

# Uncertainties estimation in the background and surface analysis under UERRA project



C. Soci and E. Bazile

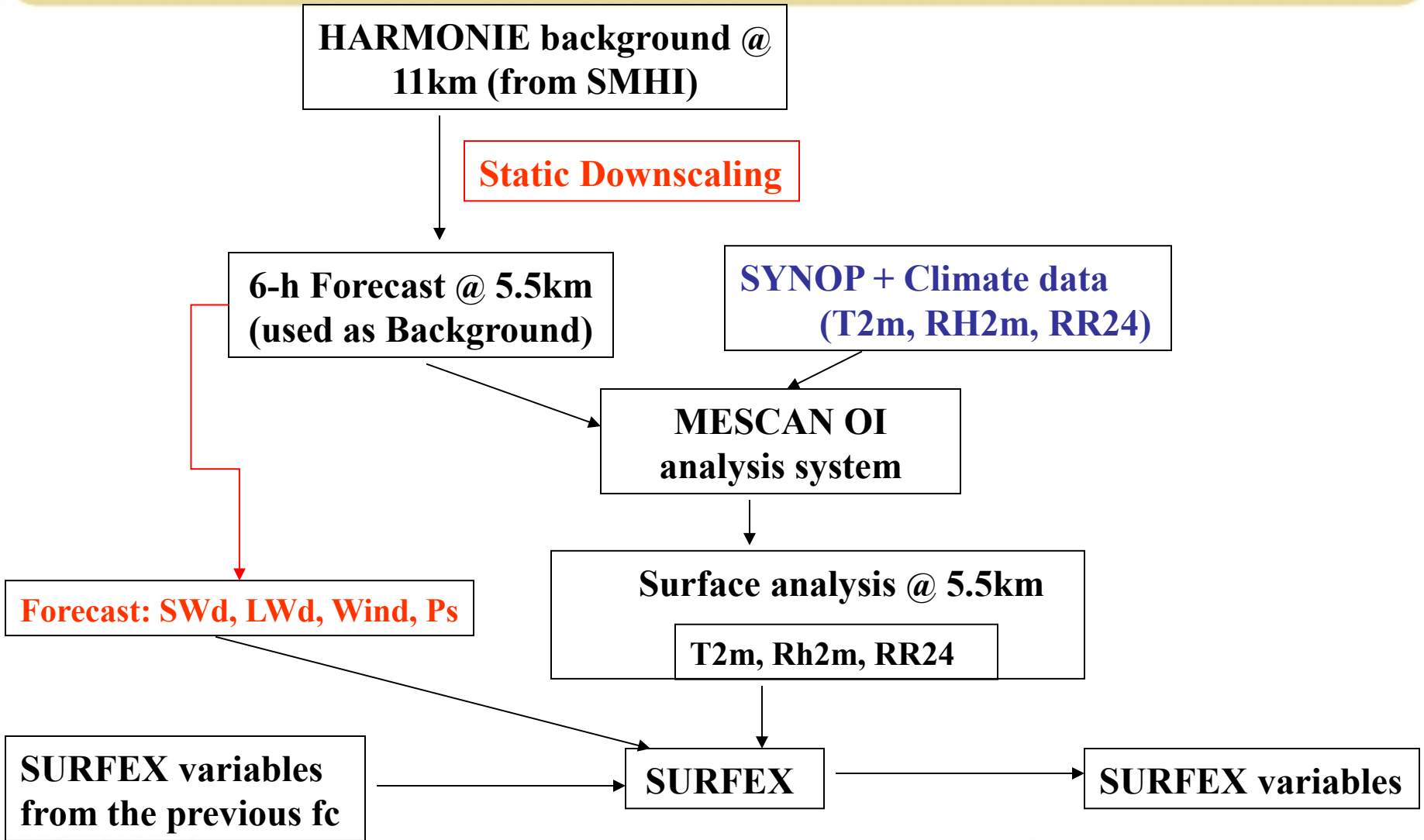
# UERRA ([www.uerra.eu](http://www.uerra.eu))

- # **UERRA (Uncertainties in the Ensemble of Regional Re-Analyses) is a FP7 (Space theme), 4-year (2014-2017) EU funded project.**
- # **Objectives:** the project will provide **long-term datasets (50 years)** of Essential Climate Variables at 11km grid (3DVar HARMONIE) on the European regional scale in order to support adaptation action and policy development. The datasets will contribute to Climate services for Copernicus, climate monitoring and research (DoW).
- # **12 partners:**
  - SMHI (project leader: Per Uden), KNMI, Météo France, MetOffice, Met No, DWD, NMA (Ro) and ECMWF;
  - Univ of East Anglia, Univ of Bonn and Univ Rovira y Virgili (Spain).
  - EDI (Switzerland)
- # **The work in this presentation is a contribution to the WP2 (Ensemble Data Assimilation Regional Reanalysis Dataset).**

