

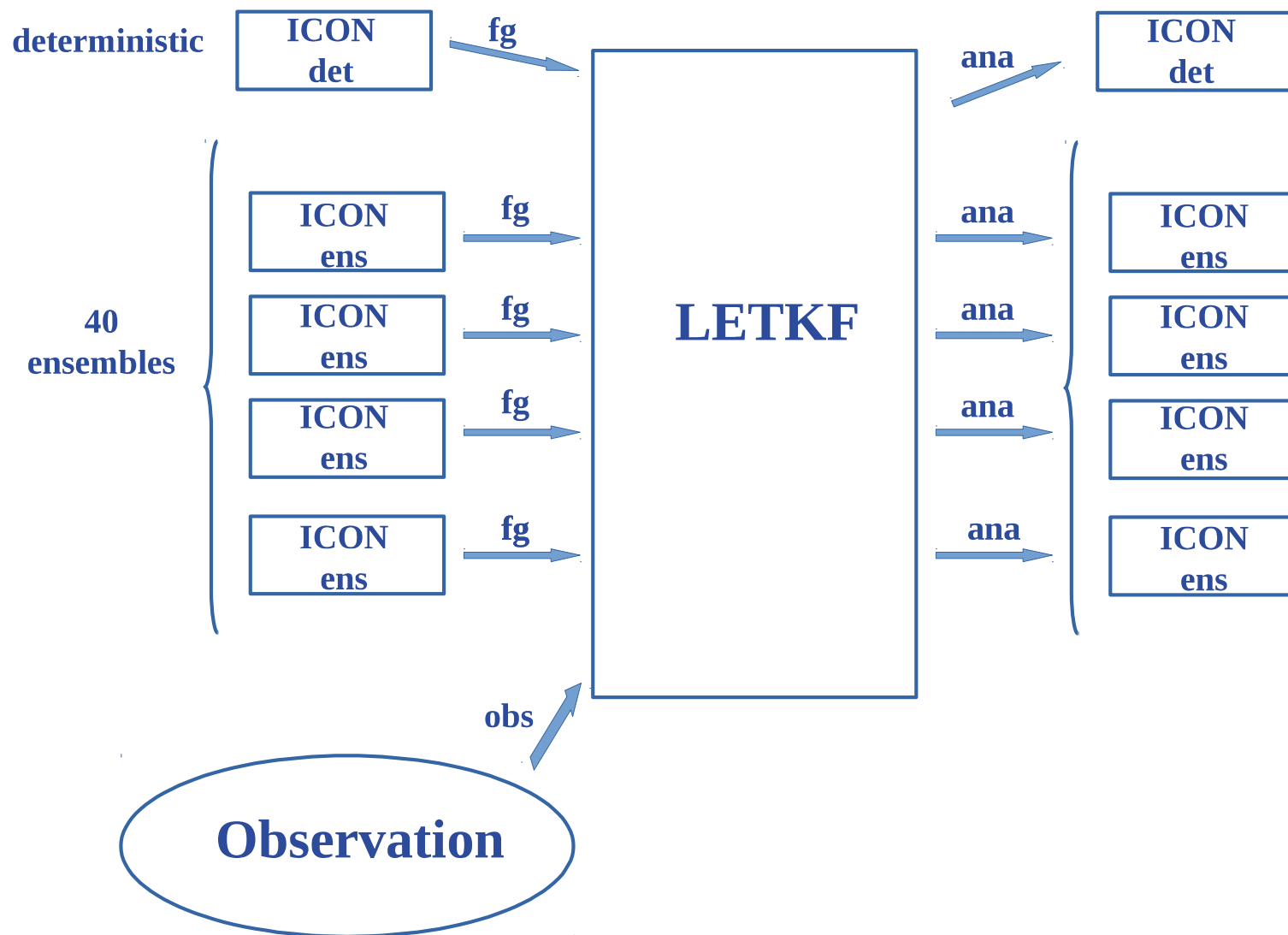
Study the effect of updating the hydrometeors (qr, qs and qg) on assimilating the radar reflectivity

**22th COSMO General Meeting
Parallel Session on data assimilation
3-4 September 2020**

Kobra Khosravian, Stephan Klaus, Christian Welzbacher, Ulrich Blahak,
Christoph Schraff, Roland Potthast



