Scatterometer Assimilation Experiments with HARMONIE-AROME Mesoscale Model over south-western Europe

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Gert-Jan Marseille (KNMI)

Thanks to:

Wenming Lin (Nanjing UIST)

Jana Sánchez Arriola (AEMET)

Ad Stoffelen (KNMI)

Outline

- meso-scale HARMONIE-AROME model
- Observing System Experiments (OSE)
- Verification over the ocean
- Conclusions and future work

HARMONIE-AROME model

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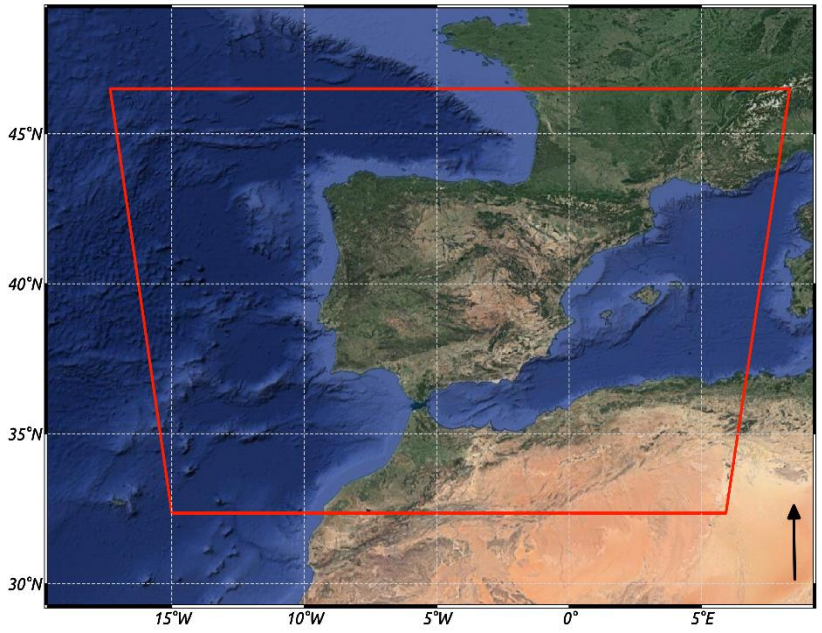
Domain IBERIAxxm_2.5



HARMONIE -AROME- Cy40h1.1

- Non-Hydrostatic
- 800 (lon) X 648 (lat) grid, 65 levels
- 2.5 km grid size
- 3D-Var, Assimilation 8 times/day
- 24-hour forecast
- ECMWF boundaries
- Time step 60s

Experimentation period

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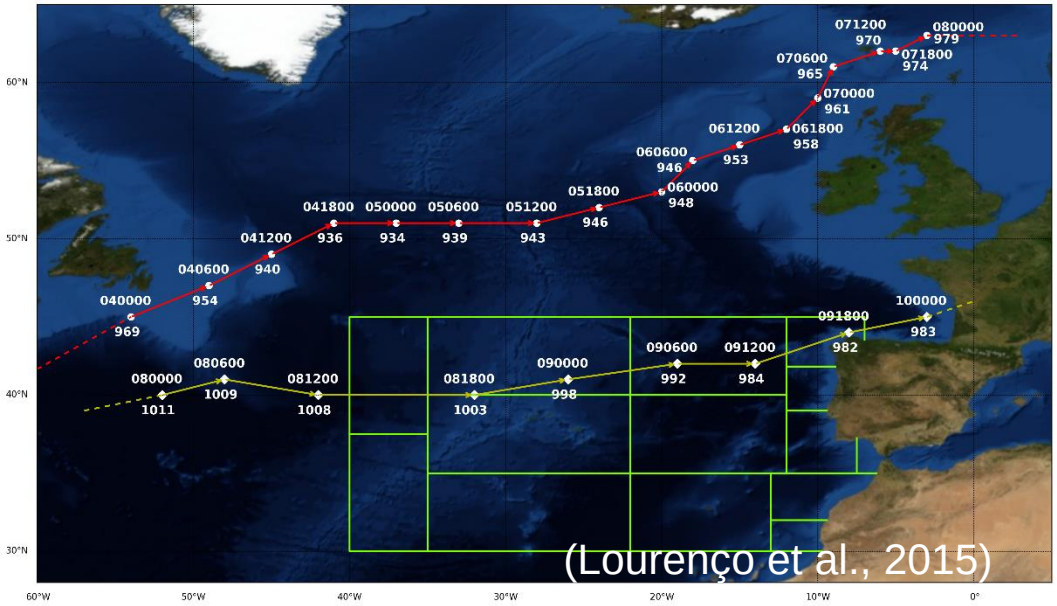
- **Experimentation period** 1 January to 15 February 2014 during stormy 2013-2014 winter. Including "**Christine**" (6-7 January) and"**Stephanie**" (9-10 February) **storms**.



(Lourenço et al., 2015)

Experimentation period

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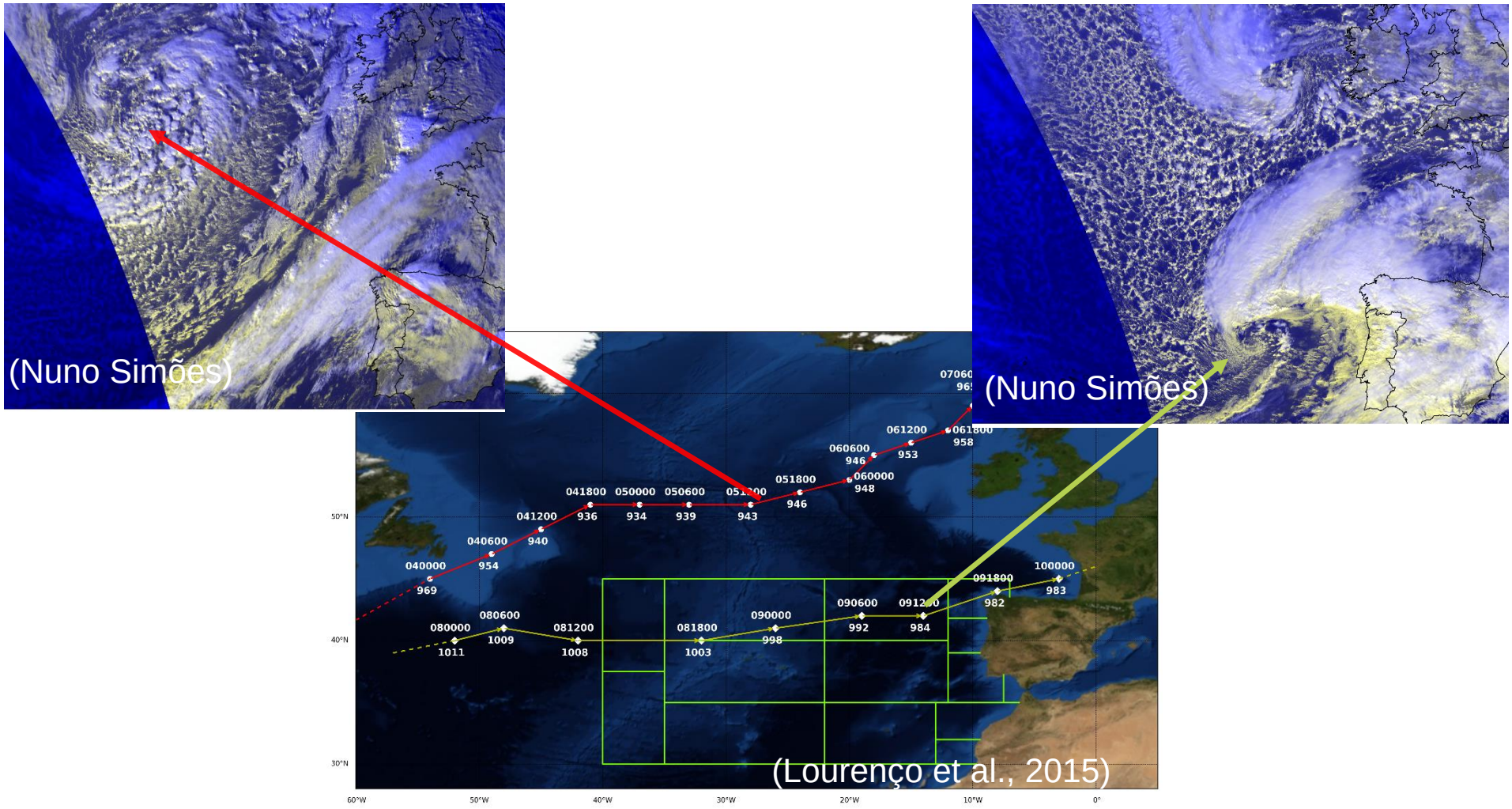
HRV Cloud RGB 05-01-2014, 1300UTC

