



SMHI Results 5-year runs

Presented at the UERRA-GA in Toulouse 1-3 Feb 2016

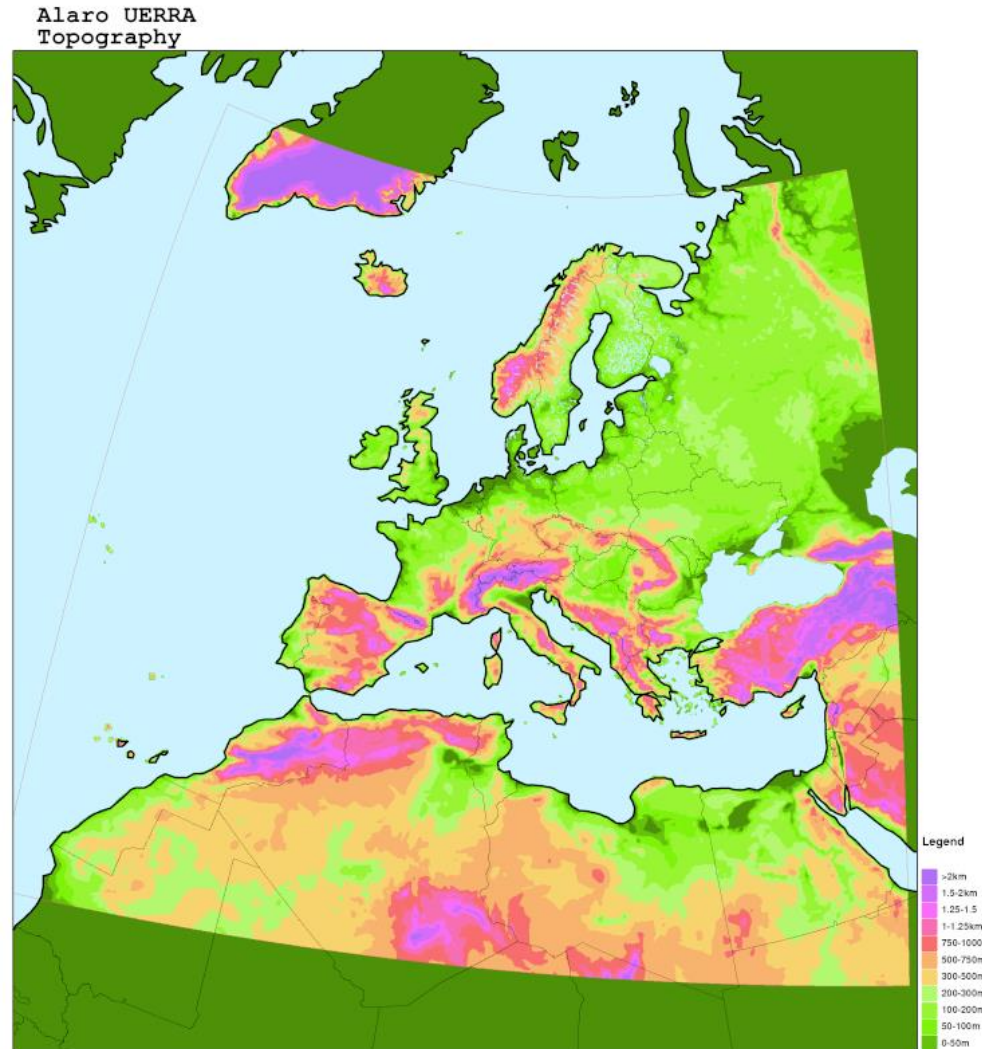
Esbjörn Olsson

**Per Undén, Martin Ridal, Heiner Körnich, Ulf Andrae,
Jelena Bojarova, Patrick Samuelsson and Tomas
Landelius**

Contents:

- Introduction
- Climatology of the 5-year reanalyses
- Mean error and spread of HARMONIE-RA mini-ensemble
- Verification against observations
- Summary

- ALARO and ALADIN physics
- 3D-var, conv. obs.
- Hydrostatic dynamics.
- 565x565 points, 11 km.
- 65 vertical levels.
- 6-hour cycling.
- ERA-interim for BC
- 48-hour forecasts 00 and 12 UTC.
- 2006-2010



Climatology of the 5-year reanalyses SMHI

- Compare with ERA-interim projected to the UERRA grid.
- Statistics over the 5 years, mean and standard deviation.
- Focusing on January and July.
- 2m-temp, 10m-wind and 12-hour precipitation.