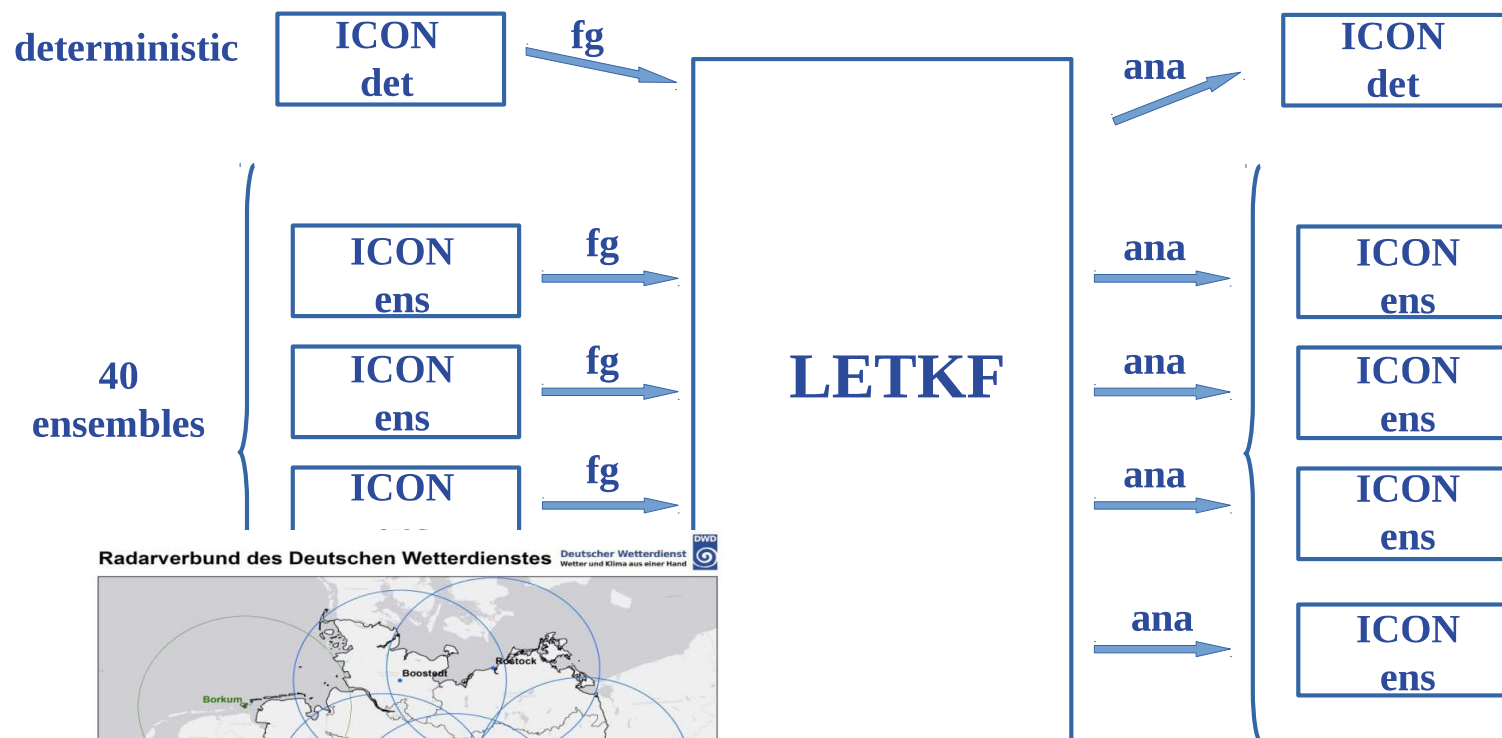
Introduction



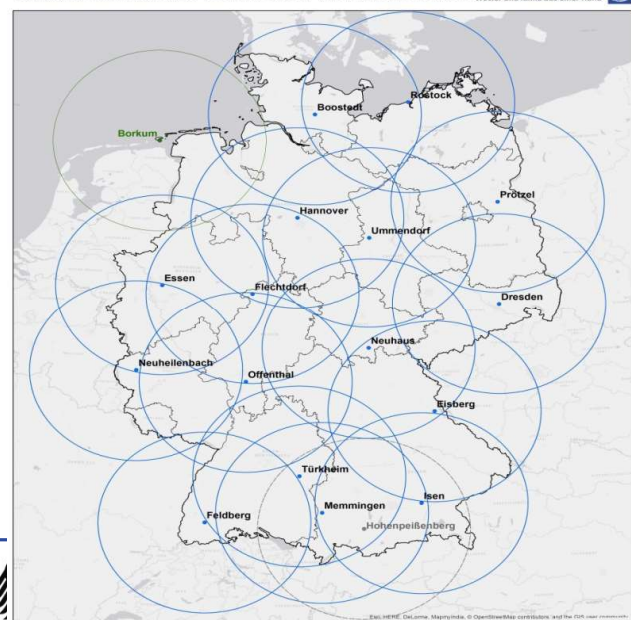


Introduction

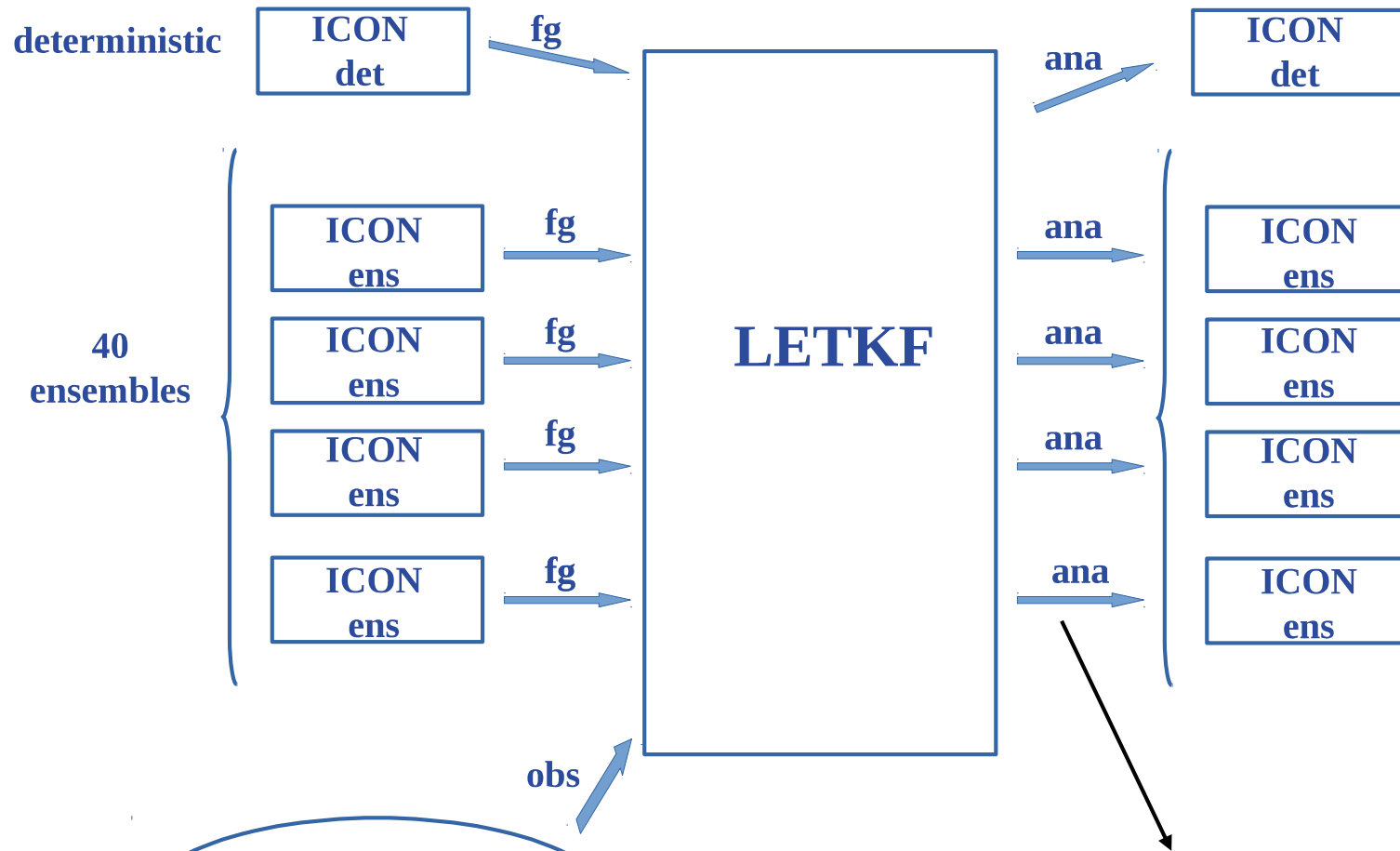
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Radarverbund des Deutschen Wetterdienstes



Introduction



Sensitivity of the model analysis to the hydrometeors (qr, qs and qg) update

Case study:

Date: from **19 Jun 2019** at **23 UTC** to **20 Jun 2019** at **00 UTC** (1 hour)

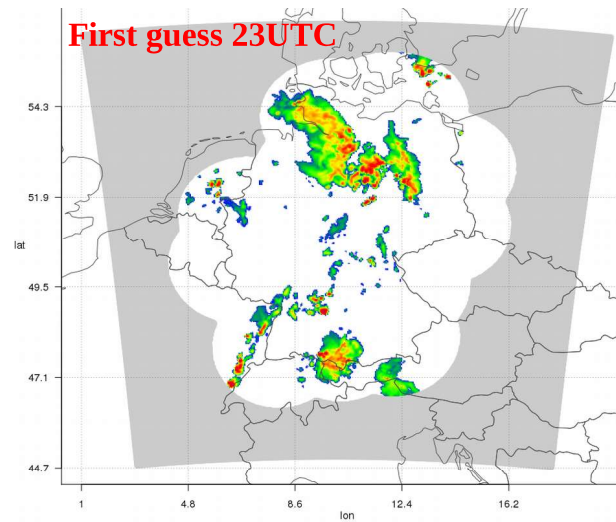
