Surface re-analysis @ 5.5km over Europe

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& C. Soci (MF stay → Oct 2015, now ECMWF)

Outline

- Surface re-analysis MESCAN for T2/Rh2m and precipitation analysis (Soci et al. 2016)

- Ensemble system for 2006-2010

  - For precipitation

  - For 2m temperature & relative humidity


- Production status

- Conclusions

UERRA surface re-analysis 1961-2015

- **2D surface analysis at 5.5km for 1961-2015 with precipitation analysis (MESCAN)**

3D Re-analysis at 11 km

Downscaling

5.5 Km over Europe

Observations

2D surface analysis at ~5 Km (MESCAN)
T2m, Rh2m, Wind, Rainfall

SW↓, LW ↓

SURFEX= surface and a complex snow model (Crocus)

SWE 2007-2008 mm

SWE 2009-2010 mm

Snow depth, snow cover, snow albedo, snow density, soil moisture, etc …
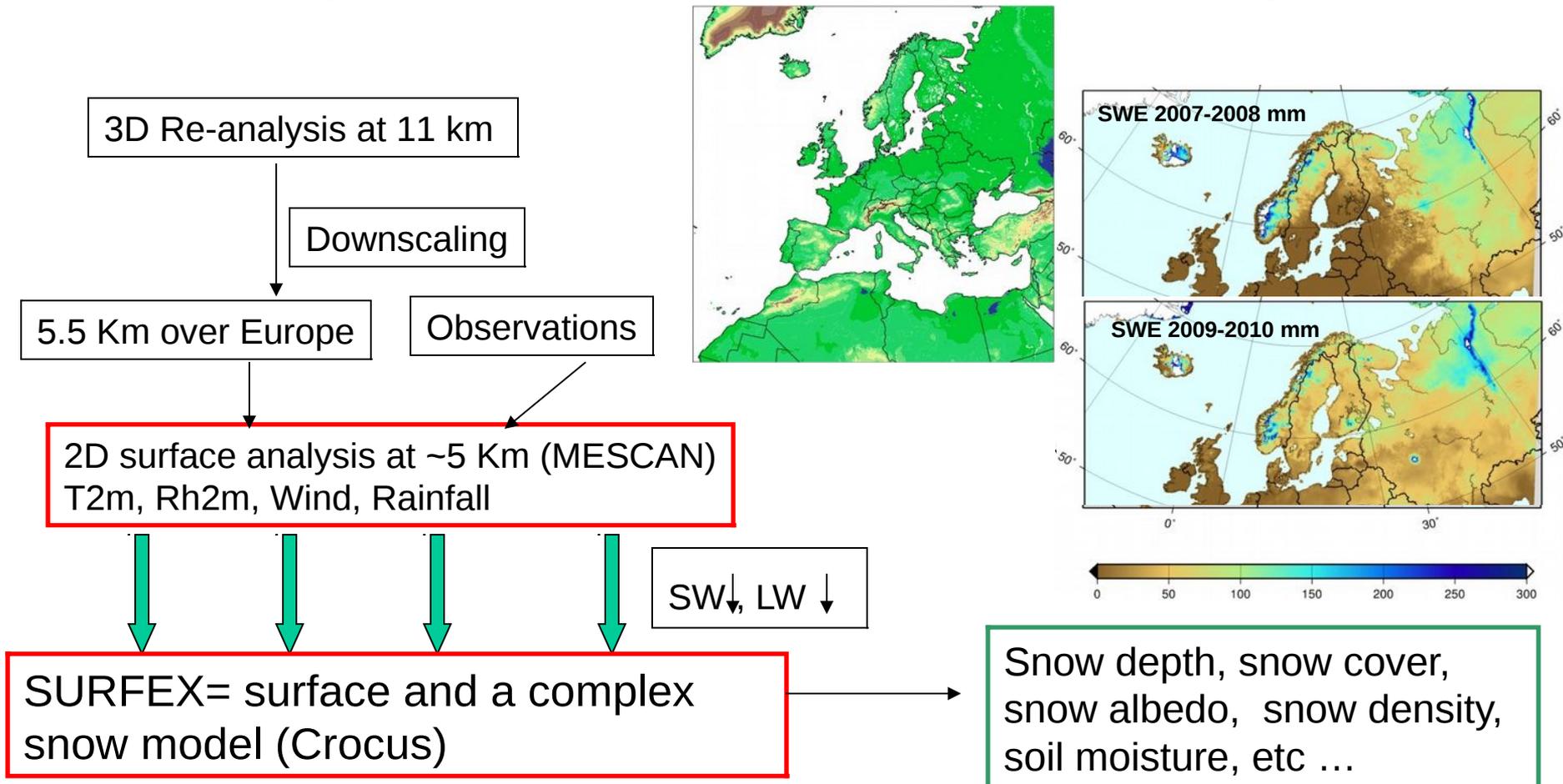
Surface observations T2m, Hu2m & RR24

\# **Surface observation density is a critical factor,** without enough observations the reanalysis tends to drift towards the model climatology.

\# A sharp increase in observation density might lead to misleading results. Particularly, for surface trend interpretation..

NUMBER OF SYNOP OVER EUROPE FROM ECMWF
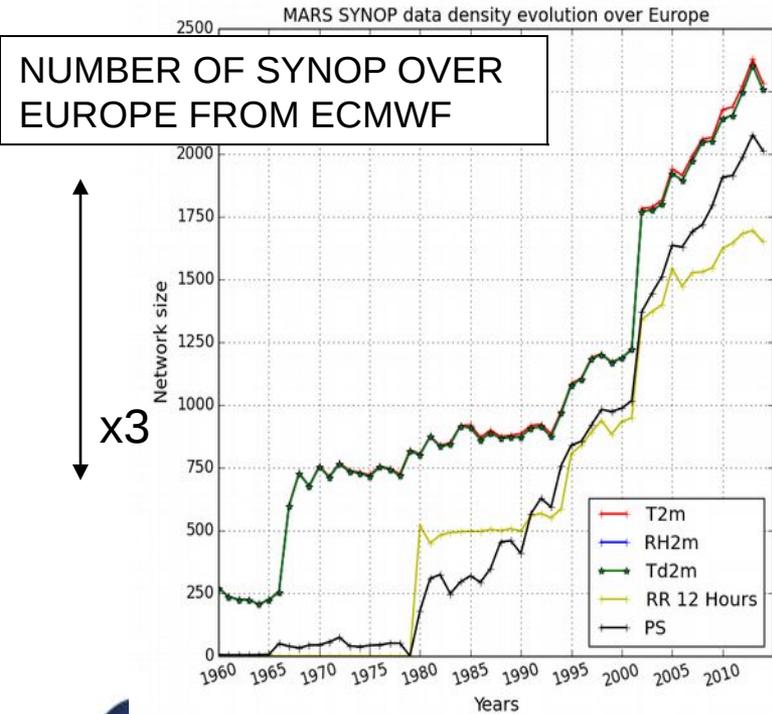
T2m obs from ECMWF 2010060112
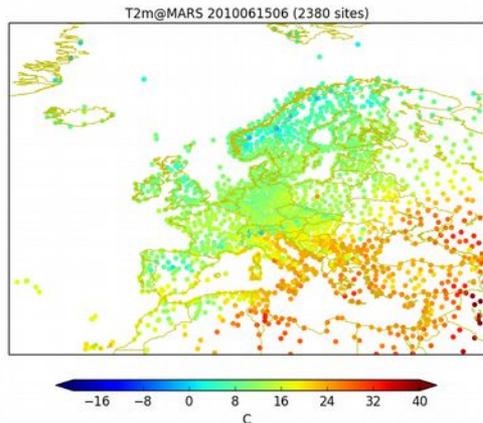
T2m obs 1965060112
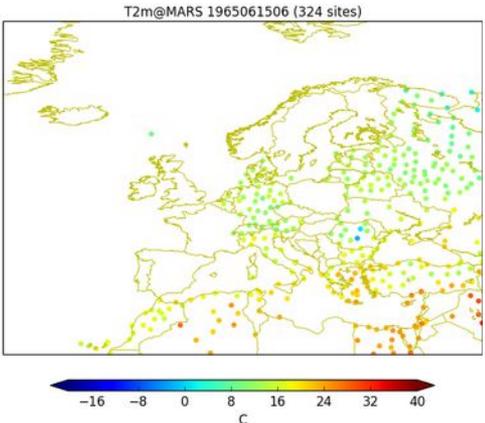
Need to merge some additional from MF, SMHI, Norway etc ..

