

Multisensor satellite observations of meso- and submesoscale surface circulation in the Liguro-Provençal Basin

Svetlana Karimova and Aida Alvera-Azcarate

Institute of Physics, University of Liege, Liege, Belgium (svetlana.karimova@ulg.ac.be)

Despite great efforts being paid to studying circulation of the Western Mediterranean Basin and the factors triggering bioproductivity of its marine ecosystem, the evidence provided by satellite imagery has not been fully analysed yet. In the present paper, we concentrate our attention on mesoscale and submesoscale circulation features of the Liguro-Provençal Basin captured by satellite radiometer, spectroradiometer, and radar images. Using such a dataset makes it possible to observe the circulation features from a wide spatial range, from the basin scale through mesoscale to the scales of a few kilometers.

Mesoscale features in this study are being mostly observed with thermal infrared imagery retrieved by AVHRR and AATSR sensors. Special attention in the work was paid to an analysis of the data coming from a geostationary satellite, namely ones provided by SEVIRI. Due to their uniquely high temporal resolution, such imagery allows observing circulation features in their evolution.

During the winter blooming events, surface circulation at meso- to submesoscales in the region of interest was additionally highlighted by images obtained in the visible range. Full spatial resolution images provided by Envisat MERIS, Sentinel-2 MSI, and Landsat TM/ETM+/OLI made the greatest contribution to this part.

The smallest scales (namely submesoscale) are being observed with synthetic aperture radar (SAR) imagery provided by Envisat ASAR and Sentinel-1 SAR. During an analysis of SAR images, it was noted that there was strikingly great amount of biogenic surfactants on the water surface in the region of interest. Apparently, low biological productivity typical for the Western Mediterranean ecosystem is not a limiting factor for the formation of surfactant films seen in SAR imagery. This finding though requires further consideration in some other researches, and hereafter we just benefited from the presence of surfactants, because they behave as good tracers of surface currents.

Even though the region of interest belongs to the areas with low mean eddy kinetic energy, analysis of the images listed above revealed that the Liguro-Provençal Basin was showing a surprisingly high eddy activity among submesoscale and mesoscale features. However, the typical size of eddies in this area was smaller than that in the southern part of the Western Mediterranean. The general impression retrieved from the observations performed is that the main contributors to generation of observed mesoscale vortical structures are (i) the instability of the main currents in the region of interest and especially frontal instability at the Liguro-Provençal front and (ii) instabilities caused by the coastline inhomogeneity, especially in the eastern part of the Basin. Submesoscale eddy activity seems to be developed to its full extent during the periods when the mesoscale activity in the region of interest is not so prominent.

This study is supported by the University of Liege and the EU in the context of the FP7-PEOPLE-COFUND-BelPD project. Satellite imagery is provided by the European Space Agency.