- ❖ 1st experiment: assimilation using conventional data and radar reflectivity **with qr, qs and qg** update
- ❖ 2nd experiment: assimilation using conventional data and radar reflectivity **without qr, qs and qg** update

Setting of radar reflectivity assimilation:

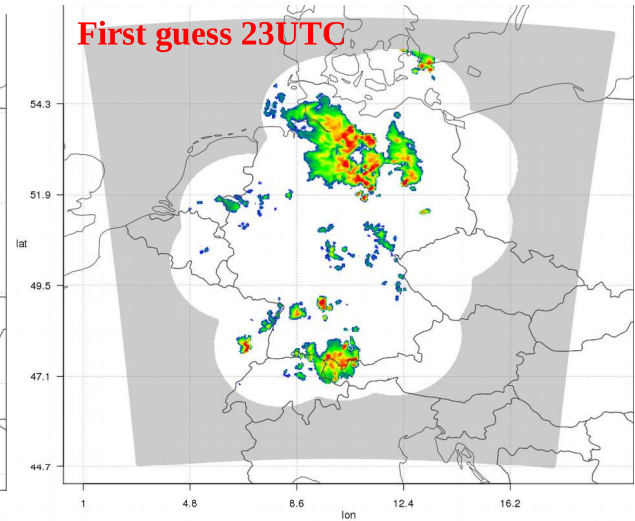
- Using **5** radar beams (**1.5, 3.5, 5.5, 8 and 12** degree)
- h_loc: **16 km**
- v_loc: **0.07 Lnp (vertically increasing)**
- Obs_error: **5 dbz**

