55 years surface re-analysis over Europe at 5.5km

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UERRA User Workshop
30 November 2017, URV, Tarragona

UERRA Uncertainties in Ensembles of Regional ReAnalyses

UERRA surface re-analysis 1961-2015 : MESCAN-SURFEX-TRIP

- 2D surface analysis at 5.5km for 1961-2015 with precipitation analysis

3D Re-analysis at 11 km (SMHI)

Downscaling

5.5 Km over Europe
SW,LW,Wind,T2m,Hu2m,RR24

Observations

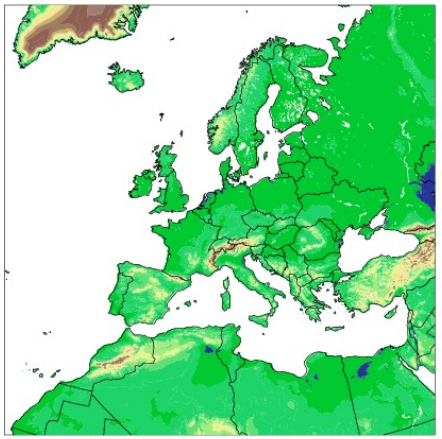
Wind,
Sw↓ Lw↓

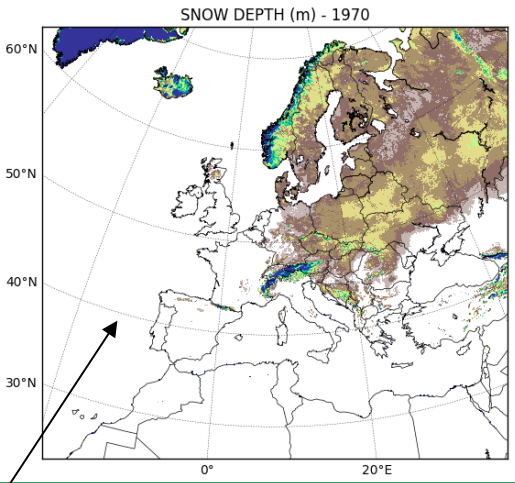
MESCAN surface analysis
T2m, Rh2m, RR24

SURFEX-Crocus (Vionnet et al. 2012)

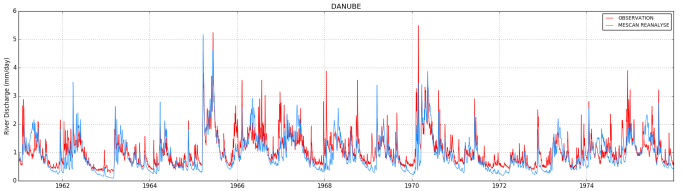
OASIS coupler

Hydrological model TRIP 0.5°





Snow depth, snow cover, snow albedo, snow density, soil moisture, etc …



river discharge (day/month), floodplain fraction,
flood potential infiltration ..

Ensemble with 8 members
ONLY 2006-2010 (UERRA report D2.9)

Two 3D Re-analysis at 11 km (SMHI)

Downscaling

Dynamical adaptation with ALADIN at 5.5km

2 bg

1 bg

5.5 Km over Europe
SW,LW,Wind,T2m,Hu2m,RR24

Observations
2 network + pert

Wind,
Sw↓ Lw↓

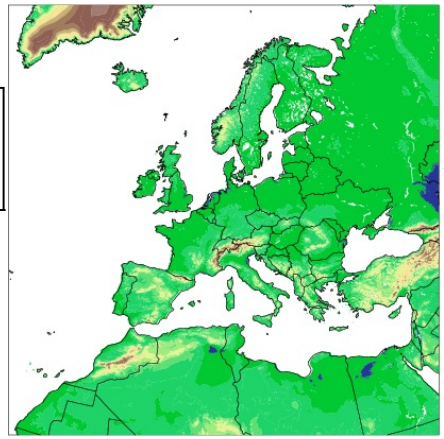
MESCAN surface analysis
T2m, Rh2m, RR24

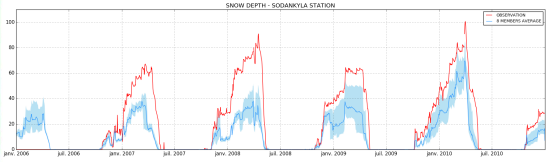
8 forcings fields

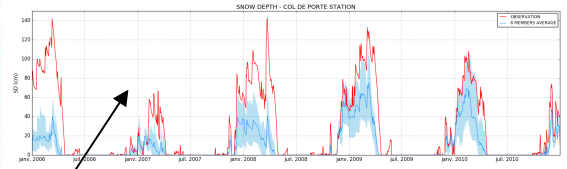
SURFEX-Crocus (Vionnet et al. 2012)

OASIS coupler

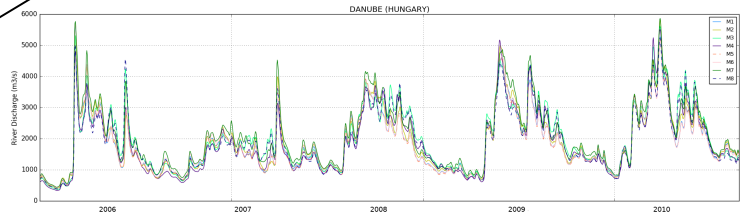
Hydrological model TRIP 0.5°







Snow depth, snow cover, snow albedo, snow density, soil moisture, etc …



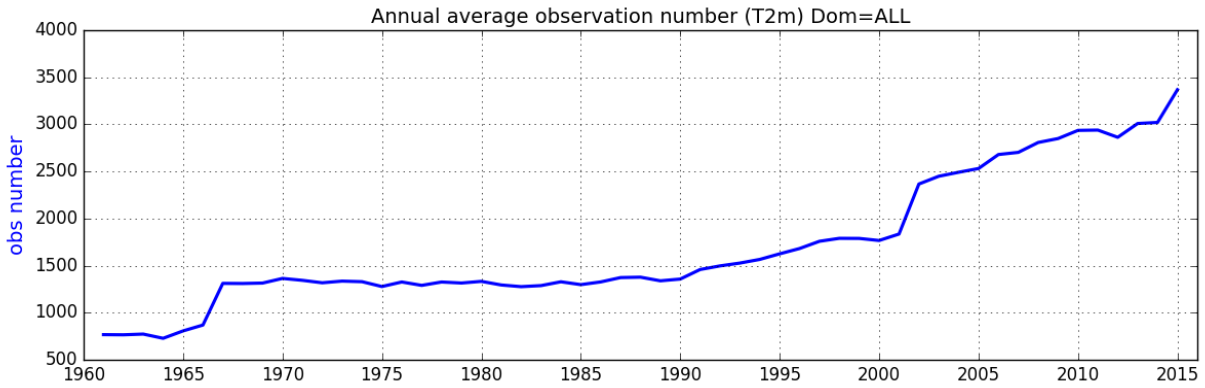
8 members

river discharge (day/month), floodplain fraction,
flood potential infiltration ..

