Geophysical Research Abstracts
Vol. 20, EGU2018-10787, 2018
EGU General Assembly 2018


# Seasonal and secular changes of ocean stratification and its implication for tides

Michael Schindelegger (1,2) and Mattias Green (3)

(1) Institute of Geodesy and Geoinformation, University of Bonn, Bonn, Germany, (2) Department of Geodesy and Geoinformation, TU Wien, Vienna, Austria, (3) School of Ocean Sciences, Bangor University, Menai Bridge, UK

Seasonality of the lunar semidiurnal ocean tide $M_2$ has been recently linked to variations of vertical eddy viscosity profiles in response to the seasonal seesawing of ocean stratification. The same mechanism is thought to account for large fractions of the secular $M_2$ changes seen in tide gauge records, yet establishing such a trend connection to stratification through numerical experiments has remained elusive. Here, both aspects of the time-variable $M_2$ surface tide are explored using a fully global general circulation model with a partial resolution of low-mode internal tides and explicit pressure loading that mimics the $M_2$ equilibrium tide. With wind stress and thermodynamic forcing neglected, the model is spun up from rest and allowed to adjust itself to varying initial stratifications specific to winter, summer, a climatological mean, as well as a long-term average with superimposed spatial trend patterns of salinity (S) and potential temperature (T) over the last 25 years. This idealized experiment reproduces—at least in parts—the well-known seasonality of the tide with magnitudes of O(0.01–0.1 m) on the European Shelf and in the Yellow Sea. On secular time scales, the effects of stratification are more subtle, with appreciable amounts of $M_2$ surface variations ($\sim$2 cm) only brought out if the imposed T/S trends are scaled to represent changes over an entire century. Simulations are repeated with different parameterizations of vertical eddy viscosity and validated against observed $M_2$ changes from selected tide gauges. Though obvious limitations (pertaining, e.g., to horizontal resolution and the treatment of sea ice-ocean interactions) remain, the study contributes to a better physical understanding of tidal variability and the quantification of associated aliasing errors in the analysis of satellite altimetry and gravimetry.