HRV Cloud RGB 09-02-2014 1200UTC



Experimentation period

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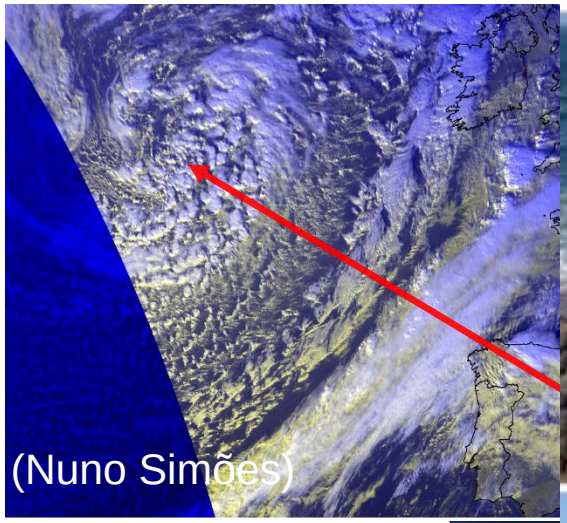
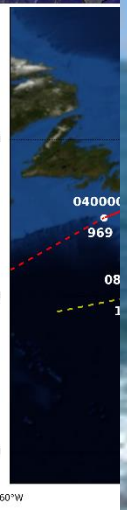
HRV Cloud RGB 05-01-2014,



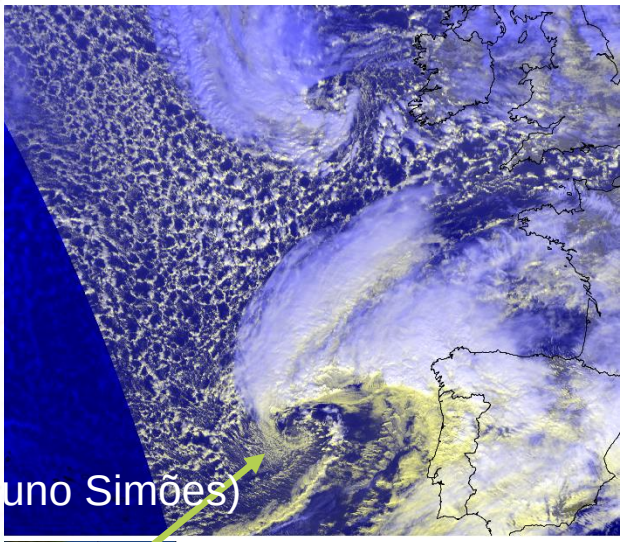


Before 2013/2014 winter

May 2014

(photo Nuno Moreira)

d RGB 09-02-2014 1200UTC



HARMONIE-AROME OSEs

EXP0 (control) - Conventional observations:

surface observations: synoptic stations, ships, and drifting buoys.

upper air observations: radiosondes and aircraft reports.

EXP2 - Conventional + ASCAT-coastal default Harmonie thinning (100 km) inherit from Météo France and ECMWF settings

EXP2_no thinning - conventional + ASCAT-coastal no thinning

ASCAT-coastal in the original grid spacing (12.5 km)

Verification

Verification over the ocean **against independent observations**:

- **HSCAT** Chinese Ku-band scatterometer on-board Haiyang-2A

  sun-syn **~0600 LTAN/1800 LTDN** @25 km sampling and **50 km effective resolution**

- **OSCAT** Indian Ku-band scatterometer on-board OceanSat-2

  sun-syn **~0000 LTDN/1200 LTAN** @25 km sampling and **50 km effective resolution**.

Sampling ≠ Resolution

- **ASCAT-coastal** @12.5 km sampling -> **28 km effective resolution**
  (Vogelzang et al., 2011)
- **HARMONIE** @2.5 km grid -> **15- 25 km effective resolution**
  (7-10 grid resolution, Skamarock, 2004)

Observations and models?

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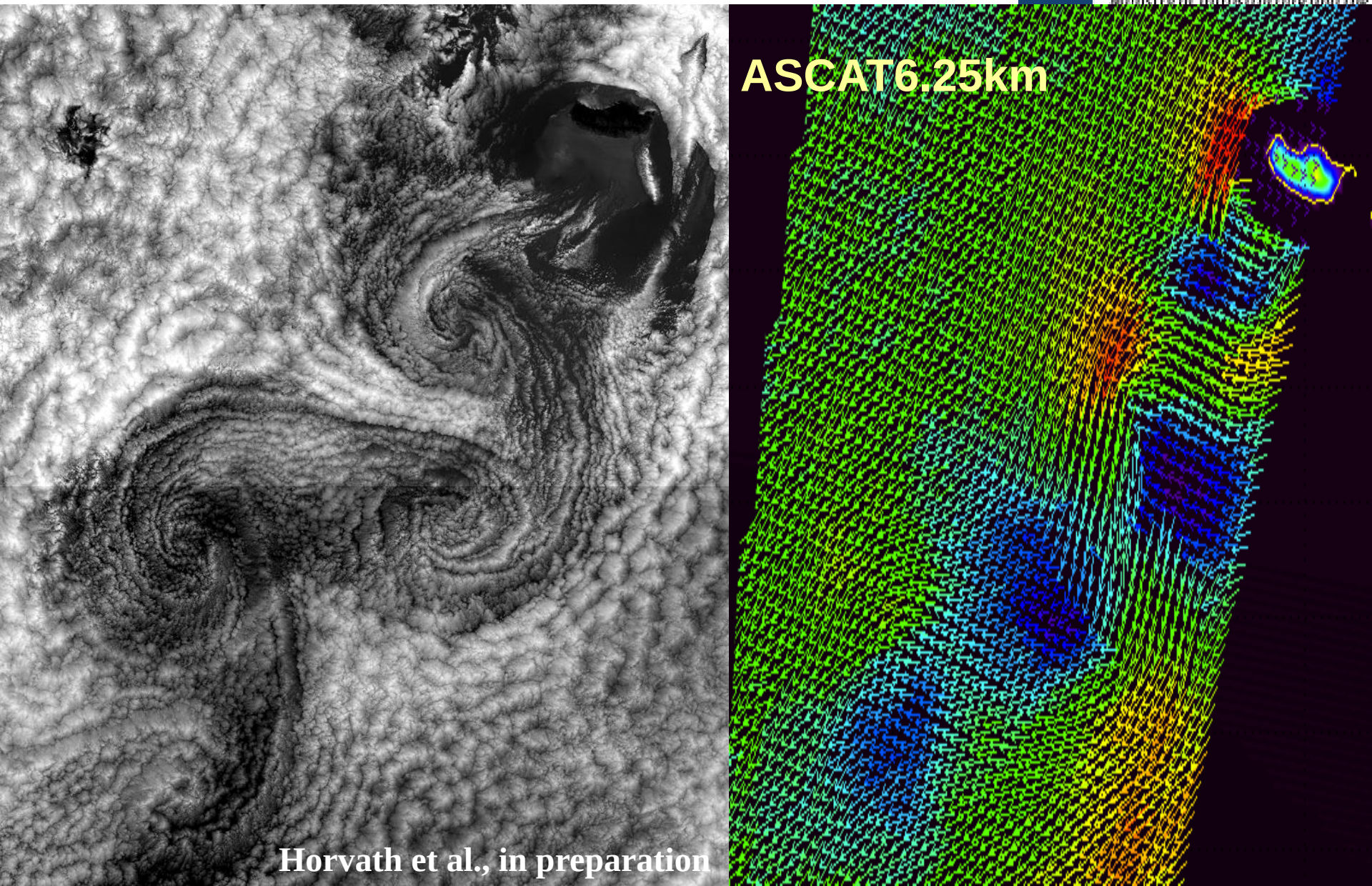

