here, these issues are addressed by applying autoregressive decomposition for the extraction of nonlinear trends and time-varying seasonal components from tide gauge records. The technique is applied to eight tide gauge records from Chesapeake Bay, for which annual and trend components are extracted by autoregressive decomposition. At all stations the annual cycle shows considerable variability in amplitude, correlated with zonal wind and anti-correlated with atmospheric pressure, while trends are mainly influenced by precipitation rate, a proxy for river discharge, explaining more than 30% of the long-term variability of sea-level in the estuary.