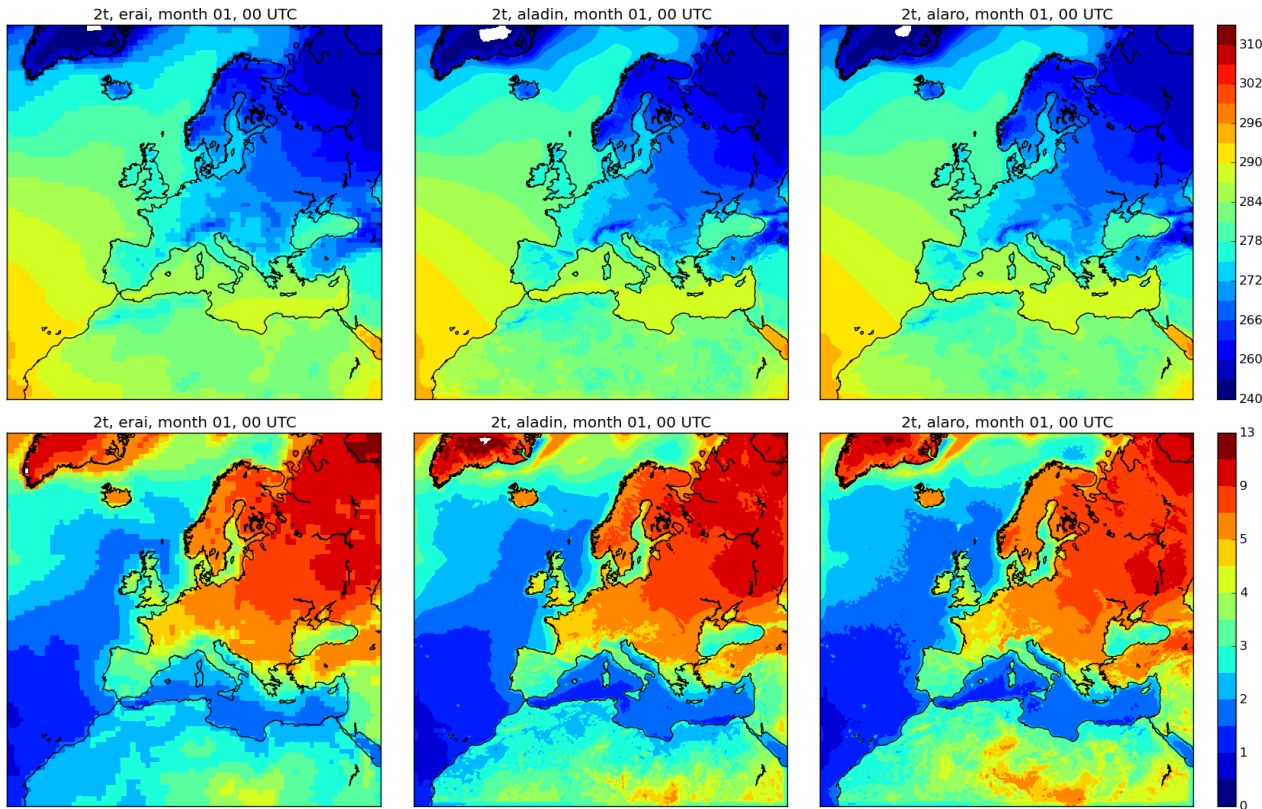
Climatology of the 5-year reanalyses **SMHI**

2m-temperature January 00UTC

ERA-I

ALADIN

ALARO



Higher variance in northern Africa for ALARO

Lower variance in eastern and northern Europe for ALARO

Climatology of the 5-year reanalyses **SMHI**

2m-temperature July 12UTC

ERA-I

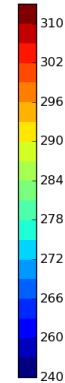
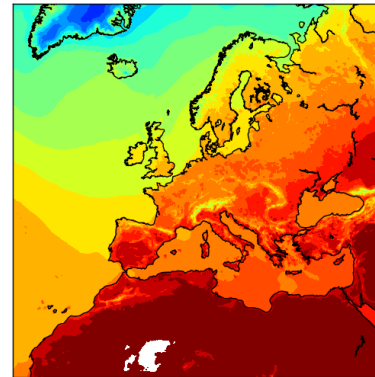
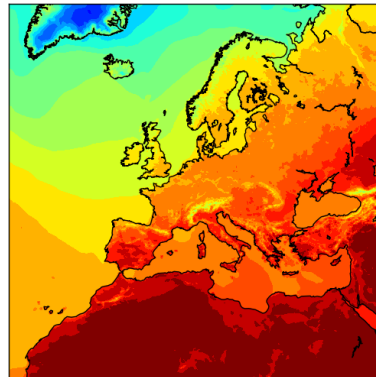
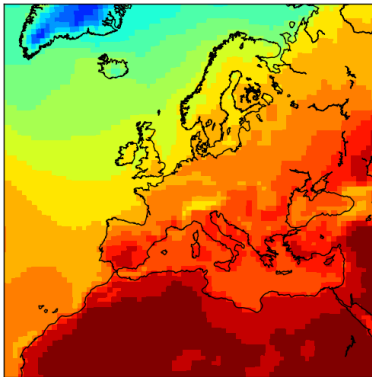
ALADIN

ALARO

2t, erai, month 07, 12 UTC

2t, aladin, month 07, 12 UTC

2t, alaro, month 07, 12 UTC

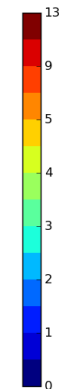
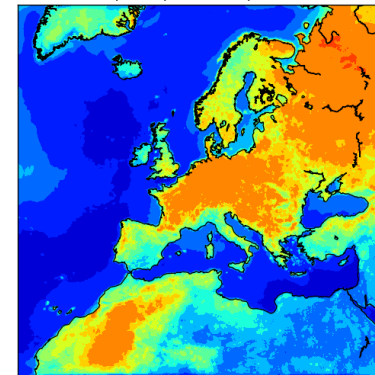
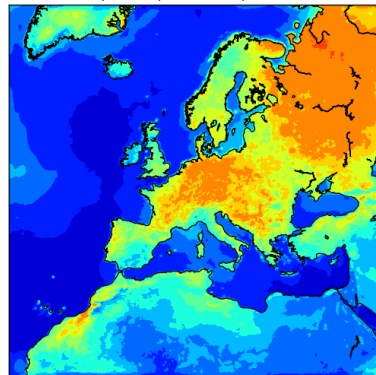
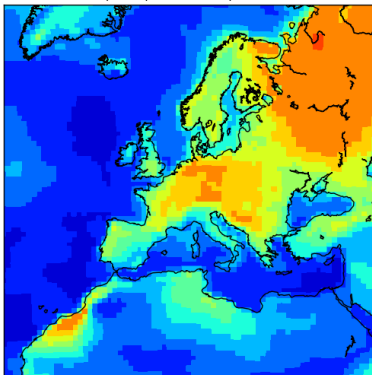