T2m, Rh2m observations used in the surface analysis MESCAN

- **Network density is not homogeneous in time and space**
- 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.

Obs T2m used in UERRA surface re-analysis



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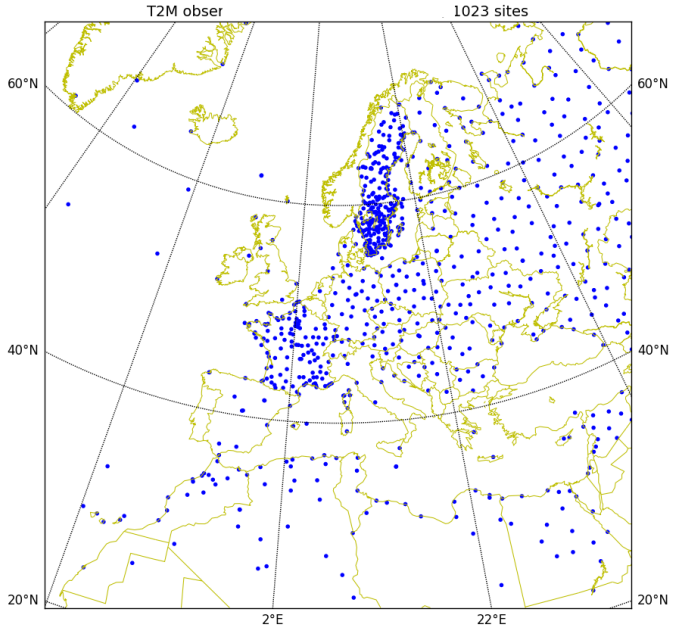

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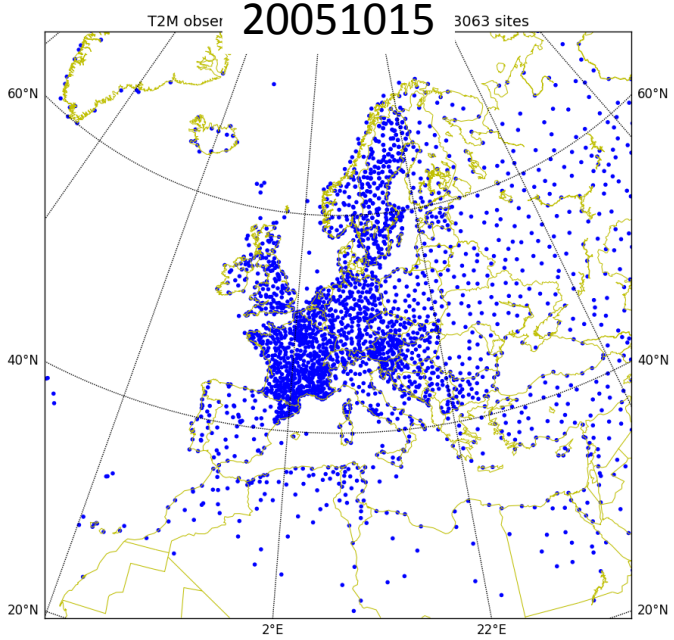
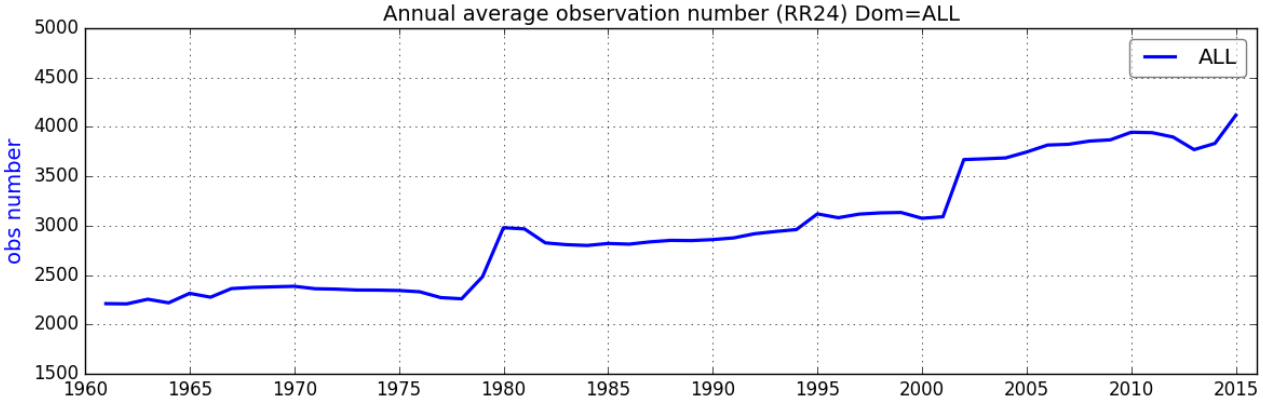


Rainfall observations used in the surface analysis MESCAN

- **Before 1978 no observations available or used over north Africa and East Europe !**
- Observations from national database (France, Sweden & Norway), ECA&D and ECMWF



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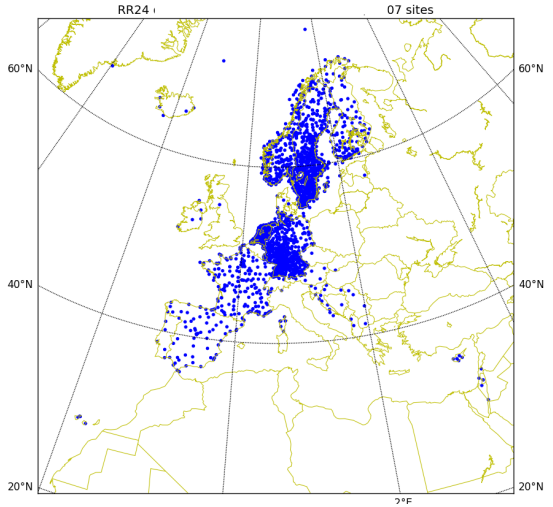