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High & low surface observation density patterns for the period (2006-2010):RR24

Low density (~ 470 obs)

High density (~ 4540 obs)

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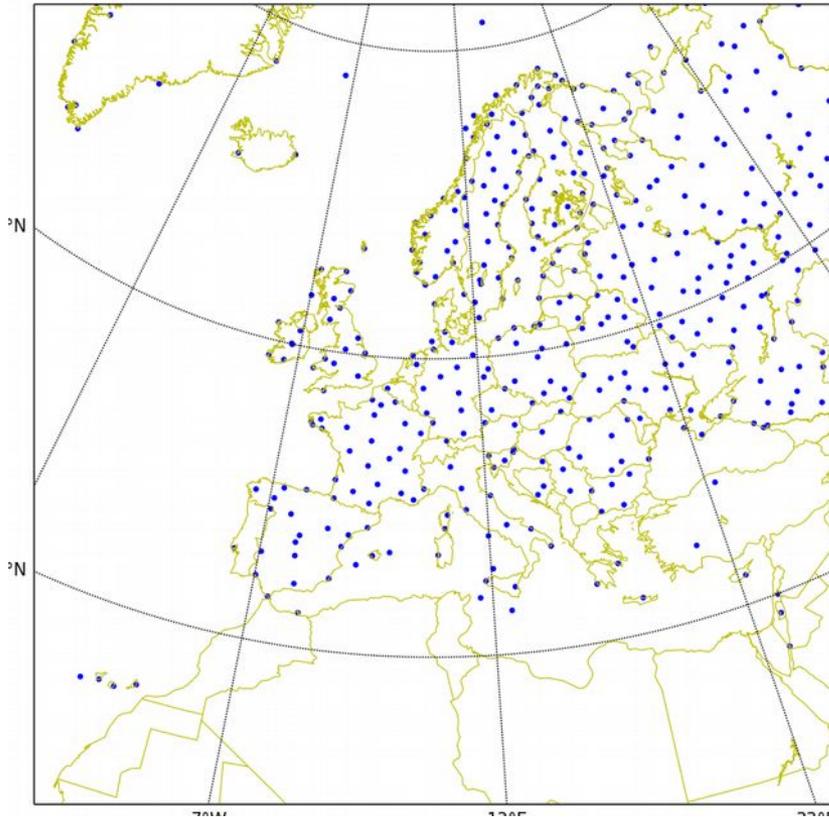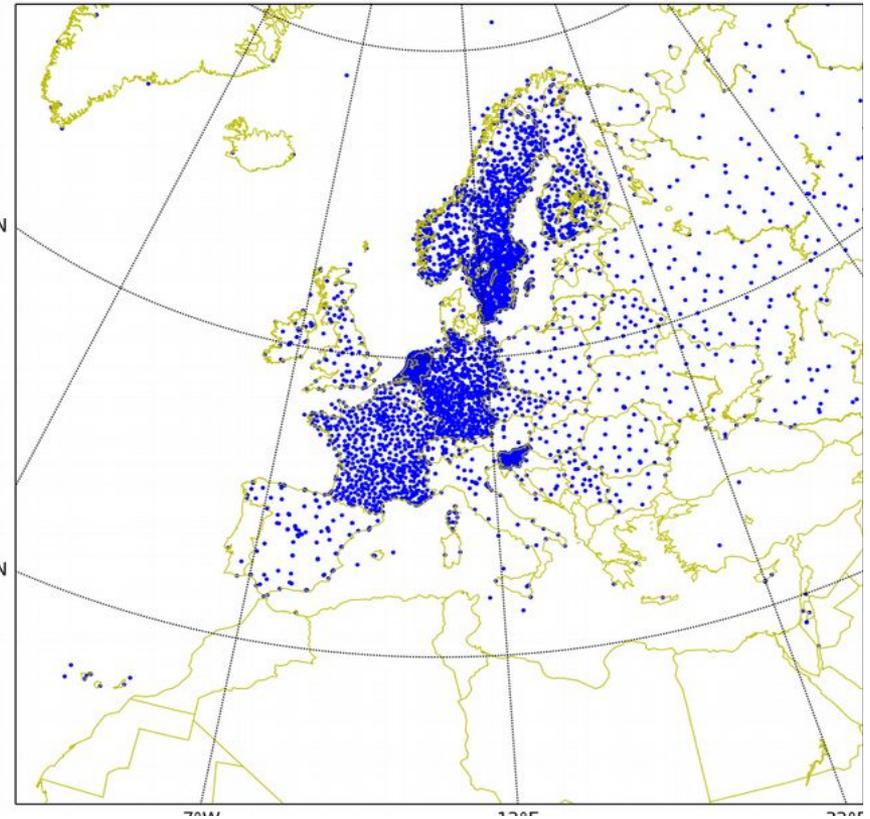
Effect of observation density and the physics on the RR surface reanalysis (JJA2010)

Impact of network density

2010 jja rr acc./aldds_ldnet-aldds_rfnet

Impact of model physics

2010 jja rr acc./aldds_rfnet-alrds_rfnet
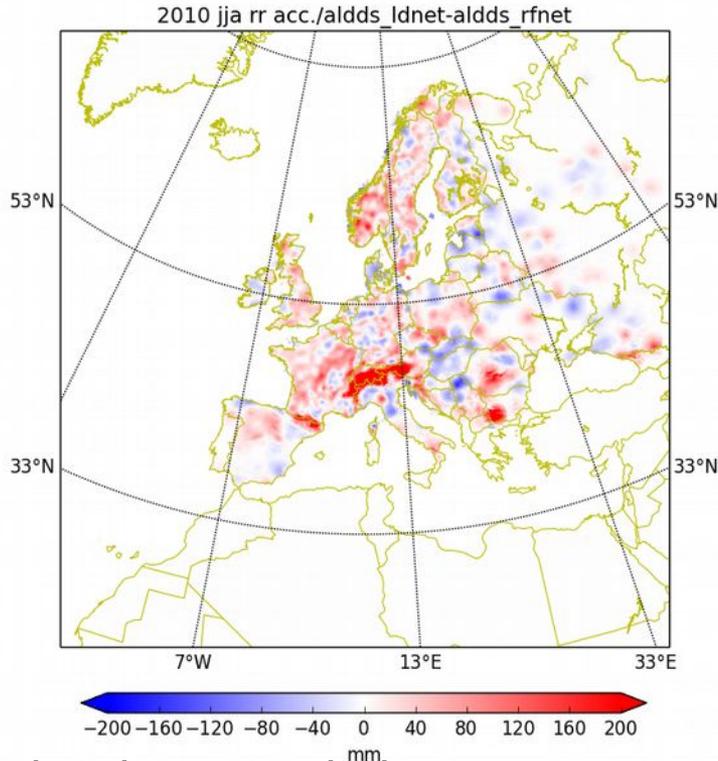
Low density network does not constrain enough model precipitations particularly over mountain
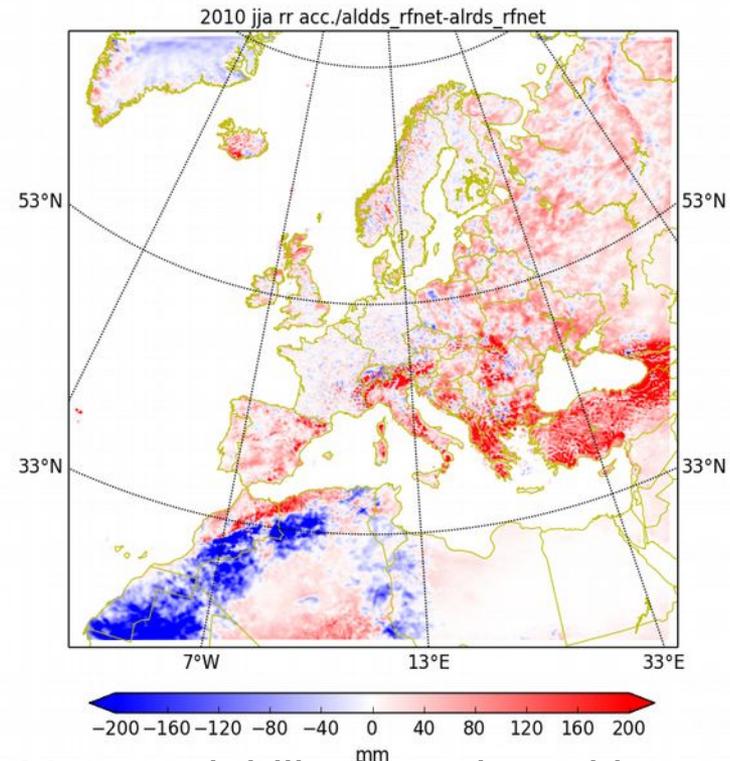
More variability in region without observations due to the physics in the model especially over North Africa and Turkey

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High & low surface observation density patterns for test-bed period (2006-2010): T2m & RH2m

