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ASCAT-6.25 validation on coastal jets

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Change record			
Version	Date	Author / changed by	Remarks
0.1	26-10-2015	J. Vogelzang	1st draft
0.2	28-10-2015	I. Monteiro/A. Stoffelen	Several additions
1.0	28-10-2015	J. Vogelzang	Final version

Introduction

In the period October 19-21, 2015, Isabel Monteiro from the Instituto Português do Mar e da Atmosfera (IPMA) visited KNMI to discuss validation of the ASCAT-6.25 wind product in the framework of a study to coastal jets off the Iberian coast using model forecasts and buoy measurements. IPMA is a beta user of the experimental ASCAT-6.25 product. ASCAT-6.25 will become operational late 2015, and the main aim of the mission was to exchange experiences with this new wind product in order to improve user guidance.

Study area

The study area is the Iberian west coast with special emphasis on the main capes: Cape Finisterra in the northwest, Cape Roca near Lisbon, and Cape São Vicente in the southwest (see figure 1). Under specific meteorological conditions in summer time a coastal jet develops offshore the Iberian Peninsula with wind maxima linked to the main capes mentioned above. Figure 1 shows an example recorded on July 28, 2011. The wind maximum linked to cape Finisterra is clearly visible.

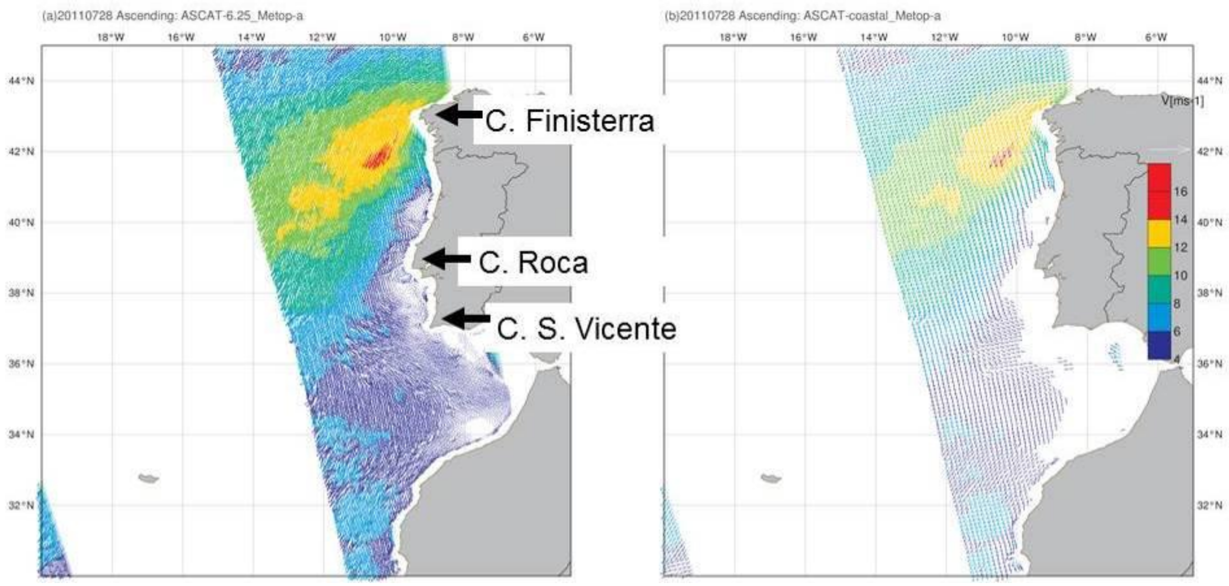

Figure 1. ASCAT-6.25 (left) and ASCAT-coastal (right) wind fields off the Iberian coast on July 28, 2011.

Data

The data used in this study are:

1. ASCAT-coastal data for the period 2010 - 2014;
2. ASCAT-6.25 data for the periods August 01 - 08, 2010, July 18 - 29, 2011, and August 2013;
3. Buoy data from five offshore buoys for the period 2010 - 2014.

The ASCAT-6.25 data cover periods with frequent occurrence of coastal jets.

Results

Visual inspection of the ASCAT-coastal and ASCAT-6.25 wind fields during coastal jet conditions reveals that the wind maxima are sharper and deeper in ASCAT-6.25 than in ASCAT-coastal. Figure 1 is an example. It shows the wind fields on July 28, 2011 for ASCAT-6.25 (left) and ASCAT-coastal (right).

