

Status of the surface reanalysis, uncertainties and observations.

E. Bazile, R. Abida, C. Soci, F. Besson

GA3 UERRA

Toulouse, 1-3 February 2016

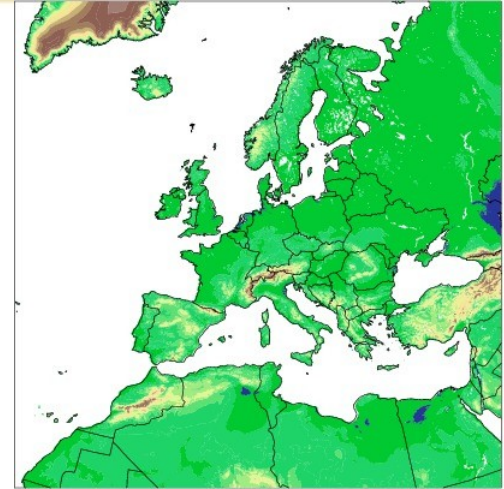
Outline

- What's new since Tortosa's *GA*
- Evaluation of the background precipitation fields
 - Static or dynamical downscaling, some results & some questions ...
- Estimation of uncertainties for the testbed period (2006-2010)
- Surface observations
- Deliverables Surface re-analysis in UERRA
 - test-bed for uncertainties estimation (2006-2010)
 - 50 years (1961-2010) surface re-analysis
- Conclusions

What's new since Tortosa's GA

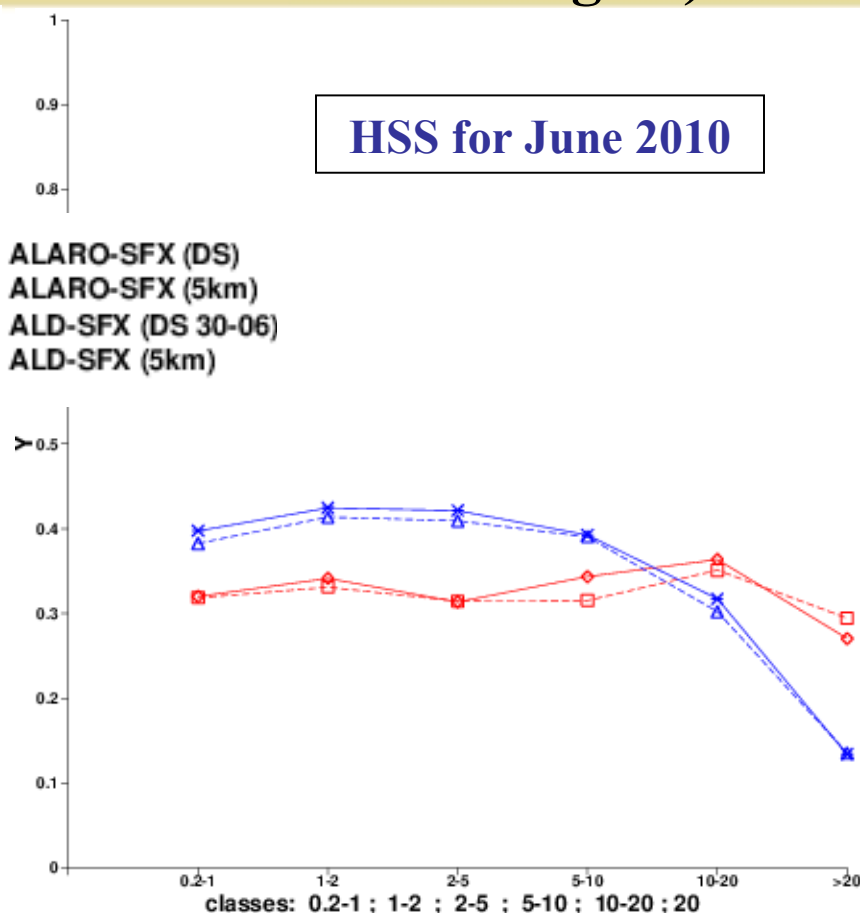
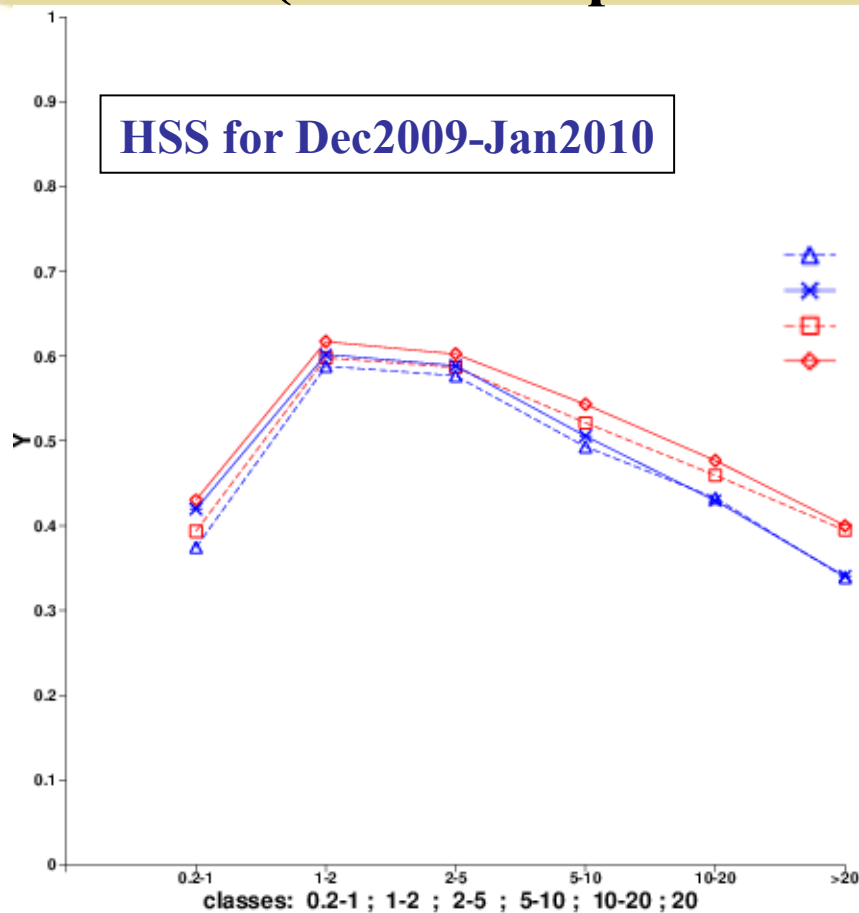
- Cornel Soci left to ECMWF 1/11/2015 after 5 years at MF (EURO4M/UERRA)
 - Soci C., E. Bazile, F. Besson & T. Landelius "High-resolution precipitation re-analysis system for climatological purposes" Tellus minor revision (new version sent last week)
- Rachid Abida since 1/10/2015 (UERRA) works on the surface re-analysis
- Camille Sczypka 15/02/2016 (UERRA) will work on SURFEX/TRIP driven by MESCOAN
- ECMWF resources : request for special project (2016-2017) ?

Estimation of uncertainties for the testbed period (2006-2010)



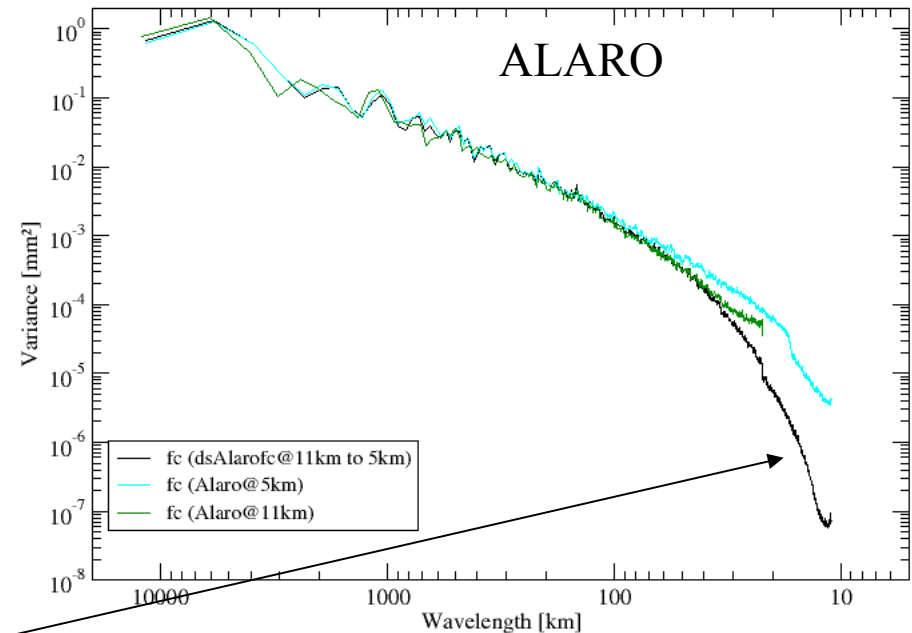
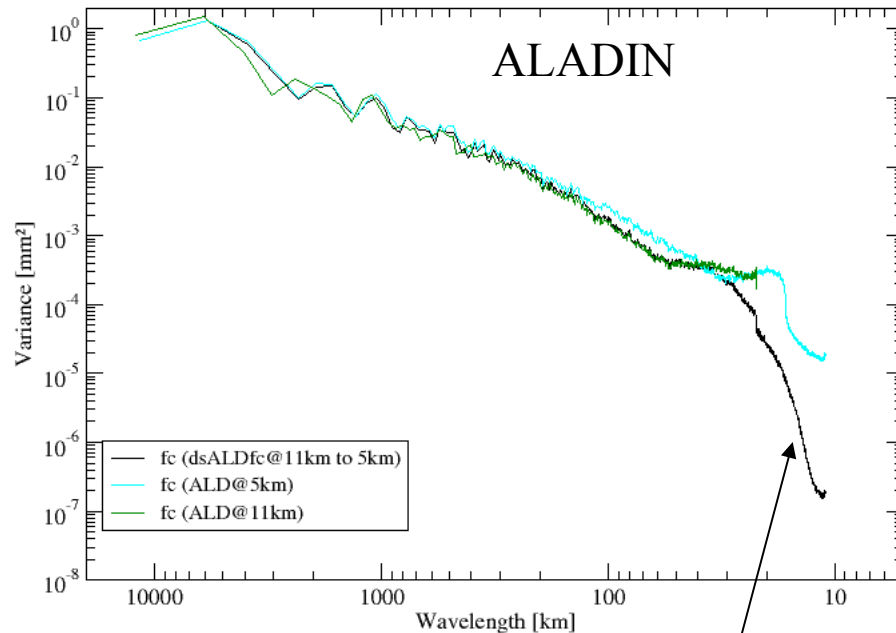
- Two horizontal resolutions :
 - 1: 576x576 @11km grid, 65Levels (same as SMHI)
 - 2: 1080x1080 @5.5km grid, 65Levels (nested)
- Several experiments with different physics @5.5km (Dec2009, Jan2010, June 2010) to evaluate the impact of an ensemble background
 - ALADIN physics with 2 surface schemes: ISBA and SURFEX
 - ALARO physics with 2 surface schemes: ISBA and SURFEX
 - Background for T2M, Hu2m and Wind are improved with the model at 5.5km vs the downscaling of the 11km background (C. Soci et al, EMS2014), also for the precipitation ?

Heidke Skill Score (HSS) of 24-h Precipitation Background (scores computed over France on a 0.1x0.1 grid)



ALADIN slightly better skill in winter, whereas ALARO better in June for light and moderate precip,
Model integration at 5.5km improves slightly the HSS for both physics (full line vs dashed line) but ...