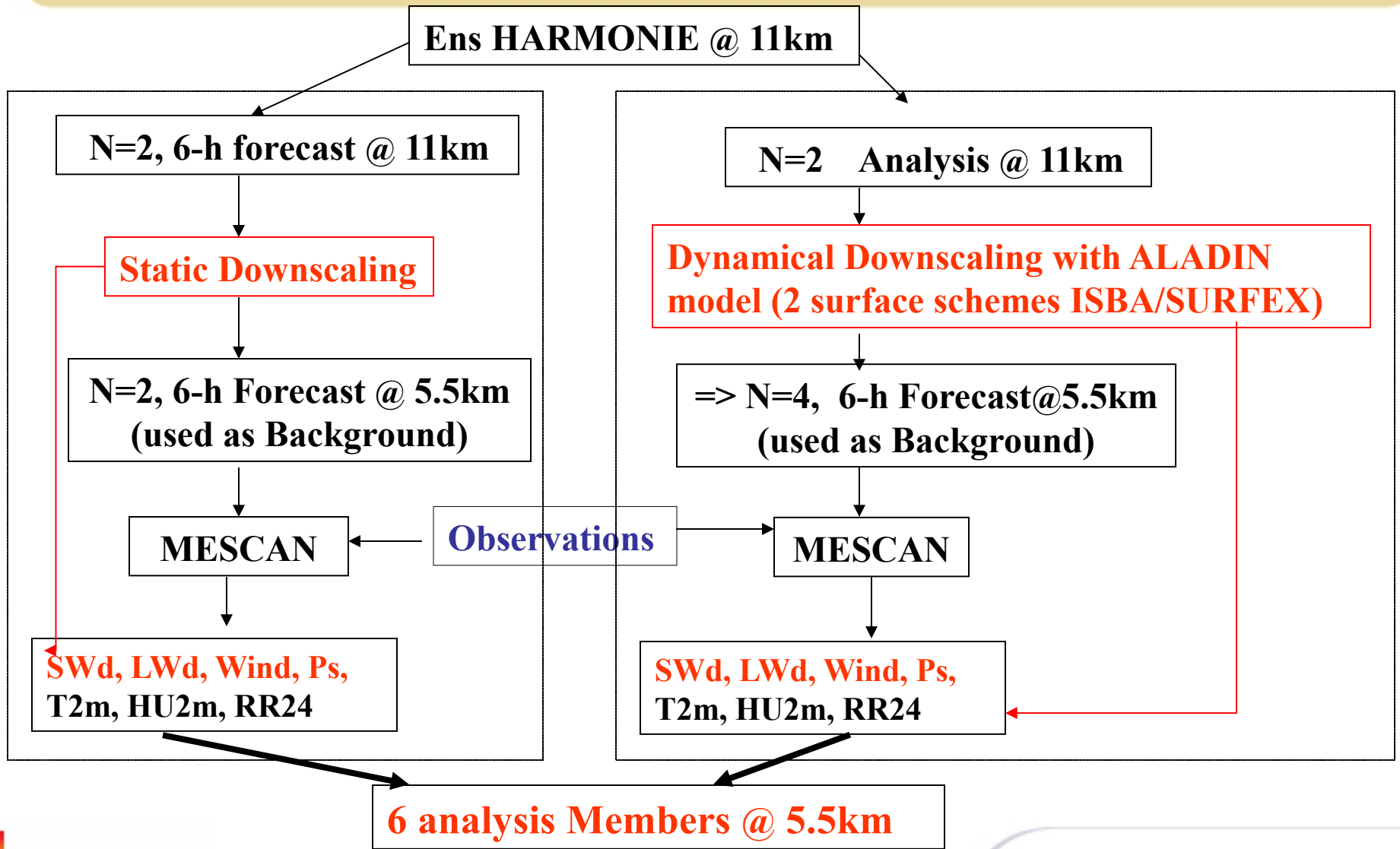
# Outline

- Surface re-analysis in UERRA
  - 50 years (1961-2010) surface re-analysis
  - test-bed for uncertainties estimation (2006-2010)
  
- Technical aspects
  
- Evaluation of the background fields – preliminary results
  
- Conclusions and Further work

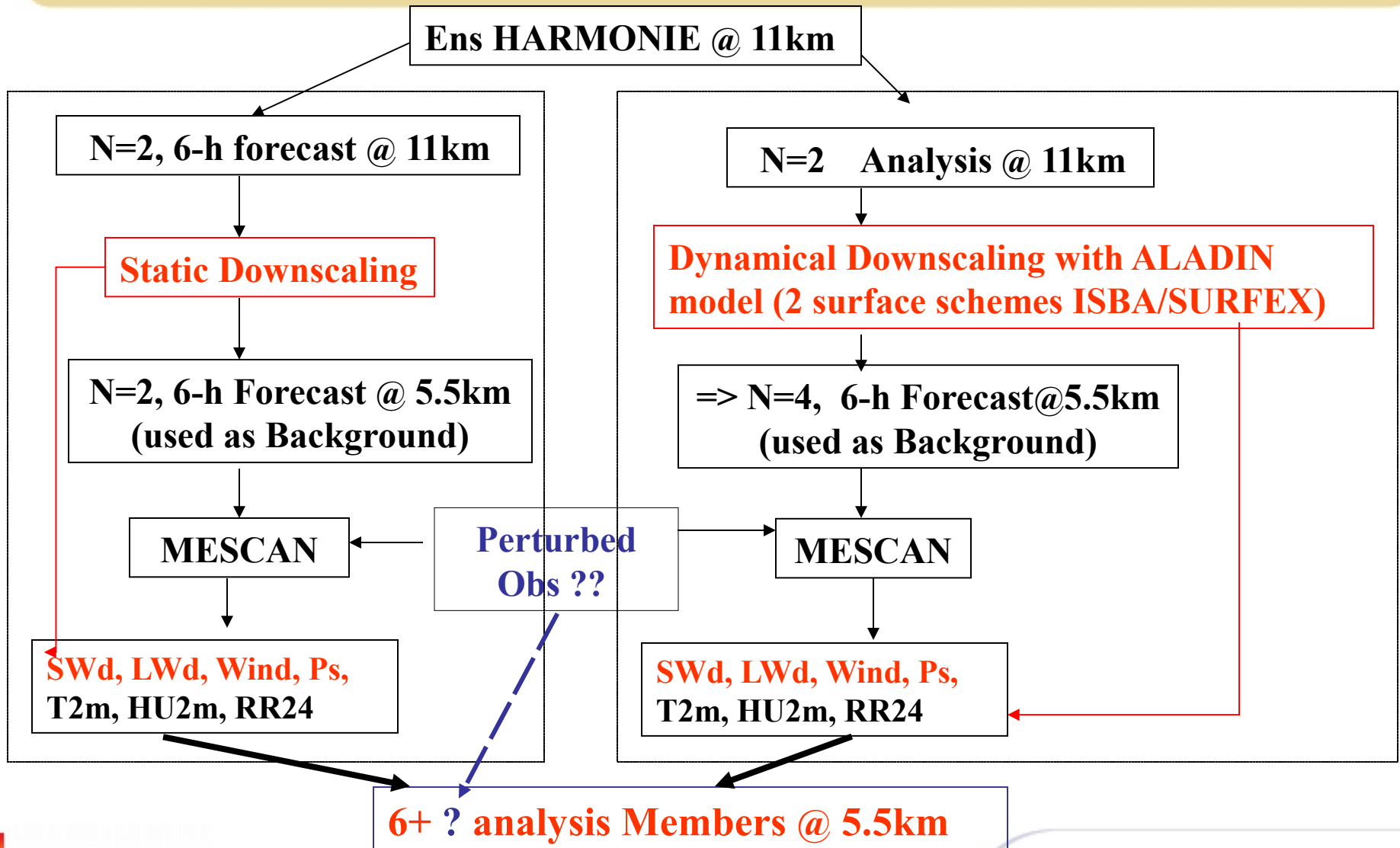
# UERRA: 50-year surface data assimilation (1961-2010)