Mean

2t, erai, month 07, 12 UTC

2t, aladin, month 07, 12 UTC

2t, alaro, month 07, 12 UTC

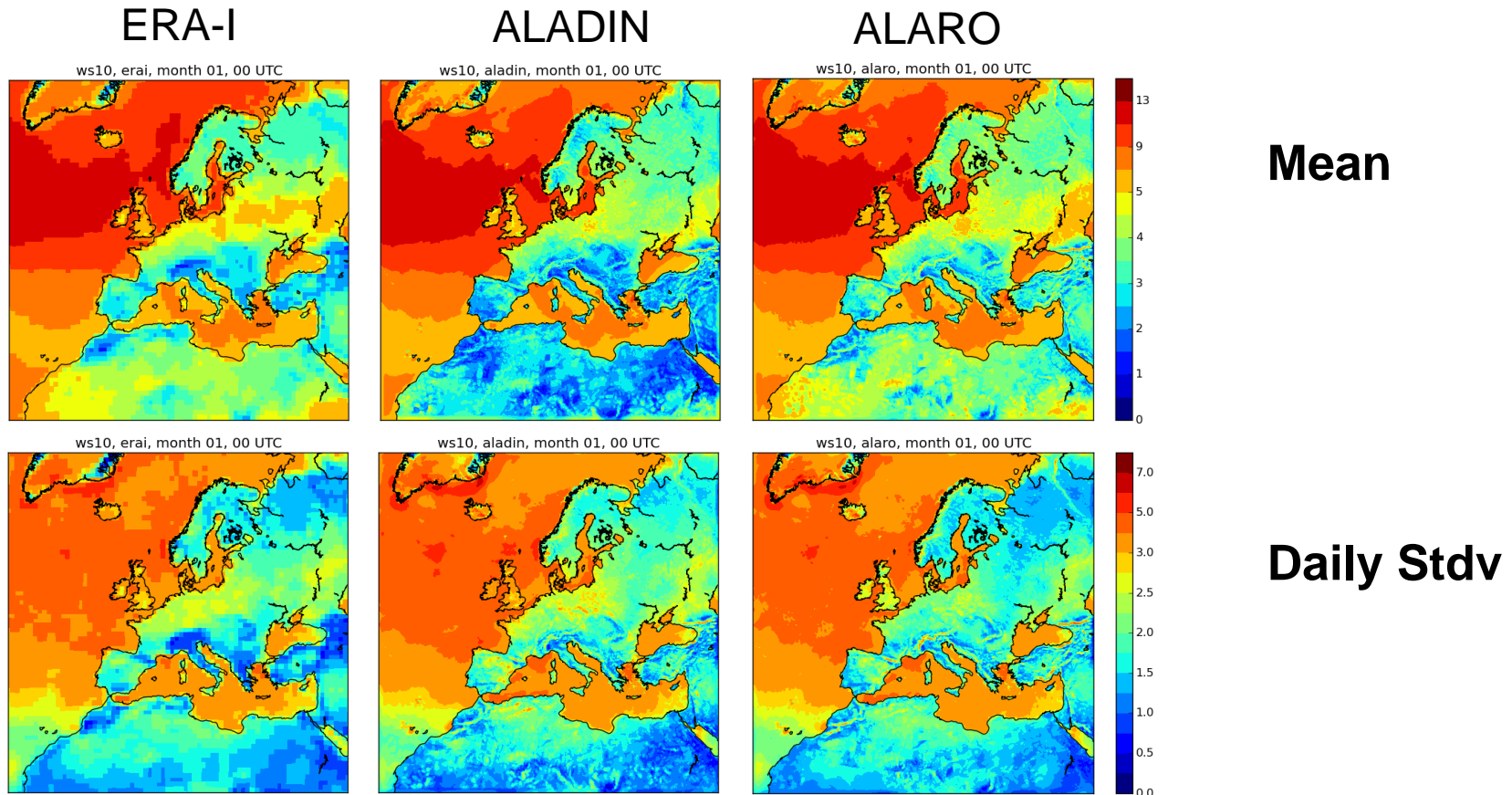


Daily Stdv

ALARO shows stronger temperature variance in middle Europe and northwestern Africa. The increased variance is surprising and needs further investigation.

Climatology of the 5-year reanalyses **SMHI**

10m-wind speed January 00UTC



ALADIN differs notably from the other two with generally weaker winds, especially over Northern Africa. Further studies are needed in order to understand the model differences that give rise to this behavior.

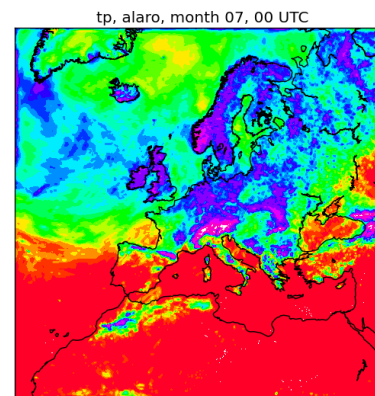
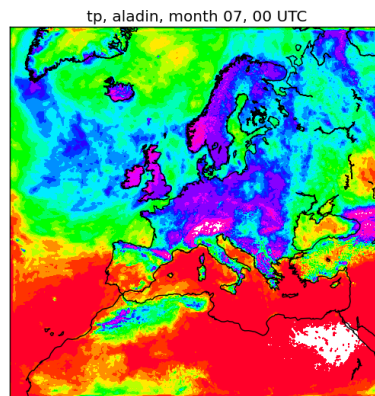
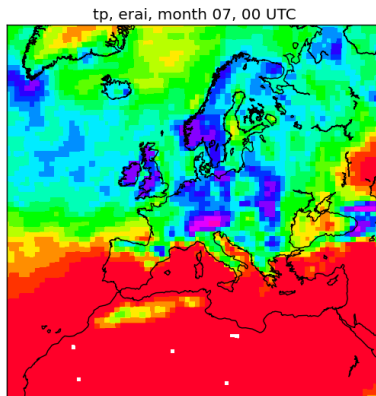
Climatology of the 5-year reanalyses **SMHI**