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

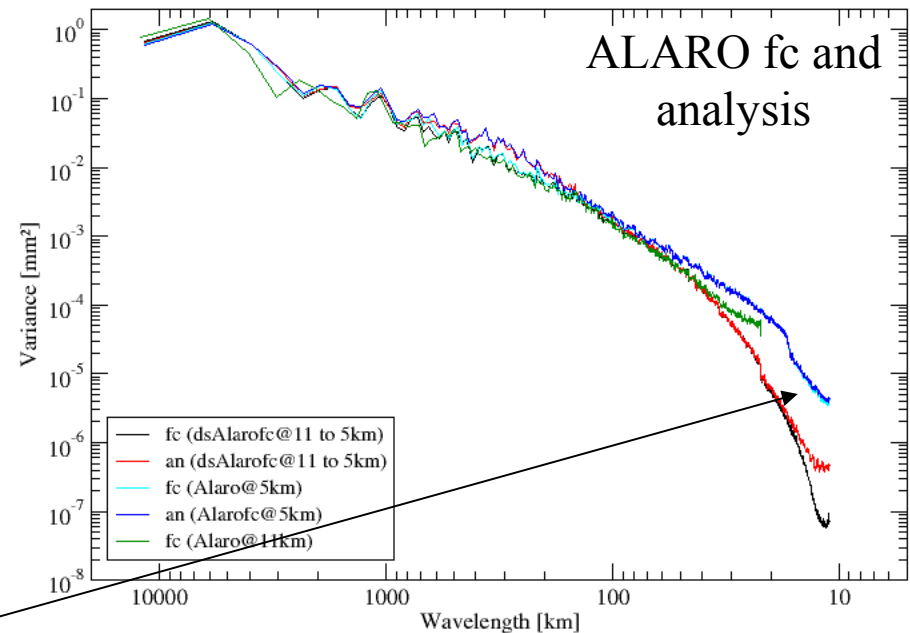
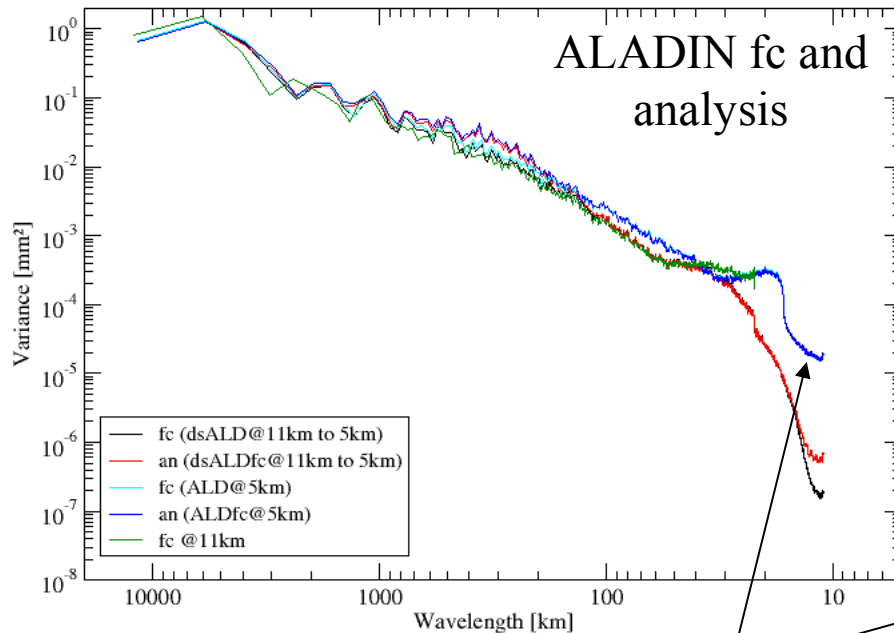


- Spurious tail introduced by downscaling (interpolation) from 11km to 5.5km grid

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

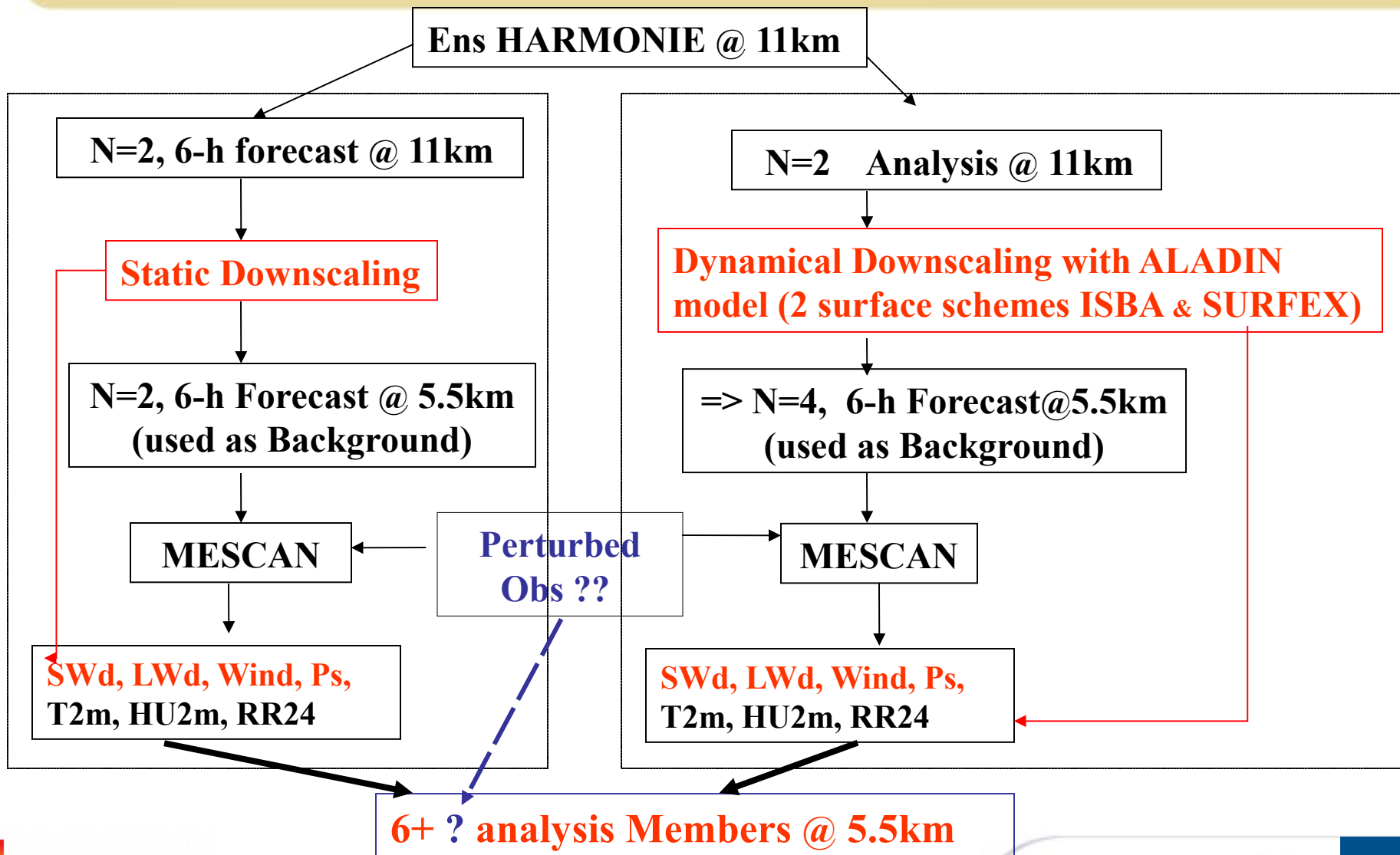
BACKGROUND fields:

- **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 of Surface analyses 2006-2010 (Test-bed)



Ensemble system at 5.5km

2 types of ensemble :

1. **Ens-6 (poor ensemble !)**: 6 members based on 6 backgrounds at 11Km and downscaled to 5.5km: 2 physics with SURFEX, and forecast length combination for RR24 (or background) 24h, 2*12h, 4*6h (Ens-6 only used for precipitation analysis)

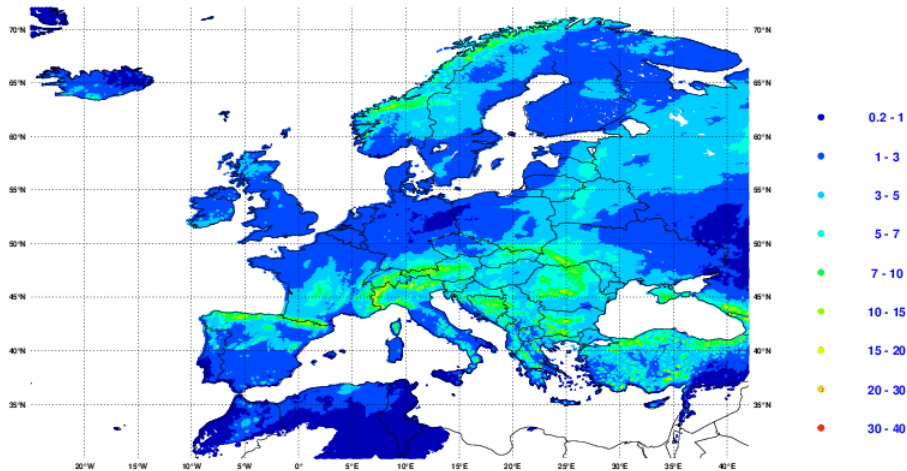
2. **Ens-8 (rich ensemble)** :

4 members from 4 physics package (ALADIN with/no SURFEX and ALARO with/no SURFEX) at 11Km → downscaled to 5.5km (static)

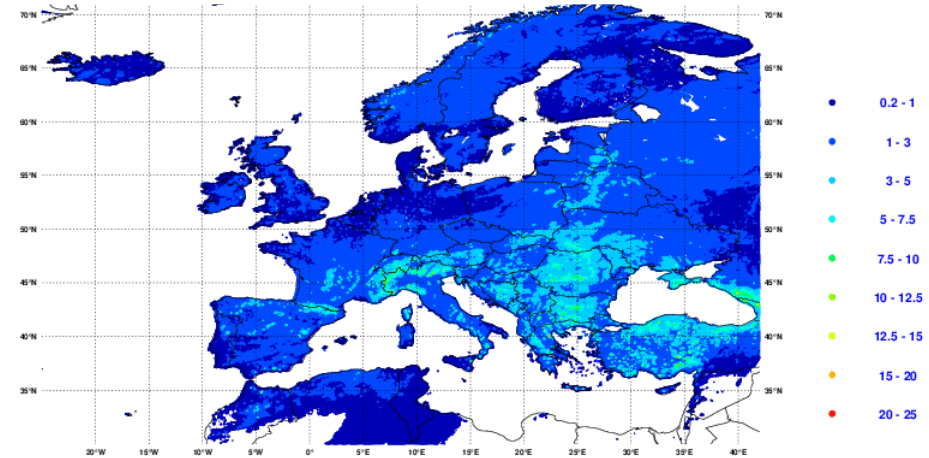
4 members from 4 physics package (ALADIN with/no SURFEX and ALARO with/no SURFEX) at 5.5Km

Ensemble (8-members) MEAN and SD of 24-h Precip Background and Analysis (June 2010)