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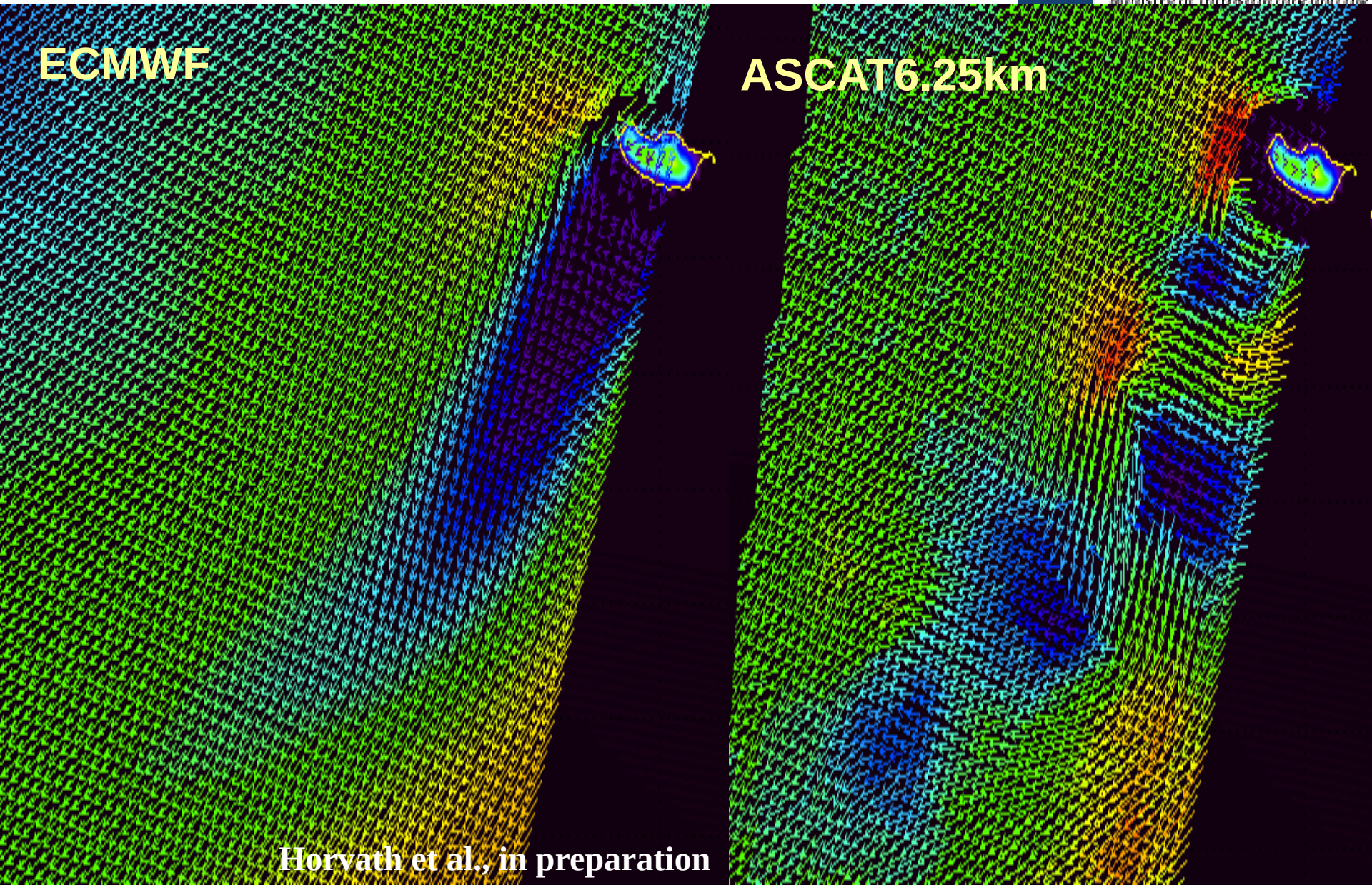

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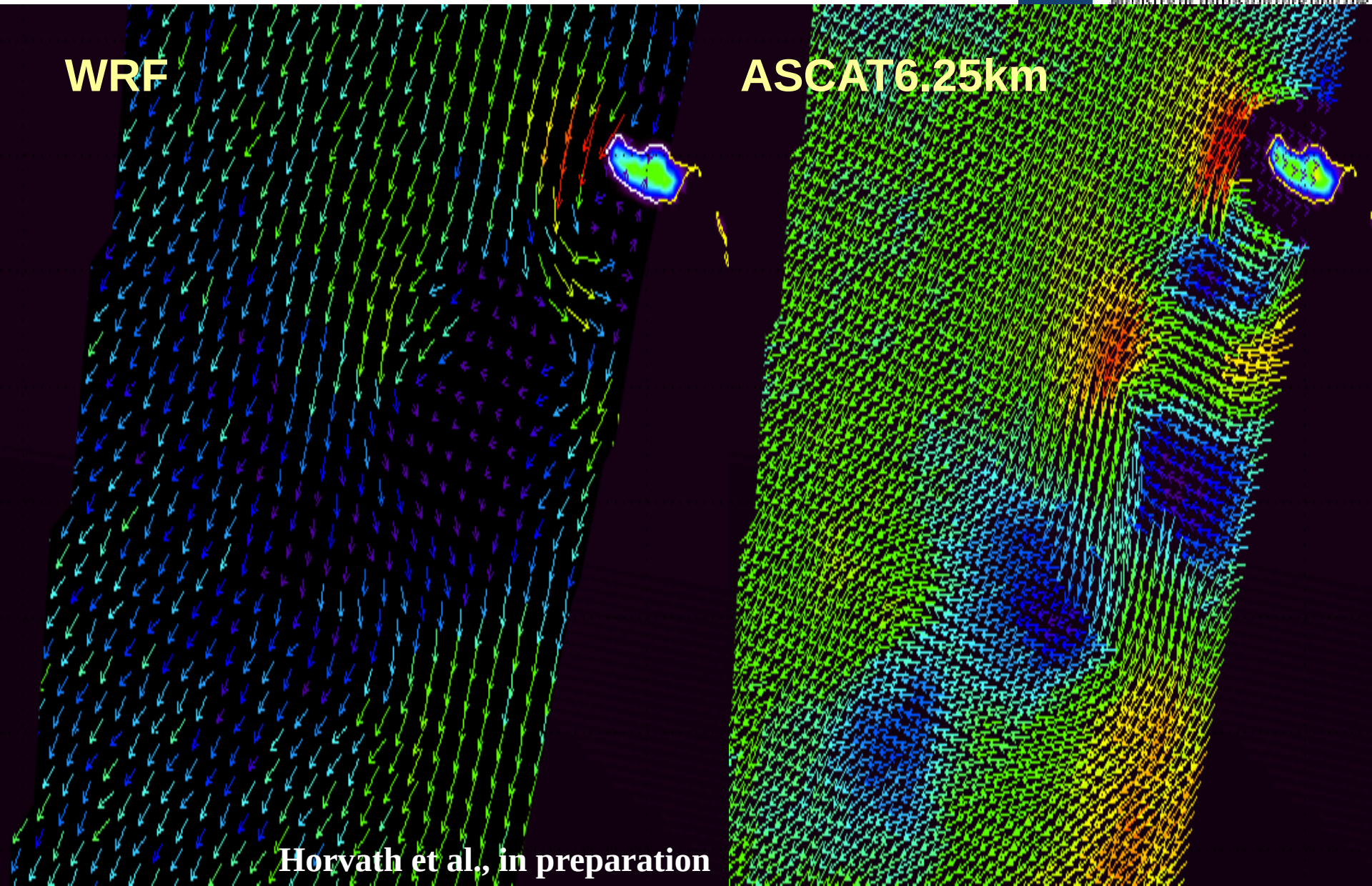
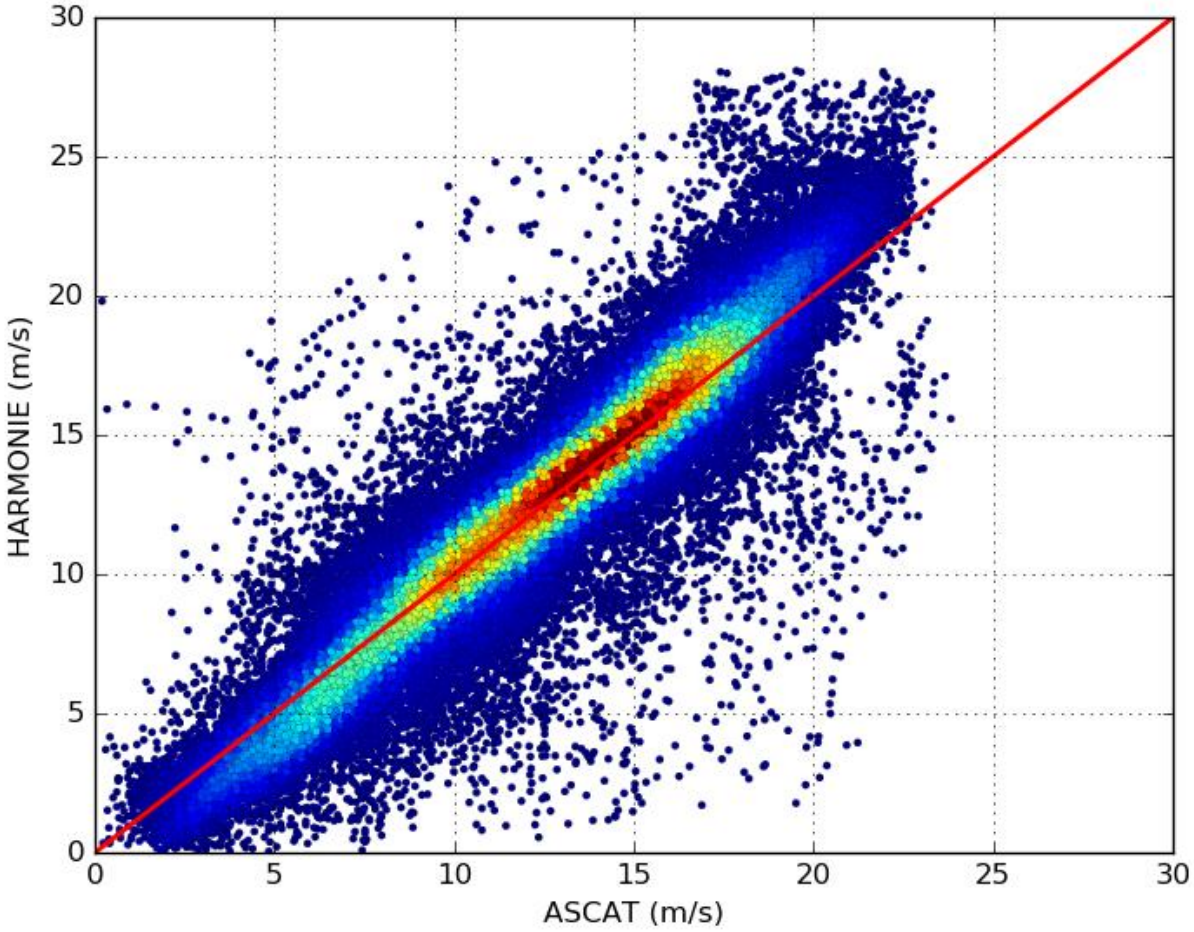


