

Scatterometer winds assimilation in HARMONIE-AROME for a domain over the Iberian Peninsula

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1. Introduction – HARMONIE-AROME @ IPMA

HARMONIE-AROME activities started in 2018 have been two-fold:

- **Targeting** delivering daily short range weather forecasts;
- **Research** in support to operations focussing on optimal use of observations from satellite instruments.

A daily HARMONIE-AROME suite has been running since August 2020 for a domain over the Iberia Peninsula (Fig.1) at ECMWF/HPC infrastructure. Conventional observations used in DA are obtained from surface stations over land (SYNOP) and sea (SHIPS and DRIBU), radiosondes (TEMP) and aircrafts (AMDAR and AIREP).

Non-conventional observations include scatterometer winds obtained from ASCAT on the 3 METOP satellites (ASCAT-A, ASCAT-B and ASCAT-C).

For more details and information on HARMONIE-AROME daily suite consult [M. Monteiro et al.](#) “2021 ACCORD highlights for IPMA, I.P.”

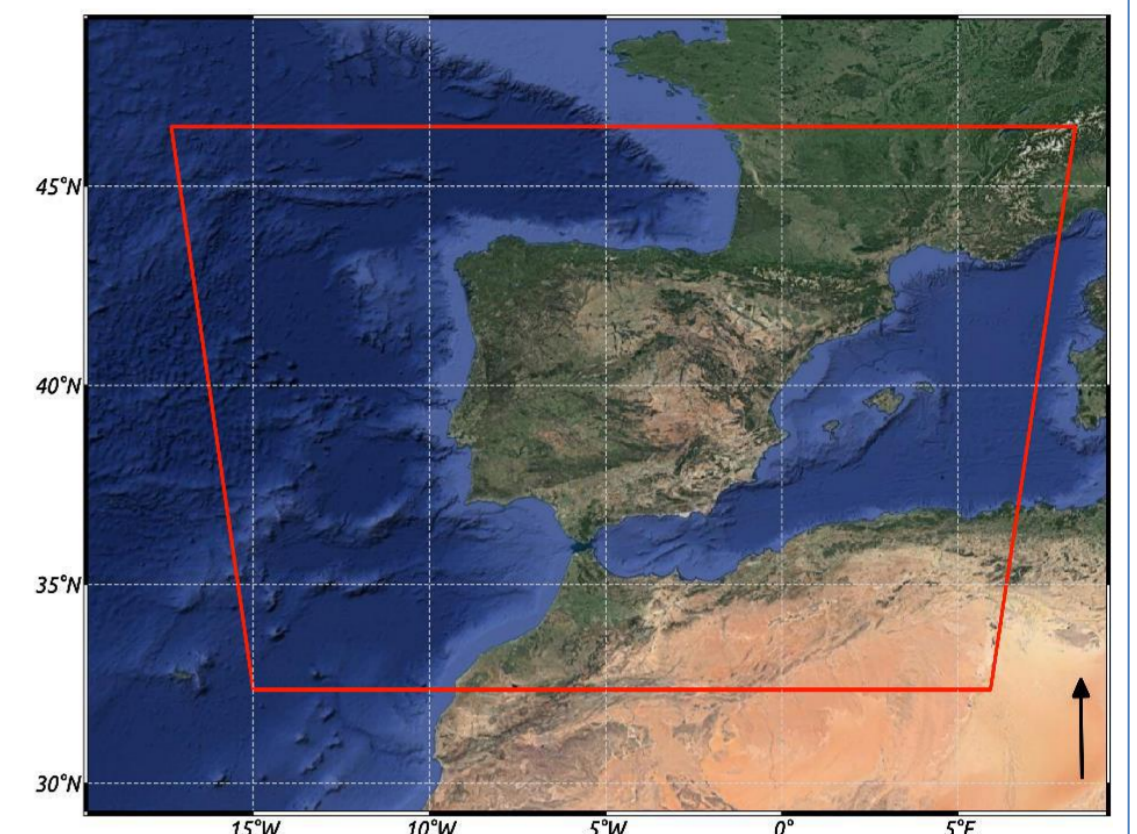


Figure 1 HARMONIE-AROME domain for Iberian Peninsula centred at 40 degrees latitude and -4.5 degrees longitude. The domain is composed of 648x800 grid points with a grid size of 2.5 km, covering a 1620 kmx2000 km area.