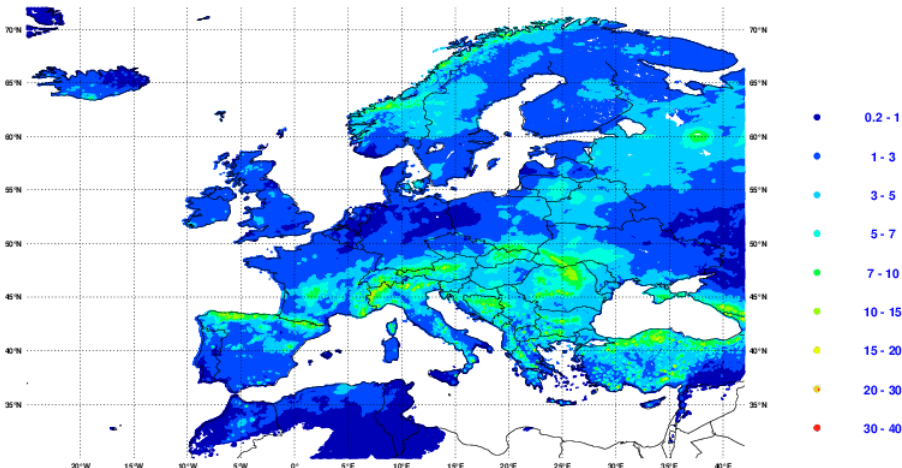
Ensemble Mean of Backgrounds



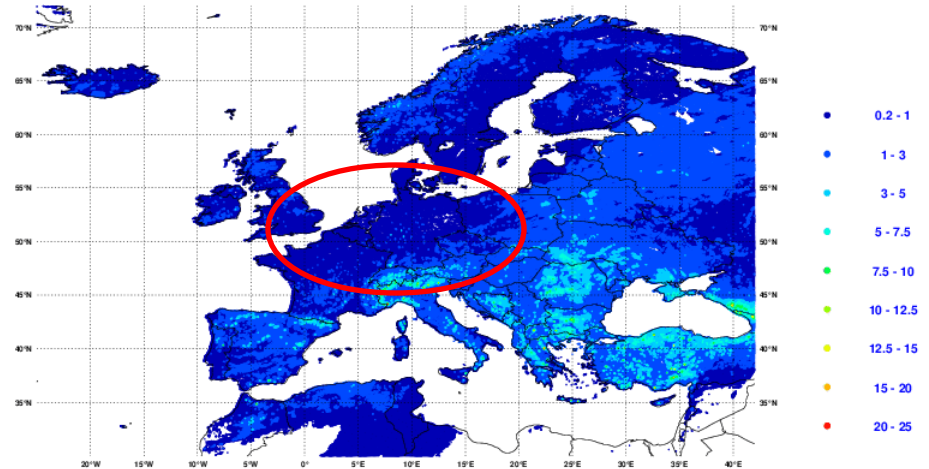
Ensemble Mean SD of Backgrounds



Ensemble Mean of Analysis

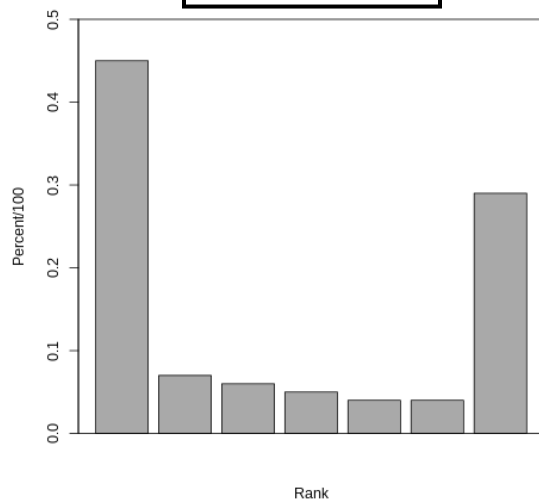


Ensemble Mean SD of Analysis



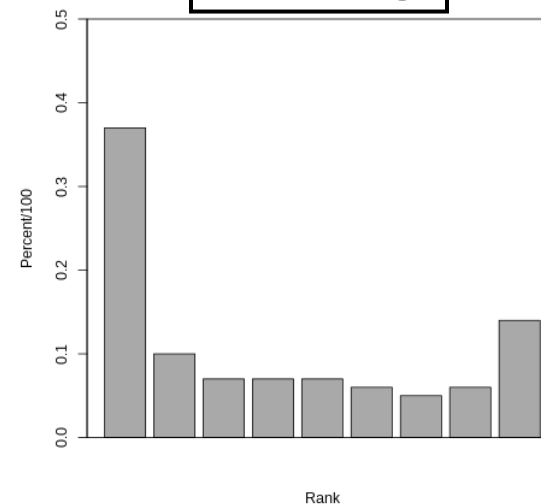
Rank Histogram for RR24 December 2009 over Europe

Ens-6 Bg



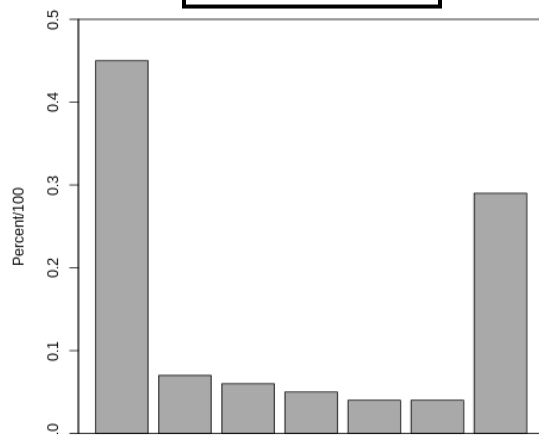
Ens-8 is slightly better than Ens-6 but still under dispersion

Ens-8 Bg



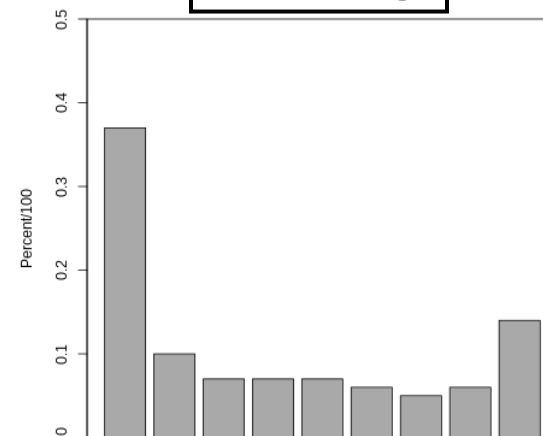
Rank Histogram for RR24 December 2009 over Europe

Ens-6 Bg

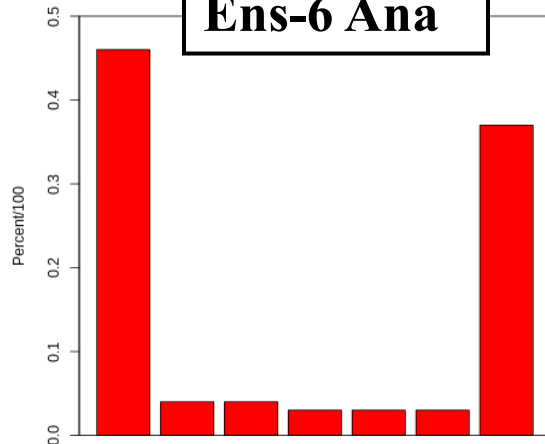


Ens-8 is slightly better than Ens-6 but still under dispersion

Ens-8 Bg

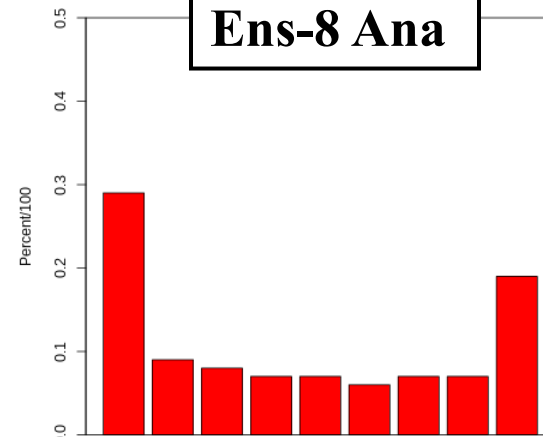


Ens-6 Ana



The analysis does not significantly improve the distribution, still under dispersion. Maybe more for Ens-8 ?

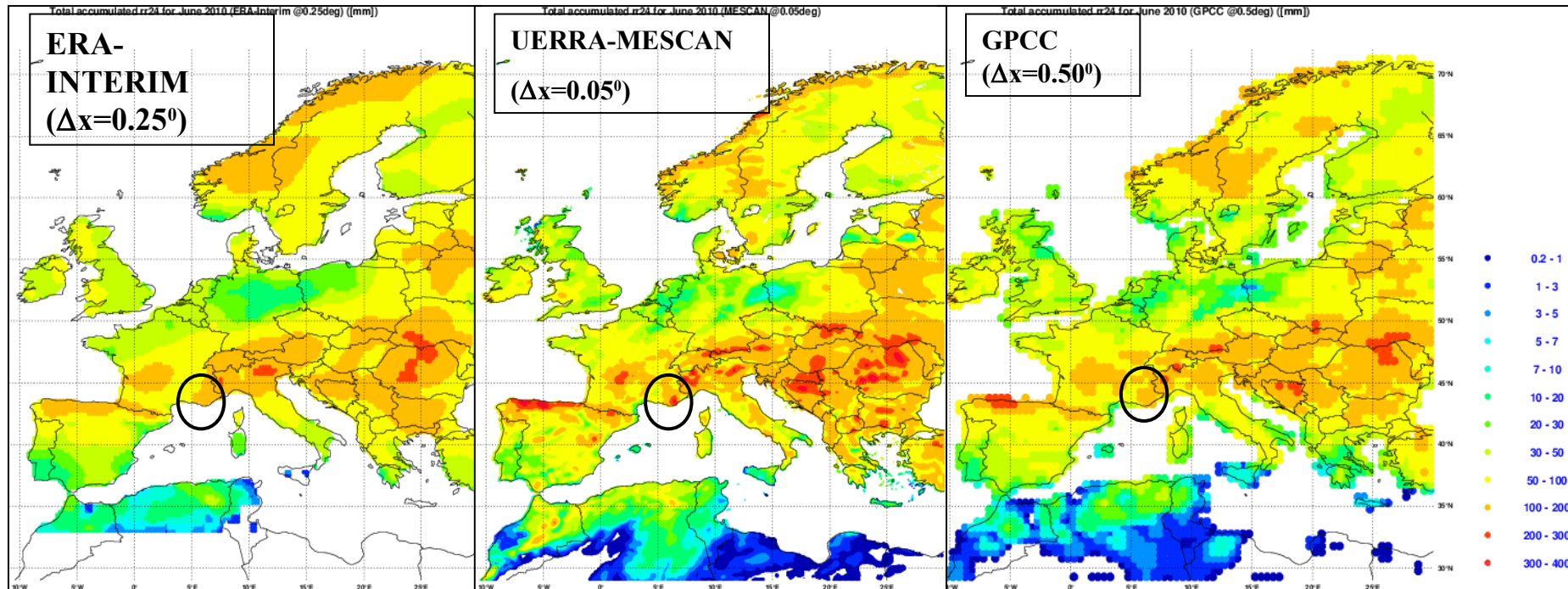
Ens-8 Ana



Rank

Rank

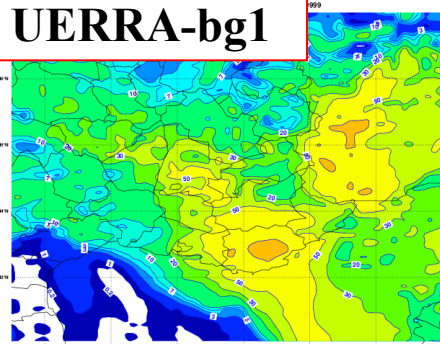
Monthly mean RR24 analysis for June 2010: MESCAN vs ERA-Interim and GPCC