How confident are we in the model?



(CONTROL experiment)

Still **some bias for strong winds.**

Nevertheless, as already pointed out by other authors (Marseille and Stoffelen, 2017; De Rooy et al., 2017).

- **HARATUUP** (cy40) **reduces bias** and **spread** relative to previous model versions.

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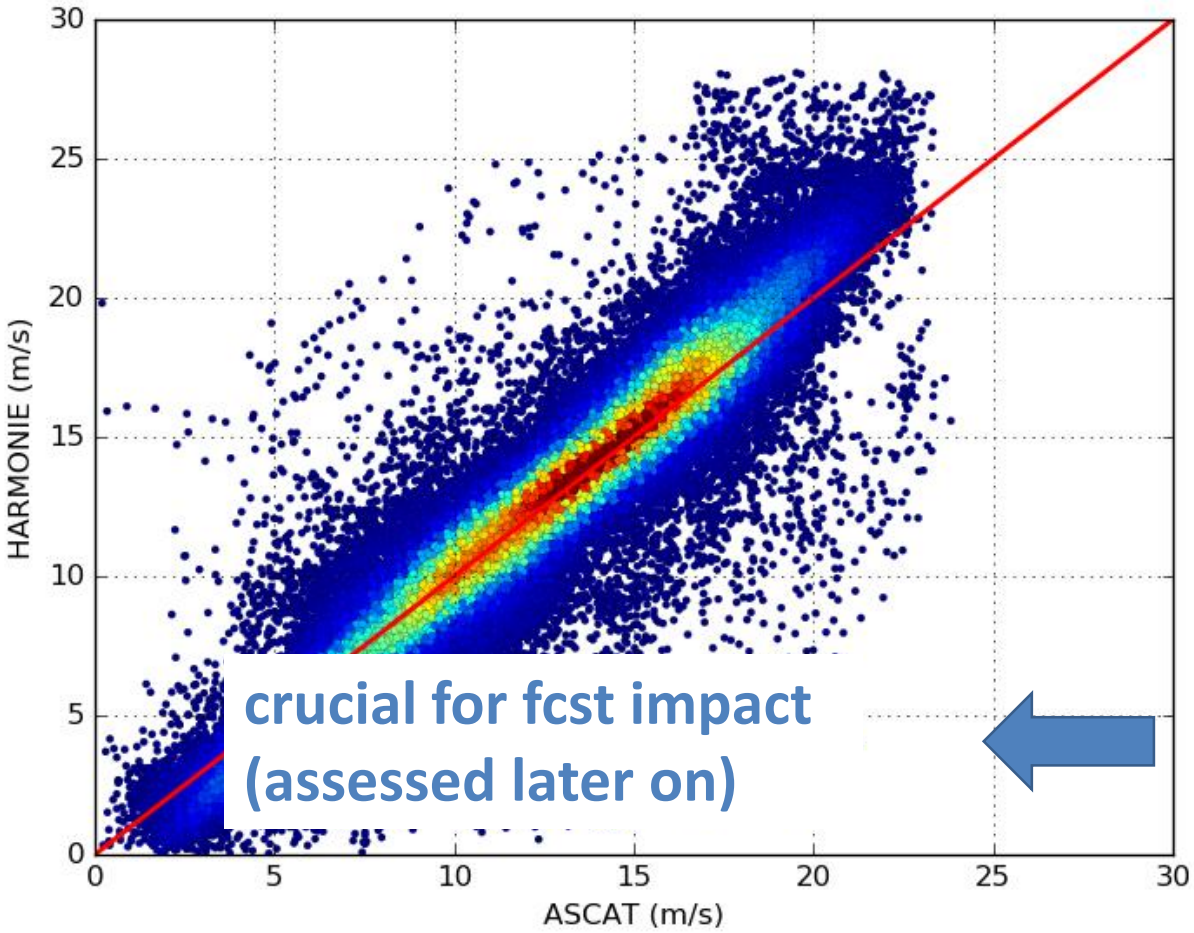

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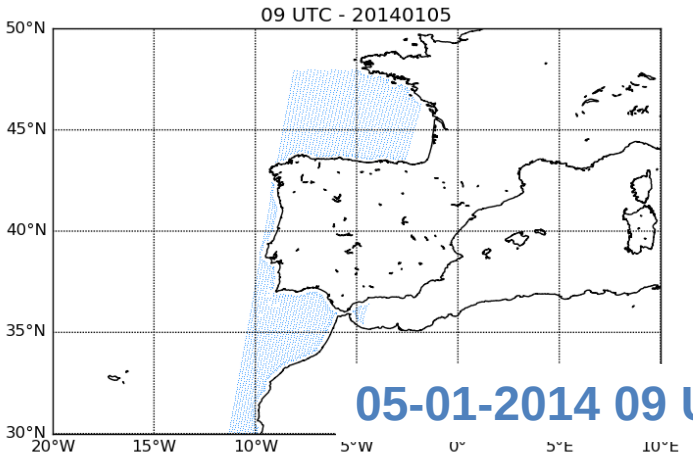
ASCAT-A/B coverage at analysis time

