Supplemental Material

Journal of Physical Oceanography

Resolving the Ubiquitous Small-Scale Semipermanent Features of the General Ocean Circulation: A Multiplatform Observational Approach

https://doi.org/10.1175/JPO-D-23-0225.1

Supplementary Material

The 1000dbar reference fields are important to the total circulation derived in our study. A test of the sensitivity of these fields to the choice of trajectory data base was done using the newly available Argo trajectory data base from the Scripps Institution of Oceanography (SIO) Argo group (Zilberman et al, 2023). We applied our mapping technique to this data base and compared the results (Figure S1) to that based on the YoMaHa data base used here.

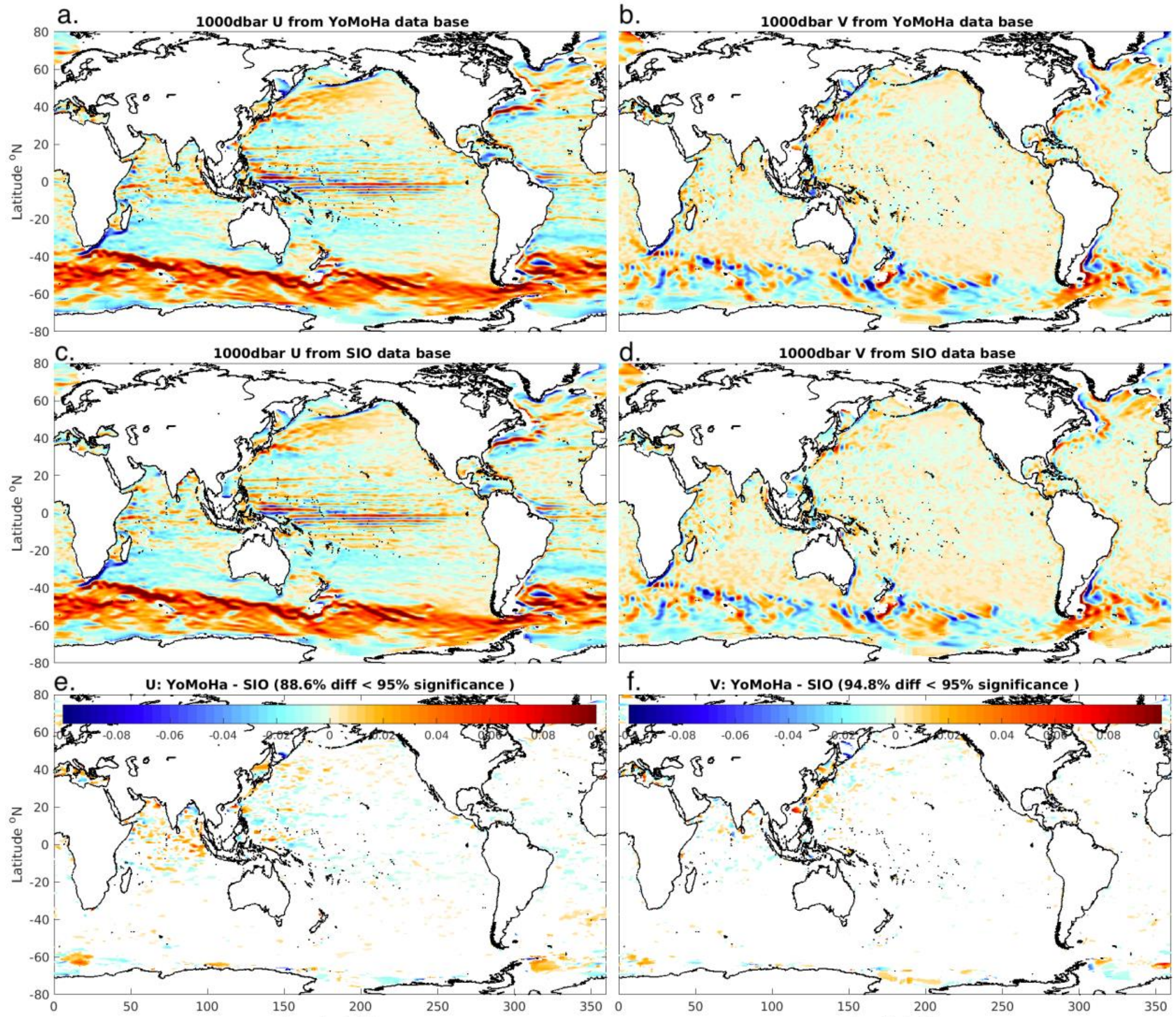

Figure S 1: Mapped mean velocities at 1000dbar for two different Argo trajectory data bases. Left hand plots are for zonal velocities, and right hand plots are for meridional velocities. Top row (a-b) is for the YoMaHa data based used in our study, middle row (c-d) is for the SIO data base while the bottom row (d-f) is the differences plotted where they are greater than the 95% significance level.