Low density (~830 obs)
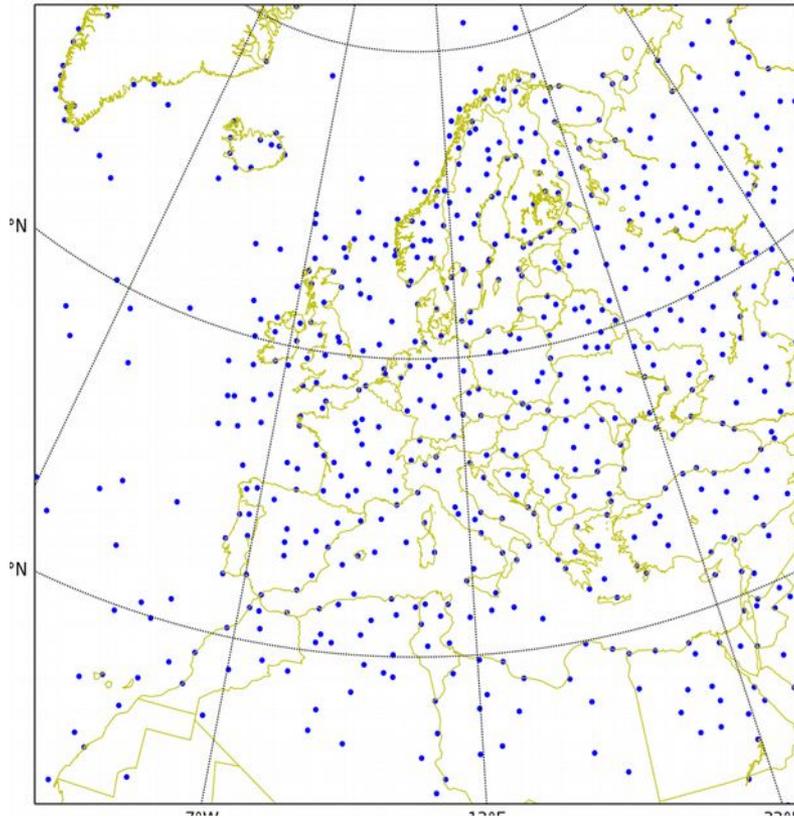
High density (~ 3080 obs)

UERRA Show case 23–24 November 2016, ECMWF, Reading, UK
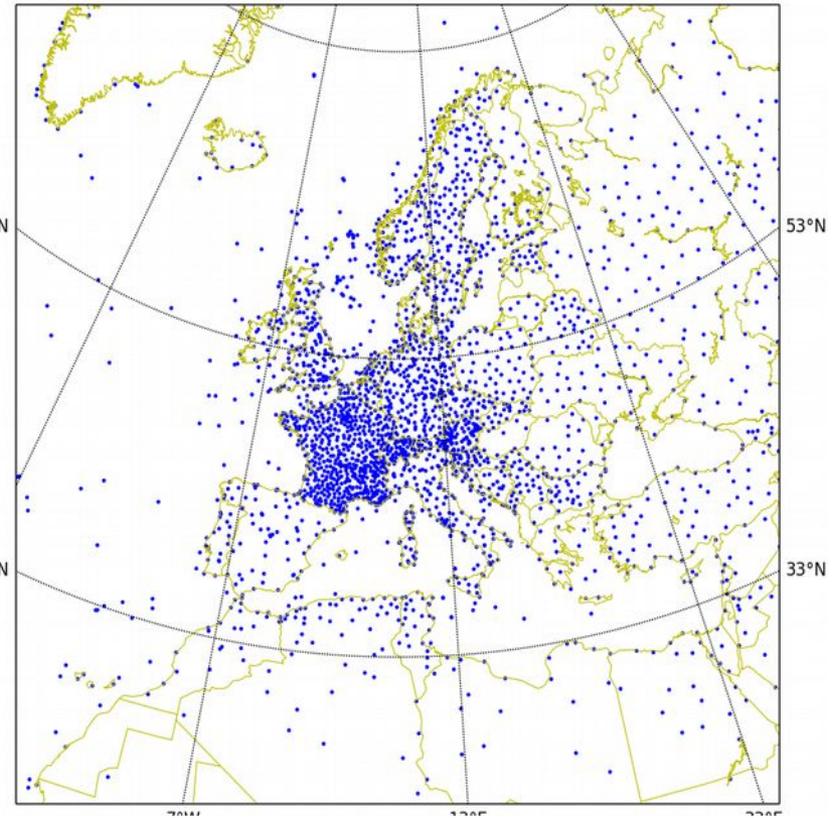
Effect of observation density and model physics on the T2m surface reanalysis (Jan 2006)

Impact of network density

Impact of model physics
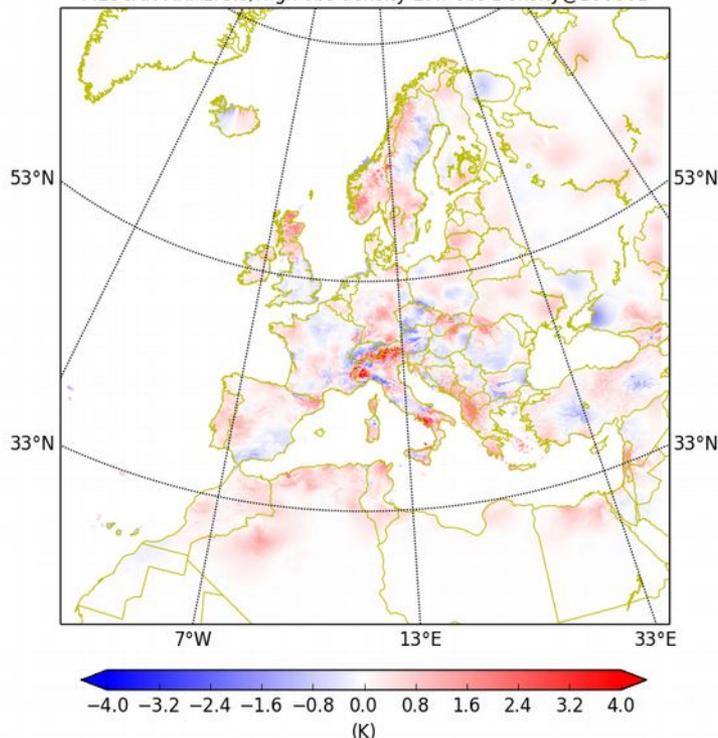

More impact in mountainous area: fine scale, larger error with snow ...
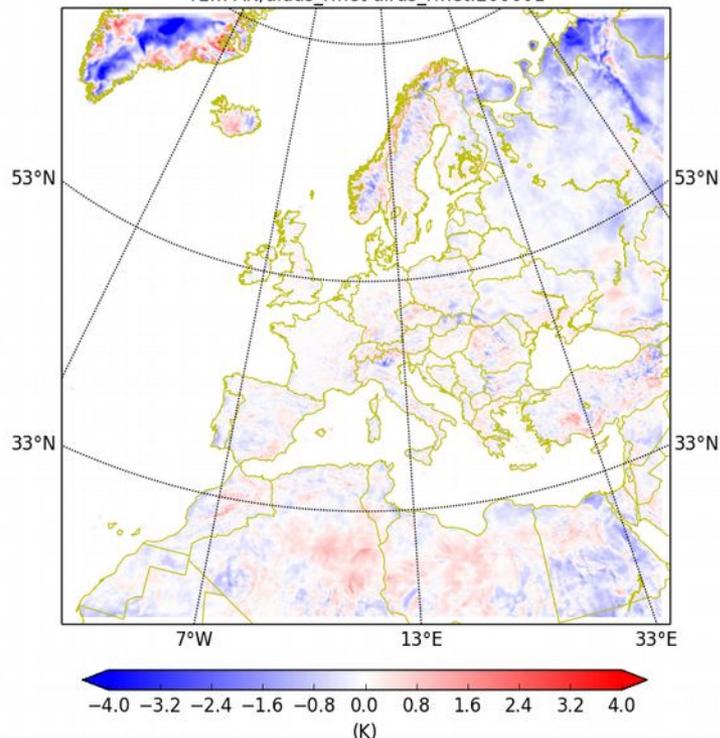
More impact where observations are sparse !

