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Investigating global ocean climate variability during 1955-2010 using Data INterpolating Empirical 0rthogonal Functions technique

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Characterizing the impact of global warming is challenging as the ocean does not warm uniformly and historical data sampling is inhomogeneous in time and space. Largest uncertainties in estimations of regional and global ocean climate variability are predominantly associated to applied instrumental bias corrections, data processing methods and interannual global variability signatures. We used a new method based on the Data Interpolating Empirical 0rthogonal Functions (DINEOF) technique to fill in gappy maps during the years 1955 to 2010. We interpolate variability modes to compute annual fields separately for in situ temperature and salinity between the surface down to 700m depth. This method is an alternative to classical optimal interpolation data processing. We have validated our method using a general ocean circulation model (ORCA) as a proxy showing, that we could improve the re-constructed field in areas of sparse data coverage. We use Argo data from a re-qualified Argo dataset (ARIVO), and historical profiles from the World Ocean Atlas (WOA09). Bathythermograph corrections according to Hamon et al. (2011) are applied to minimize instrumental biases. From the interpolated fields we provide estimates of global ocean heat content, global steric sea level and global ocean freshwater content. Moreover, we focus on significant EOF modes, highlighting the contribution of this interpolation technique in the investigation of main oceanic processes at global scale. Thereby, we bring out the Atlantic Multidecadal Oscillation and El Niño Southern Oscillation variability in the subsurface layers of the Atlantic and Pacific basins for both temperature and salinity.