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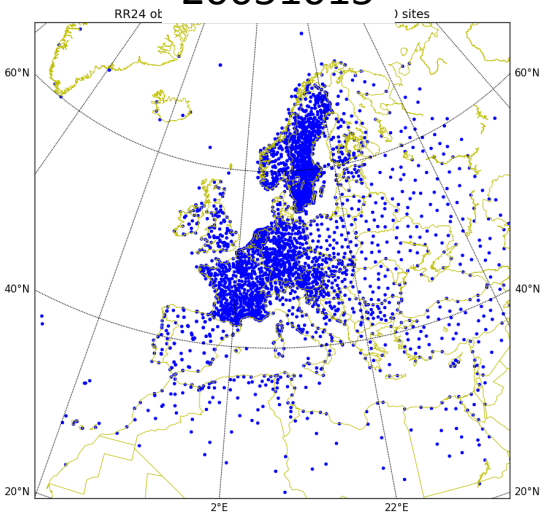
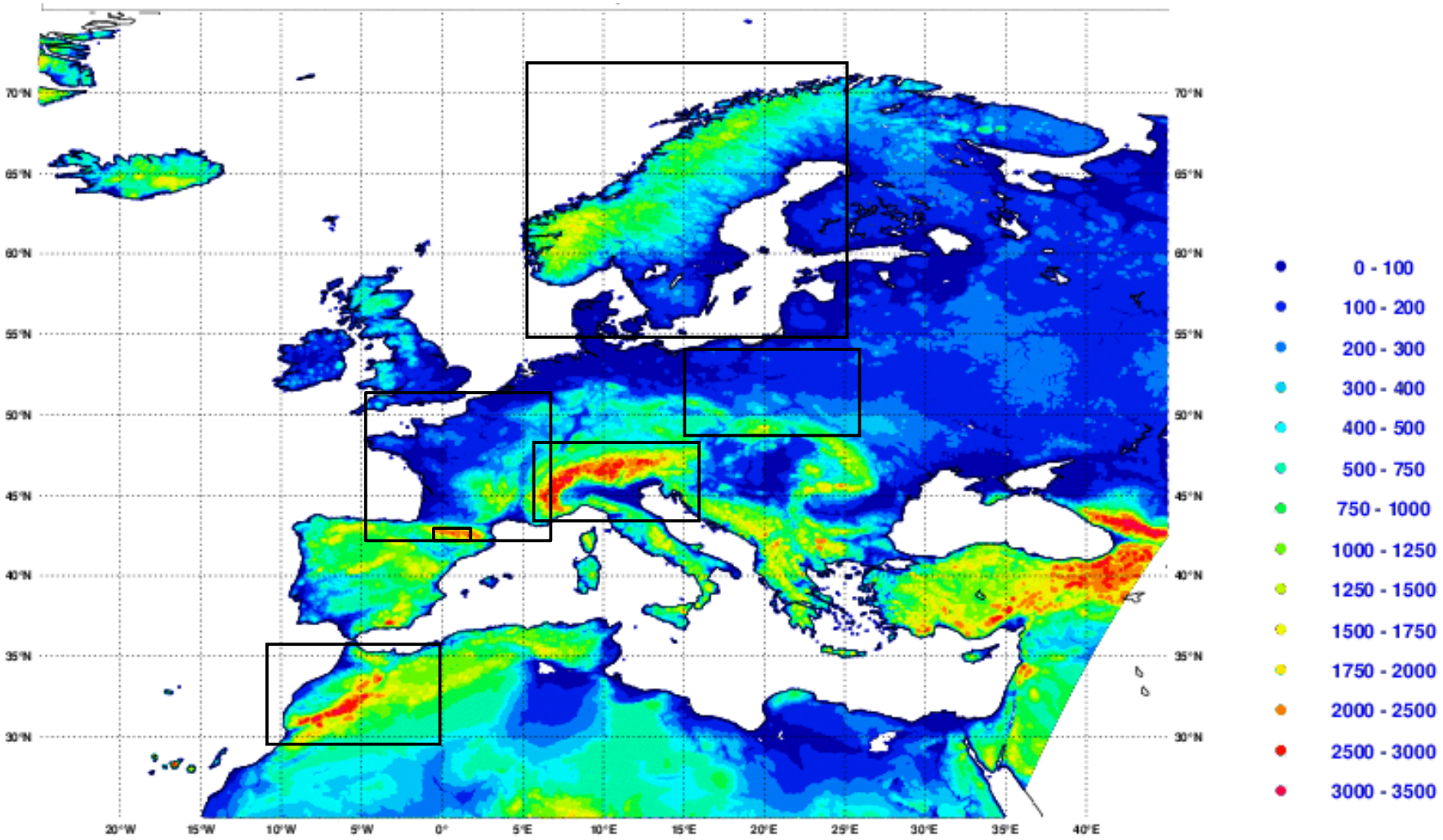
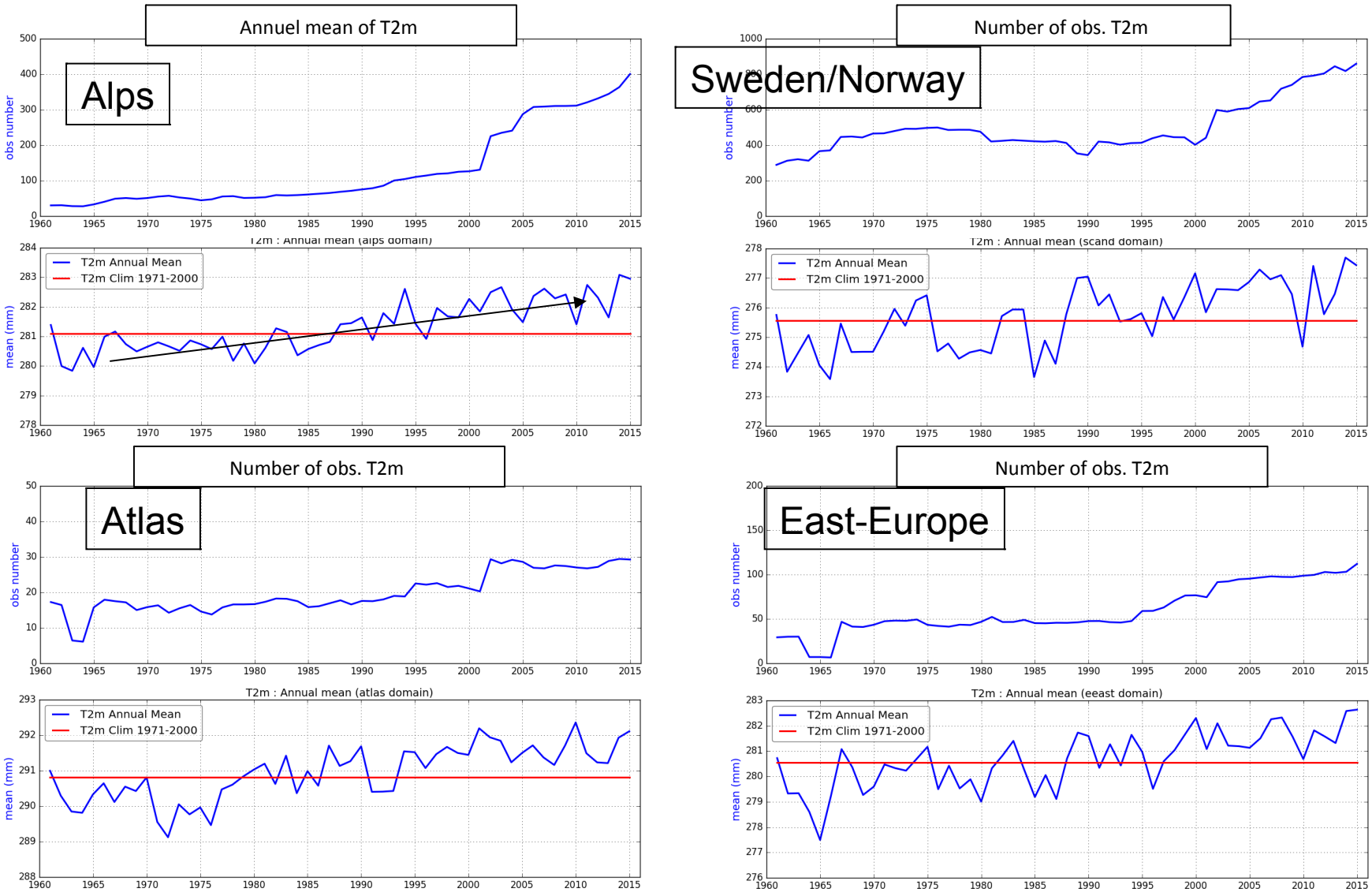