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

Ens(2) HARMONIE-ALADIN @ 11km

N=2, 6-h forecast @ 11km

N=2   Analysis @ 11km

Static Downscaling

Dynamical Downscaling with ALADIN & ALARO models (with SURFEX)

N=2, 6-h Forecast @ 5.5km (used as Background)

=> N=2, 6-h Forecast@5.5km (used as Background)

● **obs+ noise**

● **obs (hd or ld)**

MESCAN

MESCAN

SWd, LWd, Wind, Ps, T2m, HU2m, RR24

SWd, LWd, Wind, Ps, T2m, HU2m, RR24

6 + ? analysis members @ 5.5km

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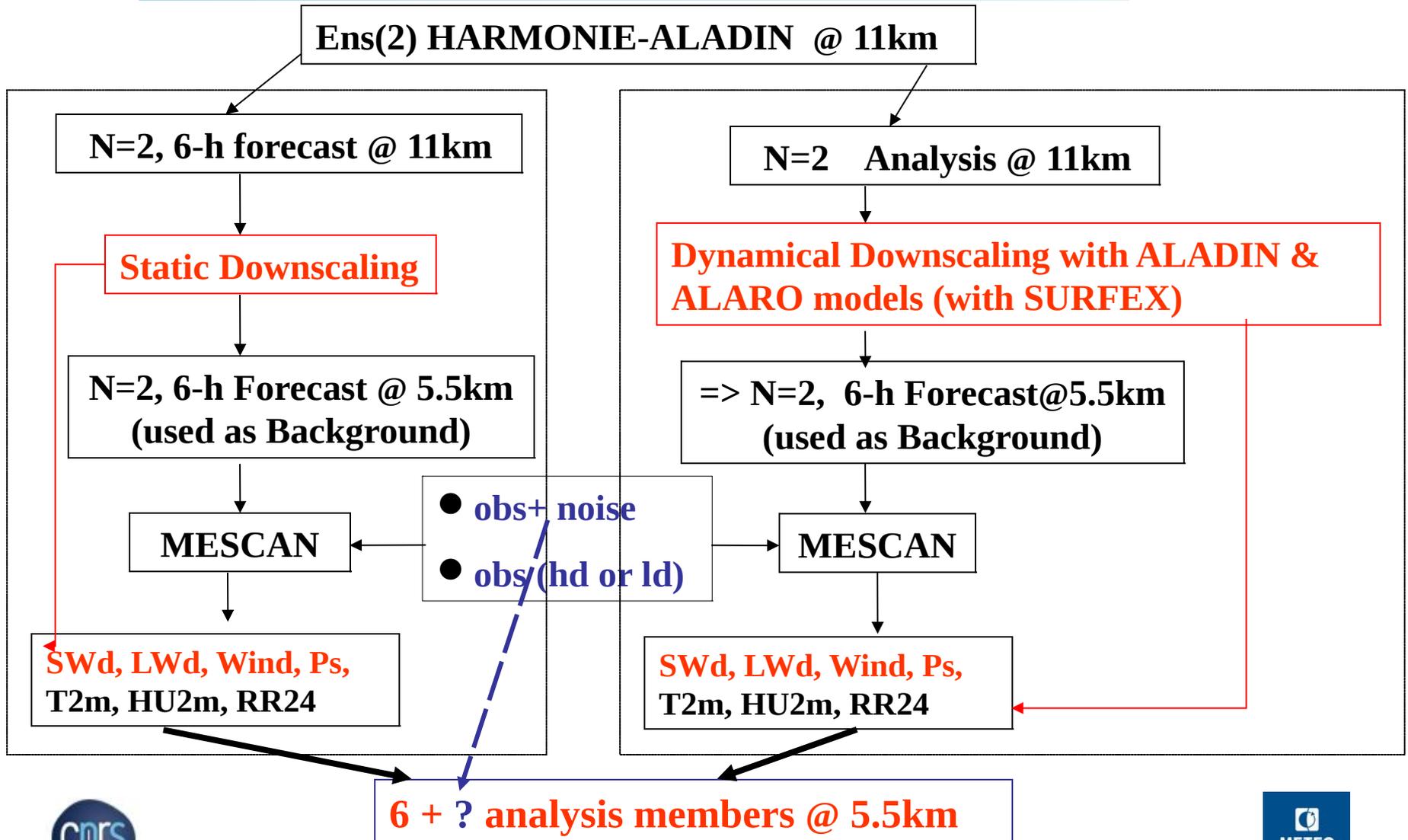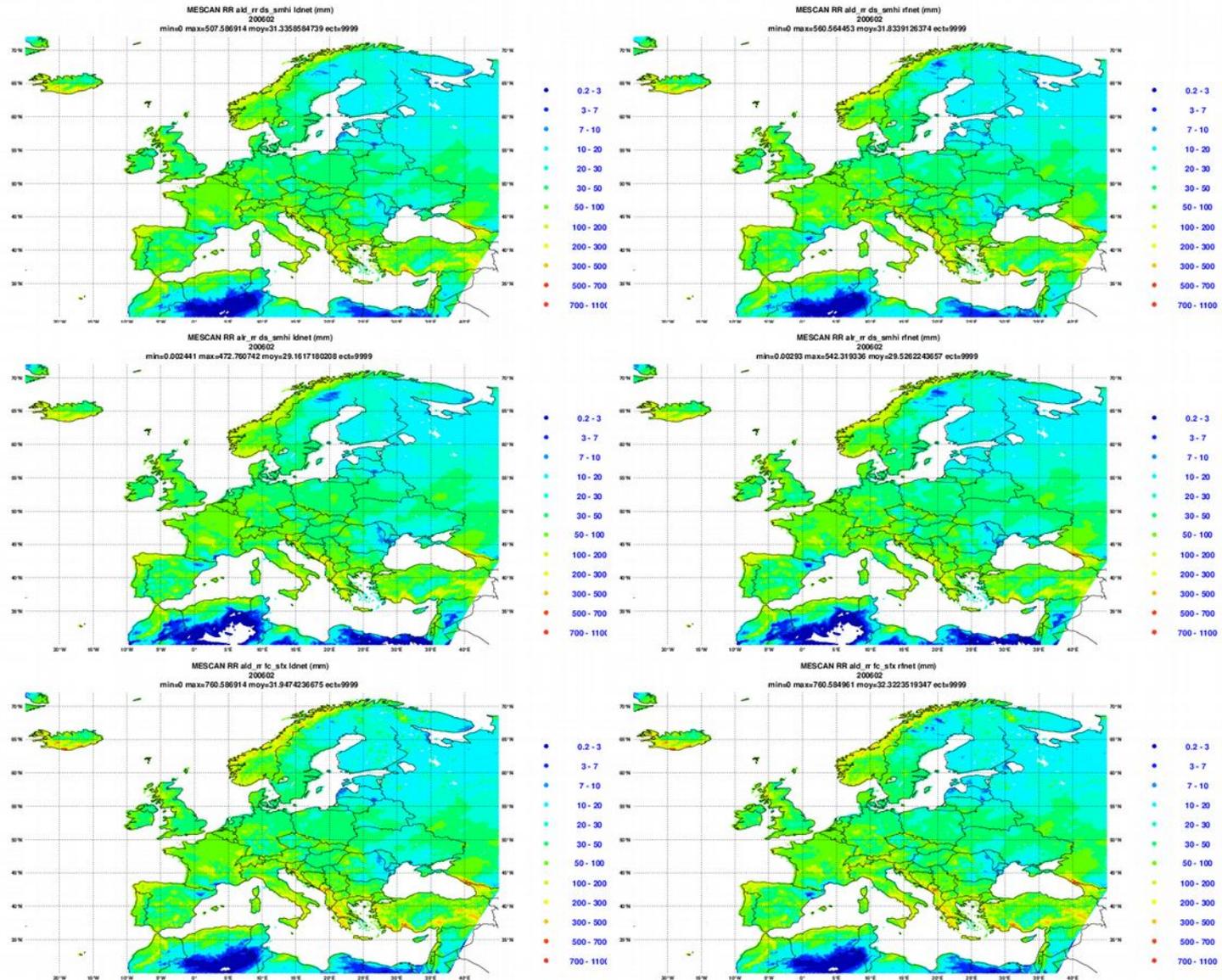
RR24 : Ensemble members for 2006-2010 over Europe