Case study

with qr qs qg update



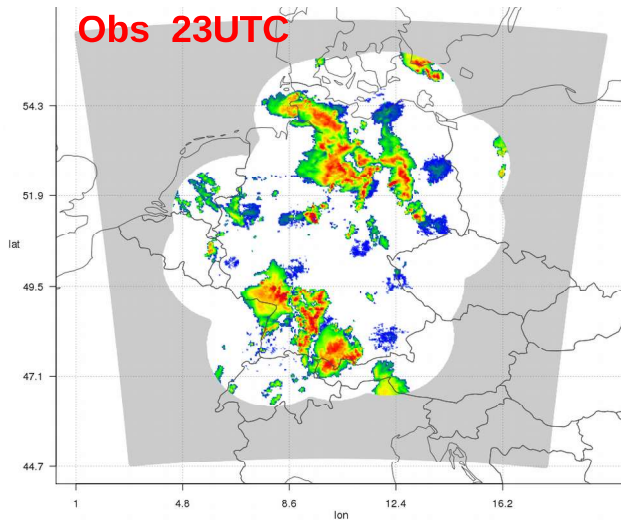
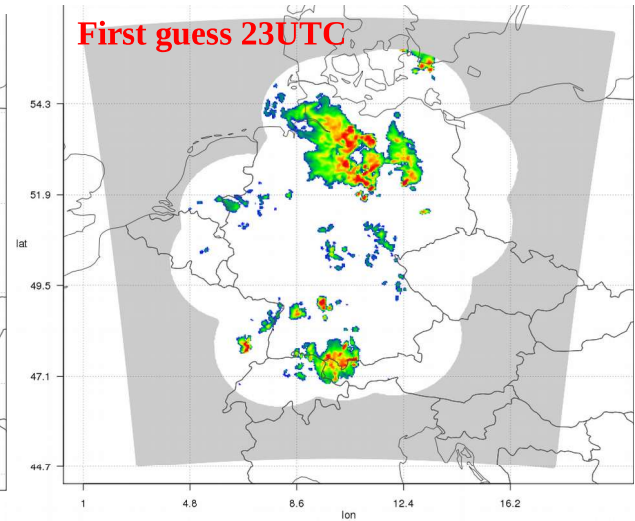
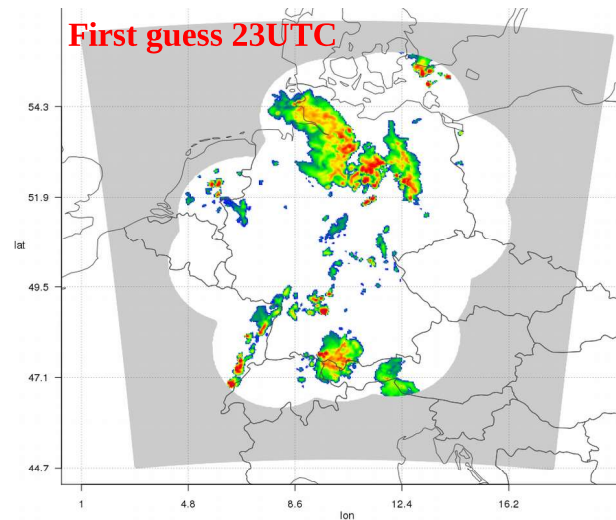
without qr qs qg update



Case study

with qr qs qg update

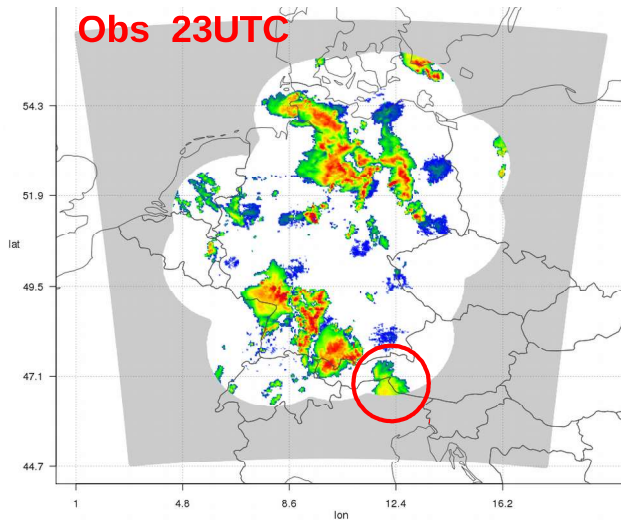
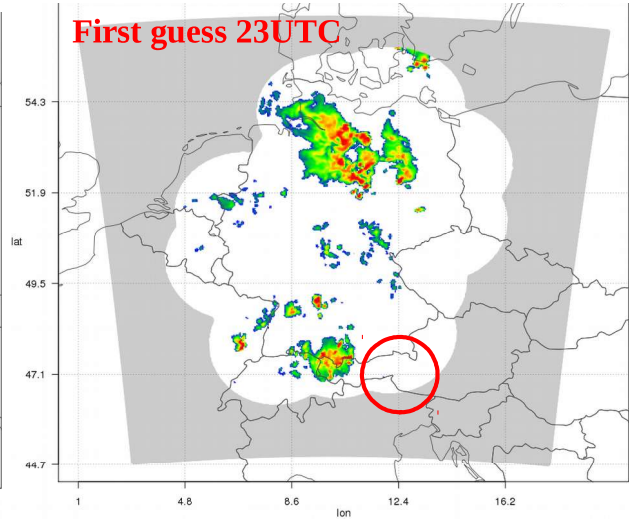
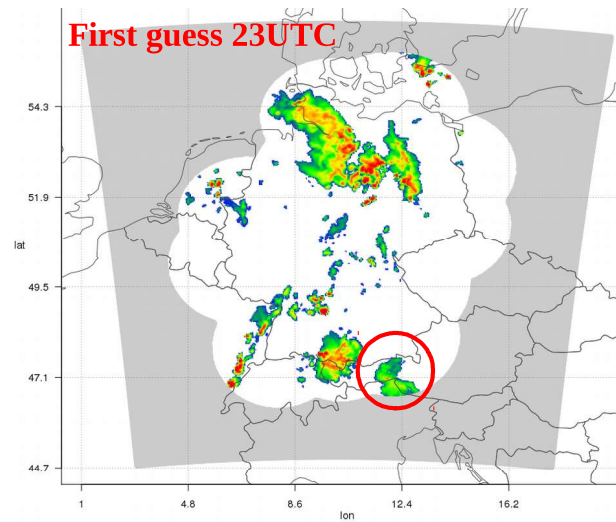
without qr qs qg update