Some preliminary results for several domains



Annual mean 2m temperature: 1961-2015



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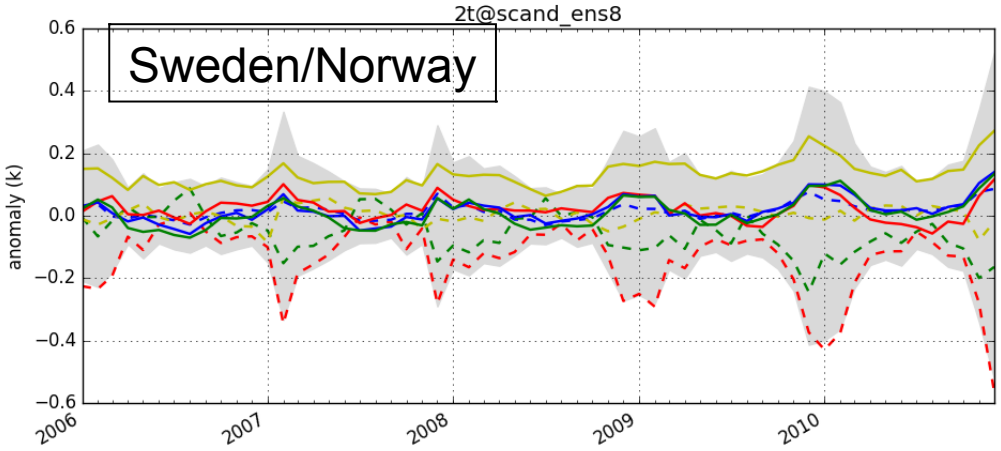
