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Altimetric lagrangian advection to reconstruct Pacific Ocean fine scale surface tracer fields

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In past studies, lagrangian stirring of surface tracer fields by altimetric surface geostrophic currents has been performed in different mid to high-latitude regions, showing good results in reconstructing finer-scale tracer patterns. Here we apply the technique to three different regions in the eastern and western tropical Pacific, and in the subtropical southwest Pacific. Initial conditions are derived from weekly gridded temperature and salinity fields, based on hydrographic data and Argo. Validation of the improved fine-scale surface tracer fields is performed using satellite AMSRE SST data, and high-resolution ship thermosalinograph data. We test two kinds of lagrangian advection. The standard one-way advection is shown to introduce an increased tracer bias as the advection time increases. Indeed, since we only use passive stirring, a bias is introduced from the missing physics, such as air-sea fluxes or mixing. A second "backward-forward" advection technique is shown to reduce the seasonal bias, but more data is lost around coasts and islands, a strong handicap in the tropical Pacific with many small islands. In the subtropical Pacific Ocean, the mesoscale temperature and salinity fronts are well represented by the one-way advection over a 10-day advection time, including westward propagating features not apparent in the initial fields. In the tropics, the results are less clear. The validation is hampered by the complex vertical stratification, and the technique is limited by the lack of accurate surface currents for the stirring - the gridded altimetric fields poorly represent the meridional currents, and are not detecting the fast tropical instability waves, nor the wind-driven circulation. We suggest that the passive lateral stirring technique is efficient in regions with moderate the high mesoscale energy and correlated mesoscale surface temperature and surface height. In other regions, more complex dynamical processes may need to be included.