12-hour (00+24 minus 00+12) precip July 00UTC

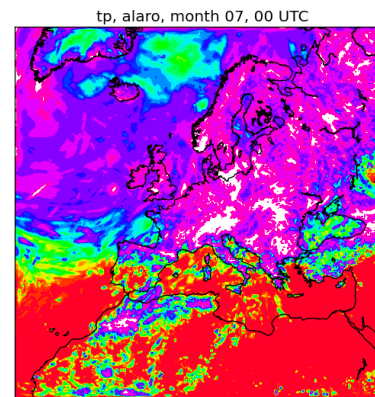
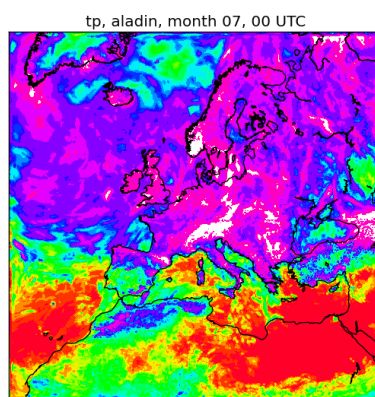
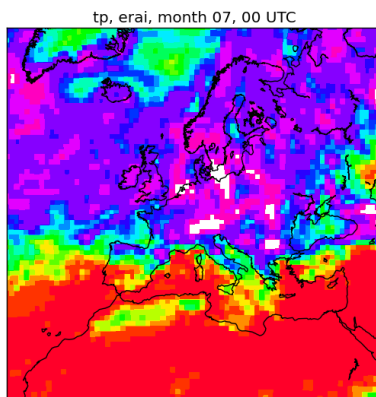
ERA-I

ALADIN

ALARO



Mean



Daily Stdv

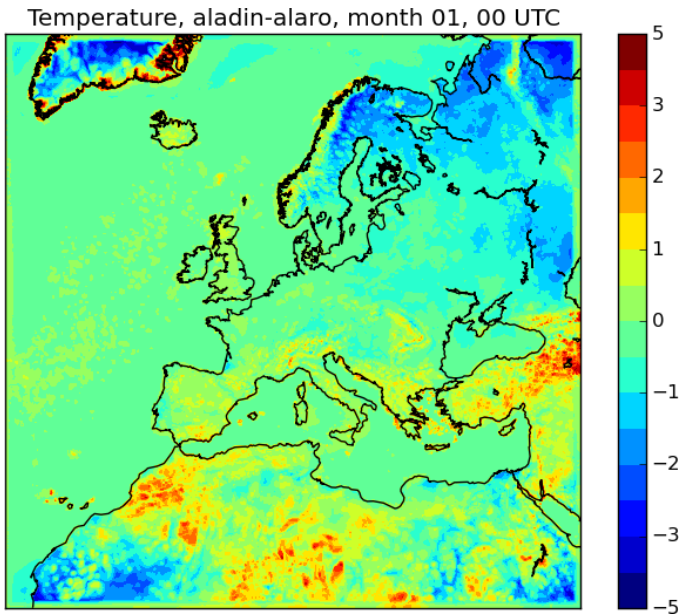
Both UERRA-reanalysis show generally higher values than ERA-I. The largest mean is shown in ALADIN, clearly visible in Middle- and Northern Europe. The daily standard deviation has largest amplitude over land north of the Mediterranean. Both UERRA-reanalyses display stronger variance than ERA-I.

- Differences between ALARO and ALADIN over the 5 years.
- Mean difference will provide estimate of systematic errors and accuracy.
- Standard deviation of the difference provides a measure for the precision of the reanalysis.
- January and July.
- 2-m temp, 10-m wind speed and 12-hour precip.

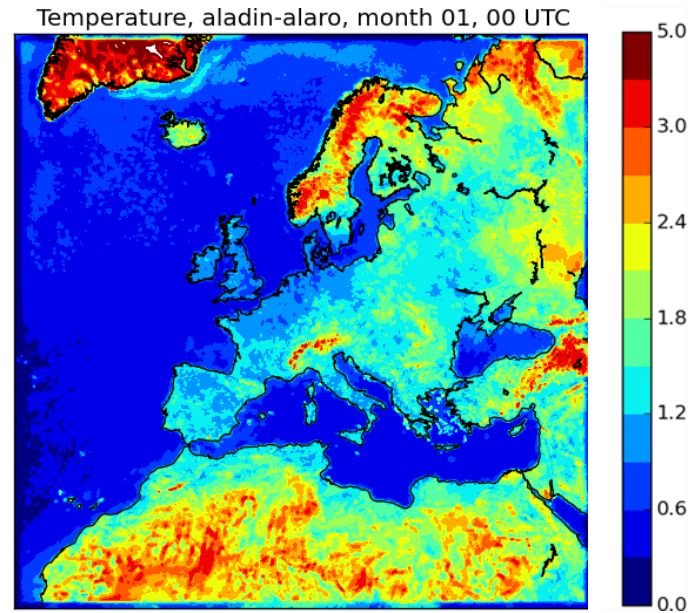
Mean error and spread of the HARMONIE-RA mini-ensemble

2m-temperature January 00UTC

ALADIN-ALARO
mean



ALADIN-ALARO
stdv

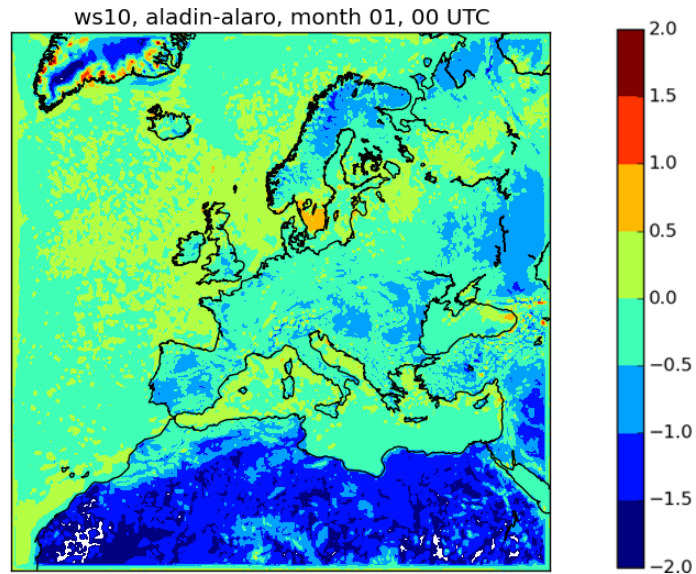


ALADIN is clearly colder than ALARO in the northern-eastern part of the domain, but ALADIN is warmer in the larger part of Northern Africa, Turkey and Caucasus. The standard deviation is larger over Northern land areas. Largest values of up to 5 K are reached over Greenland. For the southern part of the domain, the precision of the reanalysis varies. The Caucasus region shows a large uncertainty.