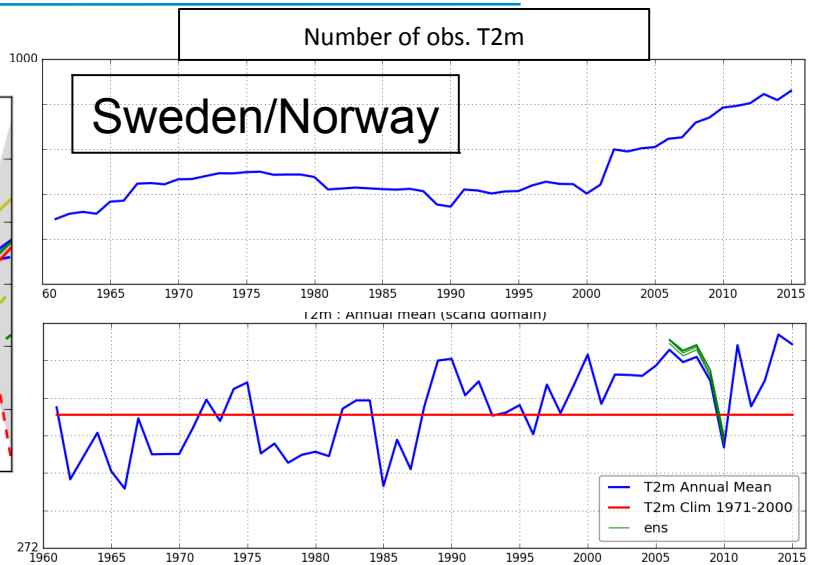
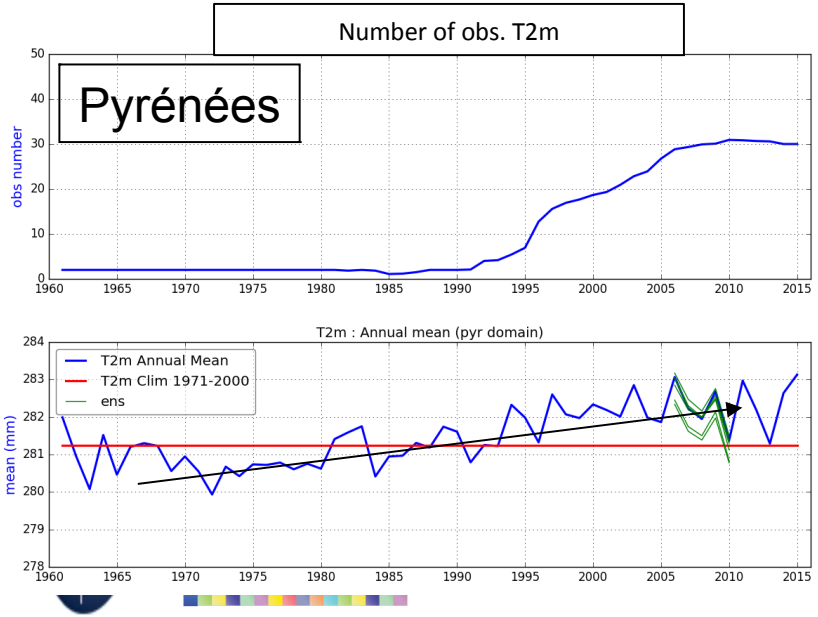
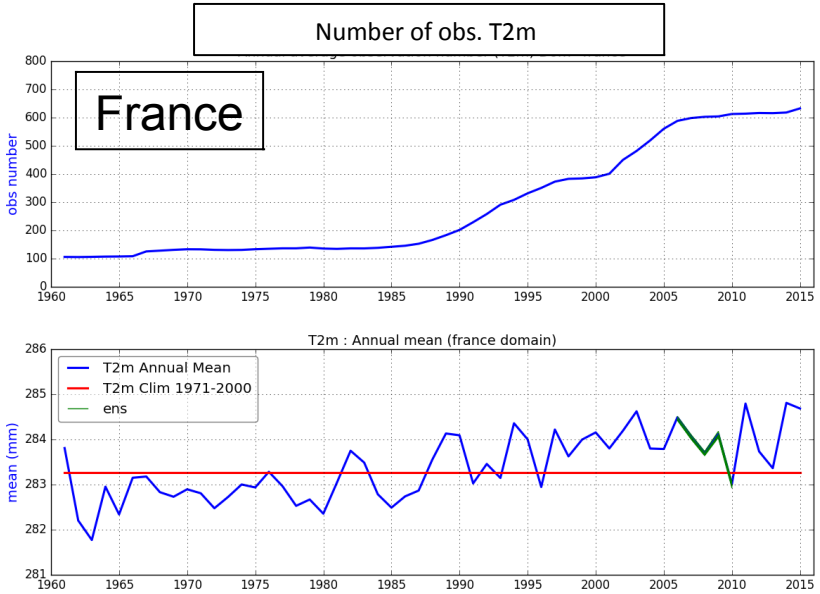
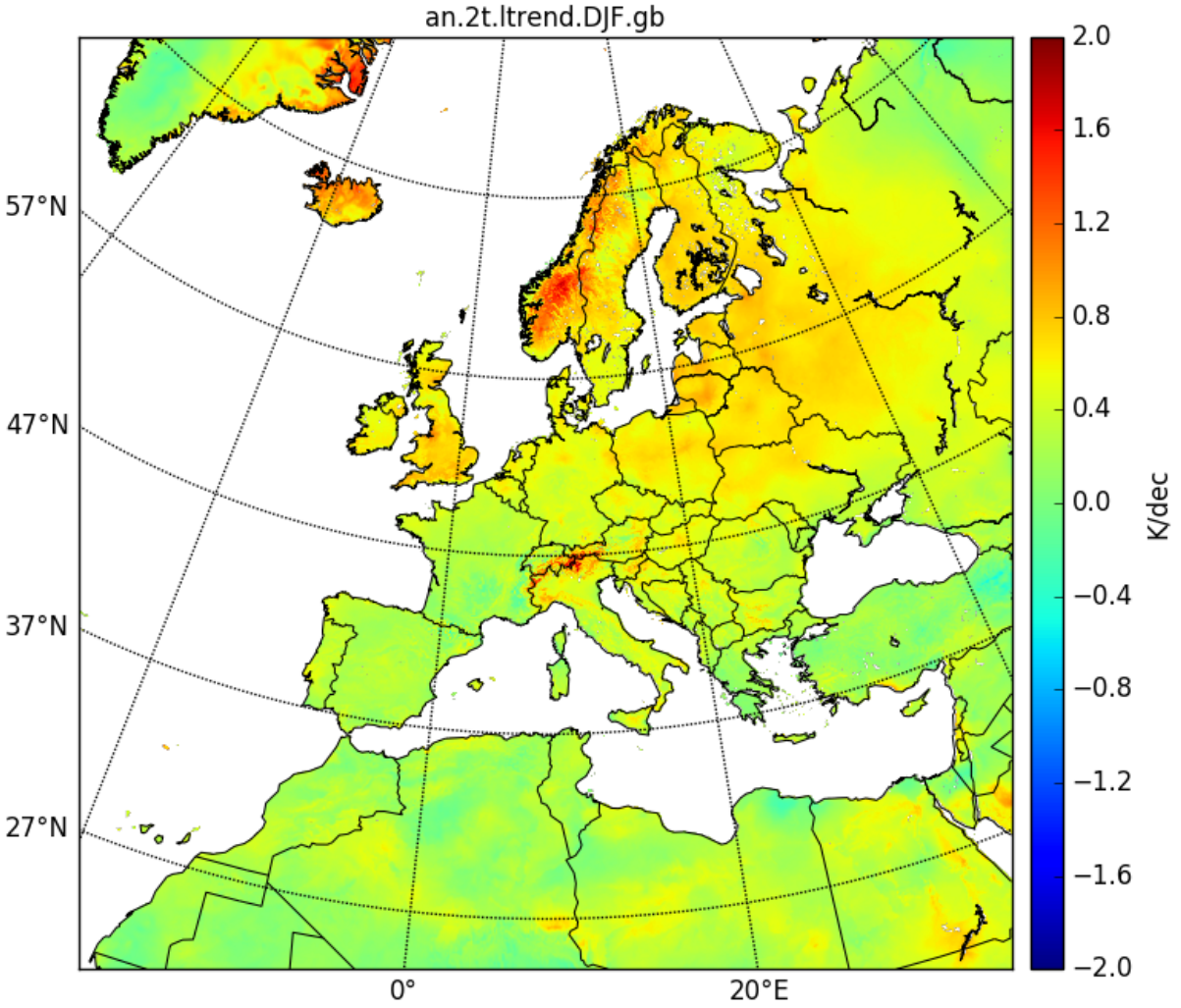




