

{rokbox title=|a) Standard deviation σ values computed from available monthly tide gauge σ records (with seasonal cycles and linear trends removed) over 1900–2010. b) As in a but values are based on annual σ time series :: Image: Authors| thumb=|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-global-mean-sea-level-variation-piecuch-et-al-2019-thumb.jpg||images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-global-mean-sea-level-variation-piecuch-et-al-2019.jpg{/rokbox}

C. G. Piecuch, F. M. Calafat, S. Dangendorf, **G. Jordà**, 2019. [The Ability of Barotropic Models to Simulate Historical Mean Sea Level Changes from Coastal Tide Gauge Data](https://doi.org/10.1007/s10712-019-09537-9). Surv Geophys, pp 1–37 (2019). <https://doi.org/10.1007/s10712-019-09537-9>

Abstract: The nature of mean sea level variation over the global coastal ocean is considered based on 219 historical tide gauge records and three barotropic ocean circulation models forced by reanalysis surface air pressure and wind stress. The consistency of the models and their ability to reproduce the data are considered on nonseasonal timescales (seasonal cycles and linear trends removed) from bimonthly to multidecadal over 1900–2010. Models consistently simulate stronger sea level variability at higher latitude, higher frequency, between winters, and over broad shallow shelves and semi-enclosed marginal seas; standard deviations in modeled monthly sea level grow from 1–2 cm on average at low latitude (0° – 30°) to 5–10 cm at high latitude (60° – 90°), with larger values simulated over some shelf areas (e.g., North Sea). Models are more consistent over narrow shelf regions adjacent to deep basins and less consistent along the broad shallow continental shelf. On monthly timescales, discrepancies between models arise mostly from differences in model configuration (e.g., fine vs. coarse horizontal resolution), whereas model configuration and surface forcing (i.e., choice of atmospheric reanalysis) contribute comparably to model differences on annual timescales. Model solutions become more uncertain at earlier times (e.g., prior to 1950). The models show more skill explaining variance in tide gauge data at higher latitude, higher frequency, between winters, and over broad shallow shelves and within semi-enclosed marginal seas; at middle and high latitudes (poleward of 45°), model sea level solutions on average explain 30–50% of the monthly variance and 35–70% of the variance from one winter to the next in the tide gauge data records. Statistically significant relationships between the model solutions and observational data persist on long decadal periods. The relative skill of individual models is sensitive to region and timescale, such that no one model considered here consistently performs better than the others in all cases. Results suggest that barotropic models are useful for reducing noise in tide gauge records for studies of sea level rise and motivate additional model comparison studies in the context of sea level extremes.

Keywords: Coastal sea level, Climate change and variability, Barotropic modeling, Wind forcing, Inverted barometer