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Long-term monitoring and the perspective of detection and attribution of long-term change

Coastal seas research faces two major challenges with significant managerial dimensions. One is the detection and forecasting of short-term events, such as the onset of algae blooms, and the detection of long-term (decades of years) change and the attribution of plausible causes, such as global climate change or local modifications. For both purposes, efforts such as the decades-long monitoring on Helgoland Roads, are essential. The statistical analysis of the resulting time series, after suitable homogenization, reveals characteristics of change, such as trends or change points, or the absence of change. Dynamical modelling, ideally conditioned by the monitoring data, allows extension in space and time, including scenarios of the effect of changing constraining conditions. Until now, the full potential of such an approach has not been explored and demonstrated, but examples of successful statistical analysis, the combination with CoastDat oceanic and meteorological "re-analysis", and steps towards multi-decadal dynamical modelling of past ecosystem statistics ("ecoCoastDat") illustrate what may be in store, when the monitoring by BAH celebrates its 60th anniversary in 2023.