HARMONIE CONTROL - ASCAT(12.5 km)



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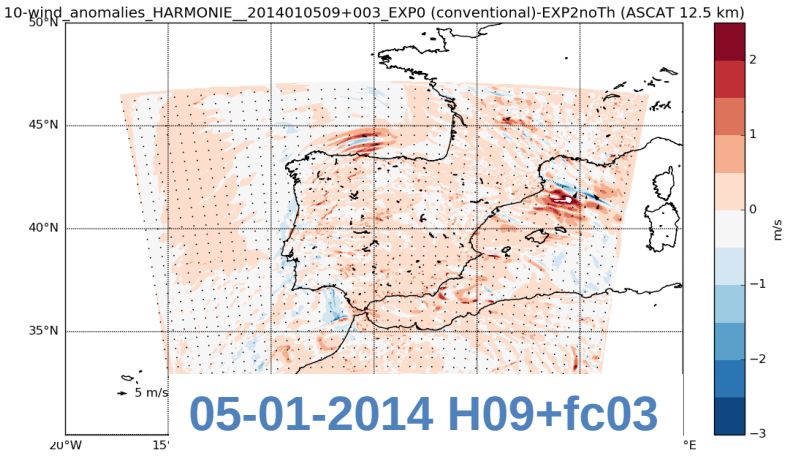
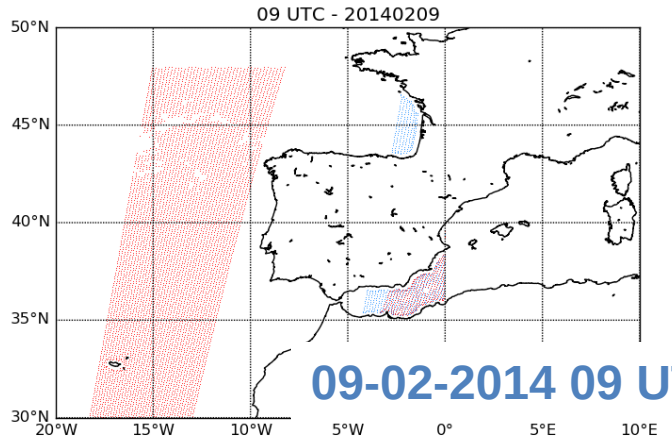


05-01-2014 H09+fc03



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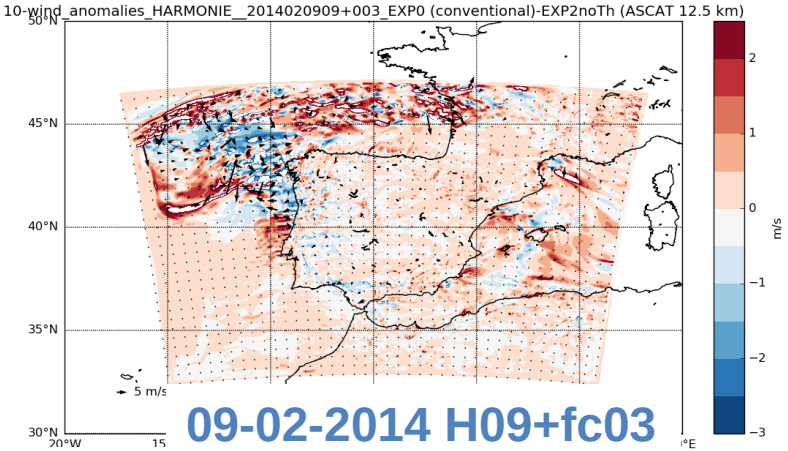

09-02-2014 H09+fc03

Blue - ASCAT-A **Red** - ASCAT-B

IPMA Verification over the ocean

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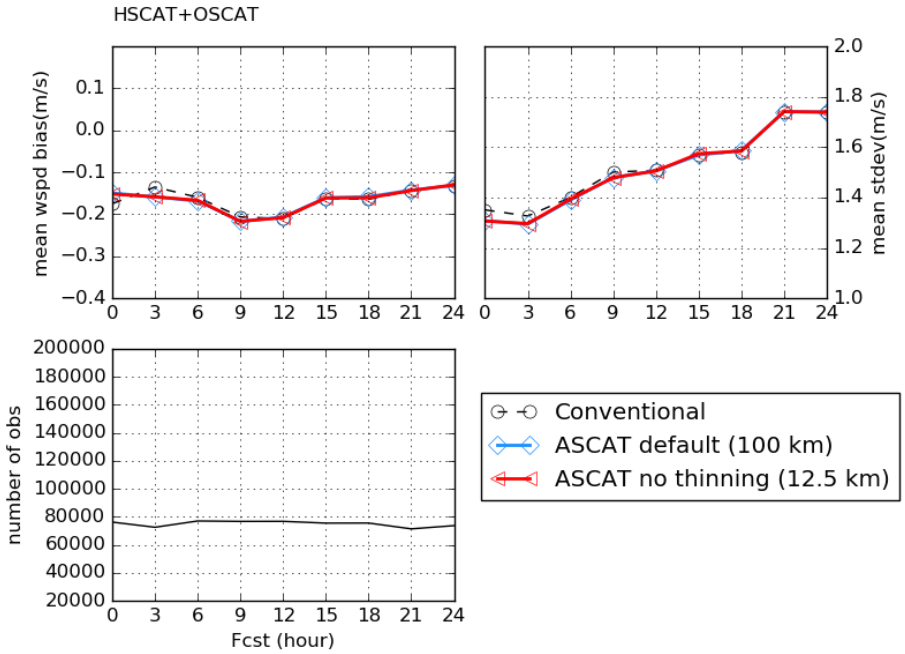
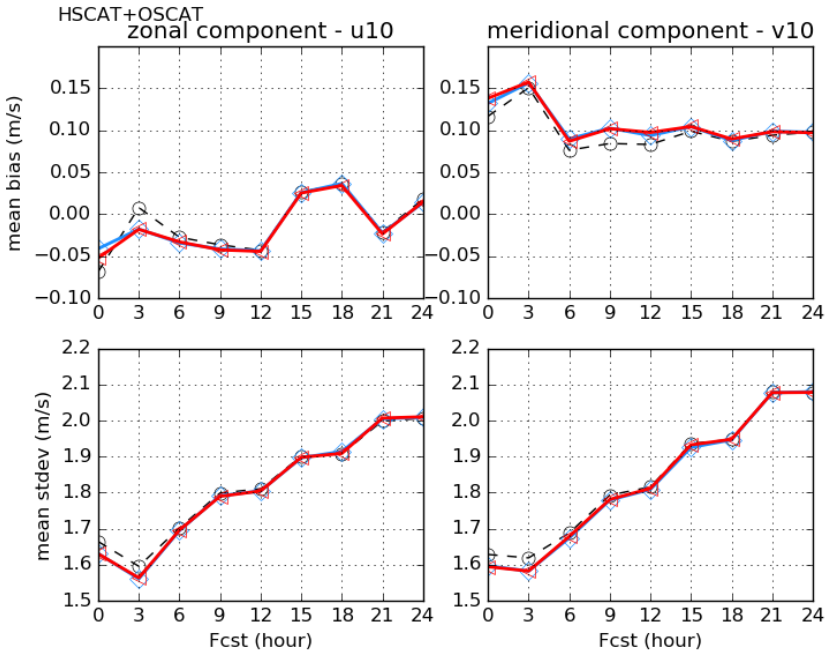
10 m wind verified against HSCAT and OSCAT





- ASCAT DA improves model forecast up to lead time 9
- Similar scores thinning and no thinning

