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Multi-nest high-resolution model of submesoscale circulation features in the Gulf of Taranto

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Recent oceanographic field measurements and high-resolution numerical modelling studies have revealed intense, transient, submesoscale motions characterised by a horizontal length scale of 100m-10000m. This submesoscale activity increases in fall and winter when the mixed layer (ML) depth is at its maximum.
In this study, the submesoscale motions associated with a large-scale anticyclonic gyre in the central Gulf of Taranto were examined using realistic submesoscale-permitting simulations.
We used realistic flow field initial conditions and multiple nesting techniques to perform realistic simulations reaching very-high horizontal resolutions (> 200 m) in areas where submesoscale variability develops.
Multiple downscaling was used for the first time to increase resolution in areas where instability was active enough that multi-scale interactions developed and produced eddies of 5-km in diameter. To generate a submesoscale eddy, it was found that about 200 m resolution is required.
A new mechanism of submesoscale eddy generation was found to be active at the rim of a large-scale anticyclonic gyre. The submesoscale eddy, which was confirmed by observational data collected in the area, formed through small-scale baroclinic instability of the gyre rim current leading to large vertical velocities and rapid restratification of the ML on a time scale of days.