RR24 : Ensemble members for 2006-2010 over Europe
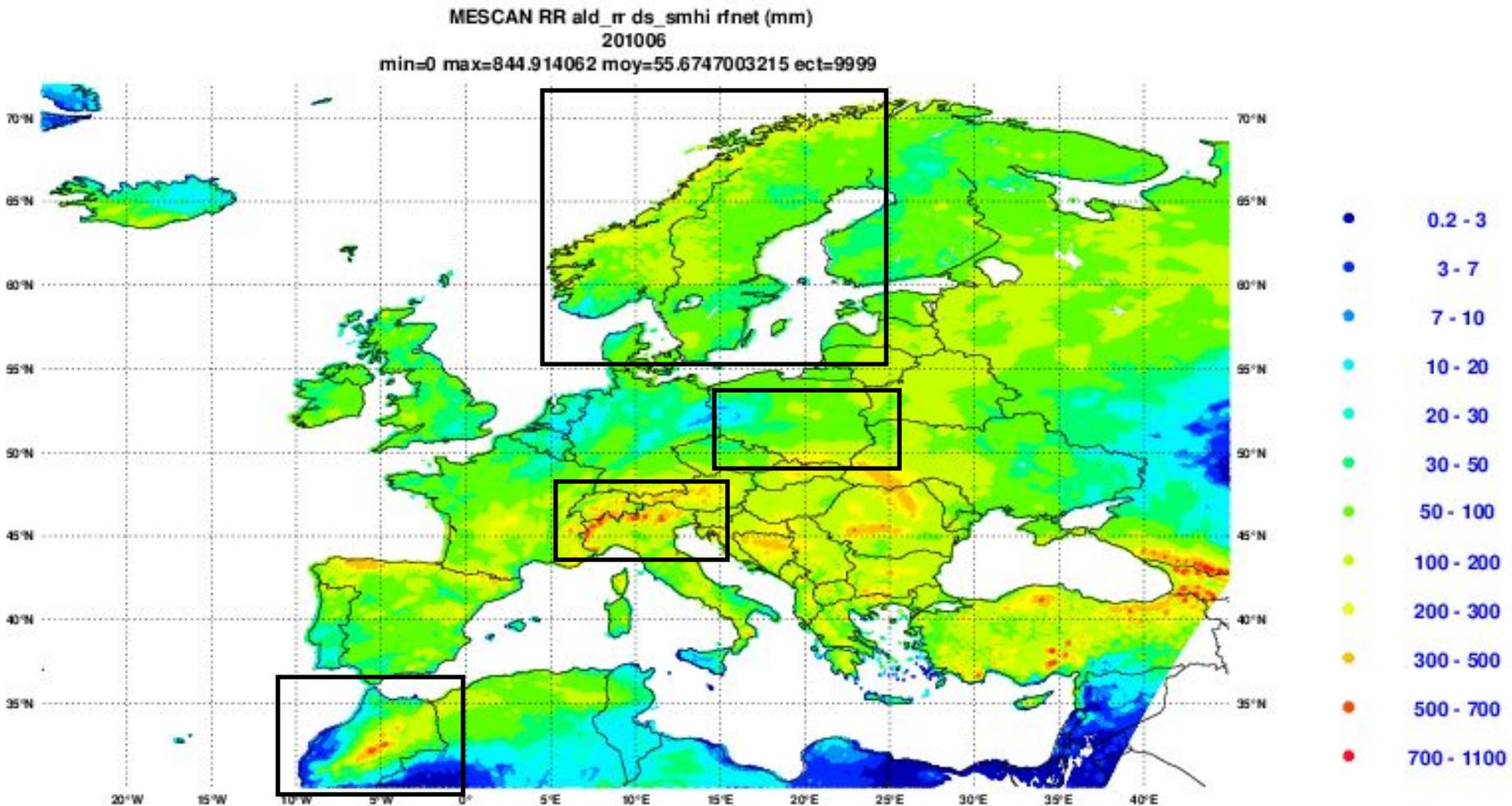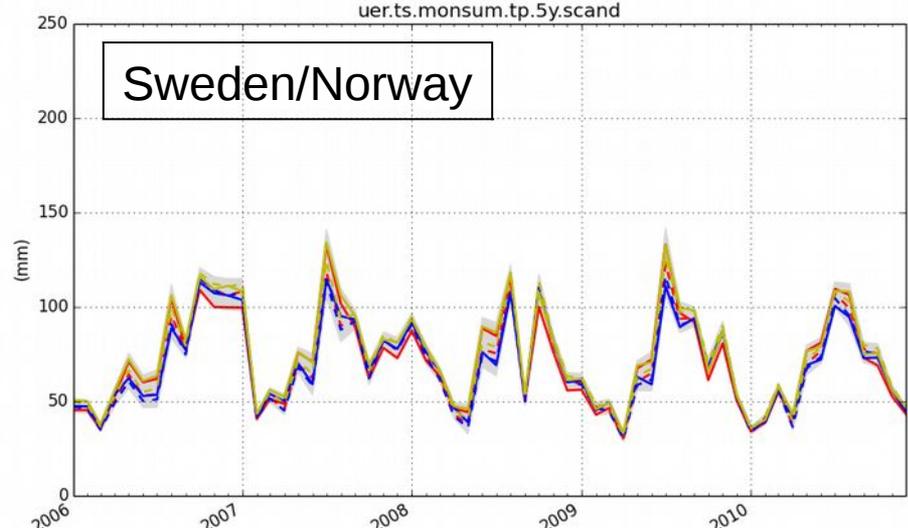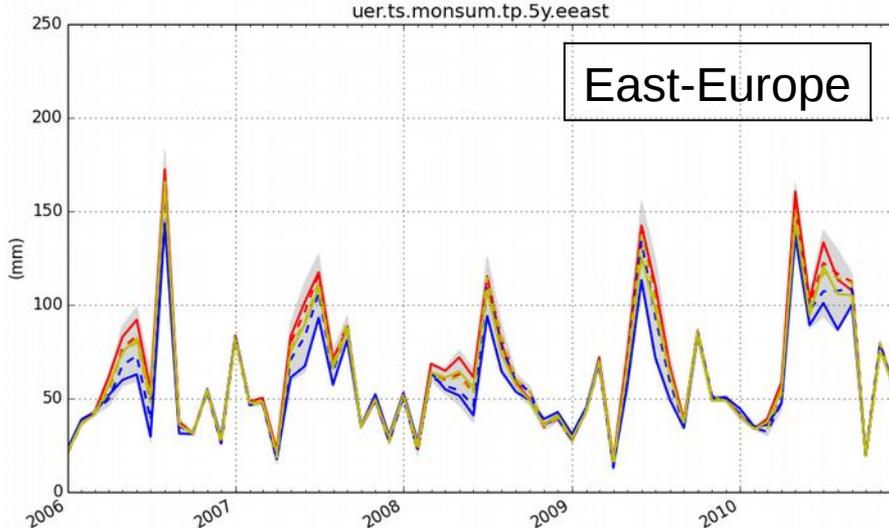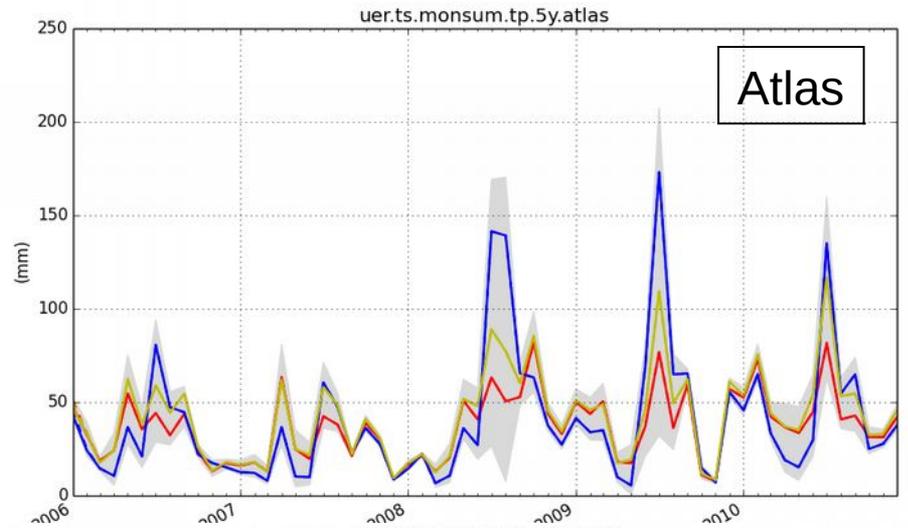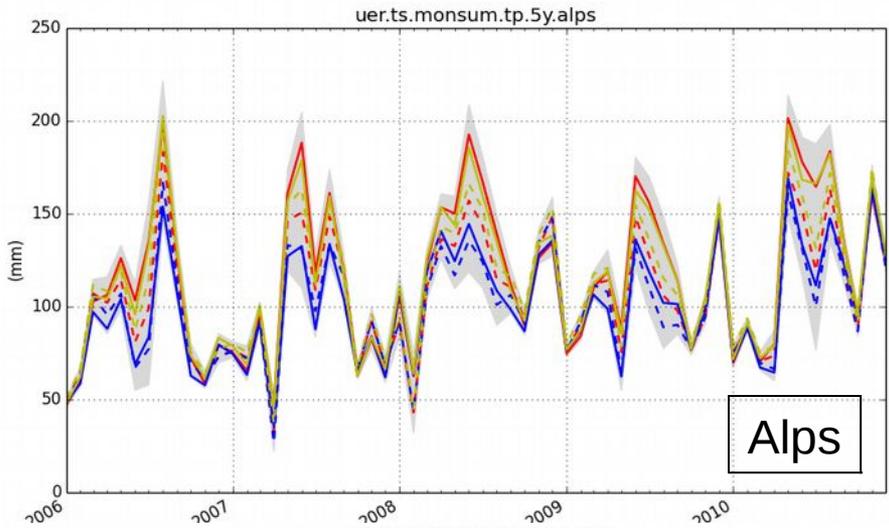
MESCAN RR ald_rr ds_smhi rfnet (mm)
201006
min=0 max=844.914062 moy=55.6747003215 ect=9999

- 0.2 - 3
- 3 - 7
- 7 - 10
- 10 - 20
- 20 - 30
- 30 - 50
- 50 - 100
- 100 - 200
- 200 - 300
- 300 - 500
- 500 - 700
- 700 - 1100

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RR24 : Ensemble members for 2006-2010 over Europe