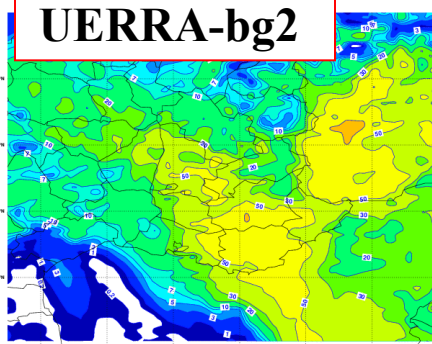
Extreme precipitation events of 15 June 2010

8 members Bg RR24h

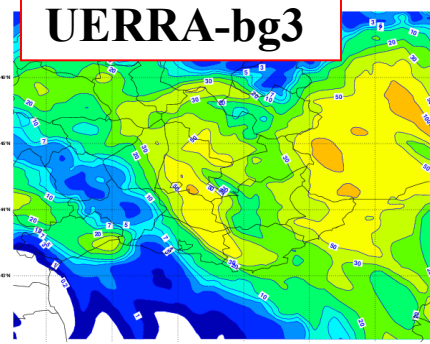
UERRA-bg1



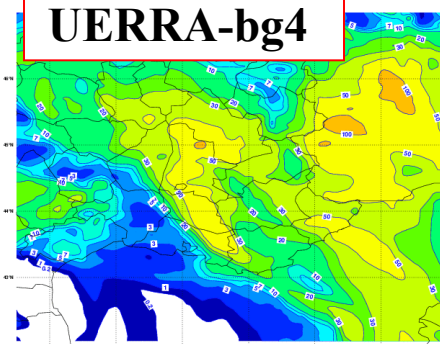
UERRA-bg2



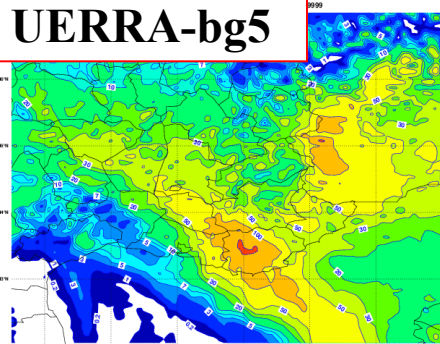
UERRA-bg3



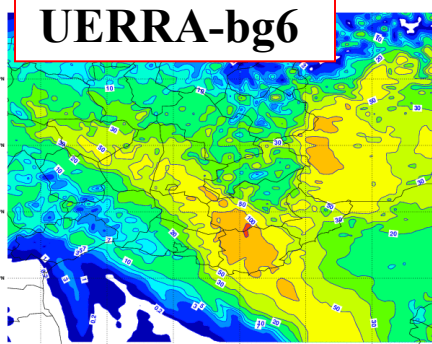
UERRA-bg4



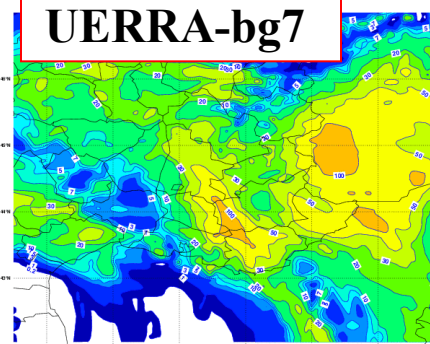
UERRA-bg5



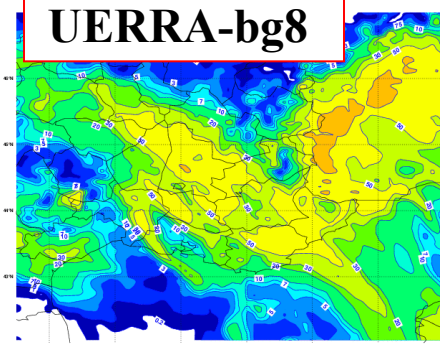
UERRA-bg6



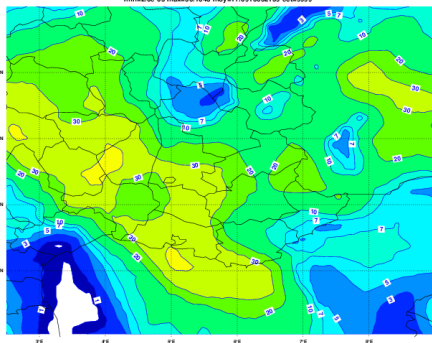
UERRA-bg7



UERRA-bg8



EURO4M-bg

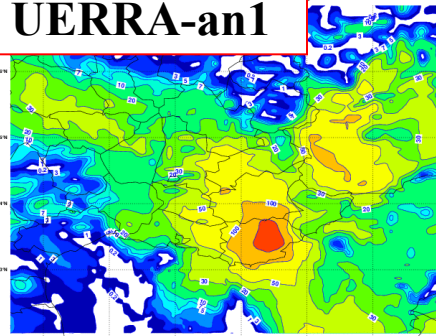


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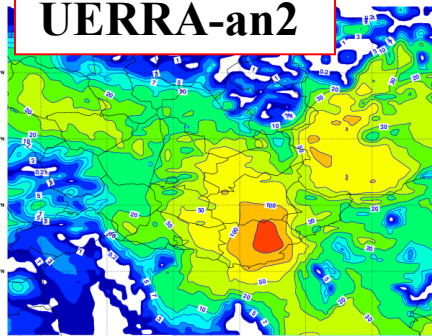
Extreme precipitation events of 15 June 2010

