

# Reconstruction of ocean currents from existing satellite observations: the challenge of high resolution dynamics

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Infrared and visible satellite observations have revealed that the ocean surface is crowded with eddies with scales  $O(10-100\text{ km})$  and submesoscale structures, like fronts and filaments, with scales  $O(1-10\text{ km})$ . Satellite infrared measurements of Sea Surface Temperature (SST) have resolutions high enough to observe submesoscales ( $\sim 1\text{ km}$ ), and the existence of multiple platforms with infrared sensors can provide observations of the same area with temporal samplings of less than 6 h. The key problem to be addressed is the extraction of quantitative dynamical information at the scales of interest from existing observations. Indeed, along-track altimetric measurements of Sea Surface Heights (SSH) are very well suited to quantify across-track currents. However, the spatial resolution of derived 2D velocities is restricted to scales above 100-150 km and the limited number of altimeters can lead to errors in the location of currents. To overcome the previous constraints, new theoretical frameworks that model the dynamics of the upper ocean have been proposed. Here, we discuss the strengths and weakness of dynamical approaches like the Surface Quasi-Geostrophic (SQG) equations to retrieve the three-dimensional dynamics of the ocean, as well as other approaches that exploit the synergy between SST and SSH measurements to provide enhanced 2D surface currents. Recent results showing the current capabilities to retrieve the velocity field at scales of the order of 10 km will be also shown.