Table 1 gives the buoy comparison for all available ASCAT data during summer time. Note that ASCAT-6.25 zonal and meridional wind components *u* and *v* compare better to the buoy measurements than ASCAT-coastal, while the wind speed statistics are comparable. This may imply that ASCAT-6.25 wind directions are closer to the buoys. However, the statistics are not for the same period, since ASCAT-6.25 has been processed for specific periods, and therefore do not contain the same number of data and data for different weather conditions.

product	wind speed bias (m/s)	wind speed Std dev (m/s)	zonal wind *u* bias (m/s)	zonal wind *u* std dev (m/s)	meridional wind *v* bias (m/s)	meridional wind *v* std dev (m/s)	*N*
ASCAT-6.25	-0.06	1.00	0.12	1.49	0.28	1.27	154
ASCAT-coastal	0.25	0.98	0.10	1.79	0.03	1.61	1477

Table 1. IPMA buoy comparison for all Iberian summer.

Table 2 shows the results for the global buoy comparison done by KNMI for August 2013 [*Vogelzang and Stoffelen*, 2015]. Only the standard deviations are shown in table 2. Comparison with table 1 shows that the standard deviations in wind speed are comparable, that those in the zonal wind component are higher for the Iberian coast, and that those for the meridional wind component are comparable for the coastal product but not for ASCAT-6.25.

product	wind speed std. dev (m/s)	zonal wind std. dev. (m/s)	meridional wind std. dev. (m/s)	*N*
ASCAT-6.25	0.99	1.38	1.64	2682
ASCAT-coastal	0.98	1.36	1.59	2682

Table 2. KNMI global buoy comparison for August 2013.

Discussion

Using the cumulative spatial response function (CSRF), KNMI concluded that ASCAT-6.25 has a true resolution of about 20 km, while ASCAT-coastal has a true resolution of about 30 km [*Vogelzang and Stoffelen*, 2015]. This is at least qualitatively confirmed by the IPMA study where it is found that the ASCAT-6.25 product gives more details and sharper wind speed maxima than the ASCAT-coastal product.

The KNMI validation study shows that ASCAT-6.25 compares slightly worse to buoys than ASCAT-coastal. This is attributed to the fact that the radar cross sections in the ASCAT-6.25 are noisier, because they are averaged over less samples and because the CSRF of the three beams do not match so well. The buoy validation at IPMA shows the opposite trend for *u* and *v*, as shown in table 1 [*Monteiro*, 2015]. However, the ASCAT-6.25 data set only covers three periods with prevailing coastal jets, while the ASCAT-coastal dataset covers the whole summer during 2010 - 2014. In order to draw definite conclusions, it is better to redo the analysis with an ASCAT-6.25 dataset extending over the same period as the ASCAT-coastal data.

In order to minimize the effect of grid size and WVC location, it would be better to do the buoy comparison with a standard ASCAT-6.25 product with an aggregation radius of 7.5 and with an ASCAT-6.25 product with an aggregation radius of 15 km. The latter product has the same sampling characteristics as the ASCAT-coastal product, but sampled on the ASCAT-6.25 grid.

The wind speed biases found at IPMA may also strongly depend on the sample, as atmospheric stability affects ocean surface backscatter variability, which may affect bias. It is of interest to further investigate this; see also *Stoffelen et al*. [2013].

Contrary to the ASCAT-coastal product, the ASCAT-6.25 product will not be processed near real time by the OSI SAF. Users interested in the ASCAT-6.25 product must do their own processing. During this VS mission it became apparent that the current description of the command line arguments in the AWDP User Manual and Reference Guide [*Verhoef et al.*, 2014] is not appropriate and needs extension. In particular, the meaning of the *-f*, *-szffl and -nwpfl* command line arguments should be clarified.

Another difference between the IPMA and KNMI buoy validations is that IPMA uses coastal buoys while KNMI uses buoys much further from the coast. Therefore land contamination or reduced radar sampling due to land flagging may play a role in the ASCAT products. In principle this may be circumvented by increasing the allowed land fraction, using the MLE and K_p to detect land contamination. As shown in figure 2, even an extreme allowed land fraction of 90% shows reasonable MLE values up to the coast, except for the very southwest of the Iberian peninsula. Effects of K_p could be tested too. However, since EUMETSAT is working on an improved land flag it was decided to readdress this question after implementation of the improved land flag.

