Geophysical Research Abstracts
Vol. 15, EGU2013-13961, 2013
EGU General Assembly 2013

Diagnostics of ECMWF Analysis Winds in the Mediterranean Basin Using ASCAT 12.5 km Winds

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This work aims to understand to what extent an advanced Numerical Weather Prediction (NWP) system and scatterometer winds fields describe the same spatial and temporal features of the wind in a semi-enclosed sea like the Mediterranean Sea, almost entirely surrounded by mountain chains, often rising nearby the coastline. The complexity of the coastal orography and the presence of mountainous islands deeply influence the synoptic scale atmospheric circulation in the Ekman layer, producing effects at spatial scales from regional ($\sim$ 150 km) to a few kilometres.

Scatterometer and NWP wind fields are seen as complementary tools for understanding the weather dynamics and its interaction with the surrounding orography in such a complex basin. The question is now to understand to what extent they describe the same features of the wind spatial and temporal variability at monthly and seasonal time scales in a semi-enclosed sea like the Mediterranean, and if and how their performances depend on geophysical conditions such as the air stability and/or the wind characteristics.

To answer to these questions, we have compared the satellite and NWP model wind fields in the Mediterranean Basin using the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) Advanced Scatterometer (ASCAT) wind data at 12.5 km spatial grid and the analysis wind fields from the European Centre for Medium-Range Weather Forecasts (ECMWF), Reading, UK at $\sim$16 km grid size (T1279) for the period February 2010-February 2012. In this period, in the whole Mediterranean Sea the ASCAT-ECMWF relative bias Δ for wind speed and direction results small (0.5 m/s and -2.6°), but the centred Root Mean Square deviation RMSc is rather significant for both (1.45 m/s, 23.1°). An interesting result is the identification of the dependence of Δ and RMSc on the distance from the coast, indicating the coastal areas as the main source of discrepancy. With respect to their value at about 50 km offshore, RMSc decreases for wind speed and direction by 21% and the relative bias by 47% and 15%, respectively, at about 200 km away from coast. This effect is more remarkable close to coastal lines affected by important orography, consistently with the results found working with the relative vorticity. The conclusion we can draw is that the major differences have been found to occur where the orography plays an important role in influencing the wind flow, i.e. in the sea areas at distances less than 150 km from coast. This is consistent with the findings obtained using a regional mesoscale NWP model, suggesting that these systematic effects could be somehow independent from the (different) physical parameterizations and implementation of the NWP models.