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Improved surface currents from the synergy of Sentinel-3 Sea Surface Height and Sea Surface Temperature

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The Sentinel-3 satellites carries on board three instruments providing indirect information about ocean surface currents, an essential ocean variable for which no direct measurement is presently available from space. The radar altimeter SRAL measures Sea Surface Height from which the geostrophic component of the currents can be derived. On the other hand, the SLSTR radiometer and the OLCI spectrometer provide measurements of the Sea Surface Temperature and Chlorophyll concentration whose distribution is partly driven by the ocean surface currents. Here we show how the Sentinel-3 altimeter and SST data can be optimally combined to get high resolution estimates of the surface currents. The method is based on the inversion for the velocity of the heat conservation equation using the altimeter velocities as background. By accurately prescribing the error both on the background velocities and on the forcing term (heat fluxes), the surface velocities are successfully improved in areas characterized by strong SST gradients and remain unchanged in low SST gradient regions, where by construction no additional information may be brought by the SST field.
The method has first been implemented and validated for the global ocean, outside the Sentinel-3 era (2003-2005). Validation has been done by comparison to drifting buoy velocities and by spectral analysis. We show that both the spatial and temporal resolution of the altimeter derived velocities is enhanced by the SST information. Major improvements are obtained on the meridian component of the velocity and in the equatorial band.
The method has then been applied on altimeter and sea surface temperature measurements from the Sentinel-3 mission in the Sicily channel area in the Mediterranean Sea. We show that the spatial resolution of the altimeter derived velocities is strongly enhanced by the use of SST information. Details down to a few kilometres resolution are visible on the obtained optimal velocities.