Extreme precipitation events of 15 June 2010
## 8 members Bg RR24h
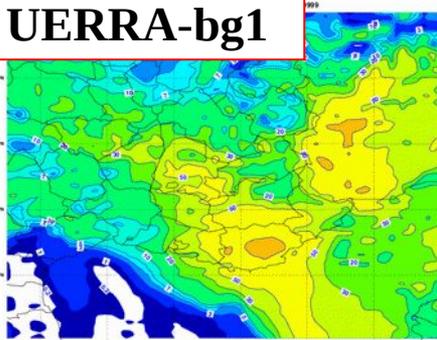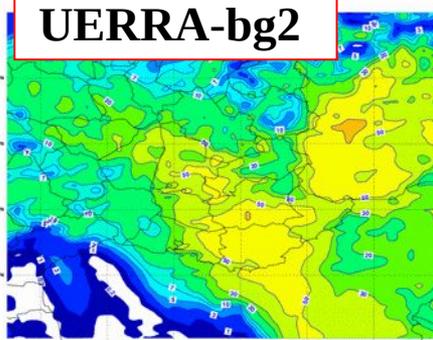
UERRA-bg1 | UERRA-bg2 | UERRA-bg3 | UERRA-bg4
UERRA-bg5 | UERRA-bg6 | UERRA-bg7 | UERRA-bg8
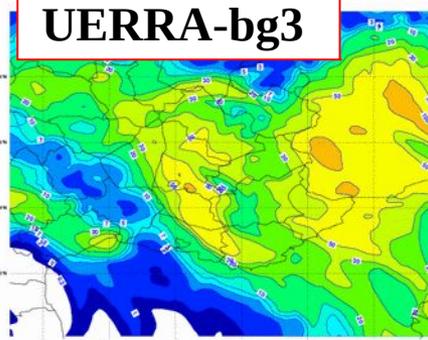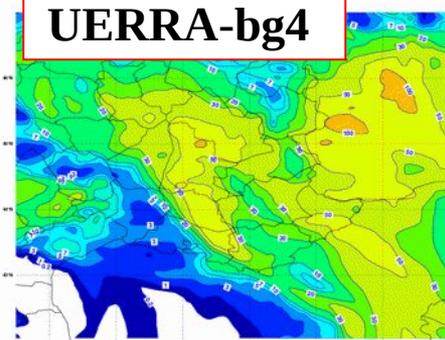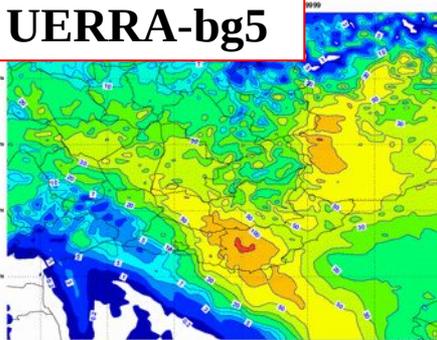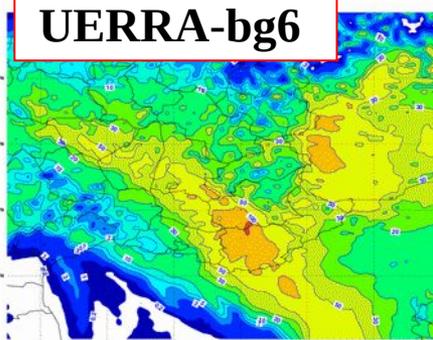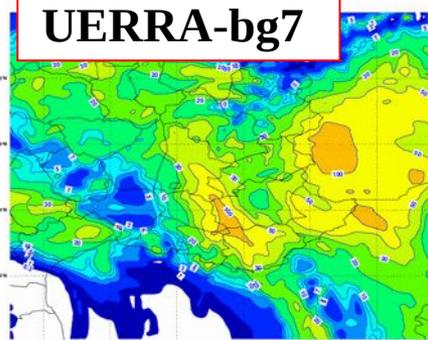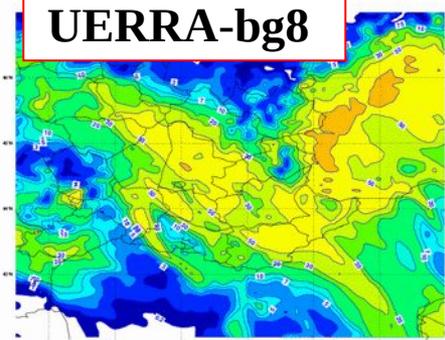
EURO4M-bg
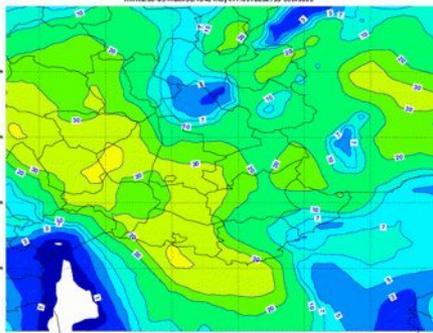
Extreme precipitation events of 15 June 2010
8 members Bg RR24h

UERRA

EURO4M

UERRA Show

ERA-INTERIM

Snow depth simulation at Sodankÿla (Finland) over the period 2007-2010
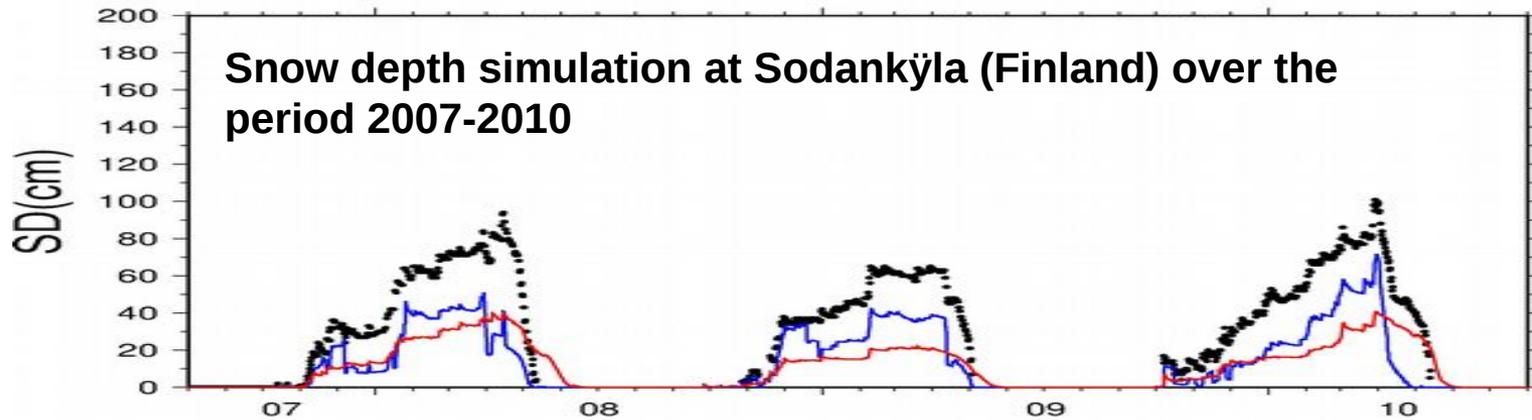
Observation, **SURFEX forced by MESCAN**, SURFEX forced by ERA-INTERIM


H (W/m2) Sodankÿla

LE (W/m2) Sodankÿla
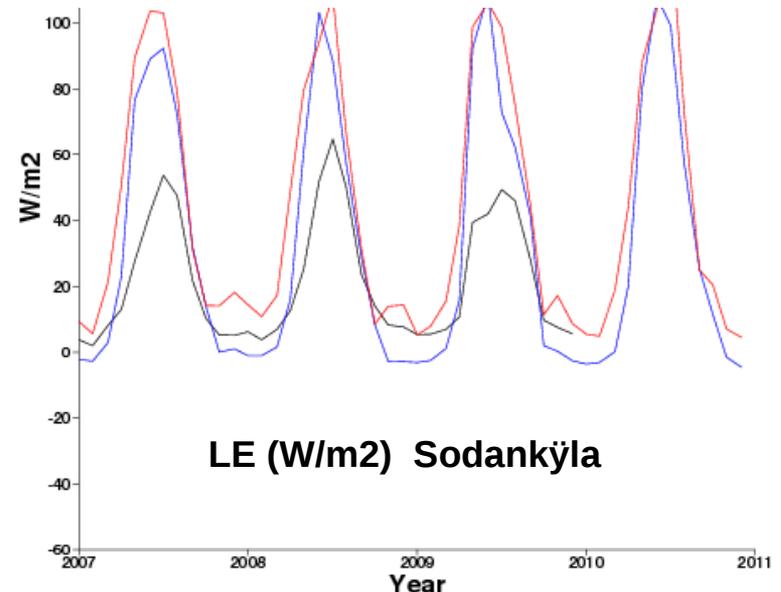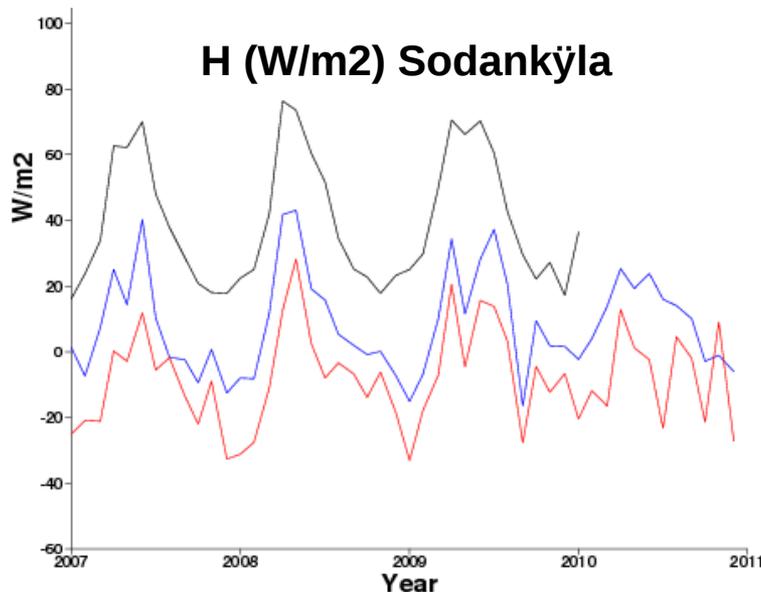
UERRA Snow case 23-24 November 2016, ECMWF, Reading, UK