Case study

with qr qs qg update

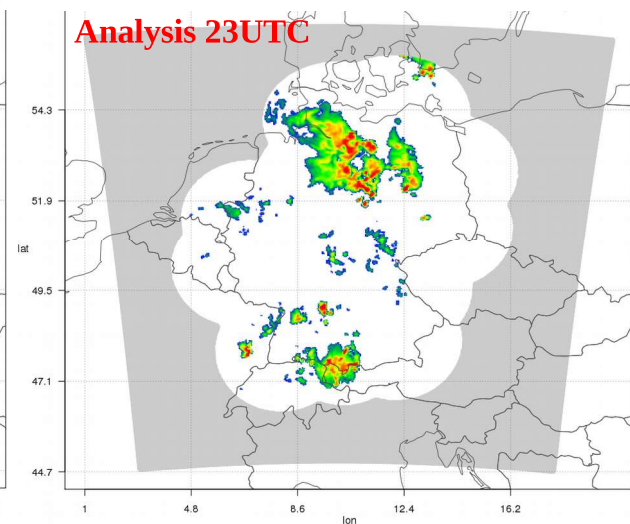
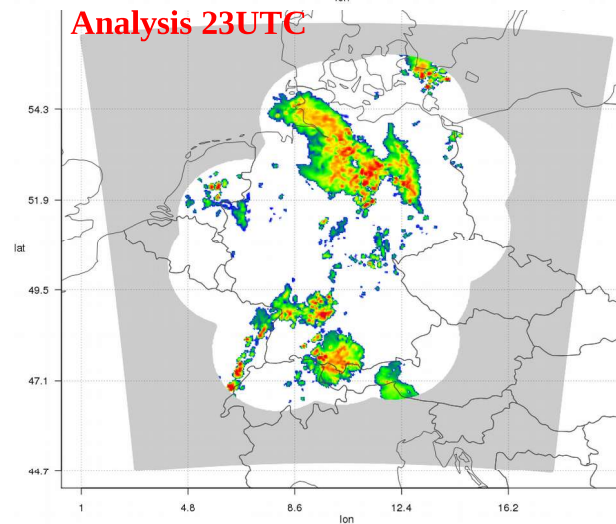
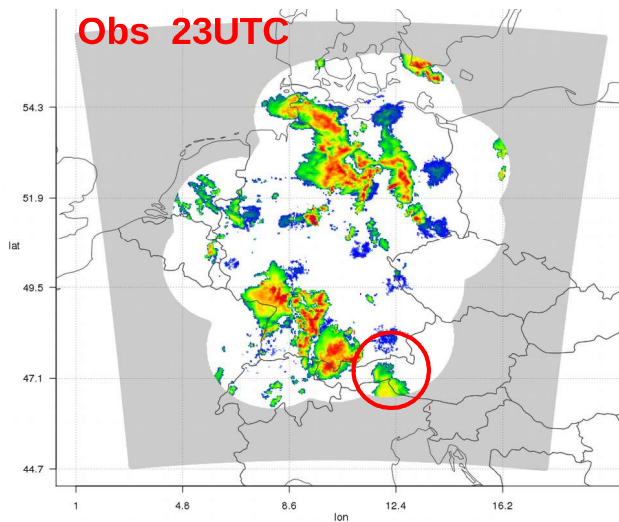
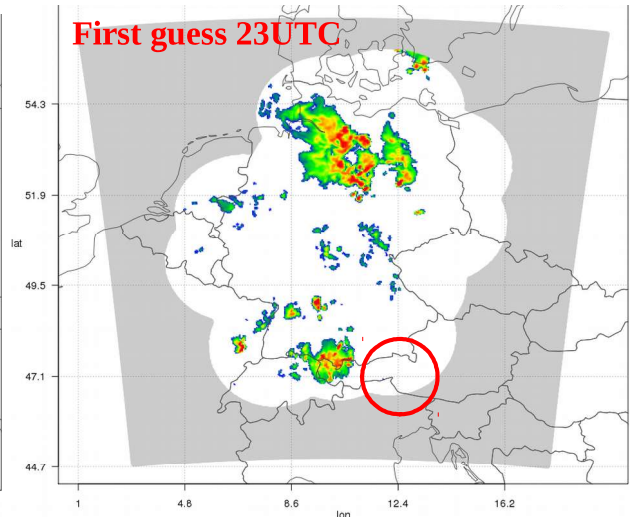
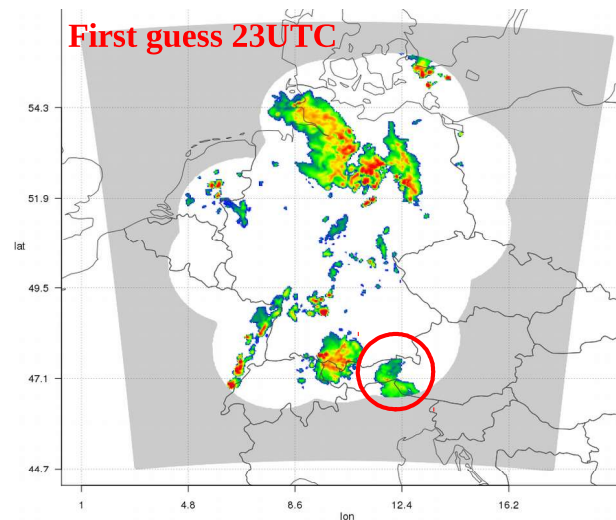
without qr qs qg update