8 members : RR24h UERRA Analysis

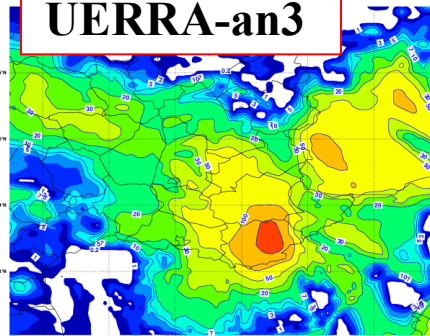
UERRA-an1



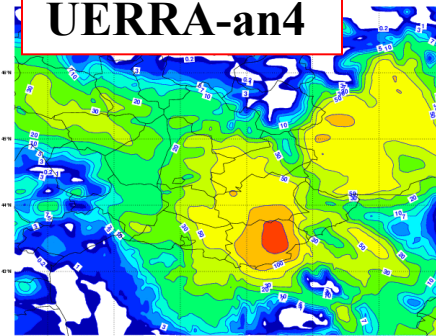
UERRA-an2



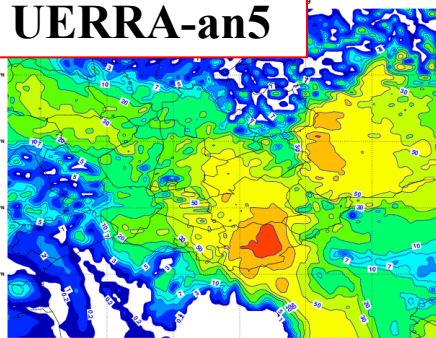
UERRA-an3



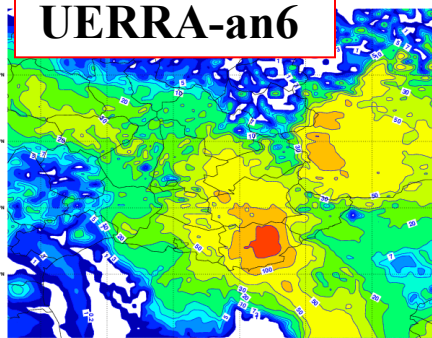
UERRA-an4



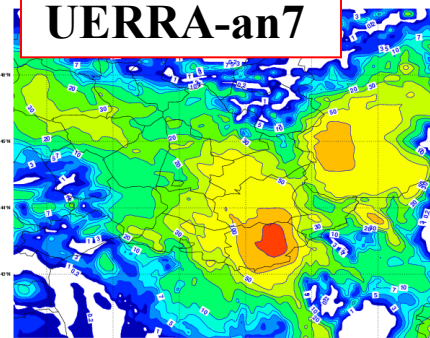
UERRA-an5



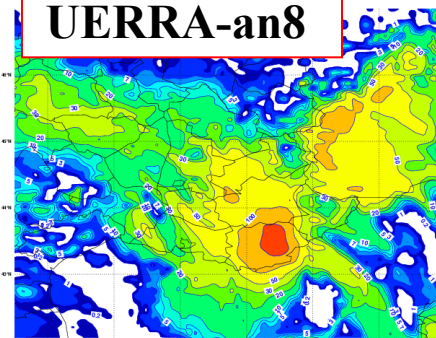
UERRA-an6



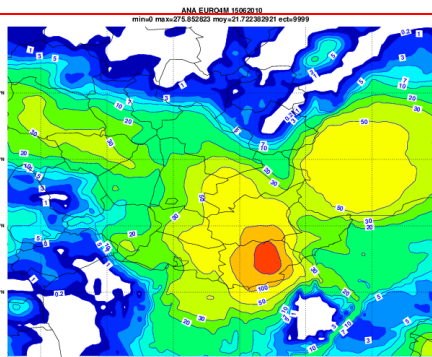
UERRA-an7



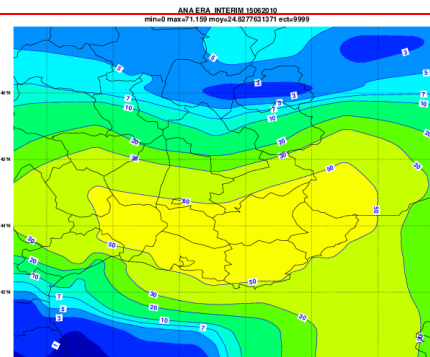
UERRA-an8



EURO4M



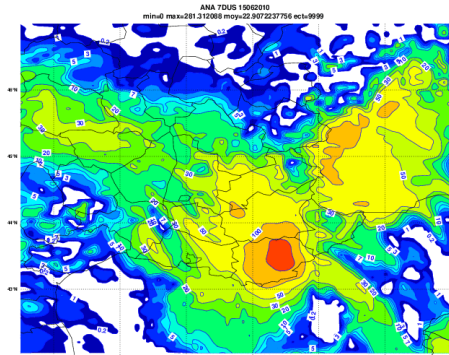
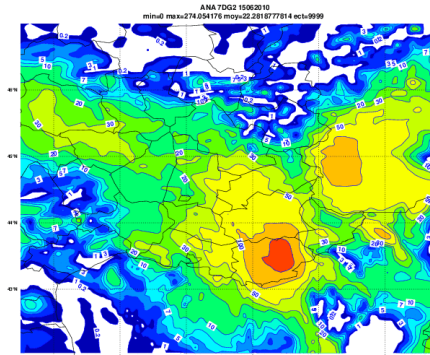
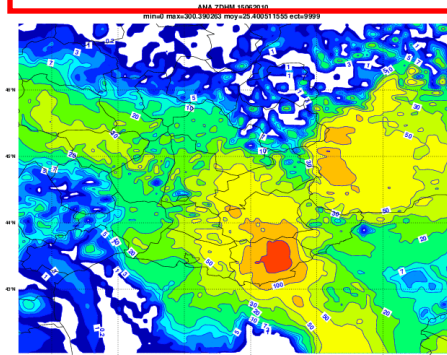
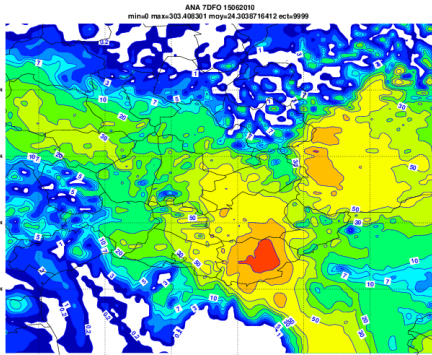
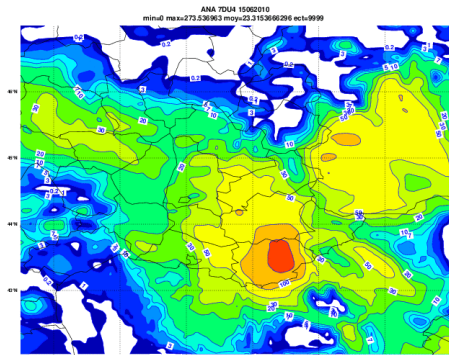
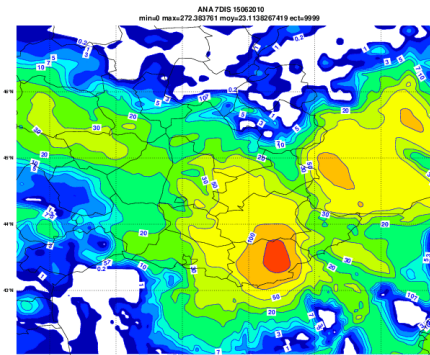
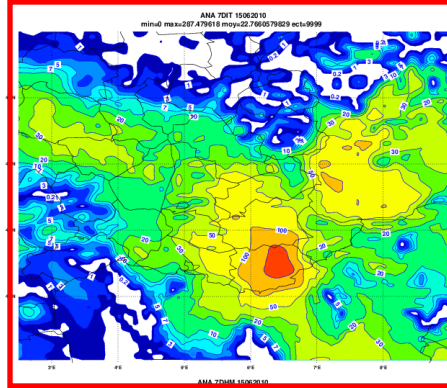
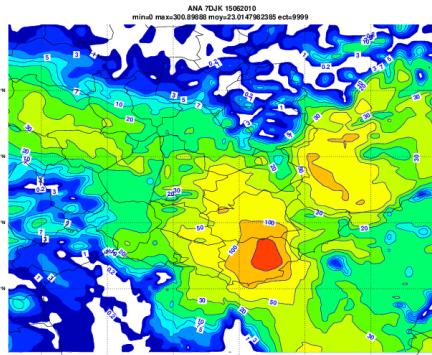
ERA-INTERIM



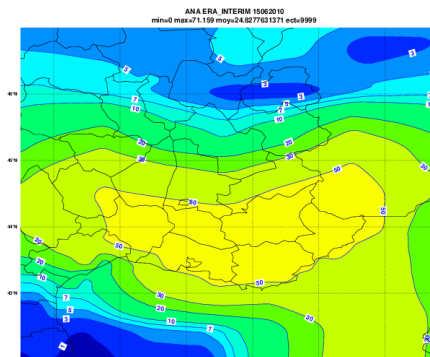
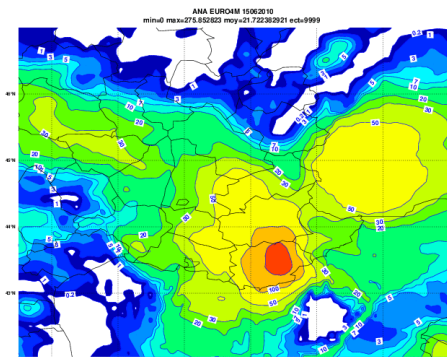
Extreme precipitation events of 15 June 2010

8 members : RR24h UERRA Analysis

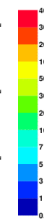
UERRA



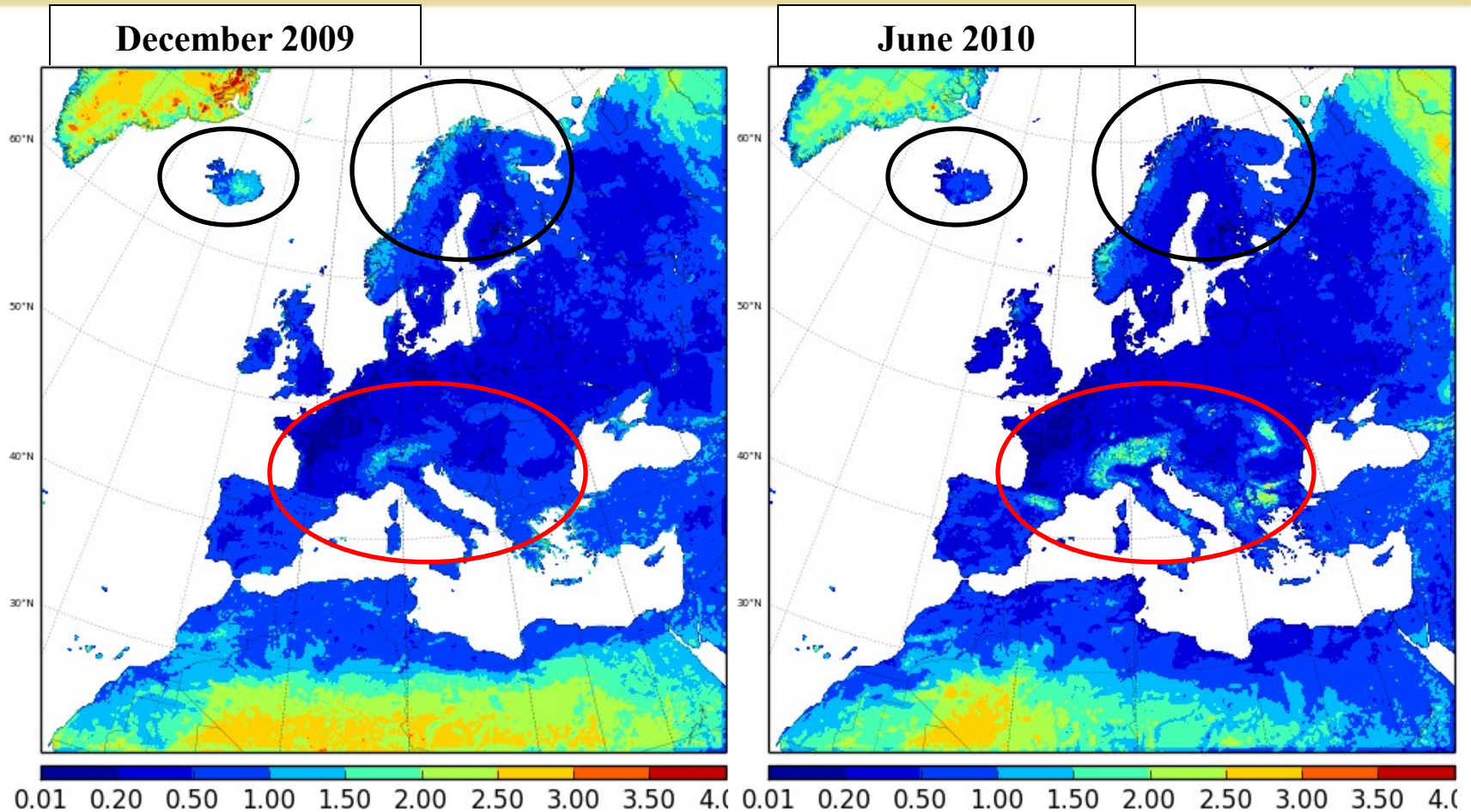
EURO4M



ERA-INTERIM



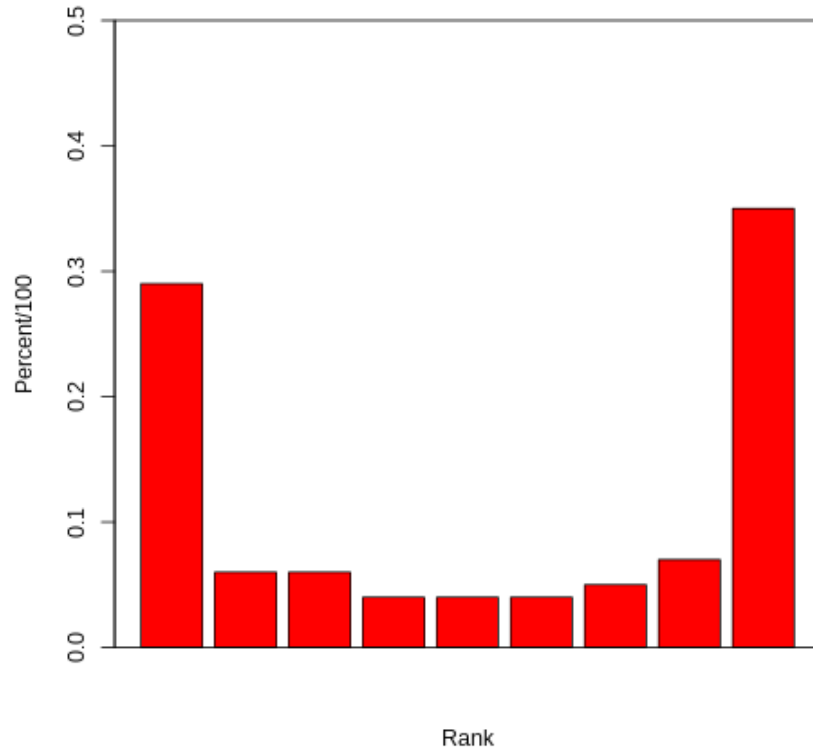
Ensemble Mean Standard Deviation of T2m analysis



- 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).