# Ensemble of Surface analyses 2006-2010 (Test-bed)



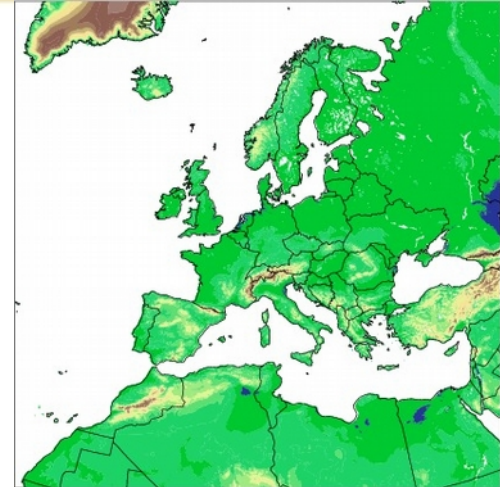
# Ensemble of Surface analyses 2006-2010 (Test-bed)



# Setup for the Evaluation of the Background Fields

## # Two domains

- 1: 576x576 @11km grid, 65Levels (same as SMHI)
- 2: 1080x1080 @5.5km grid, 65Levels (nested)



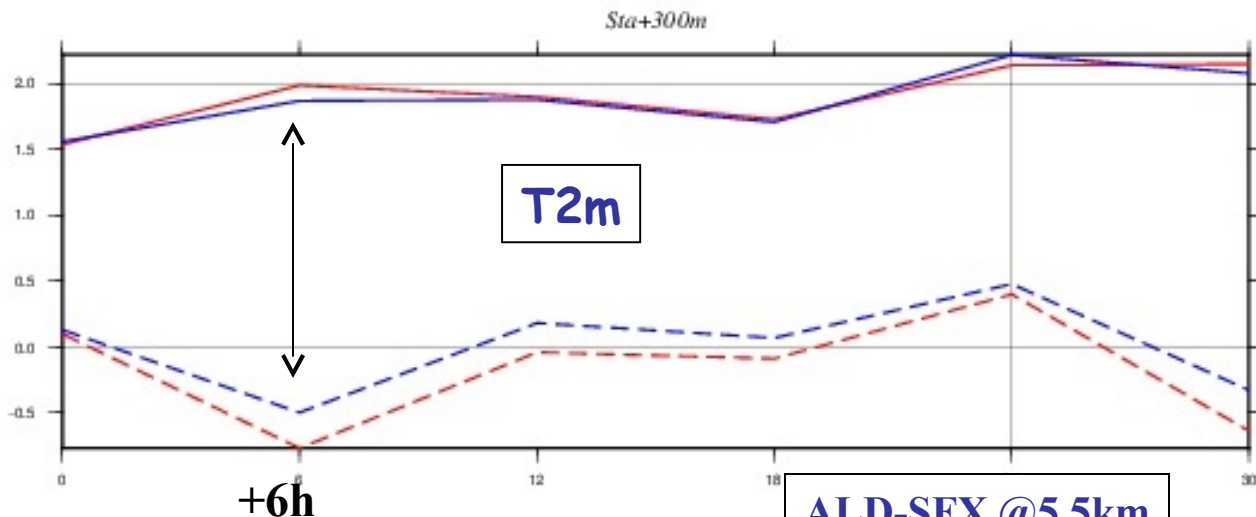
## # Four (4) forecasts with different physics:

- ALADIN physics with 2 surface schemes: ISBA and SURFEX
- ALARO physics with 2 surface schemes: ISBA and SURFEX

## # Trials for three (3) periods:

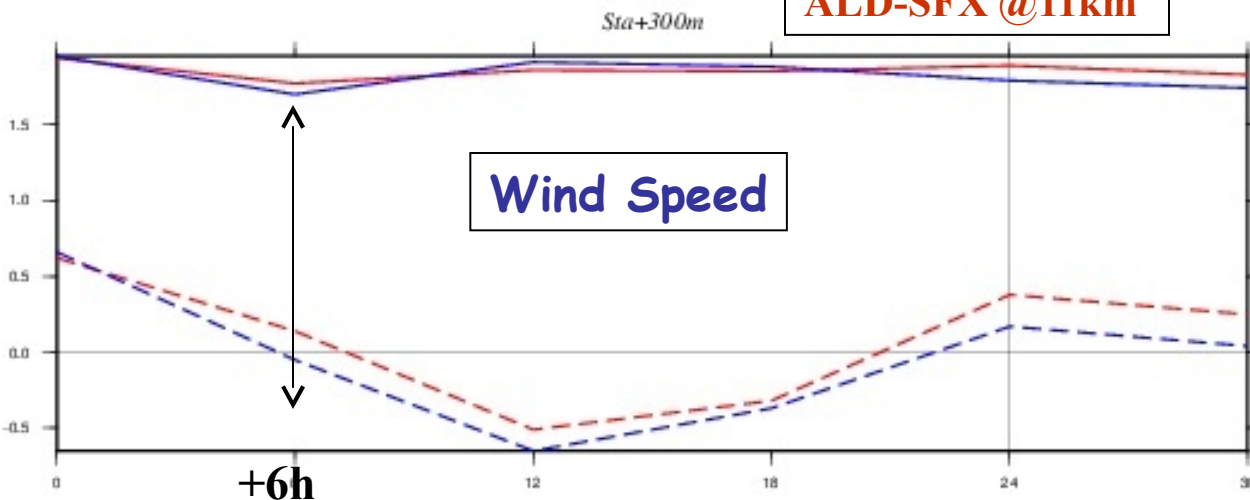
- **December 2009 – January 2010** (available analyses from EURO4M @5.5km)
- **June 2010** (available analyses from EURO4M @5.5km)
- **01-15 July 2013**

