Appendix A.

To validate the SMOS corrected product and AVISO 2014 regional altimetry we estimated the meridional salinity transport (S’v’) using these data sets at the positions of the SPURS surface drifters as well as the data from these drifters (Centurioni et al. 2015). The domain was split into several latitude bands with a half degree width, then all the drifters present in corresponding latitude band were used to estimate an average V and S and then the “turbulent” salinity transport by averaging $(v-\bar{v})*(S-\bar{S})$ over all the drifter data. This was also done retaining only the data for specific three-month seasons.

On Fig. A.1(A) the salinity transports from the different products are presented. The salinity transport with the salinity from SMOS and geostrophic velocity from AVISO (dashed line) shows a similar meridional structure to the salinity transport based on the drifter data (solid line), suggesting a divergence of salinity by geostrophic advection (mostly from the eddy component). However, the SMOS/AVISO salinity transport curve seems more noisy than the one based on the drifter data. This may be primarily caused by the AVISO altimetry uncertainty as the same experiment done with the SMOS salinity and drifter's velocity shows results quite close to the drifter's salinity transport curve (not presented). In a few cases, the differences are large enough to change the sign of the meridional transport, as seen for the spring salinity transport map (Fig. A.1(B)), or significantly overestimate the magnitude. These slight defaults of the SMOS and AVISO products do not mask however an overall similar variability to the one from the drifters alone with estimates usually inside or very close to the error bar. This is encouraging for using the AVISO and SMOS products to study advective terms instead of the in situ data that do not present a sufficient spatial coverage for the estimation of the salinity budget.

Appendix B.

Equations (1) and (2) contain terms that combine different variables with their individual uncertainties; in a space-time varying field, it is the uncertainty on the average due to its variability, as sampled by the fields. For the MLD estimates from Argo floats, it is the uncertainty on an average of a finite sample. To estimate the uncertainty on each term of the equations we use an error propagation method. The propagation of relative and absolute errors is calculated respectively as:

$$F=\frac{A*B}{C}$$

$$\varepsilon_r=\frac{\delta F}{|F|}=\sqrt{\left(\frac{\delta A}{|A|}\right)^2+\left(\frac{\delta B}{|B|}\right)^2+\left(\frac{\delta C}{|C|}\right)^2}$$

$$\varepsilon_a=\varepsilon_r*|F|$$

Figure A.1: Meridional salinity transport (S'v') from drifter's data (solid line) and SMOS (S') and AVISO (v') products (dashed line): (A) – throughout the year, (B) – spring season.

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