Rank Histogram for T2M June 2010

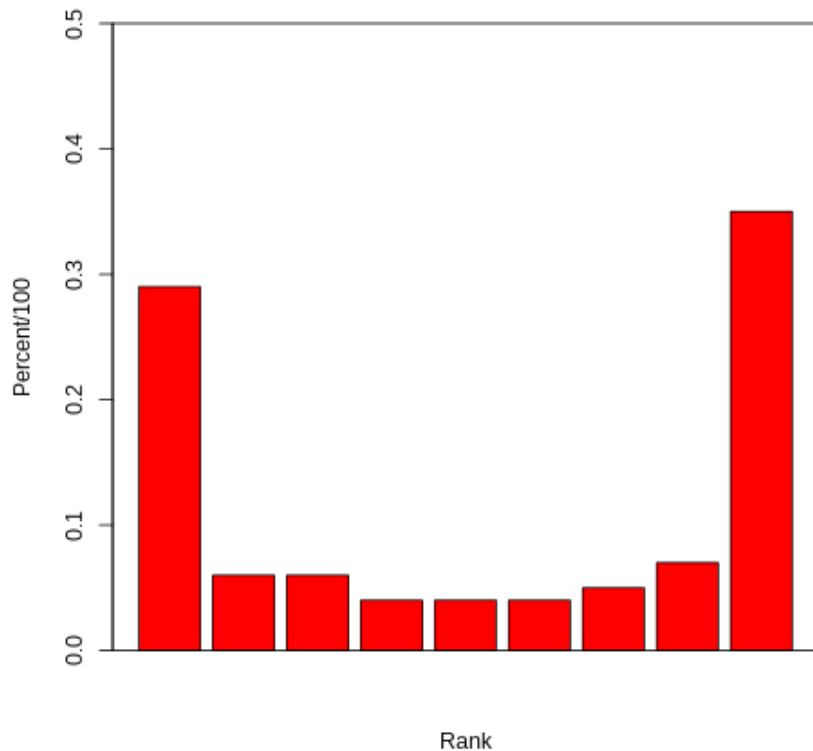
T2m (Jun10): Analysis



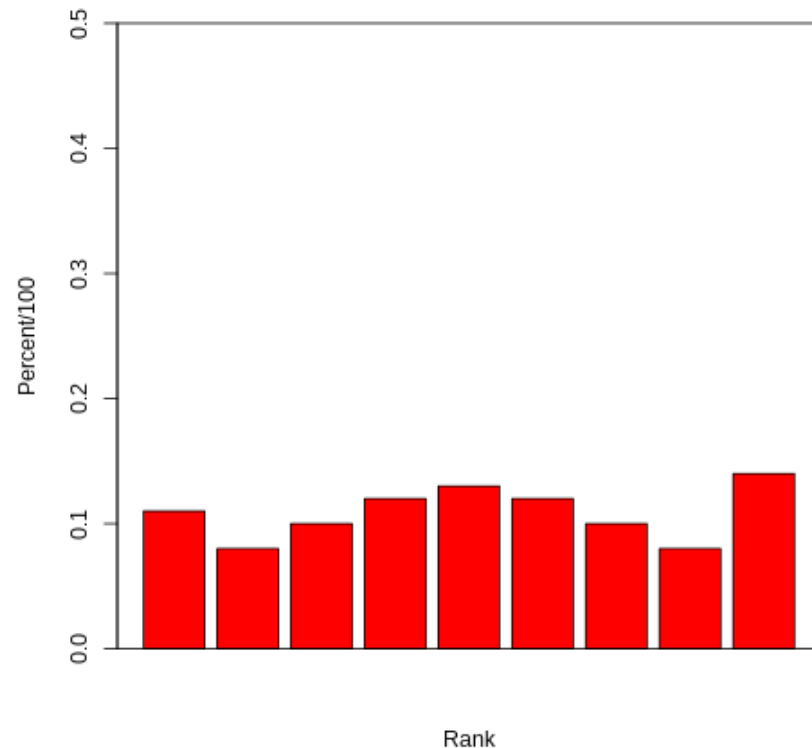
Ens-8 (4 bg ds + 4 bg high resol.)

Rank Histogram for T2M June 2010

T2m (Jun10): Analysis



T2m (Jun10): Analysis (fg ds fc)



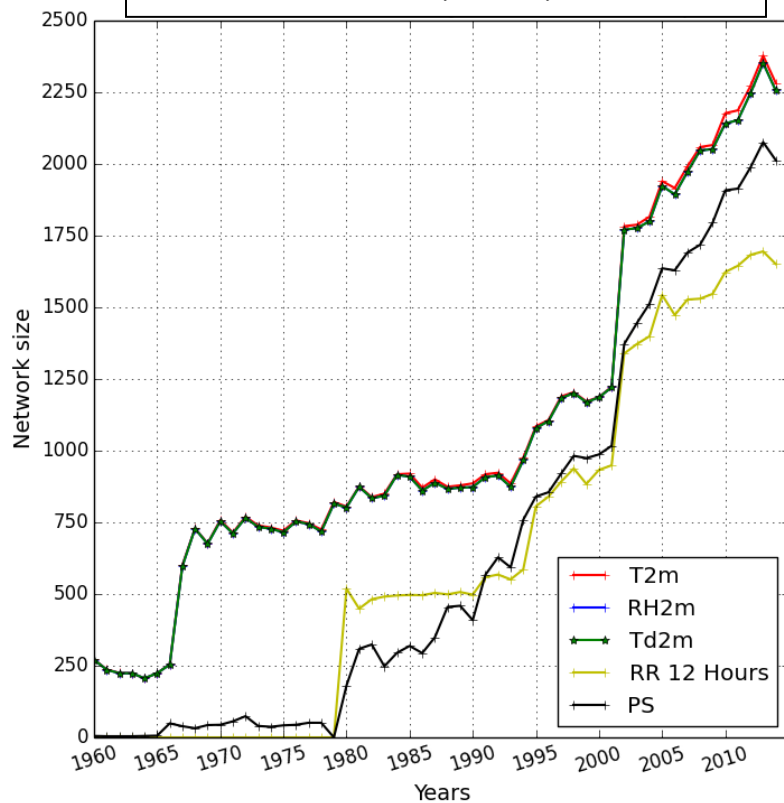
Ens-8 (4 bg ds + 4 bg high resol.)

**Perturbed obs. 8 members
(ds bg from ALADIN)**

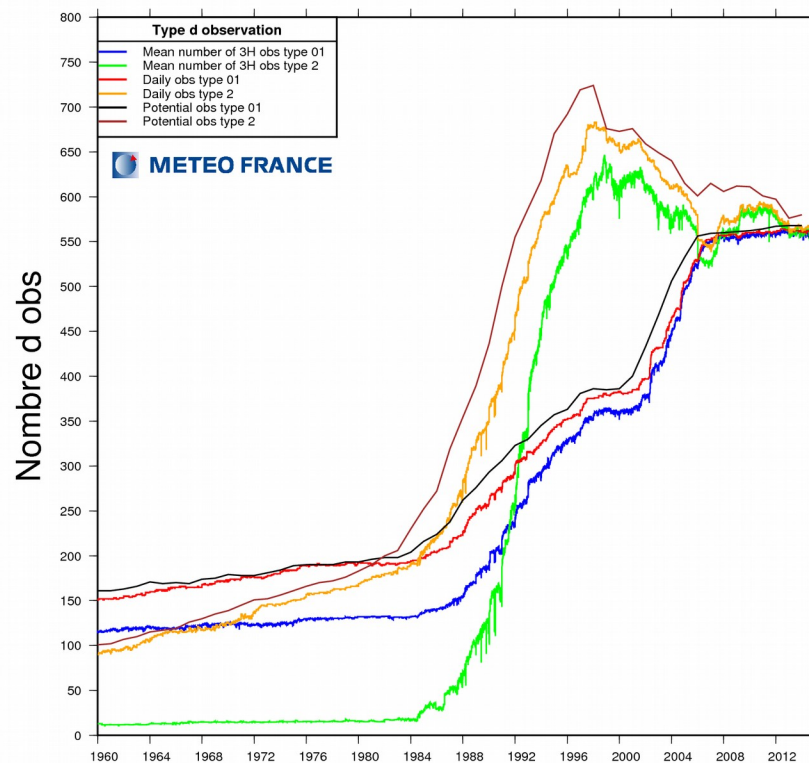
Surface observations T2m, Hu2m & RR24

#Observations files in BUFR, ODB or Ascii

NUMBER OF SYNOP OVER EUROPE FROM ECMWF



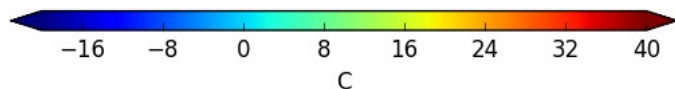
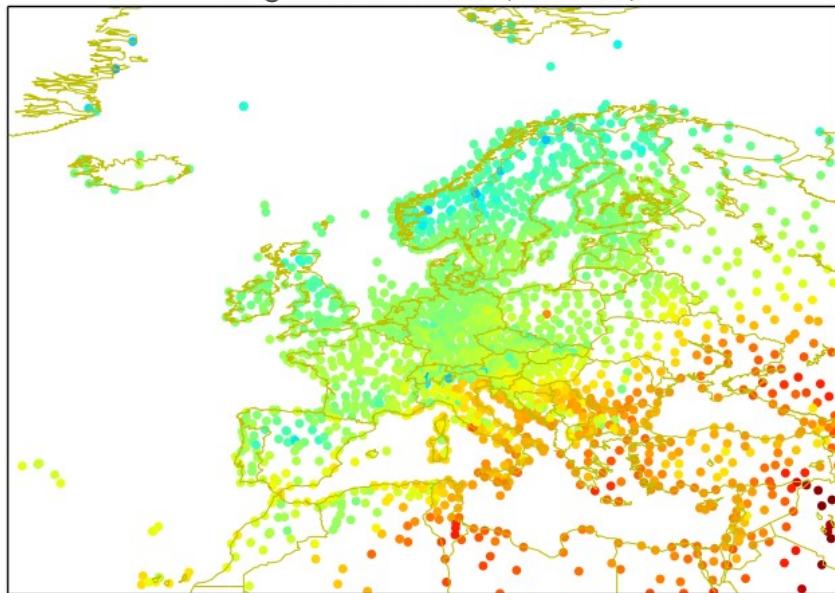
NUMBER OF SYNOP OVER FRANCE



Surface observations T2m, Hu2m & RR24

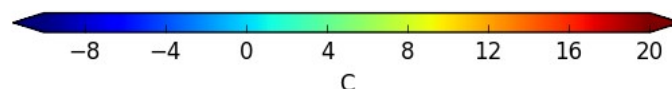
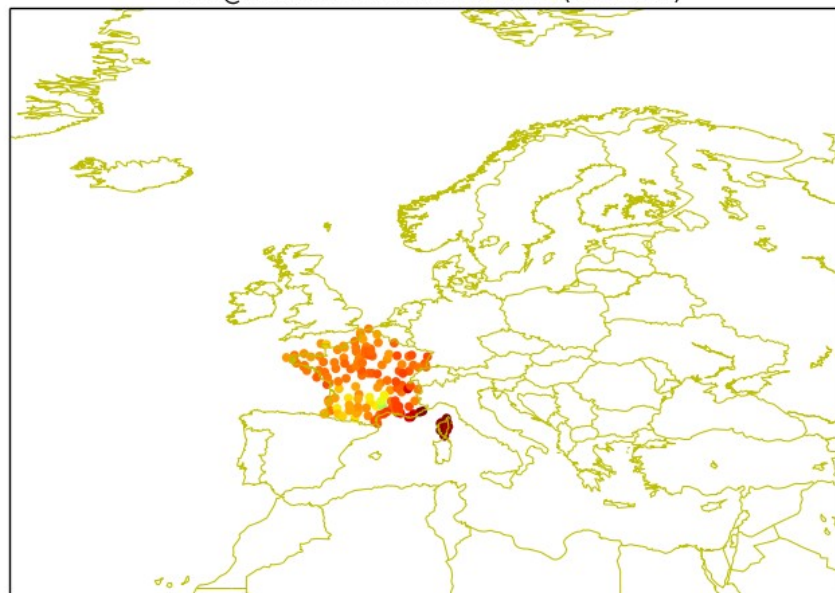
T2m obs from ECMWF 2010060112

T2m@MARS 2010061506 (2380 sites)



T2m obs (Type0) from MF 2010060112

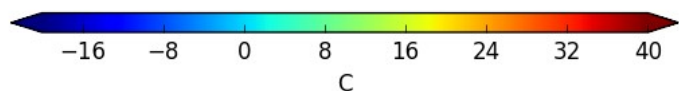
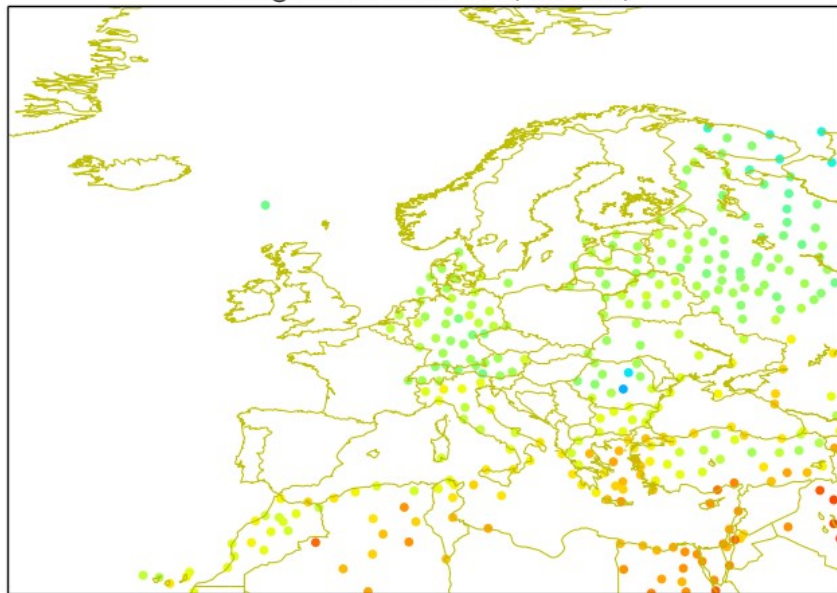
T2m@BDCLIM-TYPE0 2010061506 (145 sites)