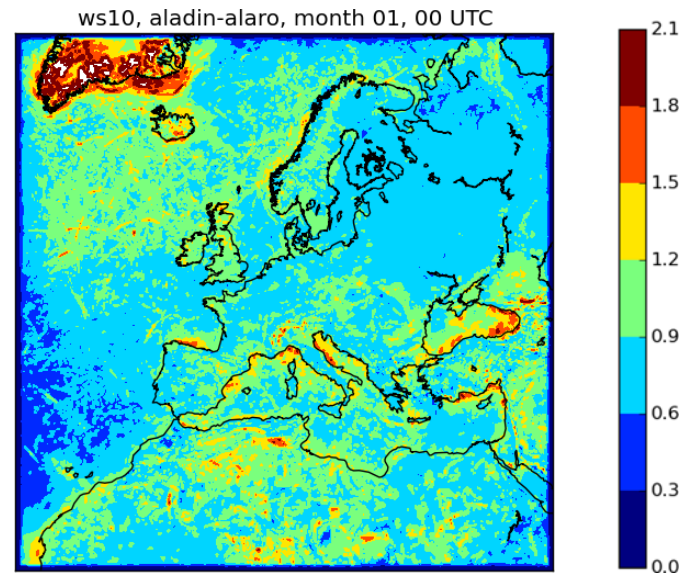
Mean error and spread of the HARMONIE-RA mini-ensemble

10-m wind speed January 00UTC

ALADIN-ALARO
mean



ALADIN-ALARO
stdv



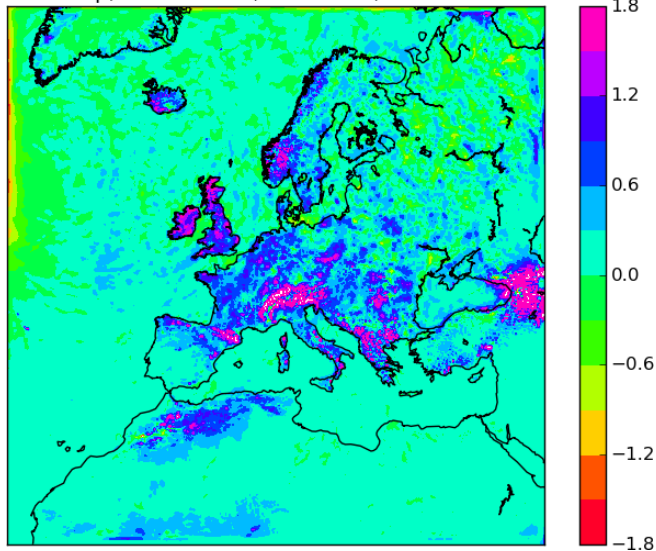
Large mean differences appear in Northern Africa. Big uncertainties over Greenland. Enlarged standard deviations can be found along certain coast lines.

Mean error and spread of the HARMONIE-RA mini-ensemble

12-hour (00+24 minus 00+12) precip July 00UTC

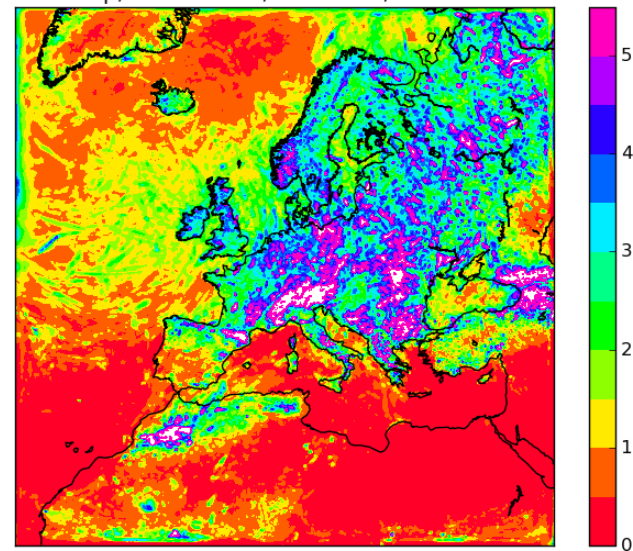
ALADIN-ALARO
mean

tp, aladin-alaro, month 07, 00 UTC



ALADIN-ALARO
stdv

tp, aladin-alaro, month 07, 00 UTC



ALADIN has generally a wetter July, especially in mountainous terrain with values up to 1.8 mm per 12 hours. Also over UK, more rain in ALADIN. Highest values in standard deviation mostly over mountainous terrain.

- Parameters
 - Surface: Temp and dewp at 2m, 10-m wind speed, mean sea level pressure, total cloud cover and 12 hours accumulated precipitation.
 - Upper air: Temperature, wind speed and relative humidity.
- Seasonally divided (DJF, MAM, JJA, SON)
- Number of observations:
 - Surface 2100-2800
 - Upper air 150-170