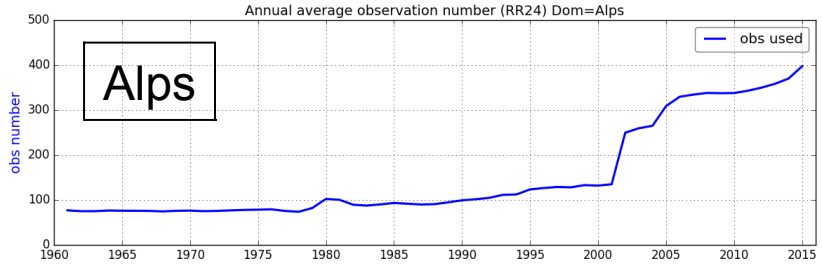


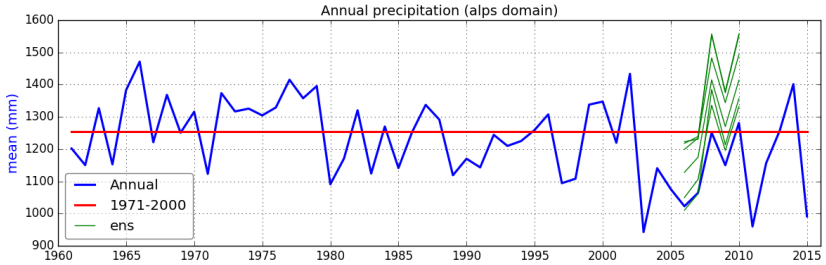


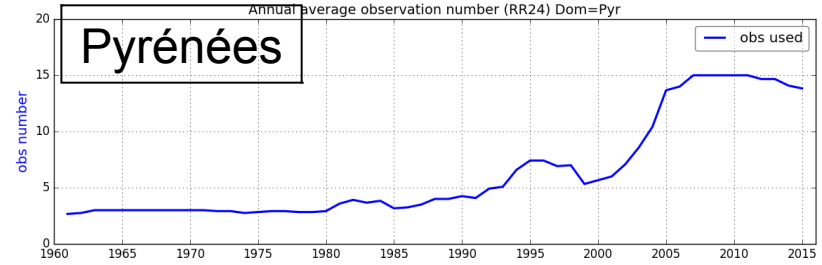
2m temperature trends for DJF (K/10years)