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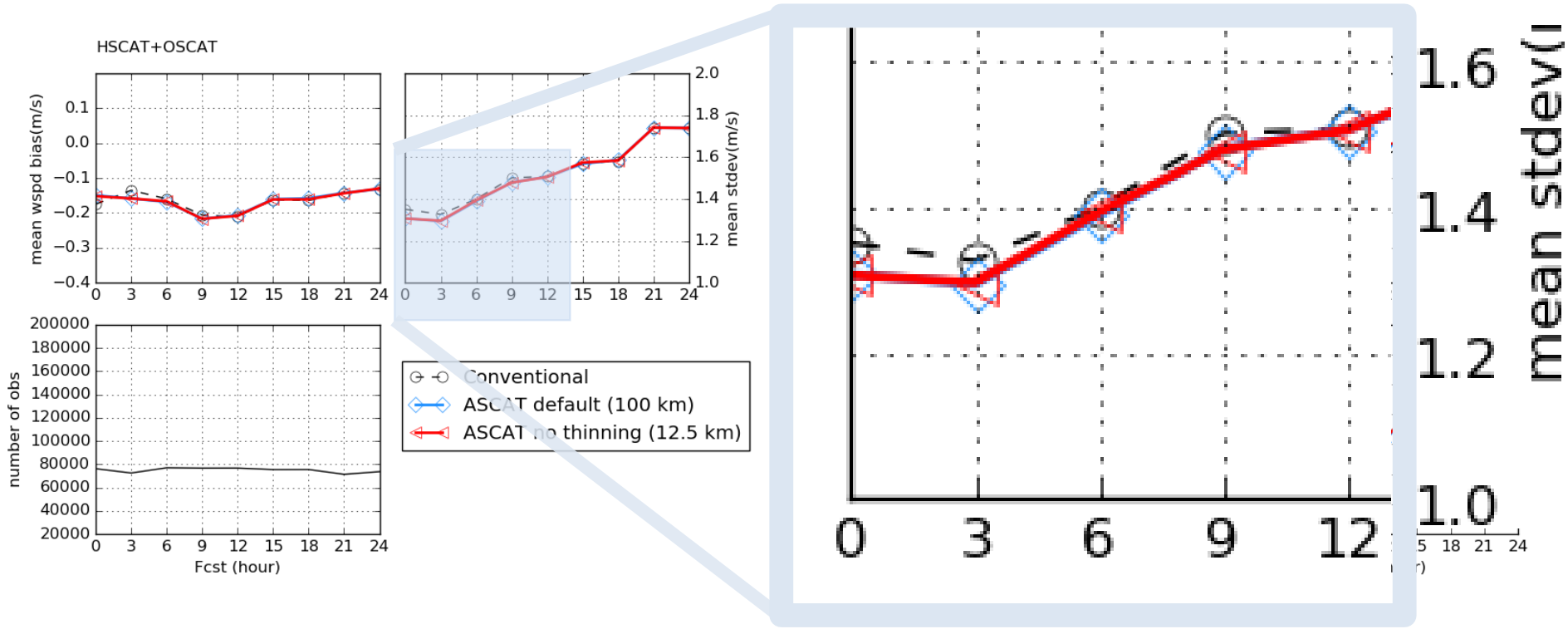

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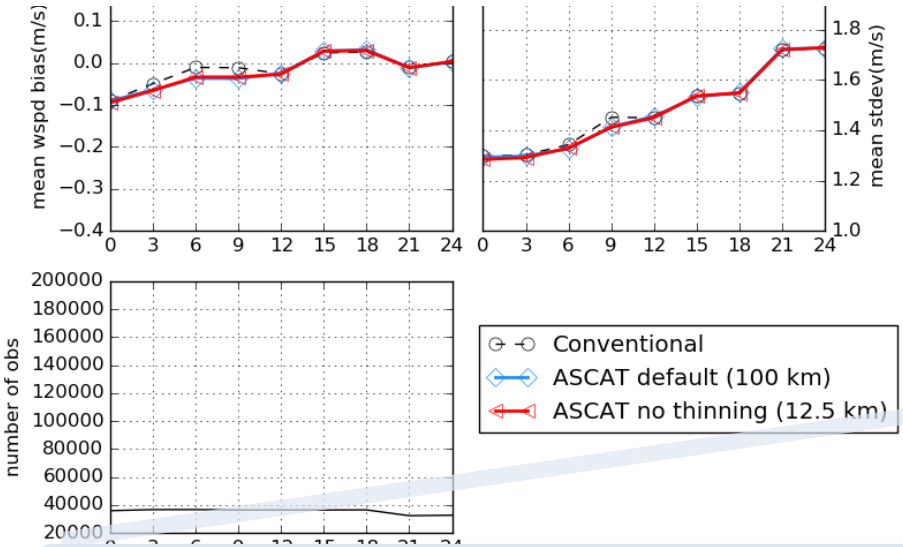