Verification against observations

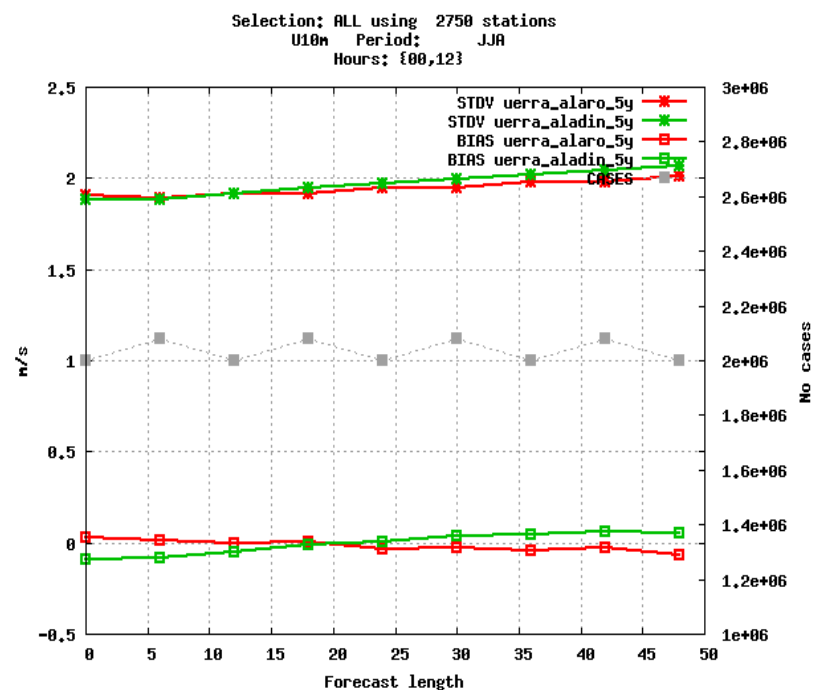
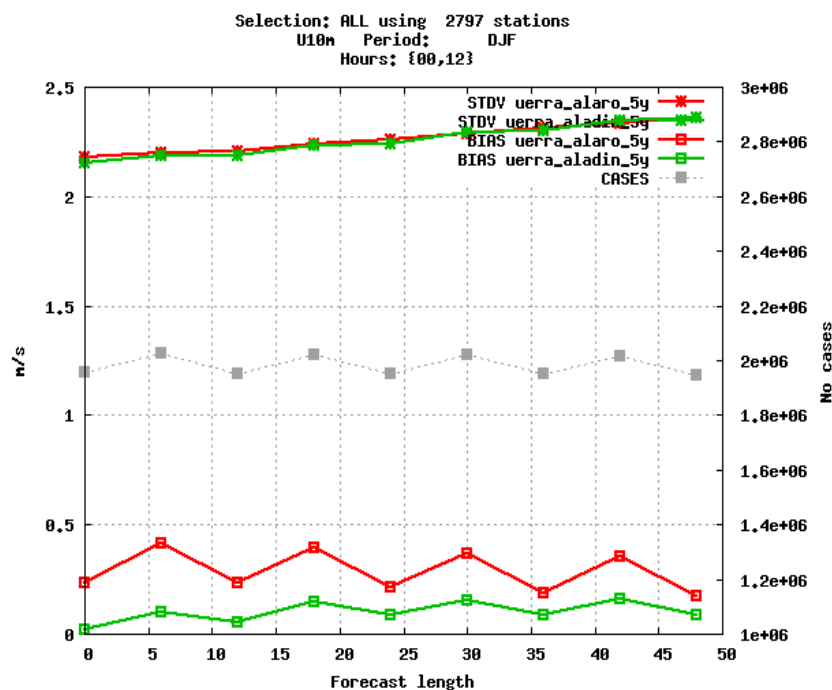
10-meter wind speed

ALADIN

ALARO

DJF

JJA



For the winter months a slightly better stdv and a smaller bias for ALADIN. During the summer ALARO a little bit better in stdv, small bias for both.

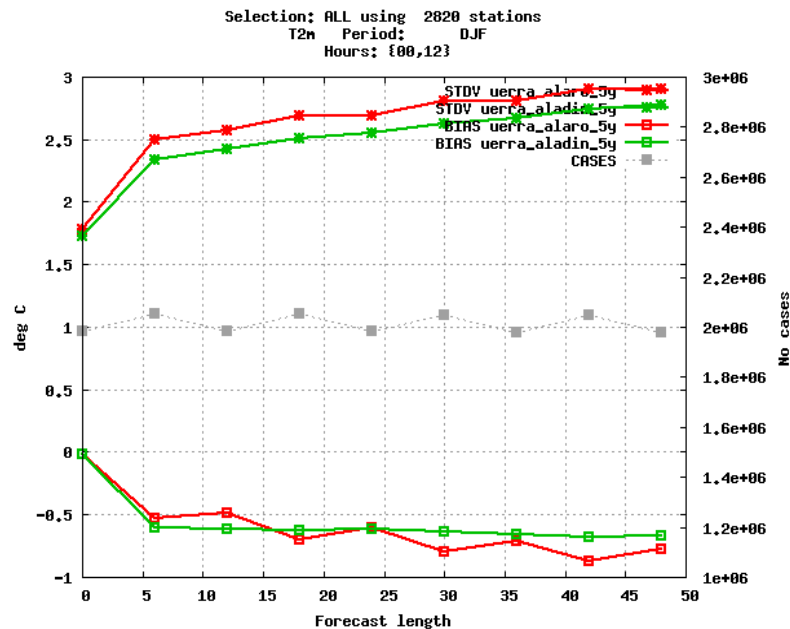
Verification against observations

2-meter temp

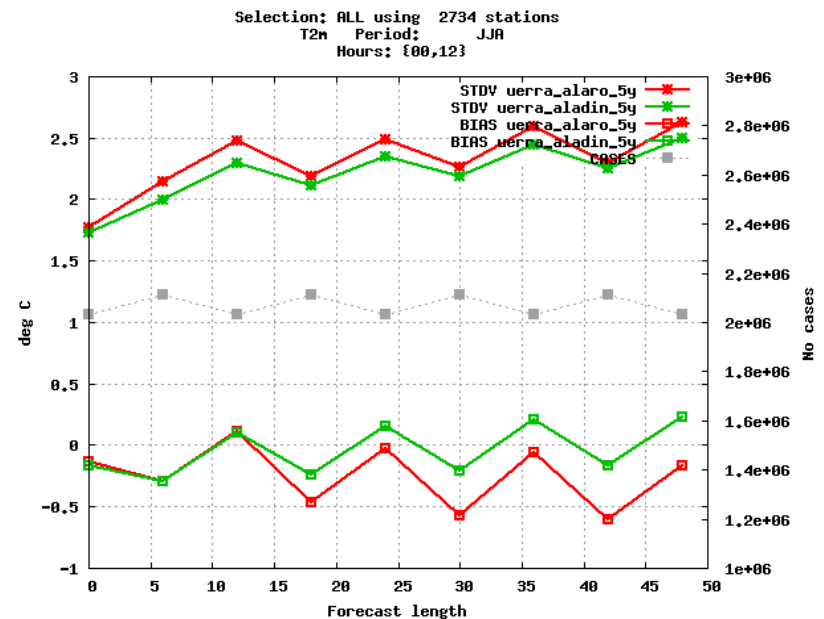
ALADIN

ALARO

DJF



JJA



A clear advantage for ALADIN in stdv for winter temperatures. Both models have a negative bias, slightly worse for ALARO. For summer ALADIN has the lowest stdv and a bias that is closer to zero than ALARO.