# Bias and RMSE of T2m and 10m Wind Speed forecasts (scores over France for June 2010)



ALD-SFX @5.5km  
ALD-SFX @11km

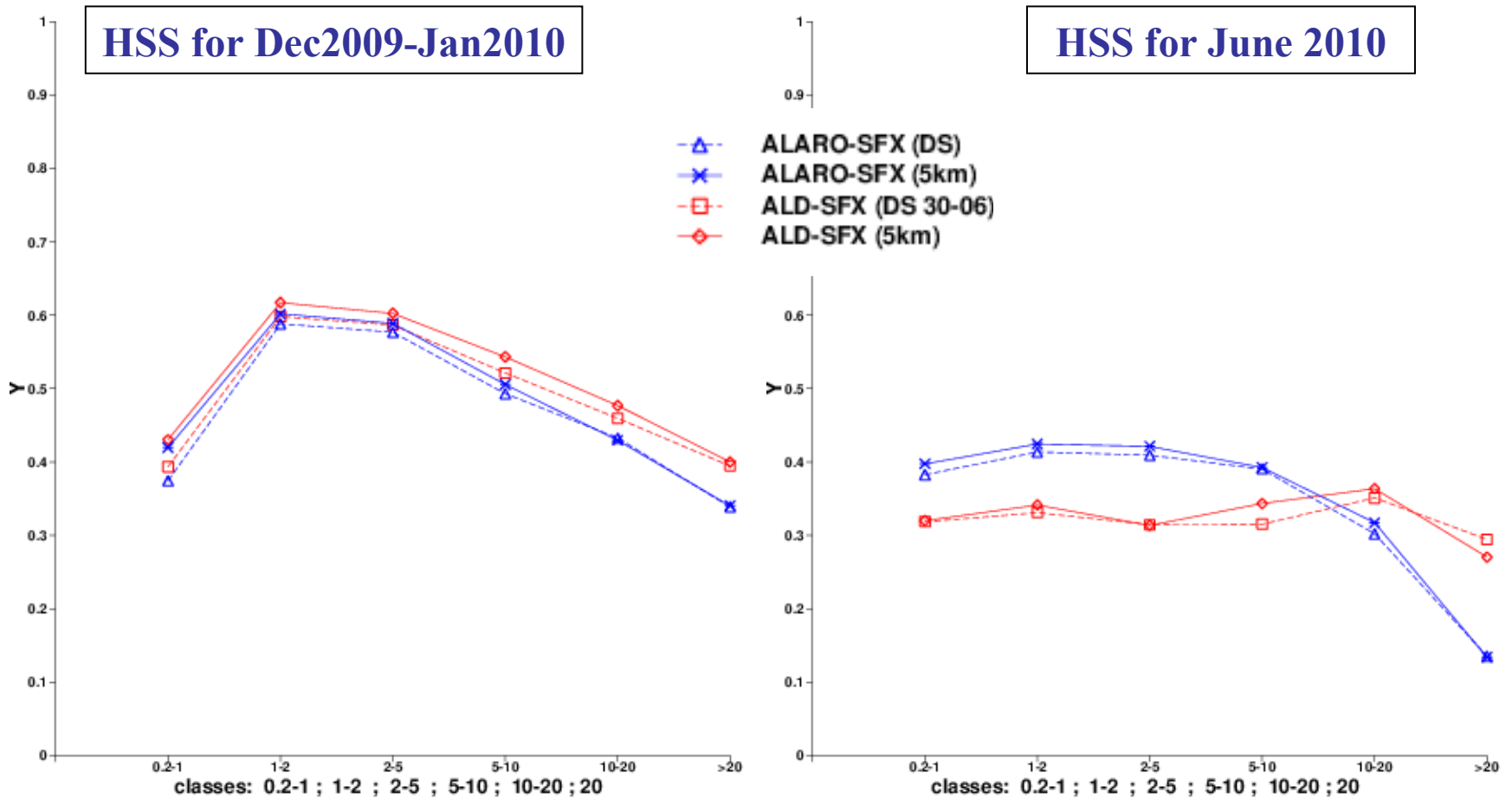
Station Alt>300m



+6h forecast:  
improvement of  
scores at 5.5km over  
complex orography.