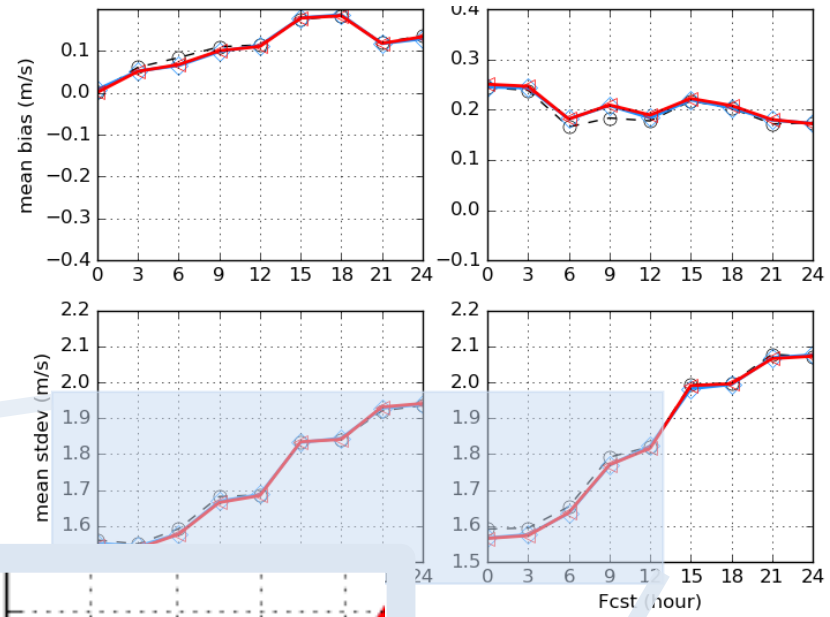

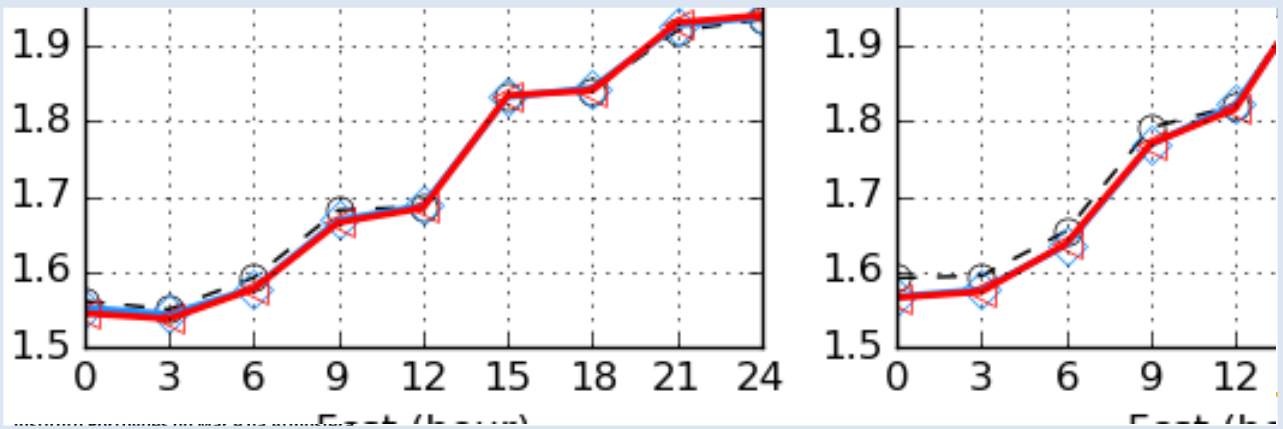

ASCAT DA improves model forecast up to lead time 9

IPMA Verification over the ocean

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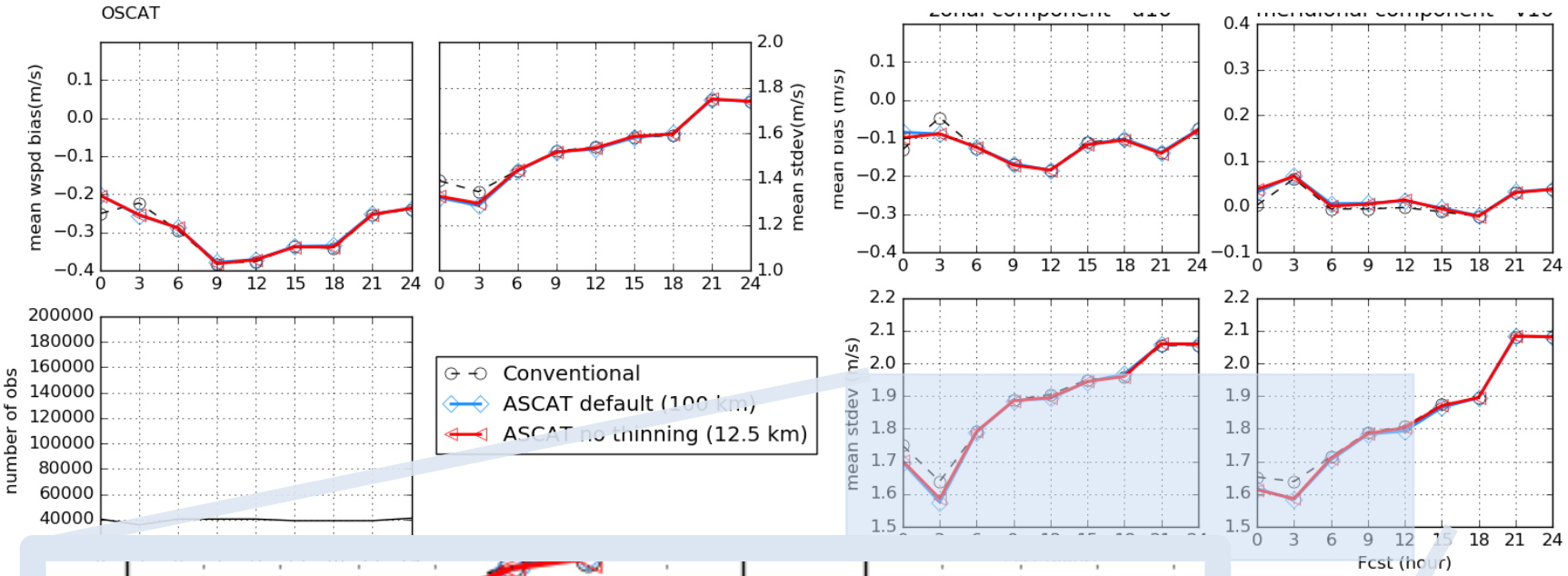
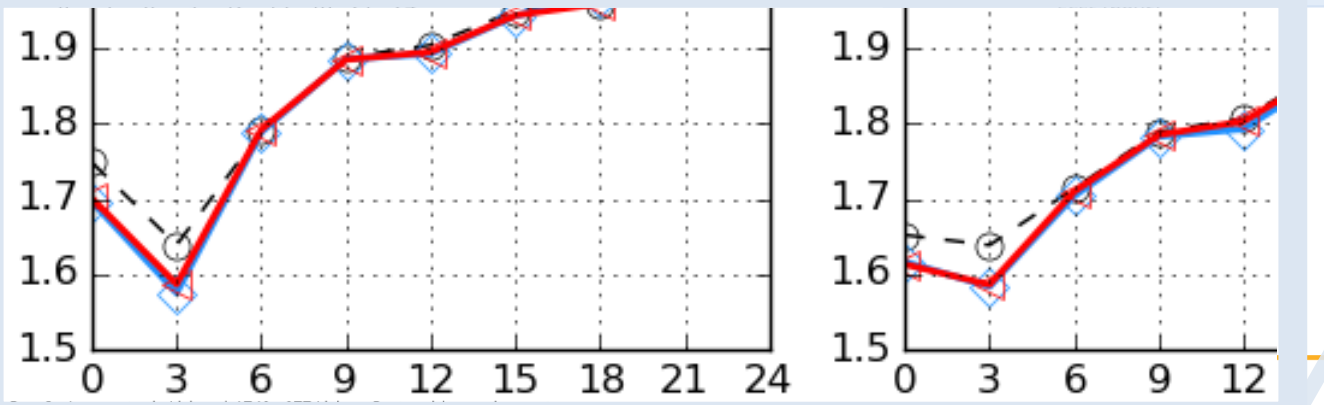
10 m wind verified against OSCAT





ASCAT DA improves model forecast up to lead time 6

Conclusions

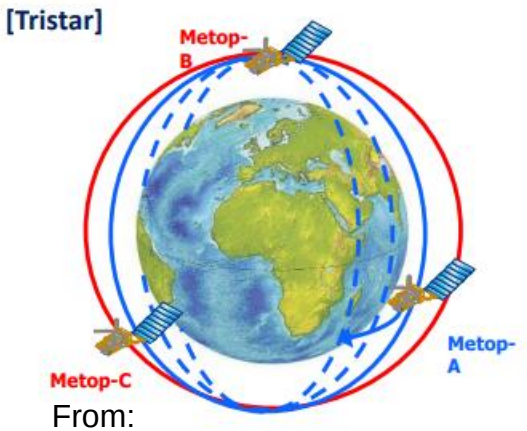
- Model simulations using **ASCAT DA present reduced** (o-f) **bias** and **stddev** when compared with **HSCAT** and **OSCAT** observations.
- **Better scores** than presented in Marseille and Stoffelen (2017) are likely the **combined effect of ASCAT DA** and the **improved cy40 relative to cy38**.
- **ASCAT experiments show impact up to fc+09!**

Outlook

- **Extend the assessment of ASCAT impact** on analysis and forecasts to other model variables (SLP, T, etc..) and over land.
- Include latest **developments for accounting the ASCAT footprint size** in first-guess departure. Work is ongoing at **KNMI** by **Mate Mile** from **Met No** in the context of the ALERTNESS project.
- **Assess** impact **of scatterometer DA** in **different weather regimes**.
- Assess the **impact** of having 3 Metops on **Tri-star phasing**

(TBC: Dec 2018 -March 2019 :

Commissioning Phase 1) with **almost complete coverage over the domain**.



From:
S Linow and K Scipal IOVWST 2018

Eumetsat Research Fellowship

WIND4D: On the 4-D Consistency of Satellite Wind Products for Regional NWP Data Assimilation

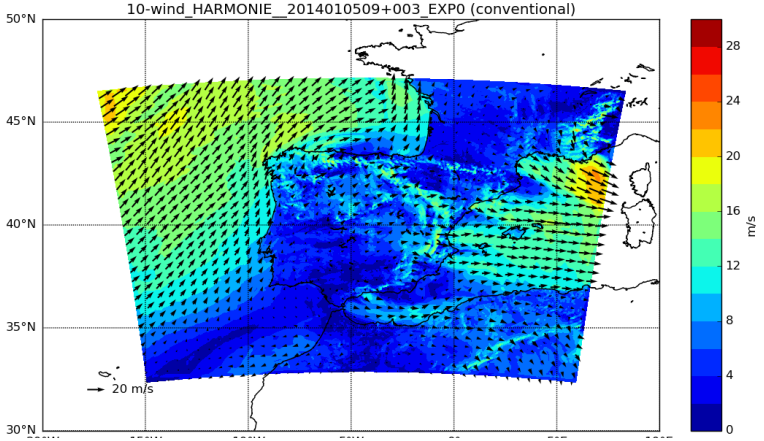
- Research position (starting in Feb/Mar 2019; up to 3 years)
- Topic: Satellite wind retrievals & data assimilation into regional NWP models
- Host: Institute of Marine Sciences (Barcelona, Spain)
- Partners: AEMET, KNMI, IPMA
- Vacancy: To be issued very soon (deadline: Dec'18/Jan'19)
- Contact: **portabella@icm.csic.es**

Obrigada!