2. Optimal use of scatterometer winds: ASCAT in HARMONIE-AROME 4D-Var

These activities have been carried out in collaboration with KNMI in the scope of EUMETSAT funded project MIDAS (Proj. Ref. No. EUM/CO/1/19/4600002345/EO) with the main goal of **taking advantage of the unprecedented coverage of scatterometers using 4D-Var.**



Observing system experiments (OSEs) considering:

- Experimentation period from 07 Feb. to 22 Feb. 2020;
- CY43 HARMONIE-AROME 4D-Var default setup:
3-h window, 3-h cycling frequency.;
- multi-incremental approach 1st loop@15 km & 2nd loop@7.5 km
- Default settings for ASCAT winds, thinn. dist. 50 Km, obs. error = 1.47 m/s.
- OSE1: 3D-Var - 3D-Var only conventional obs. in DA
- OSE2: 4D-Var - 4D-Var only conventional obs. in DA
- OSE3: 3D-Var(ASCAT) - conventional obs. and ASCAT winds in DA
- OSE4: 4D-Var(ASCAT) - conventional obs. and ASCAT winds in DA

Verification against independent observations from ScatSat-1:

- For 10-m wind, **4D-Var out performs 3D-Var** (Fig.2 a,b,c,d).
- Using ASCAT in 3D-Var and 4D-Var improves wsp scores up to lead time 18h (Fig 2b) .
- Using **ASCAT in 4D-Var** improves wsp and u-10m scores for all lead times (Fig.2 b,c).

For more details and information on HARMONIE-AROME 4D-Var attend [Jan Barkmeijer et al. talk on Tuesday](#) “Status of HARMONIE-AROME 4D-VAR”.