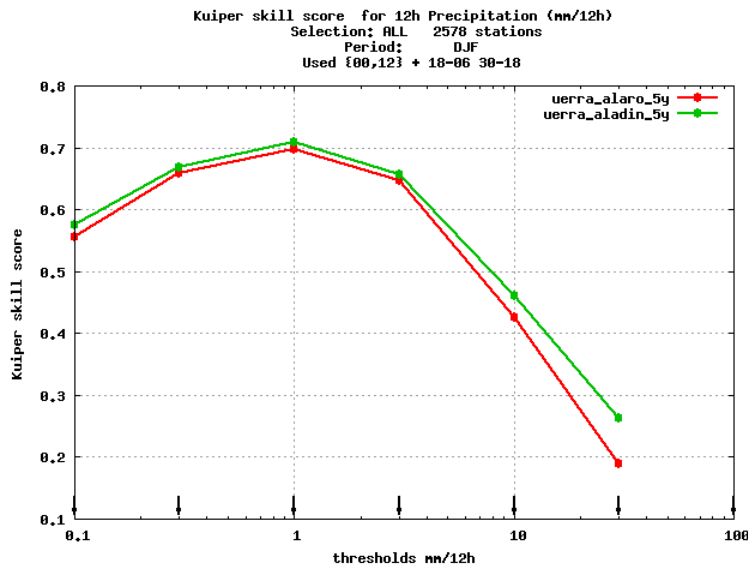
Verification against observations

12-hours precip Kuiper skill score

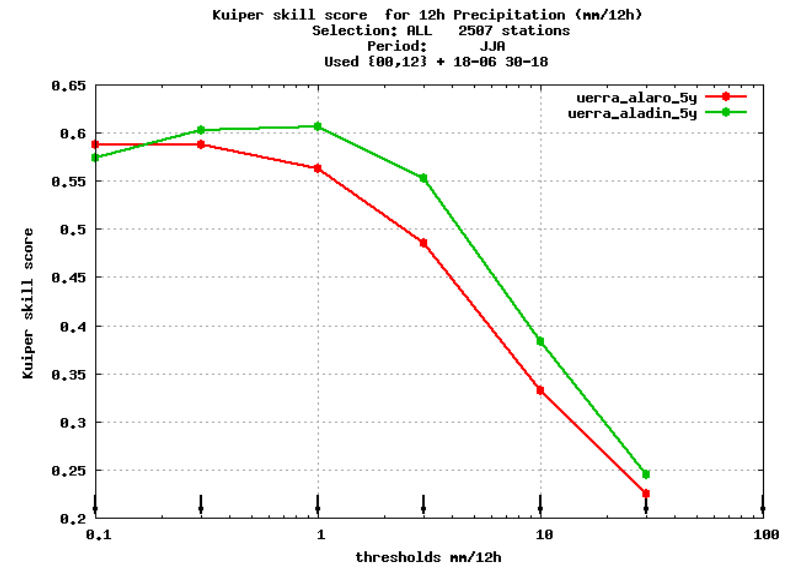
ALADIN

ALARO

DJF



JJA



A small advantage for ALADIN for all precipitation classes during winter. Even bigger ALADIN advantage for the summer, except for the smallest amounts.

