



## Impact of data assimilation and model resolution on sea level rise and variability

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In the past ten years new estimates of the sea level variability have become available also from the so-called re-analyses, i.e. optimal reconstructions of the oceanic hydrography and circulation from most of the historical data sets, such as profiles of temperature and salinity, satellite altimetry and sea surface temperature, assimilated into numerical models. In this work we present results from the assessment of several re-analyses and model outputs which represent the evolution of the global ocean assimilation activities carried out at the National Institute for Geophysics and Volcanology and the Euro-Mediterranean Centre for Climate Change over the last decade. The longest (1960-2010) re-analyses at coarse resolution available for the global ocean have been produced with Optimal Interpolation assimilation scheme and, more recently, through the implementation of a 3DVAR method. The latter allowed us to include the assimilation of along-track altimetric observations through a local hydrostatic adjustment. Recently, retrospective ocean re-analyses at an eddy-permitting resolution for the era of satellite altimetry are being produced in the context of the European Commission funded project MyOcean. At coarse resolution results show that the assimilation of sea-level anomaly observations improves the model sea-surface height skill scores as well as the subsurface temperature and salinity fields. We have also found non-negligible impact of the mean dynamic topography used: compared to a gravimeter-based mean dynamic topography the use of our mean dynamic topography improves the consistency with sea-level anomaly observations.

In the present work we provide an analysis on sea level trends and variability from simulations, altimetry and re-analysis to ascertain the improvements due to assimilation of observations and model resolution. Time scales of interest range from several years to decades in consideration of the length of the available time series in the different re-analysis and modelling records.