Surface observations T2m, Hu2m & RR24

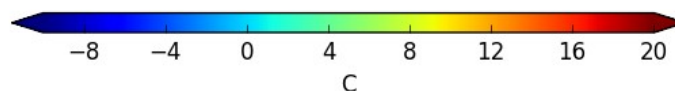
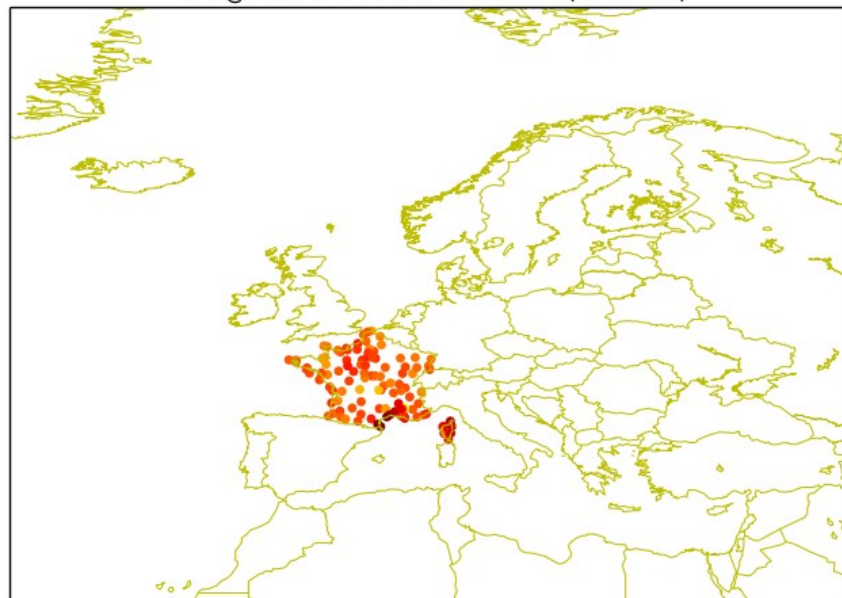
T2m obs from ECMWF 1965060112

T2m@MARS 1965061506 (324 sites)



MF T2m obs 1965060112

T2m@BDCLIM-TYPE0 1965061506 (111 sites)

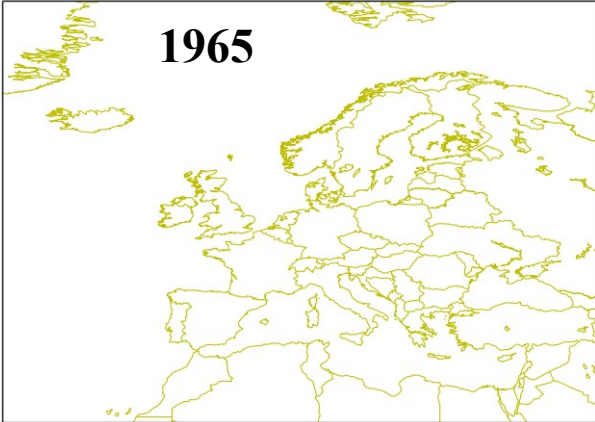


Need to merge the bufr files and some other dataspain, scandinavia, UK

24h - Accumulated Precipitation at ECMWF

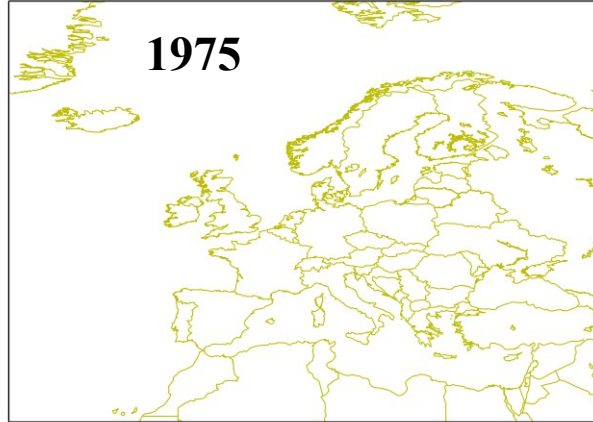
RR-24@MARS 1965061506 (0 sites)

1965



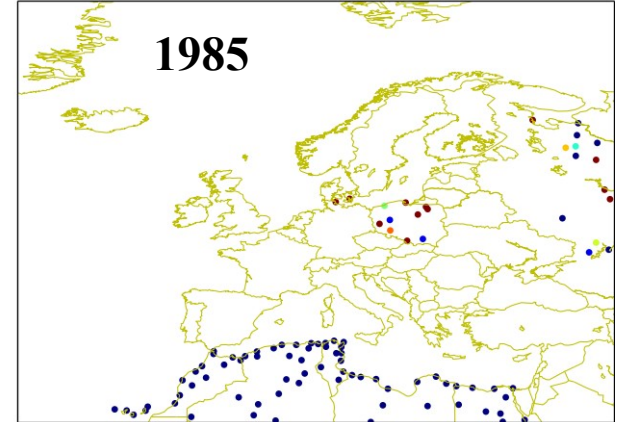
RR-24@MARS 1975061506 (0 sites)

1975



RR-24@MARS 1985061506 (94 sites)

1985



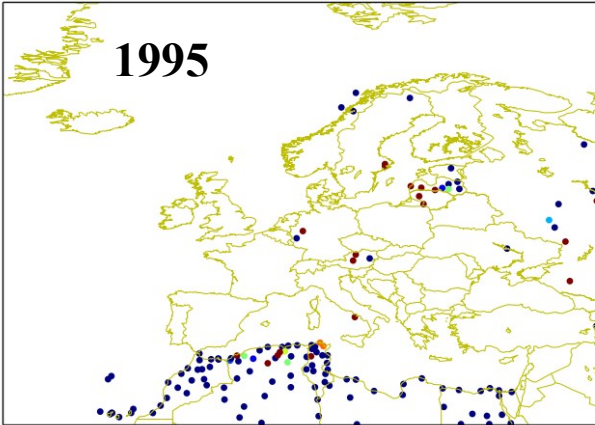
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
mm

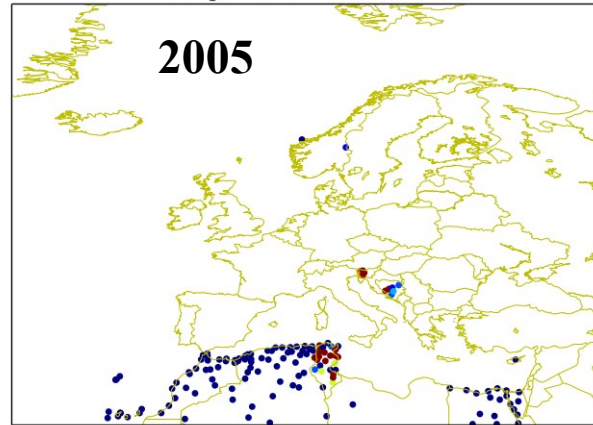
RR-24@MARS 1995061506 (134 sites)

1995



RR-24@MARS 2005061506 (143 sites)

2005



0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
mm

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
mm

12h - Accumulated Precipitation at ECMWF

RR-12@MARS 1965061506 (0 sites)

1965



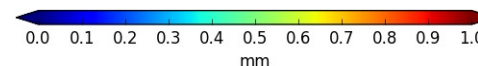
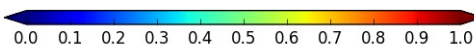
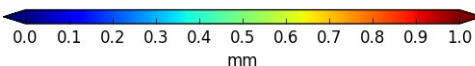
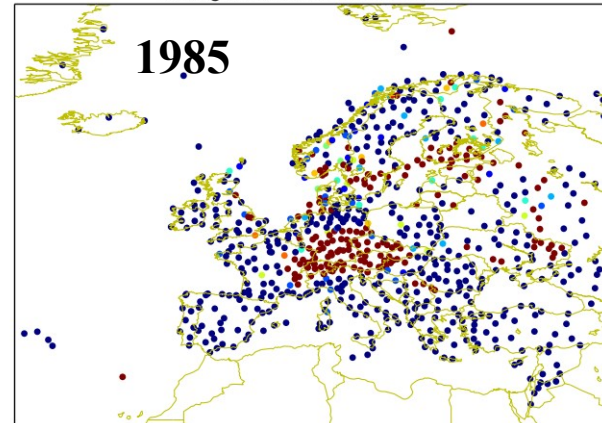
RR-12@MARS 1975061506 (0 sites)

1975



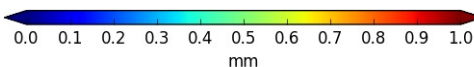
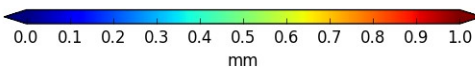
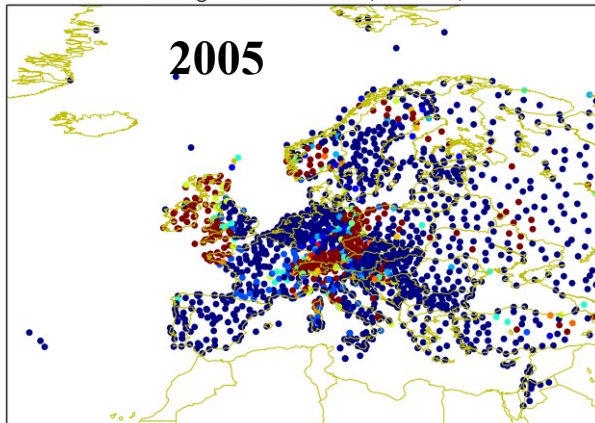
RR-12@MARS 1985061506 (759 sites)

1985



RR-12@MARS 2005061506 (1724 sites)

2005



Merge 2 12h-accumulated
RR files and the 24h RR one.
Need some help and
interaction with WP1
(KNMI, URV) to create
BUFR file for RR24.

Surface observations T2m, Hu2m & RR24

- MF Type 0 Surface observations for 55 years since 1960 are now available on ECFS (Rachid's email 11th Dec 2015)
- Data are available on 3-hourly basis for T2m, Td2m, RH2m, SP and FF. Precipitation is available on daily basis and accumulated over 24 hours, with the following convention:
 - Precipitation text file (e.g, BDCLIM_TYPE0_Q_20141231) for day J accumulated precipitations for the period [J 06 UTC; J+1 06 UTC]
 - BUFR file for J 06 UTC (e.g ob2014123106.bufr), accumulated precipitation over the past 24 hours.

On ECFS:

ec:/rml/uerra/bdclim/type0/text: for text format
(BDCLIM_TYPE0_H_20141231 & BDCLIM_TYPE0_Q_20141231).

