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Offshore Wind Mapping Mediterranean area using SAR. A case study of retrieval around peninsular regions.

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Satellite observations like Scatterometers e.g. QuickScat, and Synthetic Aperture Radars (SAR) of the ocean surface provide information about the spatial wind variability over large areas. This is very valuable, for mapping offshore wind resources for offshore wind farm installation, where the most suitable locations within a given region must be identified using at least 5 year wind data over the whole domain.
This is a special issue in the Mediterranean, where spatial information is not readily available because buoys or masts are sparse, with long periods of missing data, and measurements represent only one point.
Here, we focus on the SAR images that have the advantage of high spatial resolution (down to 100m) allowing to derive information close to the coast but with the disadvantage of low time resolution causing lack of information on regimes with low time scale.
We retrieved SAR (ENVISAT ASAR scenes acquired in Wide Swath Mode-WSM-) wind speed in the Mediterranean from March 2002 to April 2012 using the Johns Hopkins University, Applied Physics Laboratory (JHU/APL) software APL/NOAA SAR Wind Retrieval System (ANSWRS version 2.0) (Monaldo 2000; Monaldo et al. 2006). The ANSWRS software produces per default wind speed fields initialized using wind directions determined by the Navy Operational Global Atmospheric Prediction System (NOGAPS) models interpolated in time and space to match the satellite data. NOGAPS data are available at 6-hour intervals mapped to a 1° latitude/longitude grid.
Here, we present a case study in Calabria, a long, narrow and mountainous peninsula in South Italy that causes a significant wind conditions variability from one coast to the other. We considered a 10m mast, measuring hourly wind speed and direction located at the coastline at the harbor of the town Crotone, belonging to the marine network of sensors of ISPRA (Institute for Environmental Protection and Research). Three points of the SAR images were chosen at offshore distances of 4.5, 50 and 200 km and we performed a comparative analysis between wind data from 44 SAR images, the experimental data, and data from the NOGAPS for the whole year 2009. The correlation coefficient between in-situ wind speed and SAR-based wind speed at 4.5 km is R2 =0.54. The correlation between SAR and NOGAPS wind speed varies from R2=0.7 to R2= 0.8 from 4.5 km to offshore. However, the correlation coefficient of NOGAPS wind directions around Calabria from 4.5 to 50 km is R2=0.99.
Even thought that the low R2 between the coastal mast and SAR at 4.5 km is explicable, this confirms the limit of the NOGAPS horizontal resolution in presence of peninsulas. Therefore, in such cases models with higher spatial resolution would be more appropriated. Here, we use the RAMS mesoscale model at 10km resolution as input for the SAR wind retrieval system during July – August 2009 and analyze the sensitivity of the SAR wind speed retrieval system to the resolution of the model, especially in coastal areas.