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Towards an improved ASCAT wind data assimilation in global NWP

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In this study, two important aspects of the Advanced Scatterometers (ASCAT) wind data processing are addressed in order to further improve the impact of wind data assimilation into global NWP models. The retrieved wind field data from ASCAT onboard Metop satellites have been operationally assimilated into global numerical weather prediction (NWP) models over the last decade. In particular, at the European Center for Medium-Range Weather Forecasts (ECMWF), the ASCAT wind product at 25 km grid resolution has been used with an estimated wind component error value of 1.5 m/s and thinned to 100 km (which reduces the number of assimilated observations by a factor of 16, while retaining the essential large-scale information of the data). We address aspects of quality control (QC), wind quality and quantity (higher resolution) in data assimilation.

The removal of unrepresentative winds using an improved wind QC is in demand. A more aggressive QC may bring higher forecast impact, but not necessarily a closer analysis fit to ASCAT. Usually, unrepresentative observations are handled by a first guess check, but this depends on the highly variable quality of the background in highly variable cases, such as squall lines, gust fronts, etc. A more independent and observation-based QC is proposed. ASCAT-derived parameters such as the inversion residual and the singularity exponent prove to be a good proxy for local wind variability, and are in turn strongly correlated with large observation minus background (O-B) departures. A comprehensive triple collocation (buoy-ASCAT-ECMWF) analysis is carried out to reduce the uncertainties in the O/B error estimation. The ASCAT/ECMWF wind data sets from the operational 25-km and 12.5-km products are then separated into 9 wind quality categories, thus situation-dependent O/B errors.

Another important aspect of scatterometer wind data assimilation is the spatial resolution. The development of a new ASCAT wind product more representative of the NWP model resolved scales may lead to improved data assimilation impact. In global scatterometer wind data assimilation, particularly in the Tropics, the spatial representativeness error (i.e. the true small-scale variance resolved by scatterometers but not by NWP models) is quite variable and spatially correlated. To avoid such spatial correlation, scatterometer observations are currently thinned and assimilated with a relatively low weight, and as a consequence the small-scale information in scatterometer winds is not assimilated. A way to reduce the spatial representativeness error (and thus, its associated spatial correlation) is by averaging the relatively-high resolution ASCAT wind vector cells (WVCs) to lower resolution in an aggregation process. Such aggregated winds can be assimilated without thinning. As such, several ASCAT lower resolution (or aggregated) products are defined and generated. The analysis shows that these low resolution products are more representative of the winds at ECMWF scale, and that the observation errors (including the representativeness errors) are also reduced as compared to the operational ASCAT (25-km and 12.5-km) products.

Finally, impact experiments of the low resolution (aggregated) ASCAT wind products, including situation dependent O/B errors, will be soon carried out at ECMWF. The results of these experiments will be presented at the conference.