Case study

with qr qs qg update

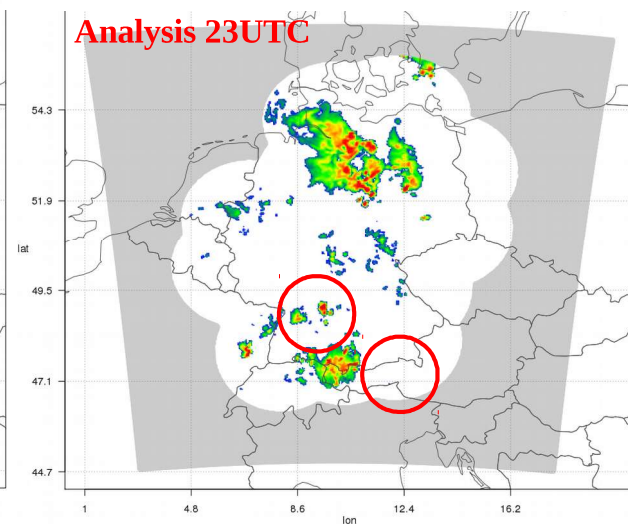
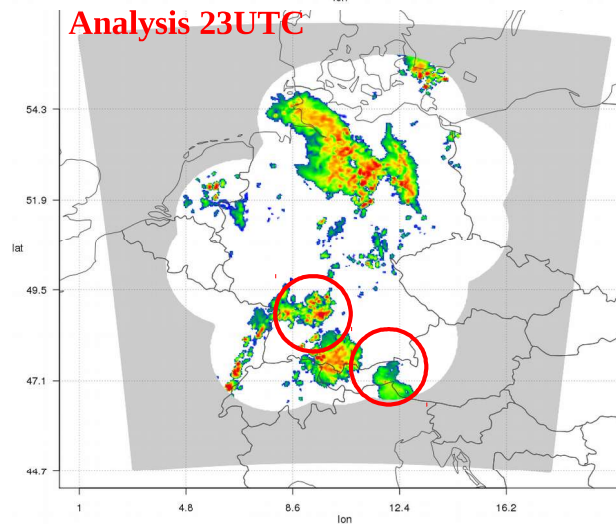
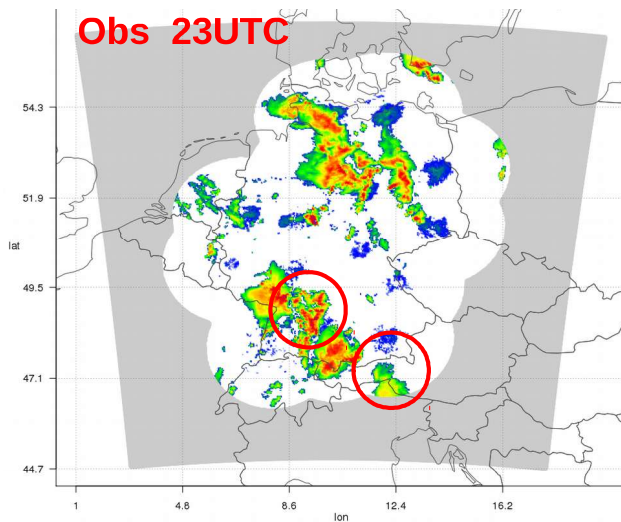
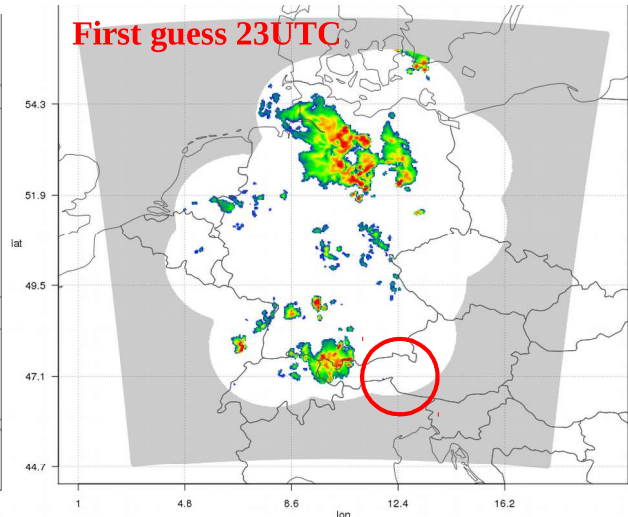
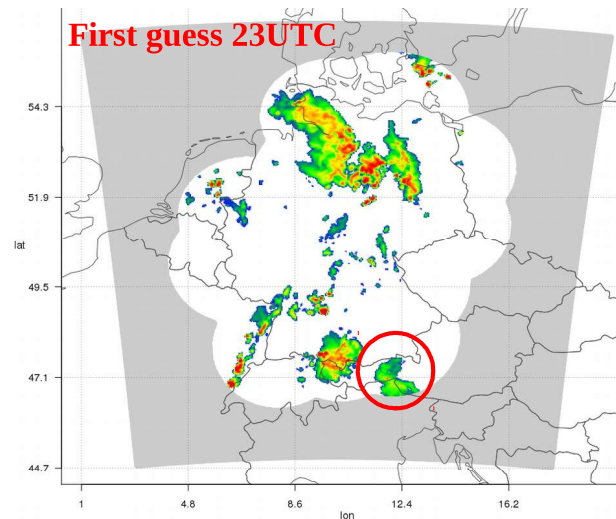
without qr qs qg update