Differences in the 20 year mean velocities are very small nearly everywhere (Figure S1e,f) except in the equatorial and North Indian Ocean and western North Pacific Ocean. By comparing the observation numbers for these regions we noted that the SIO data base had fewer estimates there suggesting they deemed some float records unusable. Outside of these regions the agreement is excellent, except along the Antarctic margin where the observation numbers are very low.

Based on a reviewers suggestion we constructed the 2000-2020 mean velocity fields for the ARMOR3D product which also synthesizes several satellite and in situ data statistically. At the surface we find very good agreement between ARMOR3D, our Atlas and the surface drifter velocities. This can be expected as the ARMOR3D velocities are referenced to the surface drifter data (Mulet et al, 2012). However, we find that the subsurface zonal striations in the ARMOR3D mean fields are very barotropic have almost no shear, and thus are quite strong in the subsurface ocean (e.g Figure S2).

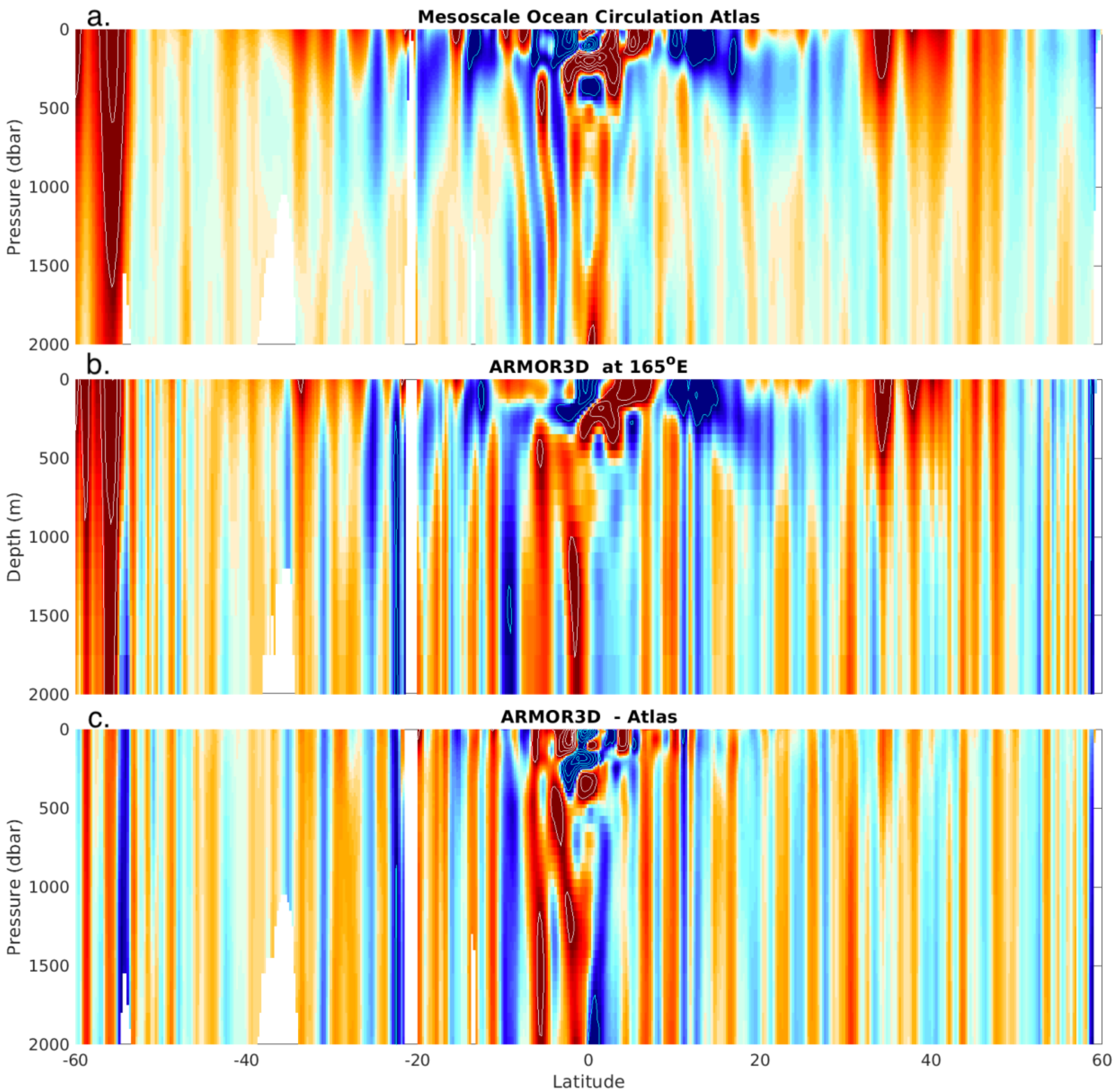

Figure S 2: Mean zonal velocity -a) from the Atlas derived here, b) from the 2000-2020 mean of the ARMOR3D product and c) the difference. Color range is as for Figure 1 and spans -0.1 to 0.1m/s. Contours are every 0.1 m/s.