Ensemble (6-members) MEAN and SD of T2m Analysis (June 2006)

Ensemble Mean

Ensemble Mean SD

T2m-Ens-Mean/200606

T2m-EnsMean-SDev/200606
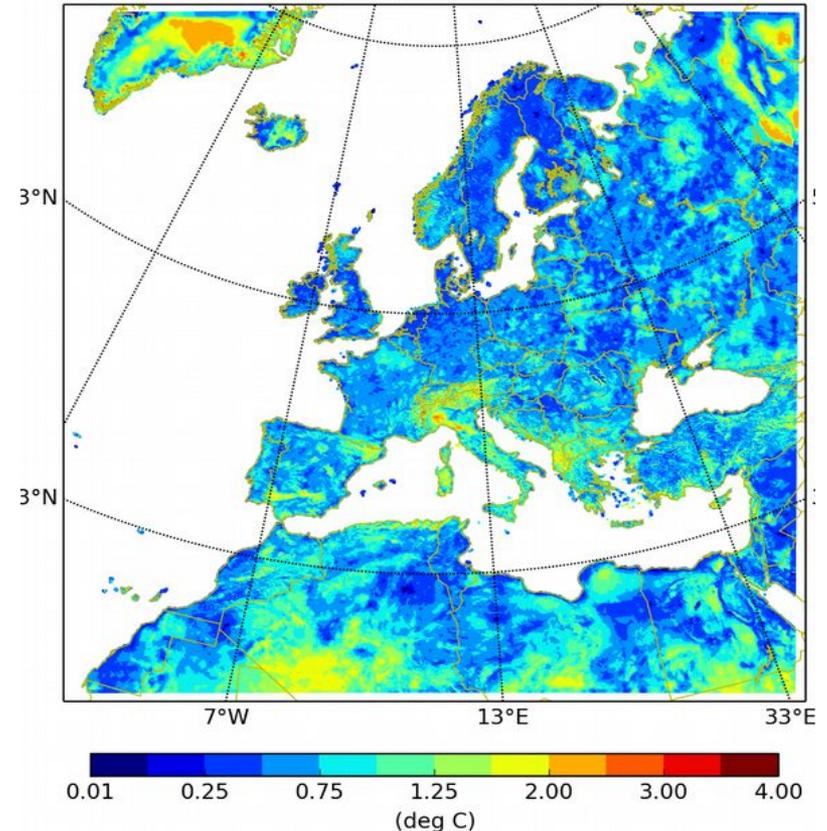
SD is below < 1° where observations are dense and in flat area.