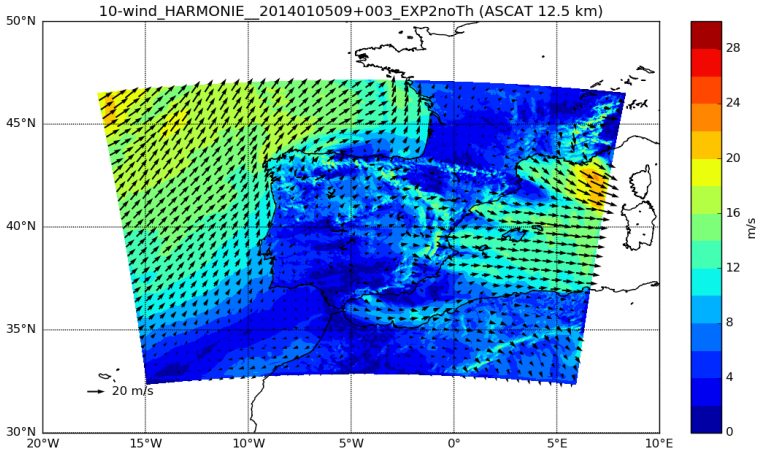
backup

05-01-2014 H09+fc03

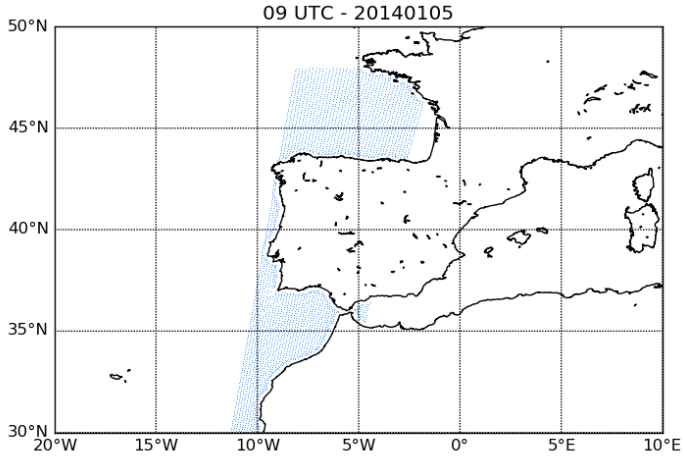
CONTROL



ASCAT noTh (12.5 km)



ASCAT coverage at analysis time



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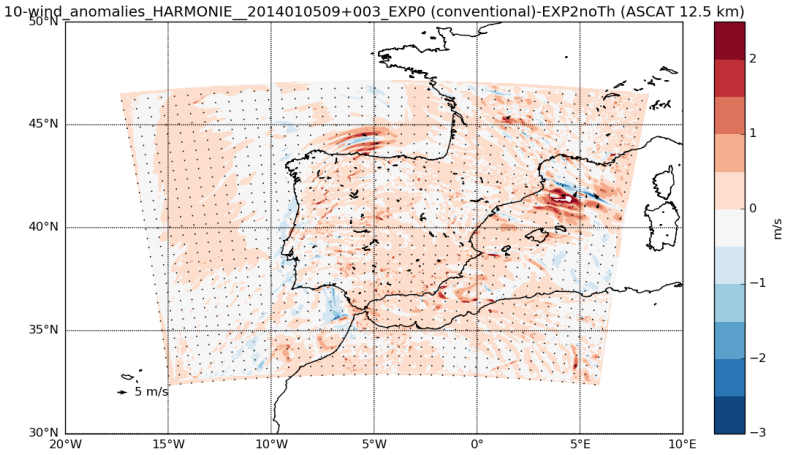

Blue - ASCAT-A **Red** - ASCAT-B

09-02-2014 H09+fc03

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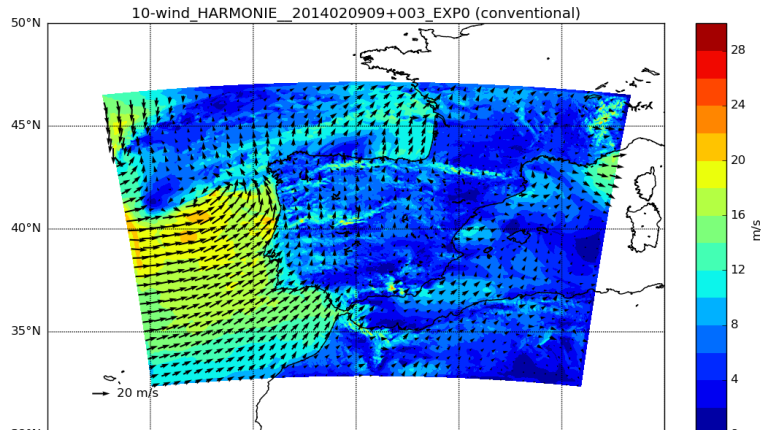

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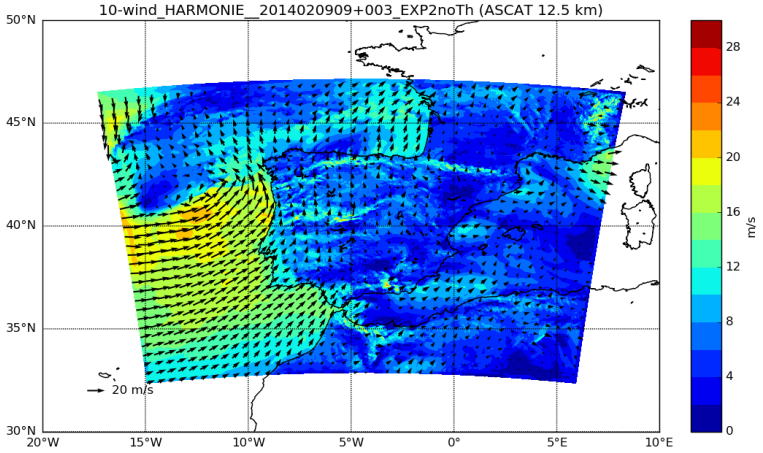

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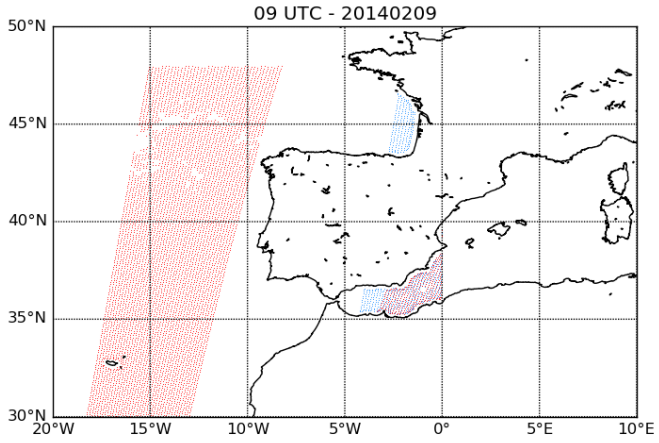

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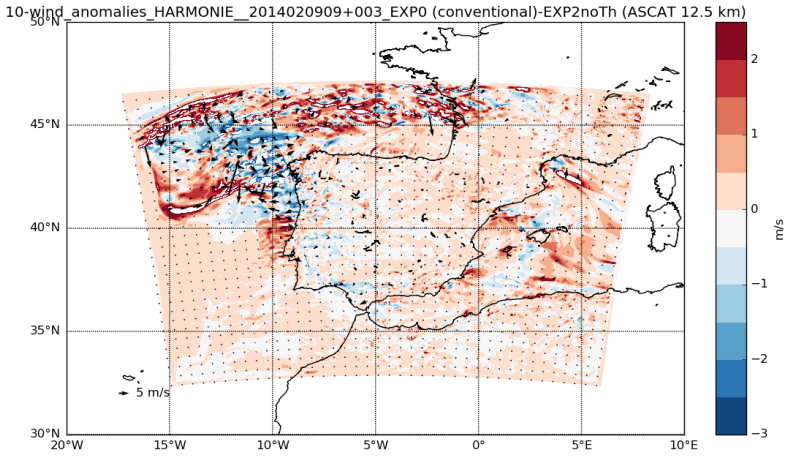

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