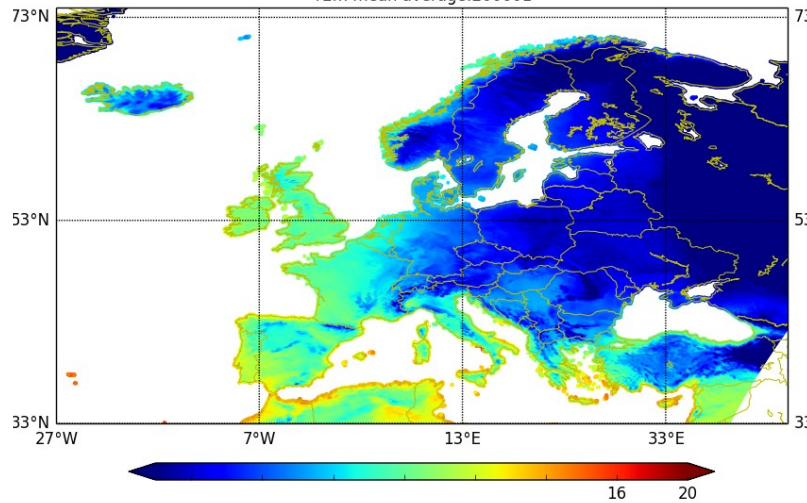
ec:/rml/uerra/bdclim/type0/bufr: for bufr format (e.g, ob2014121306.bufr).

Deliverables Surface re-analysis in UERRA

- M30 : report of ensemble re-analysis → probably delayed to M33-36
- M36 : 5 years ensemble with uncertainties
- 24h for 1 month of analysis T2M and Rh2m → 5 years in 2 months (1 member)
- **Volume space for 1 member:**
 - Analysis file: 0.7 Gb /run
 - => $5\text{years} * 365\text{days} * 4\text{ runs/day} * 0.7\text{ Gb} = 5.11\text{ Tb}$ (T2m and Rh2m)
 - => $5\text{years} * 365\text{days} * 1\text{ run/day} * 0.7\text{ Gb} = 1.28\text{ Tb}$ (RR24)
 - **Total space: 6.4 Tb (for 5 years) for native binary FA files**
- **2006 re-analysis is done for the reference analysis T2m, Hu2m, 2007 started.**
- **RR analysis will start soon for 2006 and the ensemble with the perturbed obs for T2m and Rh2m.**

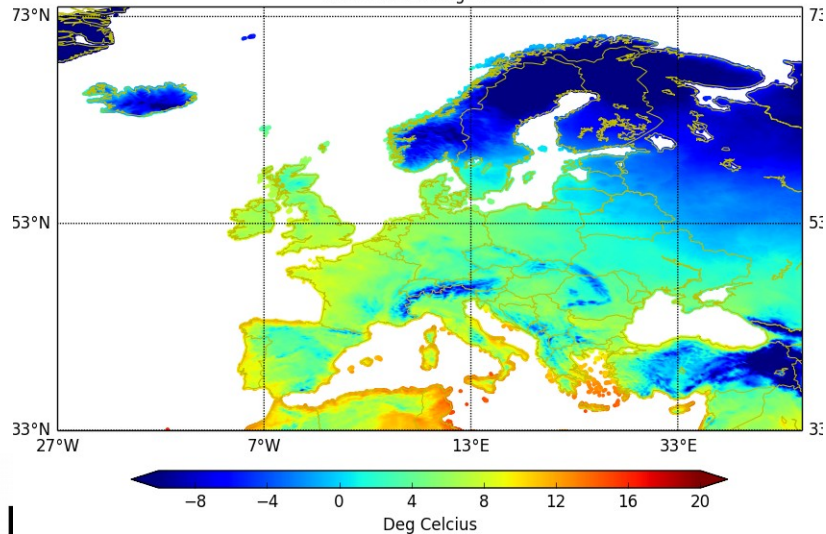
Monthly mean : T2m

UERRA 2006 January T2M



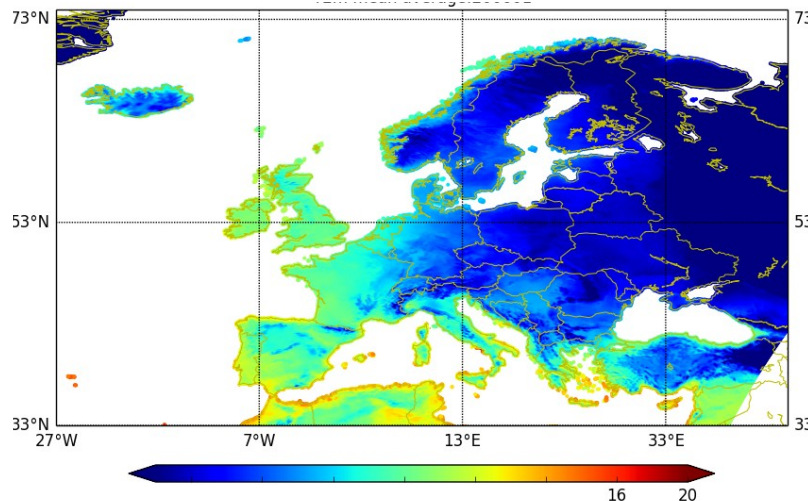
EURO4M 2007 January T2M

T2m mean average:200701

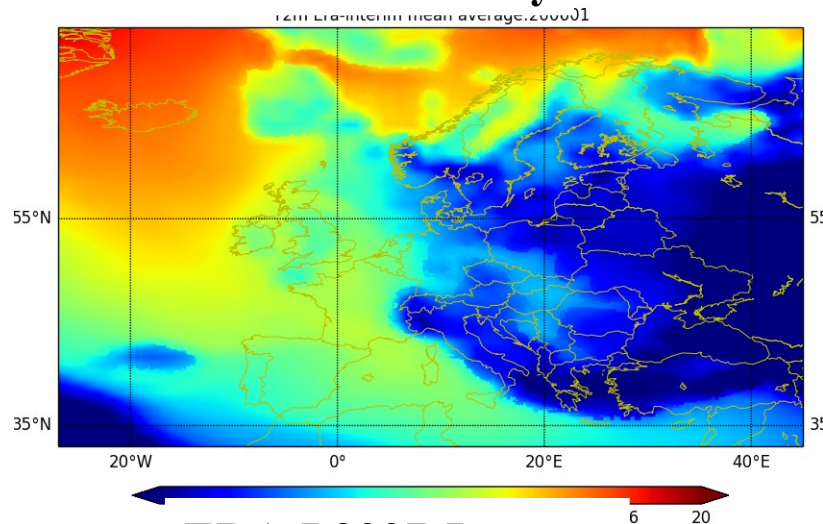


Monthly mean : T2m

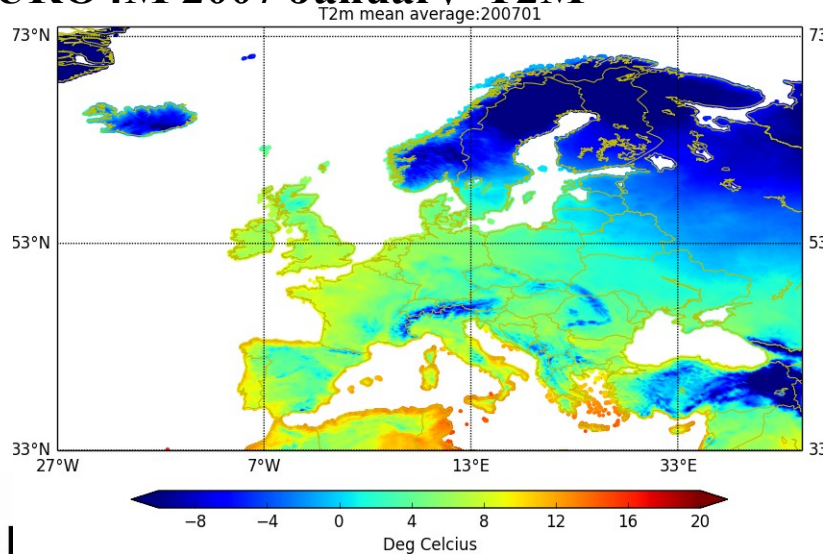
UERRA 2006 January T2M



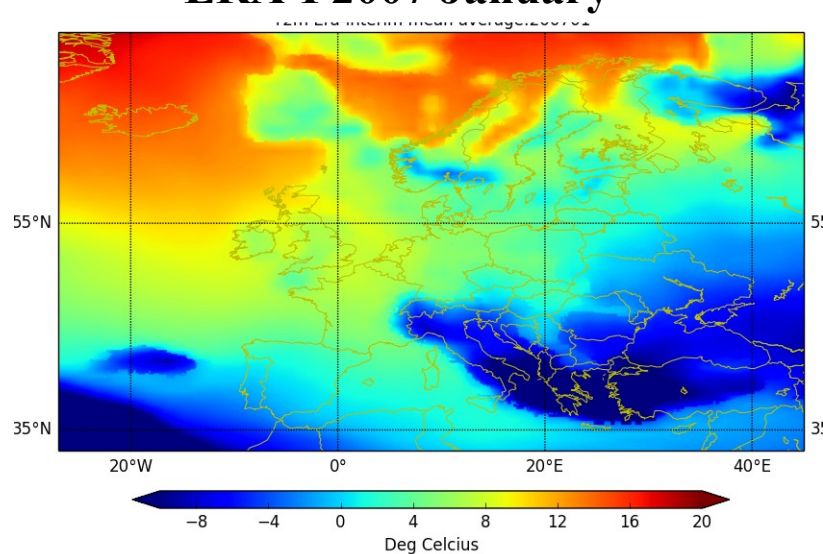
ERA-I 2006 January



EURO4M 2007 January T2M



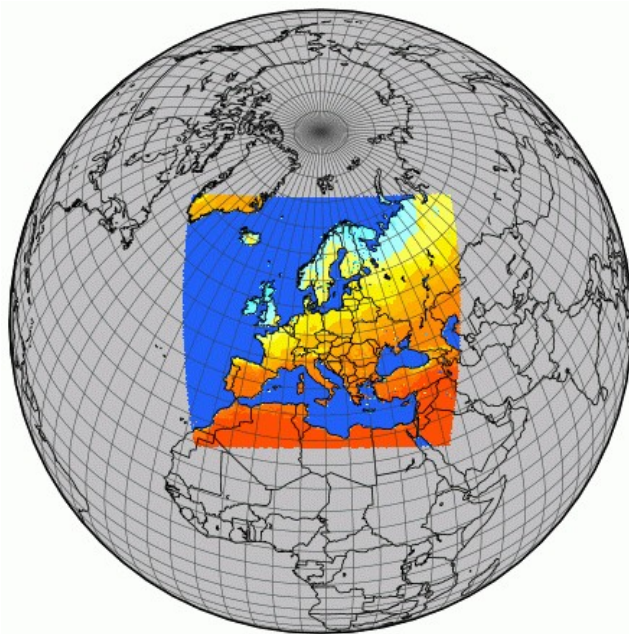
ERA-I 2007 January



Conclusions & perspectives

- # Fine scale comes from the background (especially for RR). The analysis, due to the observation network, does not modify the "horizontal scale".
- # For the T2m, Hu2m uncertainties (period 2006-2010) : the perturbed observation method with a background from HARMONIE-ALADIN at 11Km (from SMHI) downscaled at 5.5km will be used.
- # For the RR24 uncertainties :
 - # The cheap Ens-6 for RR is clearly under dispersive
 - # The Ens-8 is less under dispersive but very expensive with 4 members from a full model at 5.5km. So the perturbed observation method will be evaluated for the RR ensemble analysis . Maybe, perturbed background will be associated with perturbed observation ?
- # WP1 (URV,KNMI) and MF : common effort to create observations file (BUFR) for RR24 especially before the 80's.

Thank you for your attention! Questions ?



Acknowledgements

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