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Imprint of intrinsic ocean variability on ocean heat content and thermosteric sea level over 2005-2015

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Ocean warming accounts for more than 90% of the net Earth energy imbalance. As oceans warm, sea level is rising due to the expansion of seawater. Therefore, estimating ocean heat content (OHC) and thermosteric sea level (TSL) appears of great importance to assess the impact of the on-going global warming. Different research groups have estimated such climate variables for years now and even routinely (Boyer et al., 2016). These climate variables are derived from in situ temperature measurement at different depths with uneven spatial coverage. Two main sources of uncertainties are attributed to the evolving technology of temperature probes and to the uneven spatio-temporal distribution of in situ measurements (Boyer et al., 2016). A large ensemble of forced eddy-permitting ocean simulations revealed the existence of another uncertainty of regional OHC trend estimates (Sérazin et al 2017): a substantial intrinsic variability emerging from oceanic nonlinearities generates random multi decadal trends, which can mask its atmospherically-forced counterpart. This intrinsic variability can also leave a large imprint on regional sea level trends over the altimetry period (Llovel et al., 2018; Penduff et al., 2019). Less attention has been paid for estimating the imprint of such intrinsic ocean variability in OHC and TSL change associated with the uneven spatial coverage of in situ records. In this study, we investigate the imprint of ocean intrinsic variability and of the uneven distribution of in situ records on OHC and TLS change, by taking advantage of this large ensemble simulation. To do so, we extract synthetic in situ temperature profiles from the simulations in space, time and depth. We then interpolate these synthetic profiles using ISAS (Gaillard et al. 2016) to estimate both the imprint of intrinsic ocean variability and the uneven distribution of in situ data to OHC change and TSL change from 2005 to 2015.