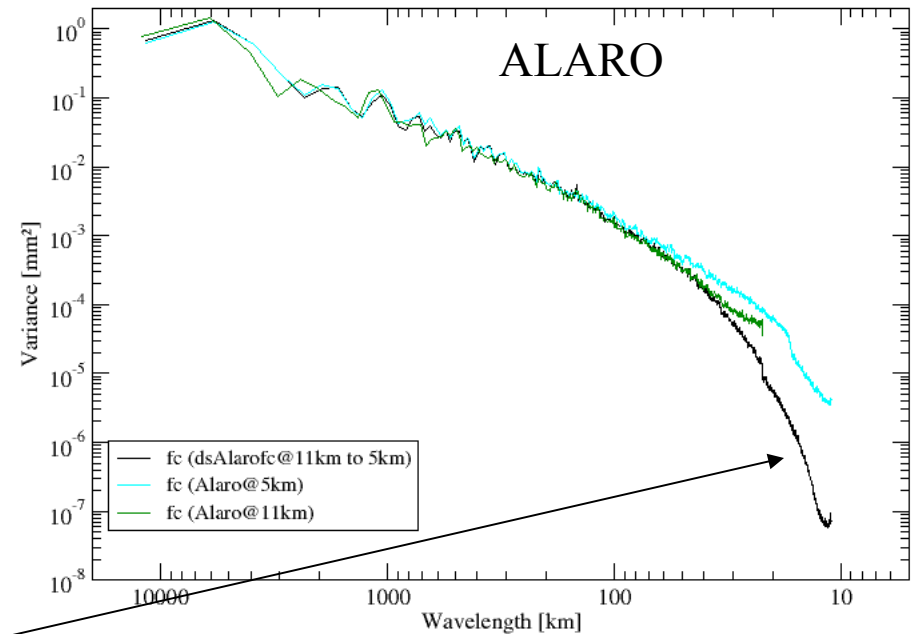
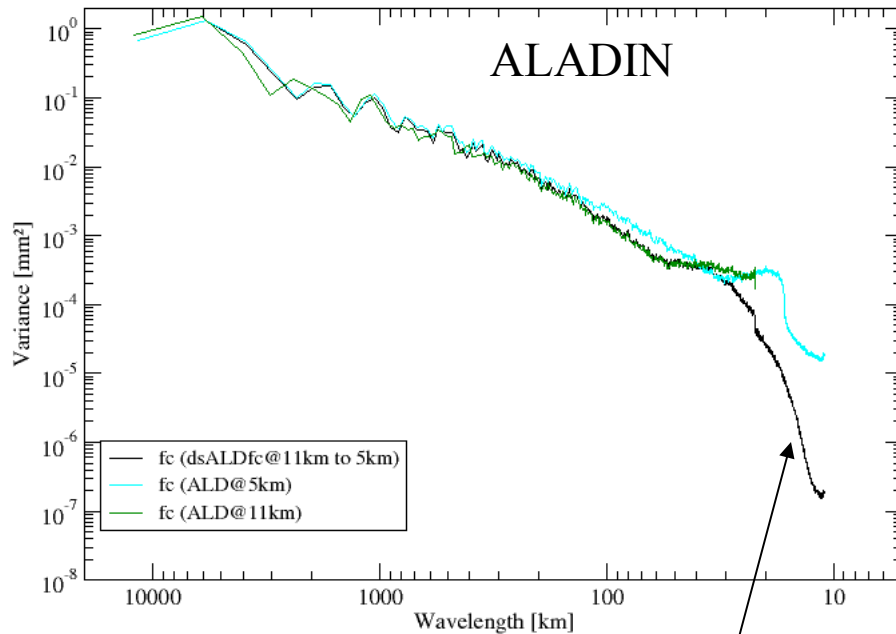


# Heidke Skill Score (HSS) of 24-h Precipitation Background (scores computed over France)



ALADIN slightly better skill in winter, whereas  
ALARO better in June for light and moderate precip

# Variance Spectra of Monthly Mean 24-h Precipitation Forecast (Dec2009)

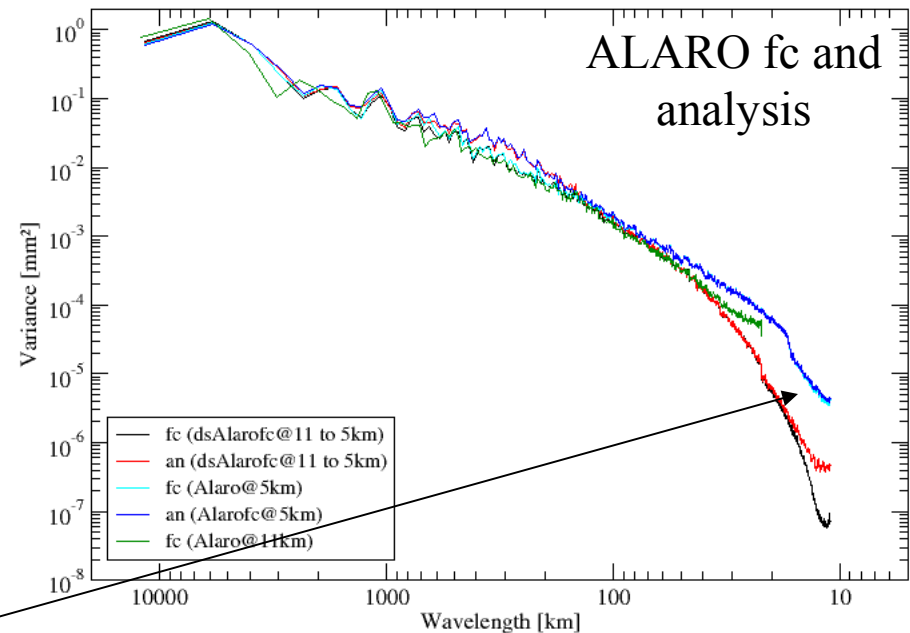
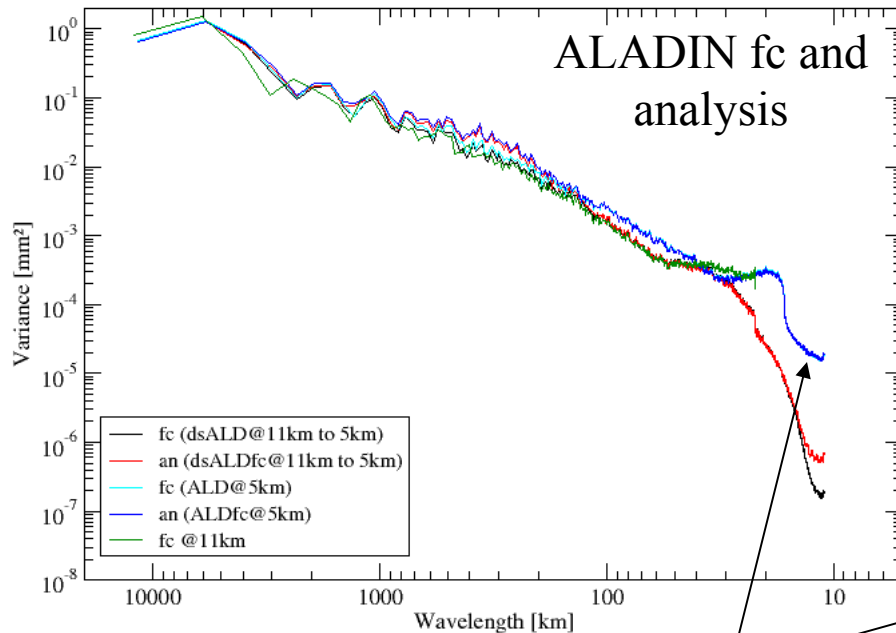