Verification over the ocean against ScatSat-1 : 07 - 22 Feb2020

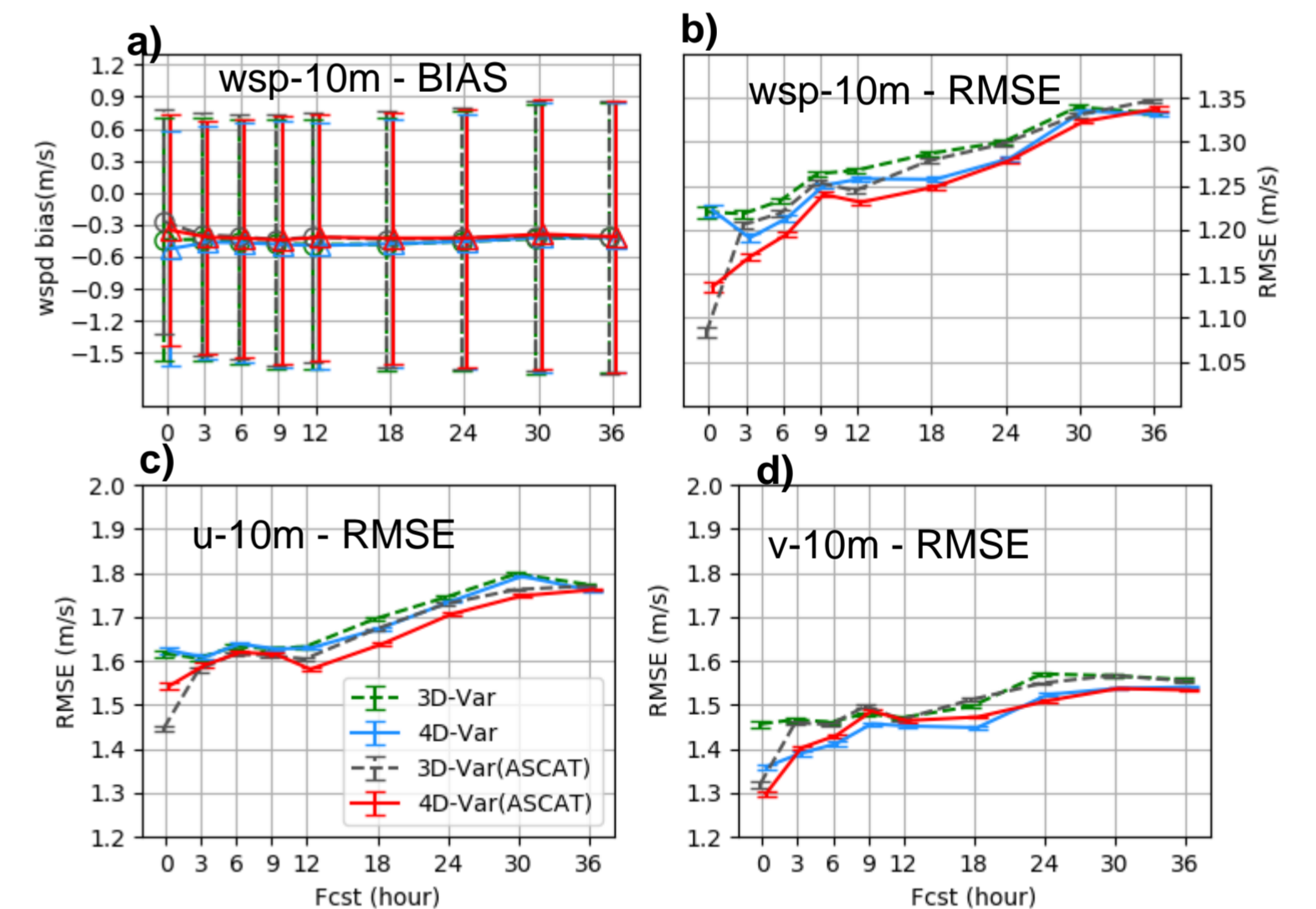


Fig. 2 (a) wind speed bias, m/s, and (b) RMSE, m/s (c) RMSE(m/s) for u-component and (d) v-component. Verification performed against ScatSat-1 winds for all OSEs described.

3. Outlook

Extend the use of ocean winds from the international constellation of scatterometers:

- Functionality tests on the use of HY-2B in CY46 were successfully conducted. (Fig. 3).
- The impact of improved temporal coverage provided by HY-2B ~06UTC/18UTC in complement to ASCAT ~09UTC/21UTC will be assessed and explored.

The combination of ATOVS+ASCAT in 4D-Var looks promising and it will be further explored.

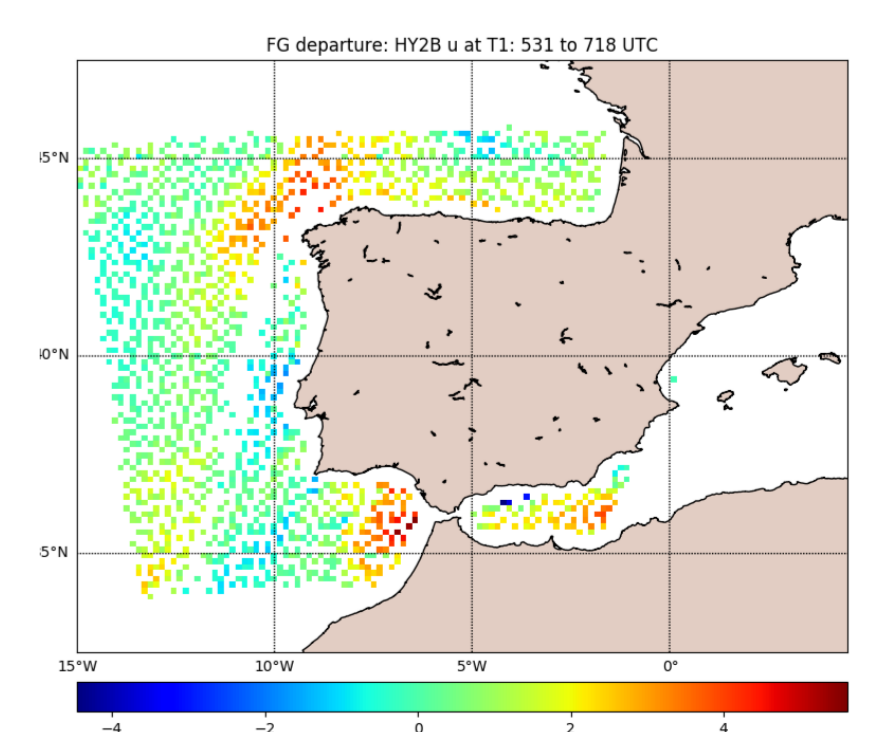


Fig. 3 first guess departure (o-b), m/s for HY-2B, test experiment CY46.