We find the 1000m ARMOR3D flow to be quite different from that derived from the Argo trajectory analysis, with the zonal striations too strong and the meridional flows much noisier (Figure S3). We believe this results from the use of the SVP-based surface geostrophic flow as a reference for the geostrophic shear. As noted in the main text, we find this a noisier choice compared to the 1000dbar estimates from Argo.

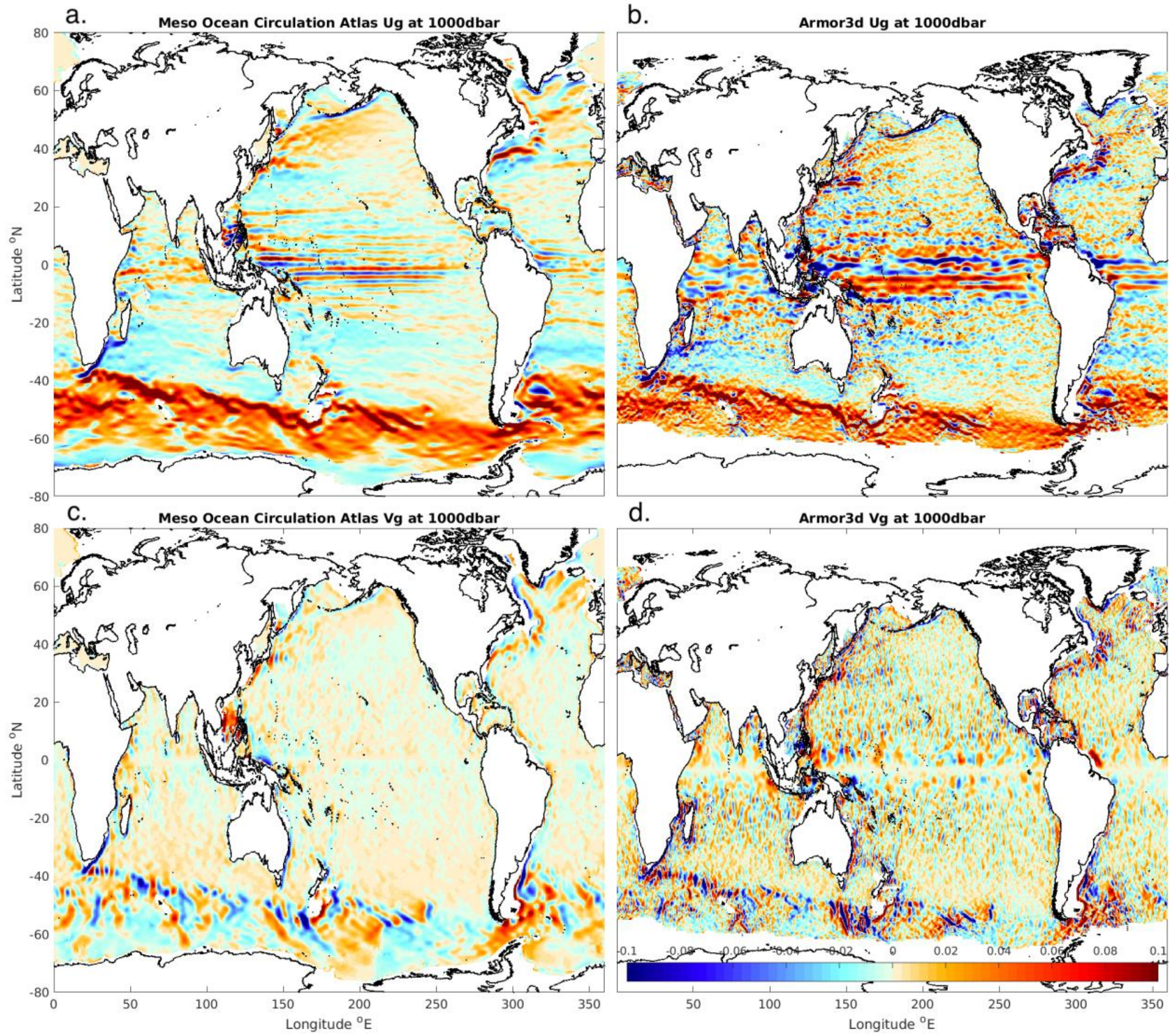

Figure S 3: Estimates for 1000dbar mean velocity: a, c - from Argo trajectories as used in the Atlas (see text) ; b, d - from the 20 year averages of the ARMOR3D product. Zonal velocities are in the top (a, b) and meridional velocities are on the bottom (c, d). Units are m/s.