- Spurious tail introduced by downscaling (interpolation) from 11km to 5.5km grid

## BACKGROUND fields:

- **Black:** downscaled fc from 11km to 5km
- **CYAN:** forecast at 5.5 km grid
- **GREEN:** forecast at 11 km grid

# Variance Spectra of Monthly Mean 24-h Precipitation Background and Analysis (Dec2009)



-The precip analysis does not modify the variance at small scales when the background is a forecast field at 5.5km.

## BACKGROUND fields:

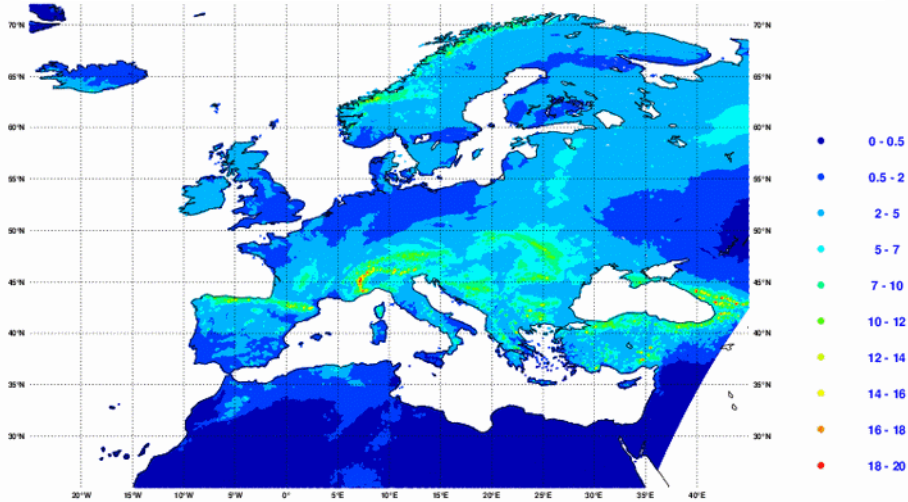
- **Black:** downscaled fc from 11km to 5km
- **CYAN:** forecast at 5.5 km grid
- **GREEN:** forecast at 11 km grid

## ANALYSIS:

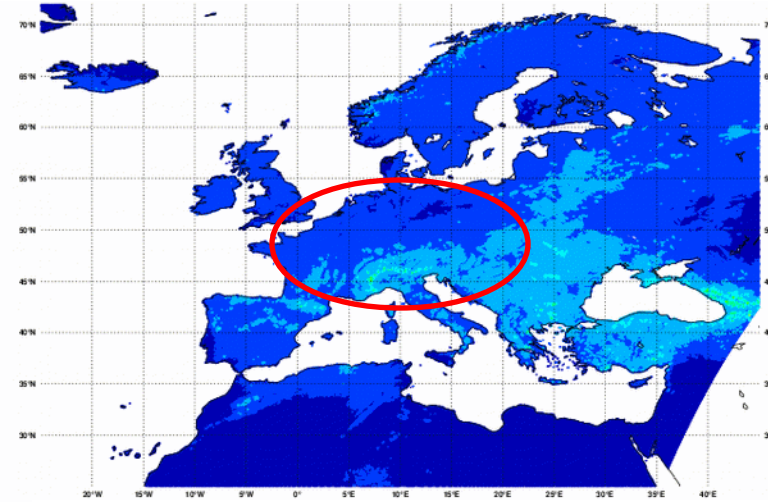
- **Red:** analysis with downscaled fields
- **Blue:** analysis with forecast at 5.5km