Verification against observations

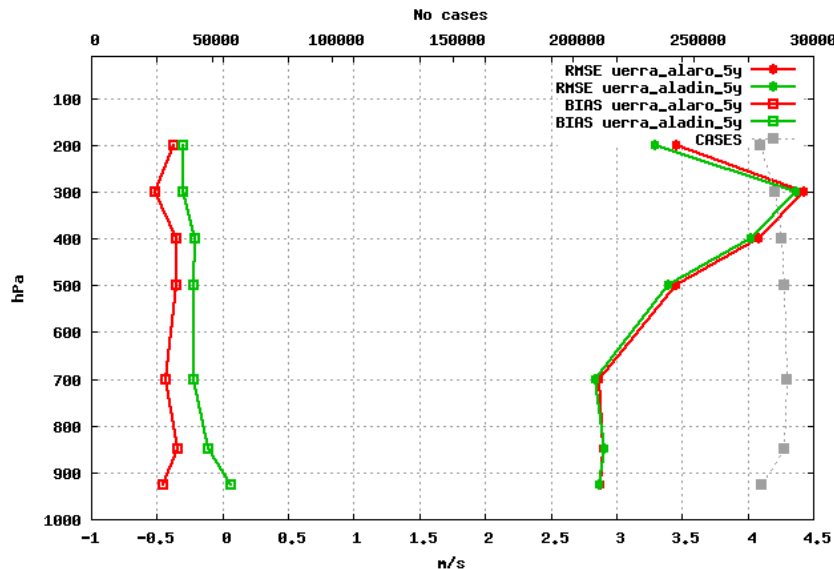
Wind speed profile 00UTC

ALADIN

ALARO

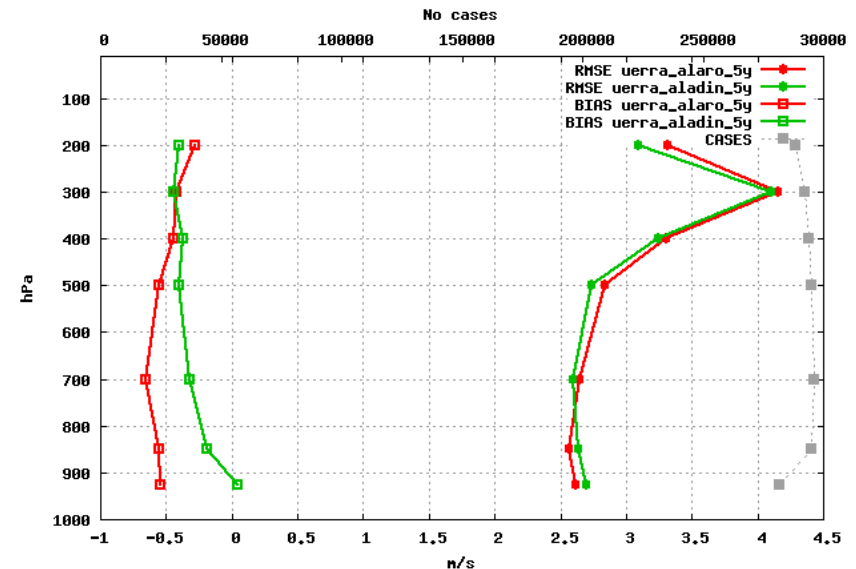
DJF

165 stations Selection: ALL
Wind speed Period: DJF
Statistics at 00 UTC Used {00,12} + 00 12 24 36 48



JJA

158 stations Selection: ALL
Wind speed Period: JJA
Statistics at 00 UTC Used {00,12} + 00 12 24 36 48



Winter: Almost identical rmse for both models with a very small advantage for ALADIN. The bias is also a little closer to zero for ALADIN. Summer: Lower rmse for ALADIN on the majority of the levels, also smaller bias for most parts.

Verification against observations

Temperature profile 00UTC

ALADIN

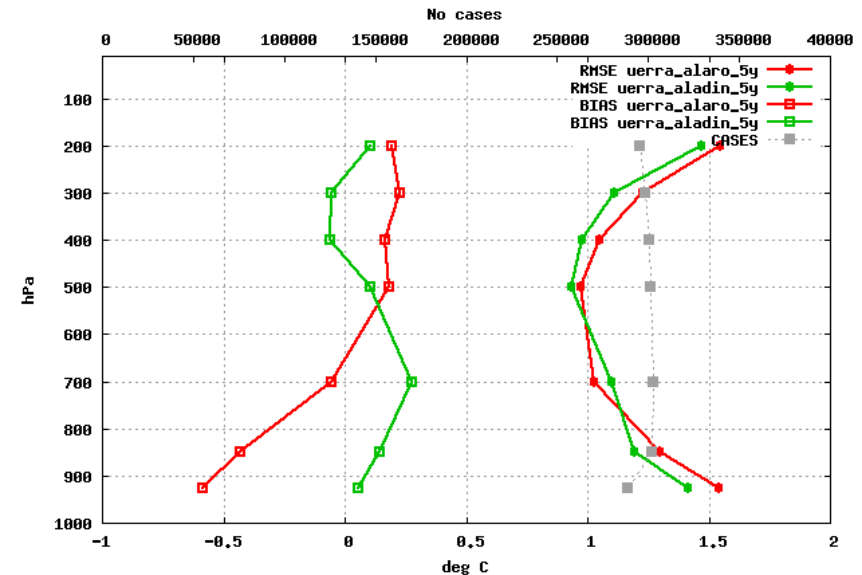
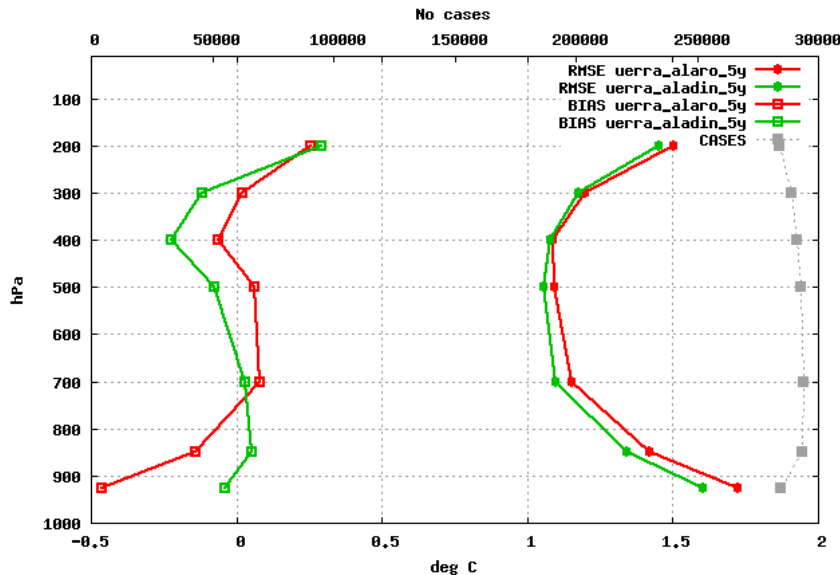
ALARO

DJF

JJA

170 stations Selection: ALL
Temperature Period: DJF
Statistics at 00 UTC Used {00,12} + 00 12 24 36 48

158 stations Selection: ALL
Temperature Period: JJA
Statistics at 00 UTC Used {00,12} + 00 12 24 36 48



Winter: ALADIN has slightly lower rmse throughout the whole profile. The ALADIN bias is close to zero in the lower parts while the ALARO bias is a little better in the upper levels Summer: Lowest rmse for ALADIN for most levels. Rather big cold bias in ALARO at the lowest levels.

Summary

- Mini ensemble reanalysis has been run for 5 years (2006-2010).
- Comparing the two members gives an estimation of systematic errors or accuracy of the reanalysis.
- The standard deviation of the reanalysis difference gives a measure for the precision of the reanalysis.
- Some large differences need to be further examined.
- Verification against observations favours ALADIN for most parameters.