Case study

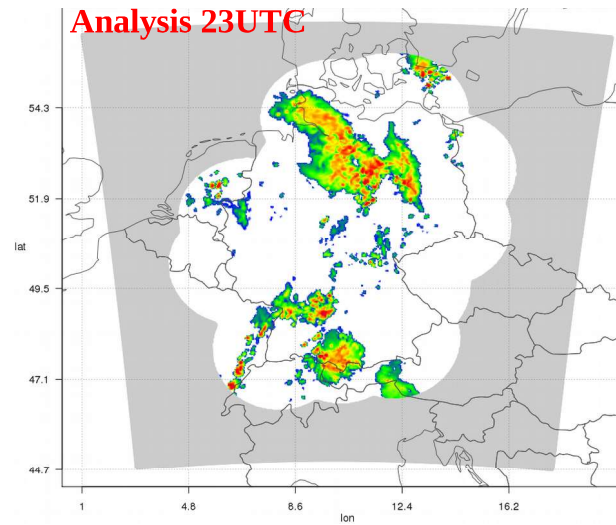
with qr qs qg update

without qr qs qg update

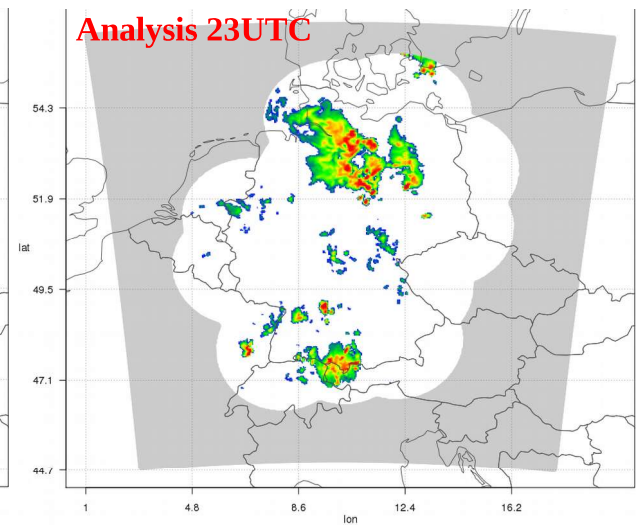


Case study

with qr qs qg update

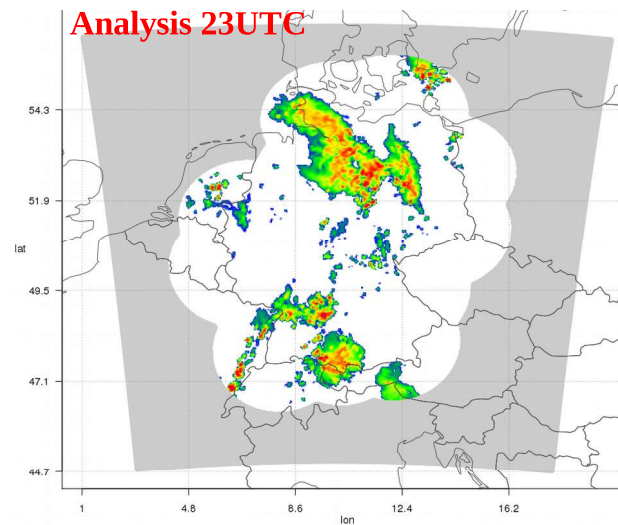


without qr qs qg update

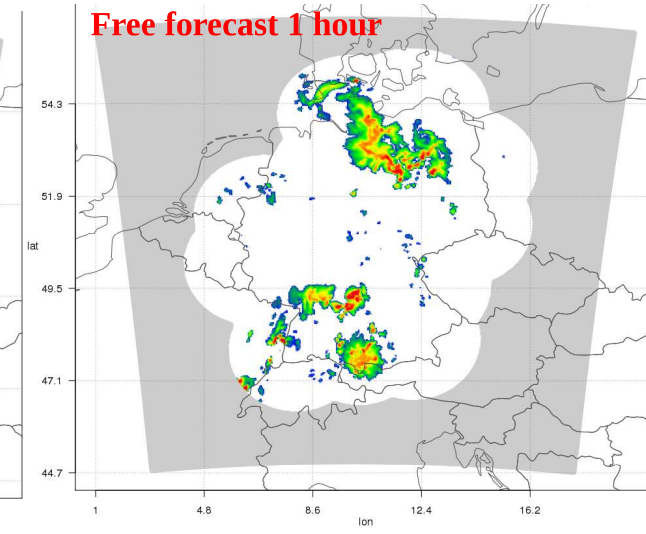
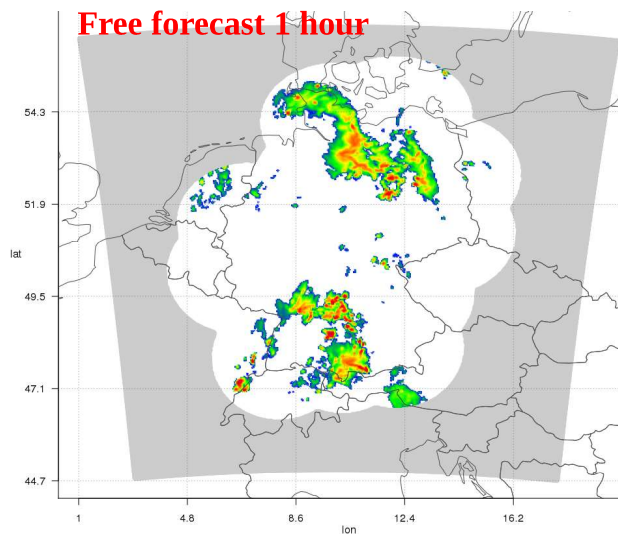