# Ensemble (6 members) MEAN and SD of 24-h Precip Background and Analysis (June 2010)

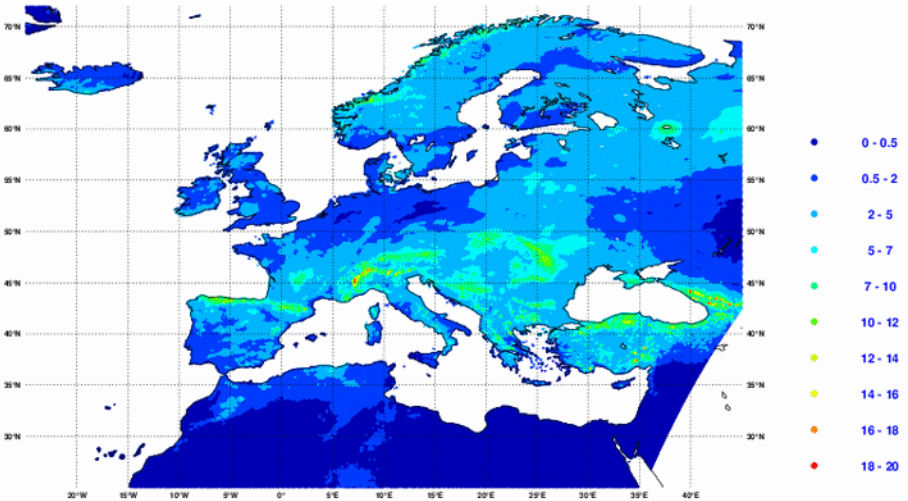
## Ensemble Mean of Backgrounds



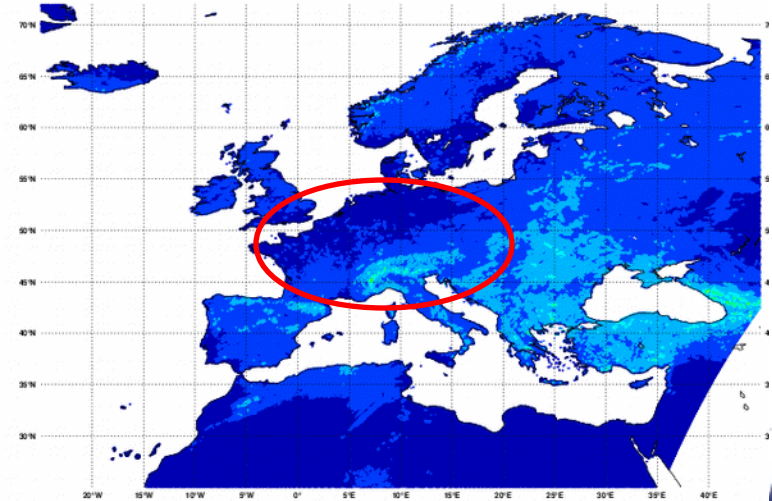
## Ensemble Mean SD of Backgrounds



## Ensemble Mean of Analyses

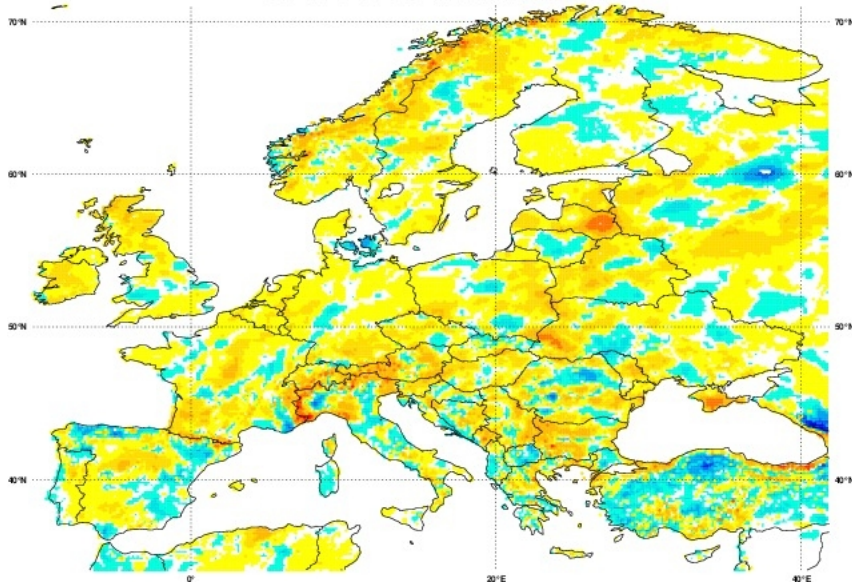


## Ensemble Mean SD of Analyses

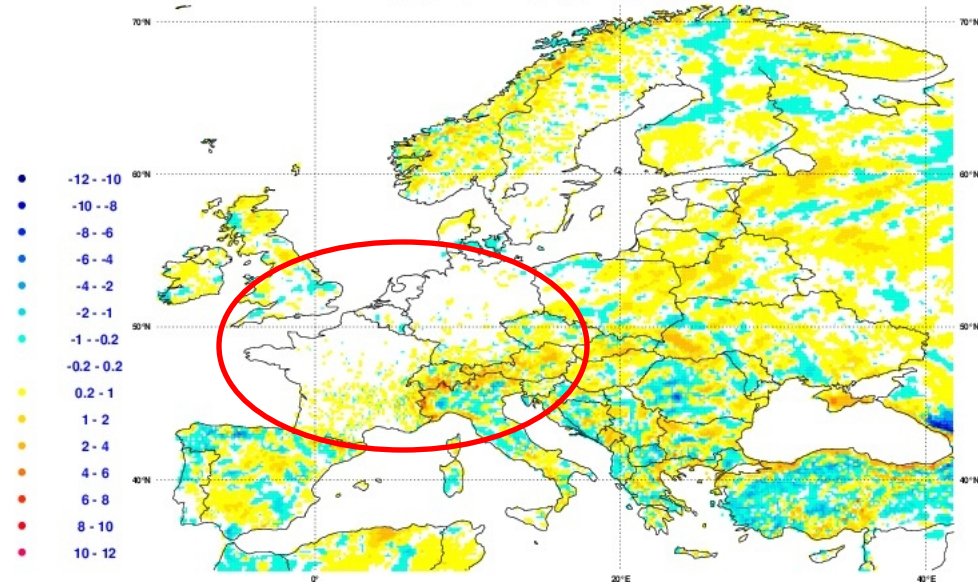


# Diff between the Ensemble Mean of 24-h Precip Forecast/ Reanalyses and the EURO4M Reanalyses (June 2010)

Difference of the Ensemble Mean of  
Backgrounds (EN-EURO4M)