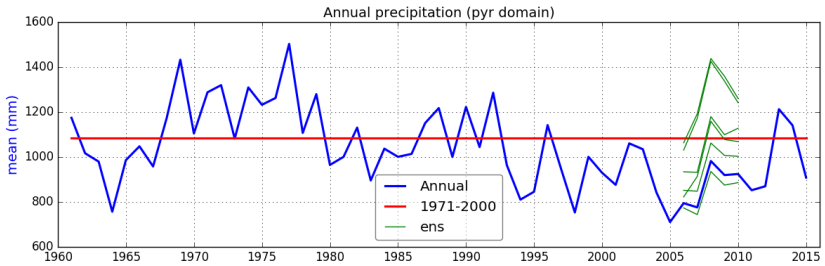


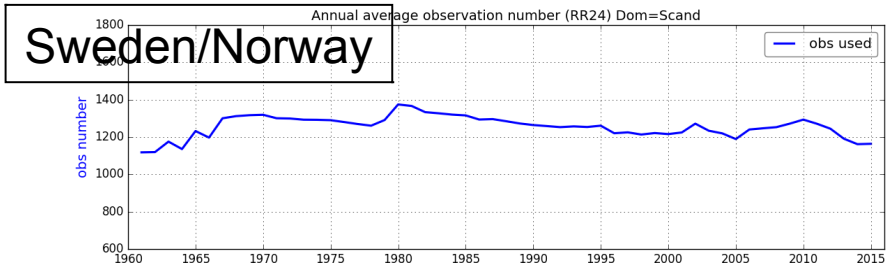
Annual rainfall 1961-2015

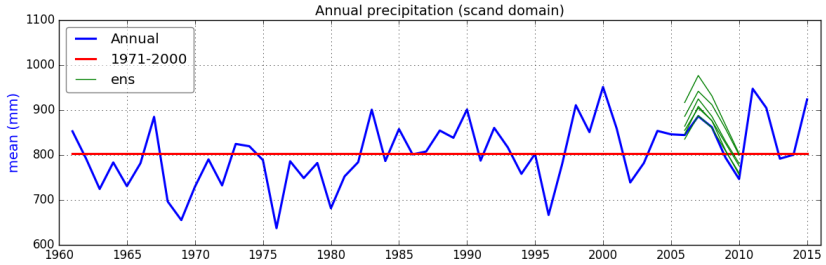


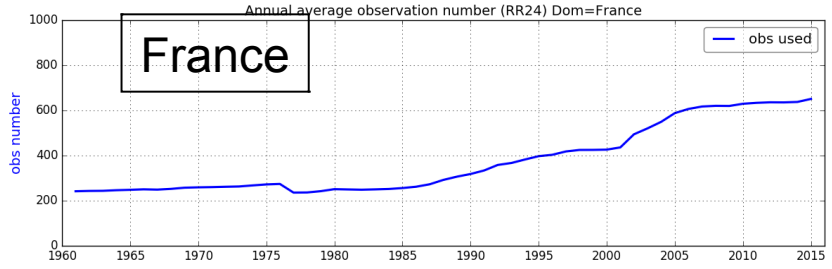


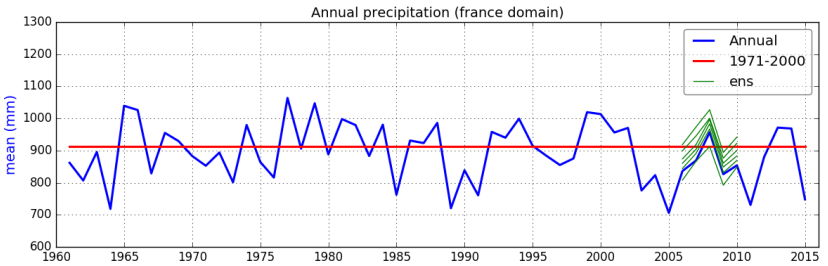




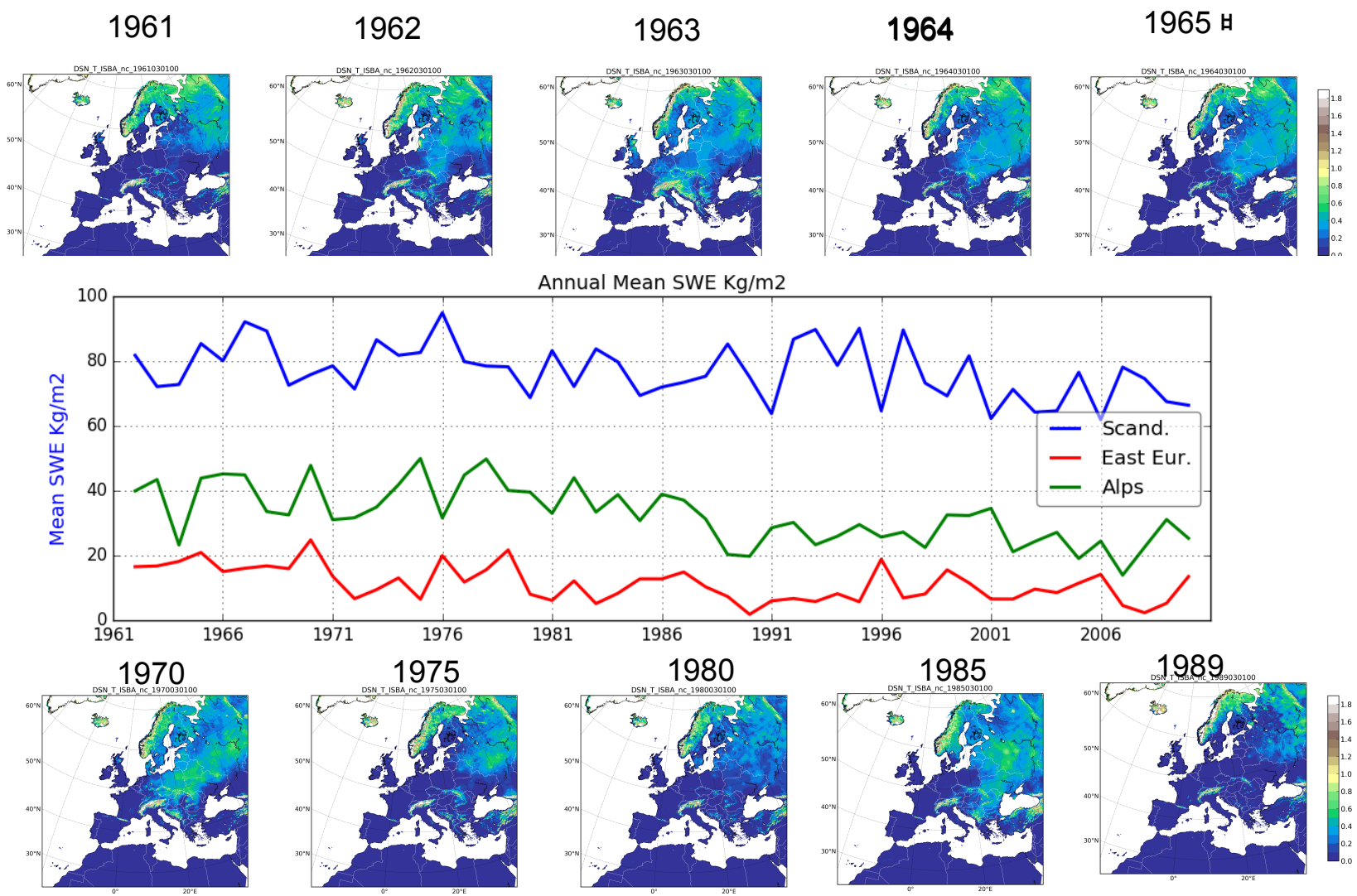




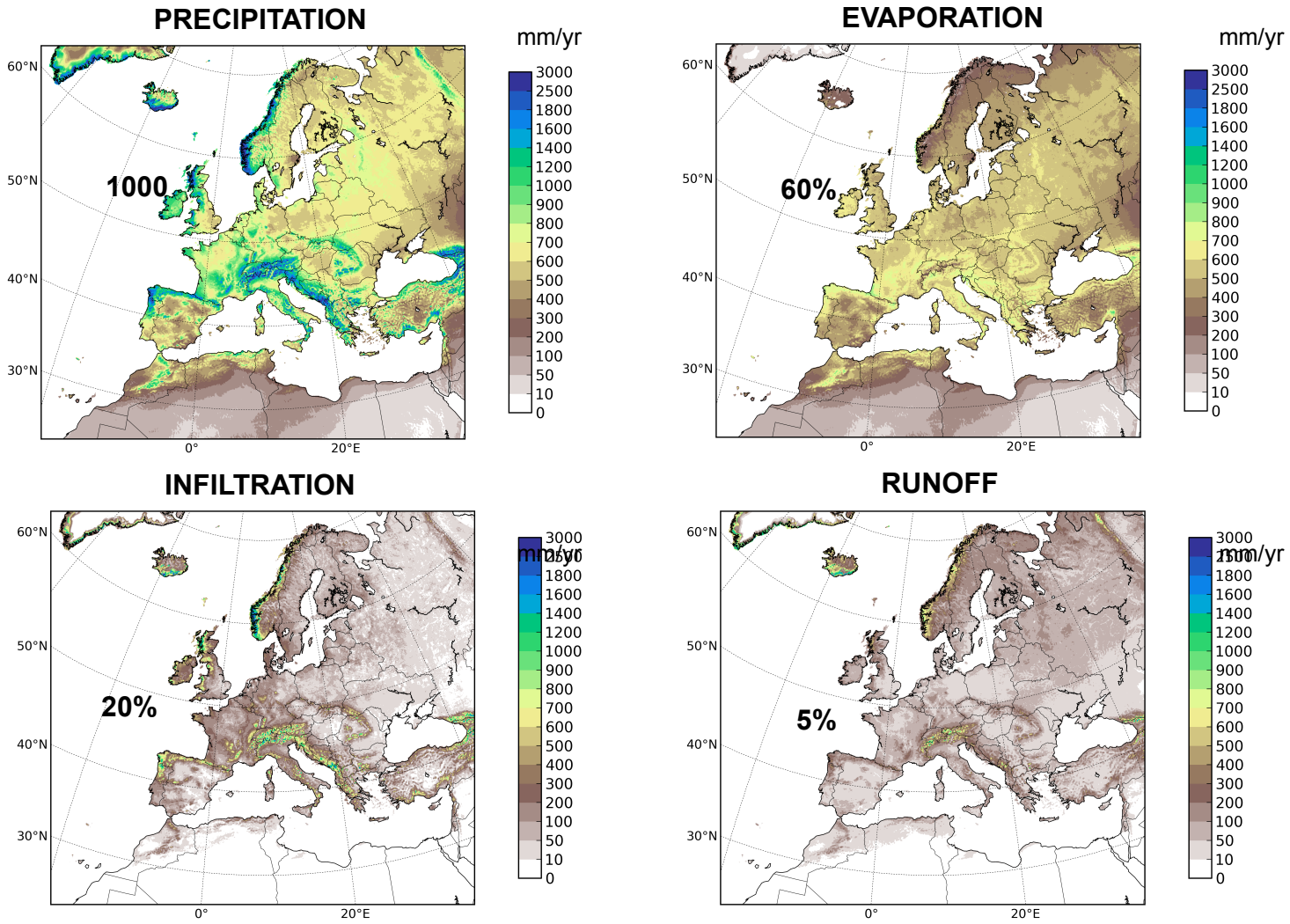




Snow height and SWE from MESCAN-SURFEX



Water Balance Components: 1961-2010



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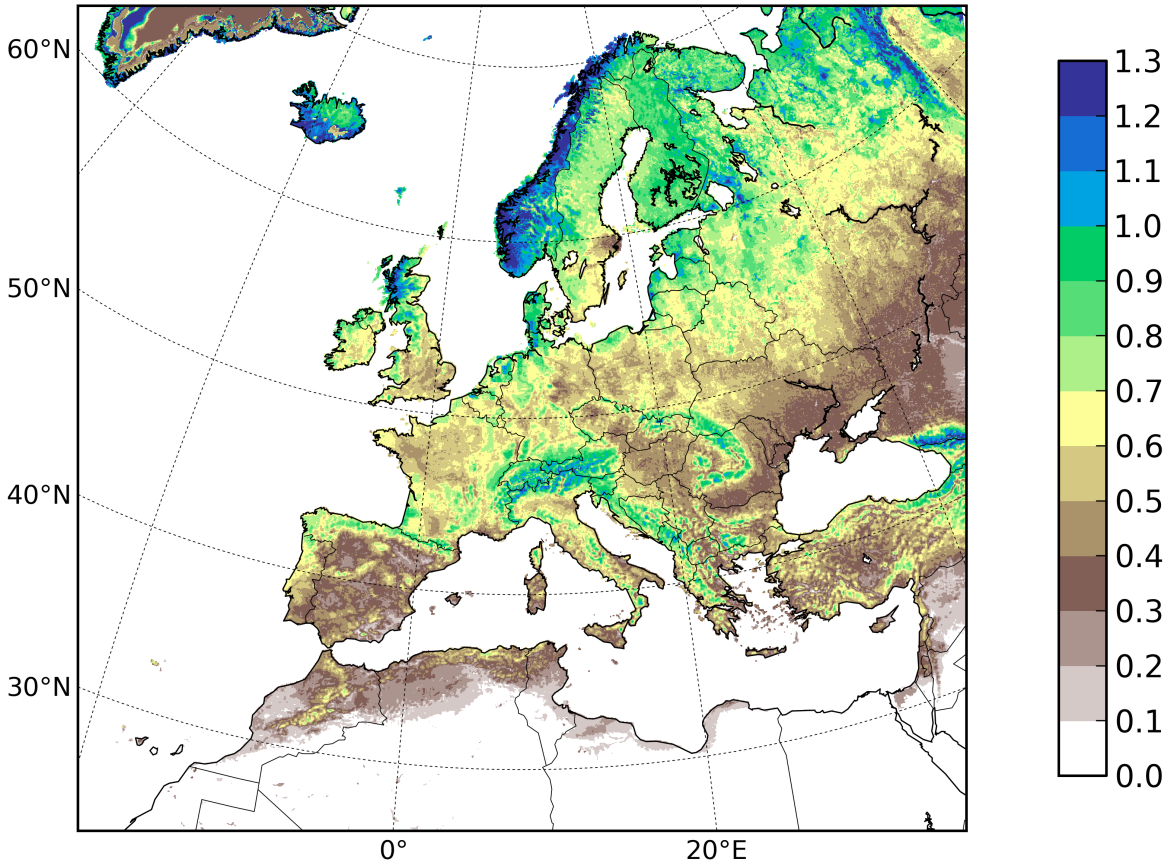
Soil Wetness Index: 1961-2010

Water storage = Precip – Evap – Runoff – Infiltration

SWI = (Wg – Wwilt) / (Wfc – Wwilt)



MESCAN-SURFEX output @ ECMWF MARS archive

Surface variables @ 5.5km from 1961-2015:

- T2m, Rh2m, Ws10m, Wd10m every 6h and 24h precipitation
- Every 1h: Ts, Snow depth, snow density, albedo, SWE, SWd, SWnet, LWd, LWnet, LE, SH, surface run-off, soil heat flux
- Every 1h for all the 14 soil layers: soil temperature, total soil moisture , liquid soil moisture (non frozen)

MESCAN-SURFEX dataset is probably the first 55-yr product @5.5km over Europe with a great consistency between all the surface variables AND using a precipitation analysis.

But please keep in mind:

- the observations network is not constant in time and in space.
- Use also the 5 years MESCAN-SURFEX-ENS → an idea of « uncertainties » especially for the precipitation analysis in mountain area