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Confronting mesoscale and sub-mesoscale tracer patterns obtained from altimeter-derived lagrangian sea surface advection south of Tasmania with in-situ data

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Meso- and sub-mesoscale processes at the ocean surface can play an important role in the global ocean, creating strong horizontal gradients that can impact on lateral mixing, and enhance exchanges between ocean interior and surface through important vertical velocities. However, the space and time coverage of global in situ data is insufficient to resolve ocean surface dynamics at scales $<\sim$300 km, whereas gridded satellite altimetry products resolve scales to $\sim$100 km. Satellite measurements of SST generally offer better resolution, with global coverage at 10-25 km resolution. A better understanding of the role of small scale ocean surface dynamics therefore needs to rely on a combination of improved space observations.

However, surface lagrangian advection of a surface tracer field (SSS or SST for example) with time-evolving altimeter derived SSH geostrophic velocities has been recently shown to simulate quite effectively mesoscale processes and fronts (Despres et al., 2010). This method thus potentially offers plenty of information on meso- and submesoscale processes on a global scale. However, the method's limitations – such as the non-divergence of the simulated horizontal flow or the absence of water property modifications during advection – hinder its use for now. Finer studies will therefore be needed before it can be used as a reliable simulation of small scale activity.

In this study, we apply this advection method in the Southern Ocean region south of Tasmania. The first guess of the tracer field is derived from SSS and SST gridded products from either in situ data (Coriolis Argo floats objective analysis on a 1/2° grid), or satellite imagery (AMSR-E SST at 0.25° resolution). A first goal is to evaluate the altimetry-advection technique's ability to simulate mesoscale and sub-mesoscale activity, by comparing advected tracer fields with high resolution data from the Survostral repeat cruise section over 2002-2007. A calibration of the advection method is proposed for optimal simulation, as well as an analysis of biases introduced by the method or the first guess field, and possible corrections needed for these biases.

In the Southern Ocean, mesoscale and sub-mesoscale structures are important in the horizontal an vertical advection of tracers, in ocean mixing and in maintaining the overturning circulation. An important component of the Southern Ocean circulation is associated with the ACC fronts, the behaviour of which can be explored in the simulated fields.

Finally, an analysis of the biases and corrections introduced in the advection technique leads us to better evaluate air-sea exchanges in the region south of Australia. The enduring mesoscale and sub-mesoscale SST distribution can directly impact on the air-sea fluxes, which retroact onto the ocean dynamics. Preliminary work on this feedbackwill be discussed.