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Evaluating the Sentinel 1 wind product quality near the coast: the role of high resolution numerical models

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Wind variability at coastal areas is very high due to the effects of local topography, sea breezes, coastal katabic winds and boundary layer rolls. The analysis of anisotropic coastal areas, where the problem of the land-sea border is compounded by the preferential directions of air/water flows (e.g. topographic steering for channeled wind fields) poses a formidable challenge that lies at the core of this work. Over the land there is a large amount of meteorological stations, which together with numerical models allow the scientific community to describe and understand the different physical processes responsible for the wind variability. However, over the sea, there is an important lack of information. Meteo-ocean buoys are expensive and difficult to maintain, so only a few in-situ observations are usually available at the sea-side. These deficiencies have been balanced with different satellite products such as scatterometters (i.e. Sea Sat, Seawinds and ASCAT, among others), passive polarimetric sensors (WindSat) and Synthetic Aperture Radar (SAR; i.e. ERS1, ERS2, Envisat). However, the most common satellite products are only useful for open sea application due to the grid resolution and the footprint contamination on the coastal proximities. For instance, the spatial resolution of scatterometer data is typically 25 km.
On April 2014 the European Space Agency (ESA) launched the first Sentinel-1 satellite. Sentinel-1 is a constellation mission of two satellites (1A launched in 2014 and 1B launched in 2016). Both satellites carry a SAR that measures the ocean surface roughness related to the wind speed. However, in order to retrieve the wind speed from the SAR images the wind direction has to be known a priori. In the case of Sentinel-1 Level 1 products provided by the European Space Agency (ESA), wind direction data from ECMWF products are used in the wind retrieval process.
The aim of this work is to perform a quality assessment of the Sentinel-1 wind products released by the ESA. The Balearic Sea (NW Mediterranean Sea), which is a reference area with high economic, social and ecological interest, has been selected to perform the study. Moreover, this area has a considerable number of meteo-ocean stations (11) that would allow to validate the satellite wind retrievals and analyze their dependence on the distance from the coast. Finally, data from the WRF atmospheric model at high resolution (4 km) is used to redo the wind retrieval process and study the sensitivity of the wind speeds to the spatial resolution of the wind direction input.