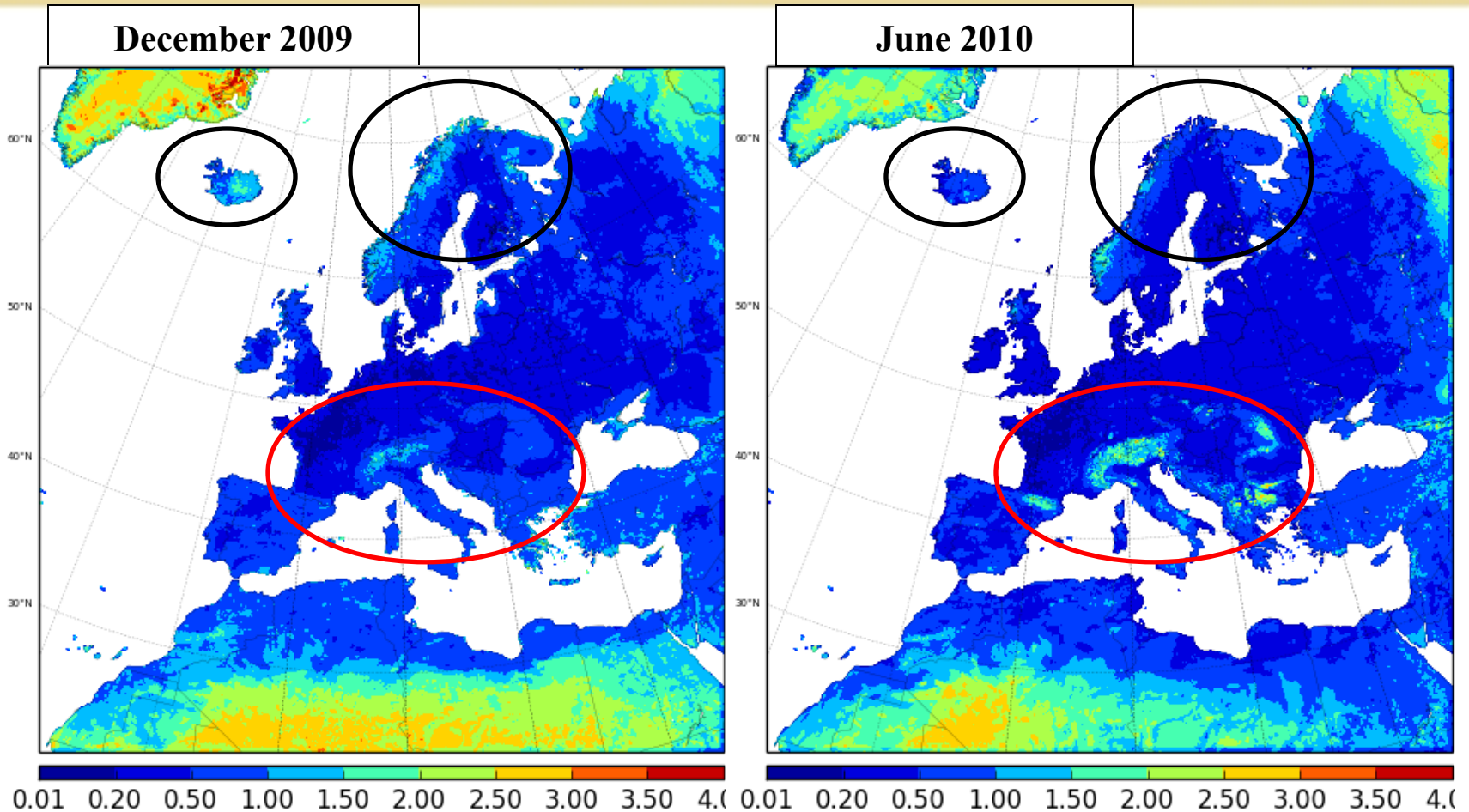


Difference of the Ensemble Mean of  
Reanalyses (EN-EURO4M)



Reduced “bias” where the density of the observations is high (hopefully)!

# Ensemble Mean SD of T2m analysis at 06UTC



- Higher uncertainties over the mountains in summer compared with winter time (red ellipse), and in northern Scandinavia and Iceland in winter compared with summer (black ellipse).

# Conclusions

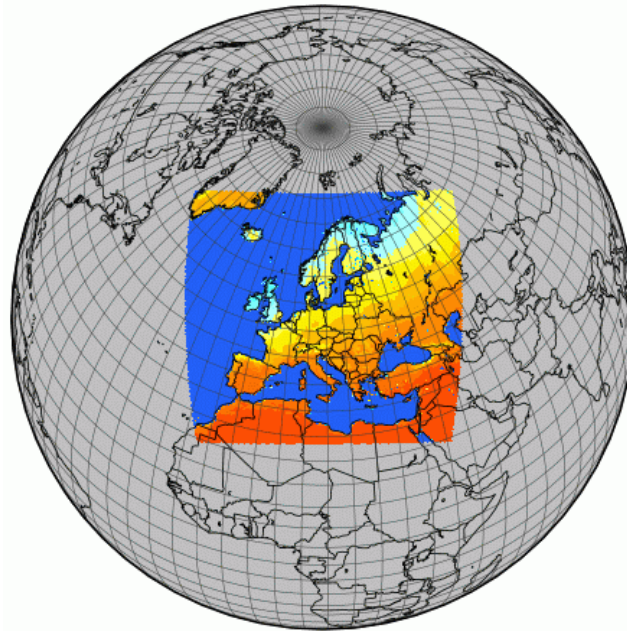
- # Improvement of scores of +6h forecast of T2m and 10m Wind speed at 5.5km over complex orography => reliable T2m background field for reanalysis;
- # 24-h precip background better from the forecast at 5.5km grid than downscaled from 11km to 5.5km;
- # Estimation of uncertainties:
  - do we really need to run the model or several models at 5.5km ?
    - Yes, for the 10mWind and T2m over the complex orography
    - **Yes**, for the RR24 analysis following the RR24 variance spectra of 5.5km forecasts vs downscaling and due to the lack of high resolution observation.      **No**, following the HSS scores.
    - Yes, if we want homogeneous radiative forcing fluxes (required for the Land Surface Models such as SURFEX and other end-user applications) with associated uncertainties (not shown yet ...)

# Perspectives

- # Work to be done prior to begin the production of reanalyses:
  - assess the ensemble of T2m/RH2m/RR24 reanalyses through an ensemble approach (e.g. Rank Histogram)
  - To set the background for RR24 reanalysis: 4 x 6-h, 2 x 12-h, 30-6h (or shall we use the 3 of them ? If ever => 6 members: 3x(Aladin +Alaro))
  - Work on observations, particularly on 24-h precip
  - For the 5 years (2006-2010):
    - static or dynamical downscaling vs perturbed background and/or observations (generating an ensemble of backgrounds/obs if any);
    - perturbed observations (depend on the density network?)
    - perturbed background before or after the static downscaling?



Thank you for your attention! Questions ?



### Acknowledgements

The research leading to these results has received funding from the European Union, Seventh Framework Programme (FP7-SPACE-2013-1) under grant agreement n° 607193.