Application : The coupled hydro-meteorological modelling system MESCAN-SURFEX-TRIP
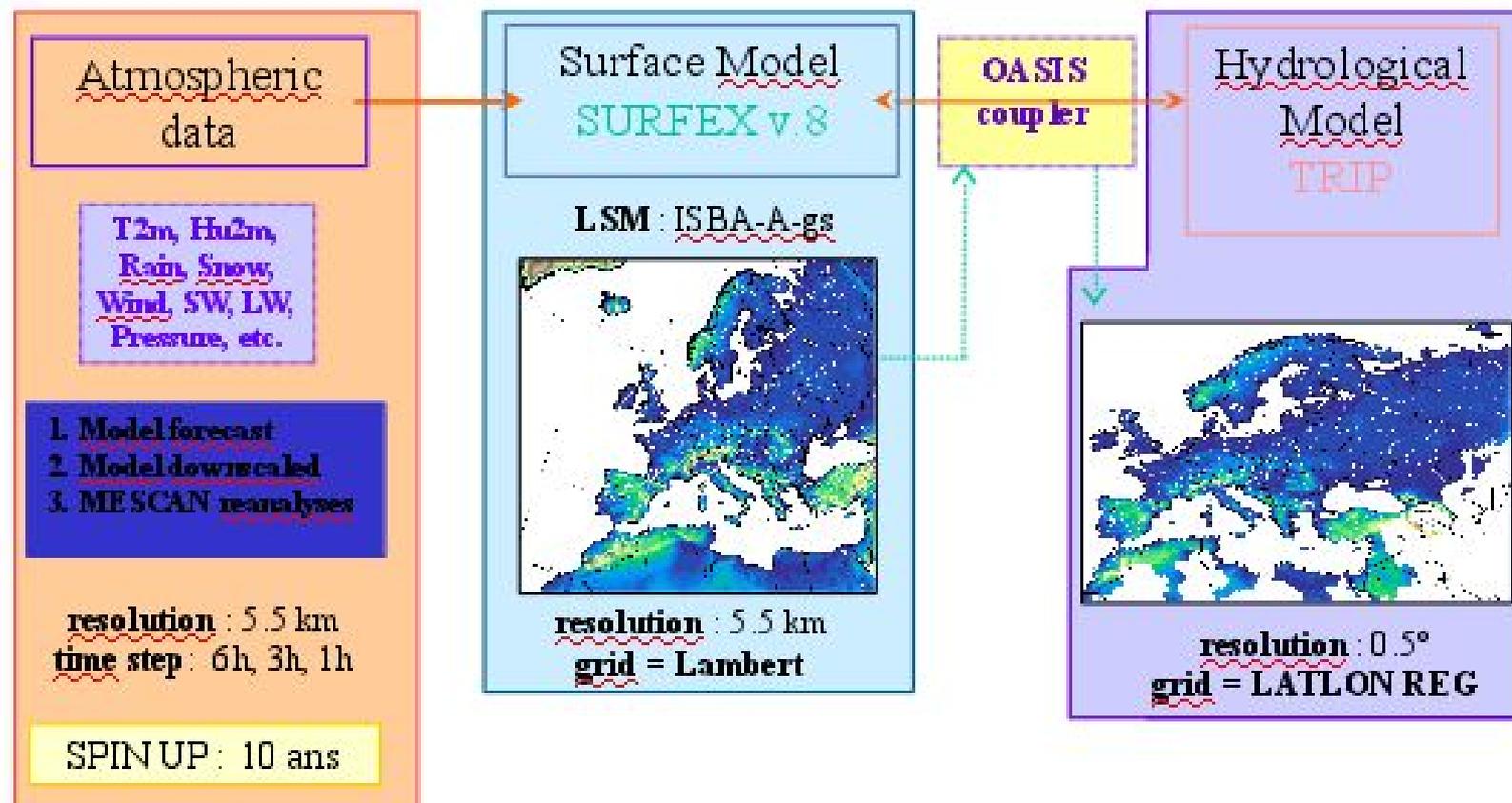
Application : The coupled hydro-meteorological modelling system MESCAN-SURFEX-TRIP
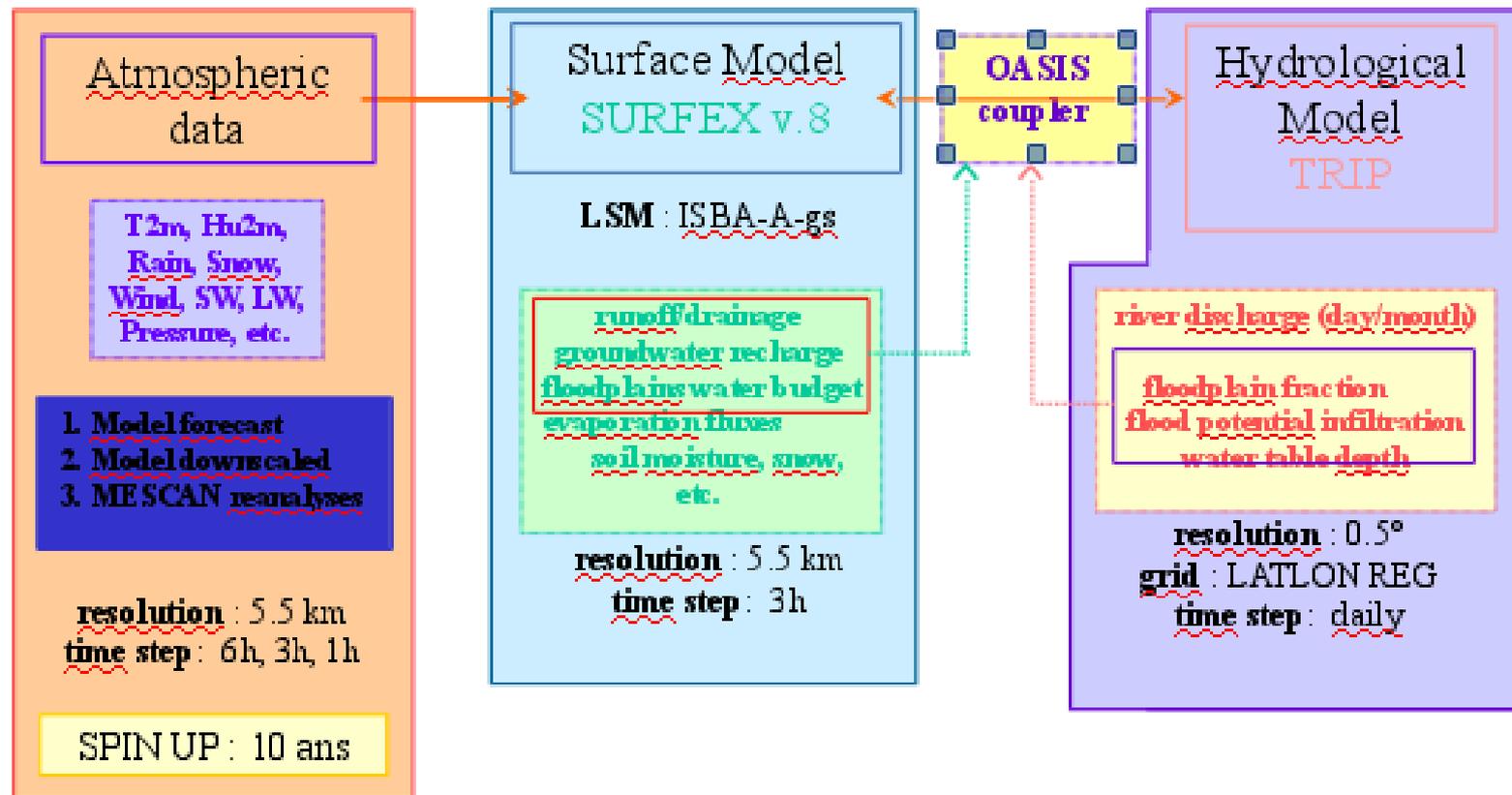
The coupled hydro-meteorological modelling system : preliminary results year 2008
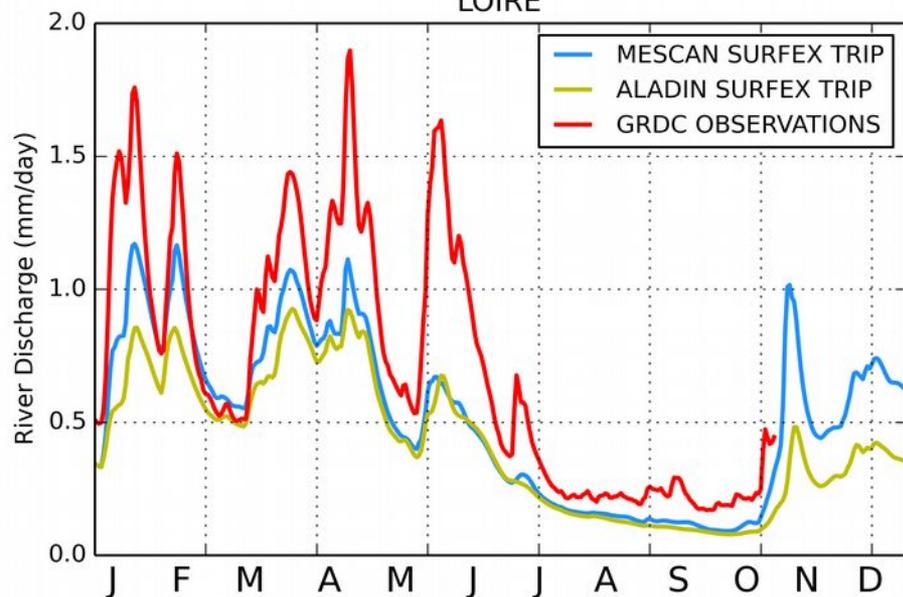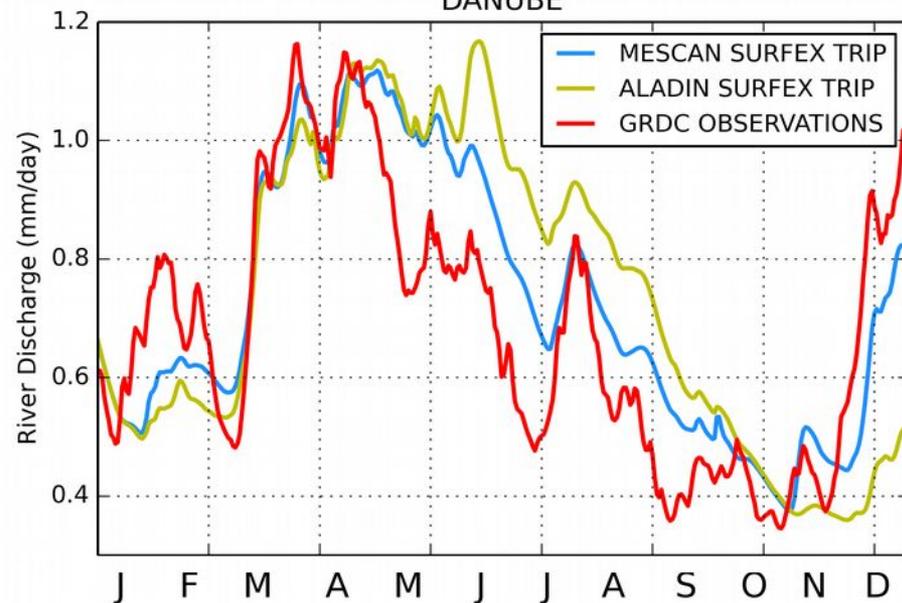
Production status

➤ **For the period 2006-2010**:

  ➤ Ensemble is complete for the T2m/Hu2m with 8 members and for the 24H precipitation analysis with 6 members.

  ➤ Grib1 file are available BUT not yet in GRIB2 and not available on Mars.

➤ **The reference production has started based on the new downscaled SMHI-3Dvar-ALADIN :**

  ➤ First we need to downscale the SMHI-ALADIN background (T2m, Hu2M and precipitation)

 ➤ Period done: 1961-1964, 1970-1971, 1990-1993, 2000-2002, 2006-2012

Production status

➢ **The reference production has started based on the new downscaled SMHI-3Dvar-ALADIN :**

   ➢ Precipitation analysis done for 2006-2010 : one year in 1.5 days BUT we will need probably to re-run some periods due to suspicious observations …

July 2007
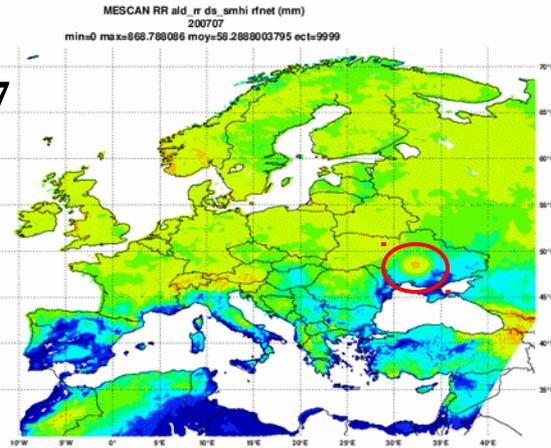
Aug. 2008
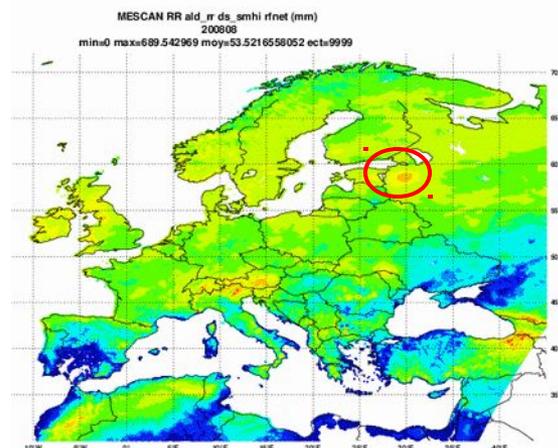
   ➢ Temperature/Relative humidity done for 2008.

      ➢ 2006 almost finished 15th November & 2007 29th july

Thank you for your attention! Questions ?

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