ASCAT-coastal data are used at IPMA operationally to check the position of cyclones in the Atlantic given by NWP models [*Lourenço et al.*, 2015]. Such nowcasting activities might benefit from the increased resolution in ASCAT-6.25 and also the use of MLE information [*Stoffelen et al*., 2013]. However, cyclone centres in ASCAT-6.25 are more prone to noise, QC rejections, and subsequent ambiguity removal errors because of the poorer radar statistics. It was therefore concluded that the ASCAT-coastal product is now more suited for such applications, but that this may change when the QC, spatial processing, and ambiguity removal in AWDP is improved in the future.

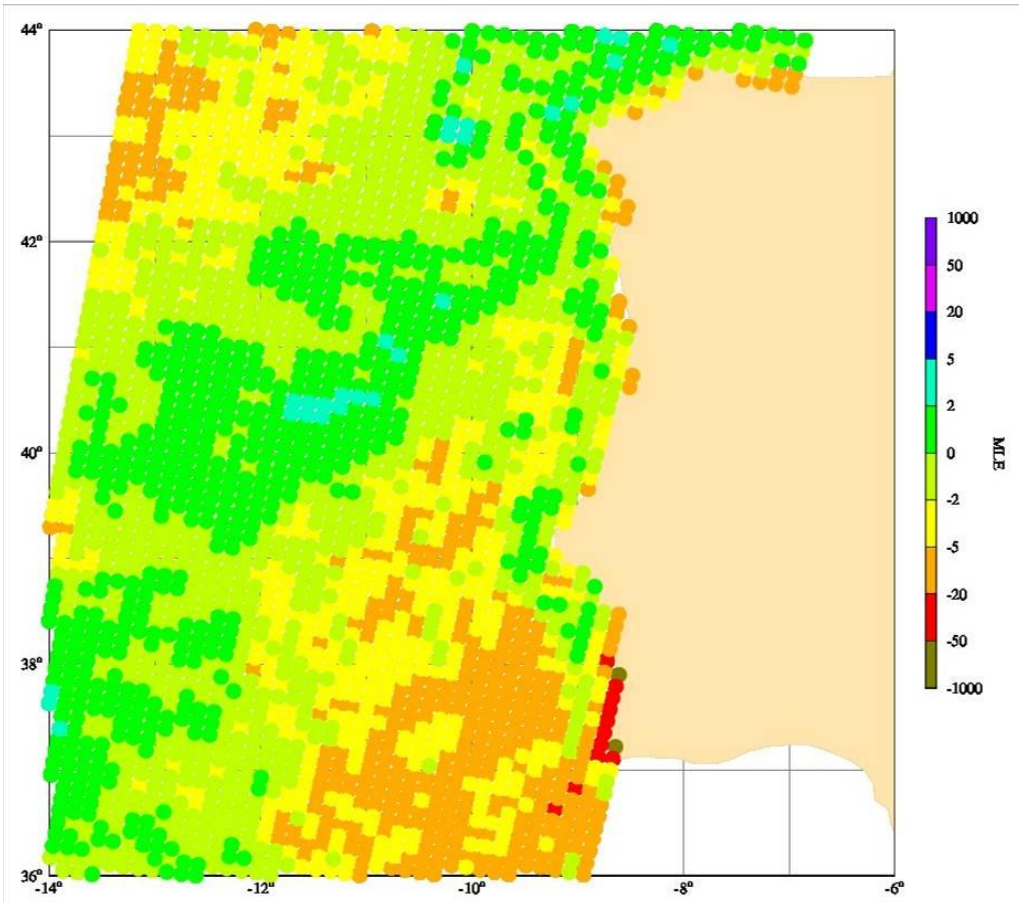

Figure 2 MLE for ASCAT-6.25 on August 17, 2013, with a maximum allowed land fraction of 90%.

Recommendations and further actions

IPMA will extend the ASCAT-6.25 dataset to cover the same period as the ASCAT-costal datasets. ASCAT-6.25 will be processed with aggregation radii of 7.5 km (standard product) and 15 km (oversampled coastal product). The buoy comparisons will be redone with these new sets.

KNMI will improve the AWDP User Manual and Reference Guide in order to give new ASCAT-6.25 users better guidance in how to do the processing.

IPMA and KNMI will keep in contact on the ASCAT-6.25 validation.

Improvements to the AWDP processing at high resolution may include:

- Incorporation of the EUMETSAT land contribution flag;
- Coastal screening, based on land backscatter, ocean backscatter, land contribution flag, K_p and MLE;
- Improved MLE computation by reducing aggregation of backscatter values prior to wind retrieval;
- Constrain matching of the three CSRFs of the three contributing beams; this may imply increased oversampling;
- Improvements in mesoscale 2DVAR analyses and ambiguity removal;

These topics will be considered in the CDOP2 and CDOP3 plans.

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