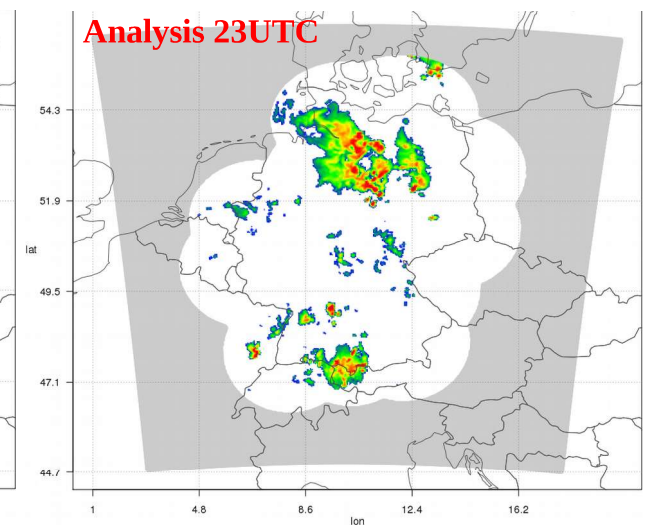


Case study

with qr qs qg update



without qr qs qg update



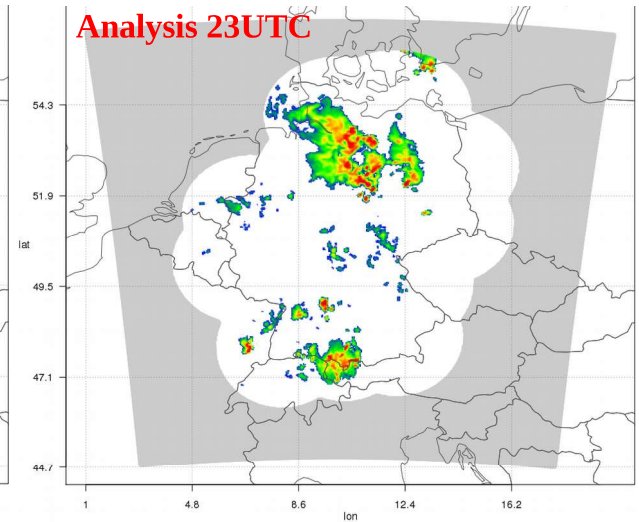
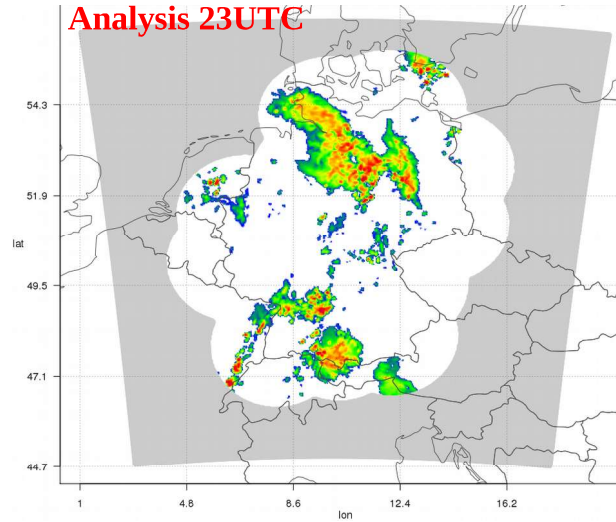
Case study

with qr qs qg update

without qr qs qg update

Analysis 23UTC

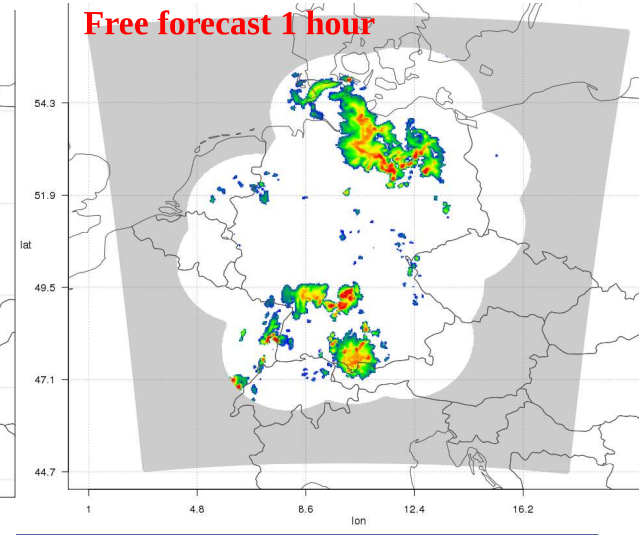
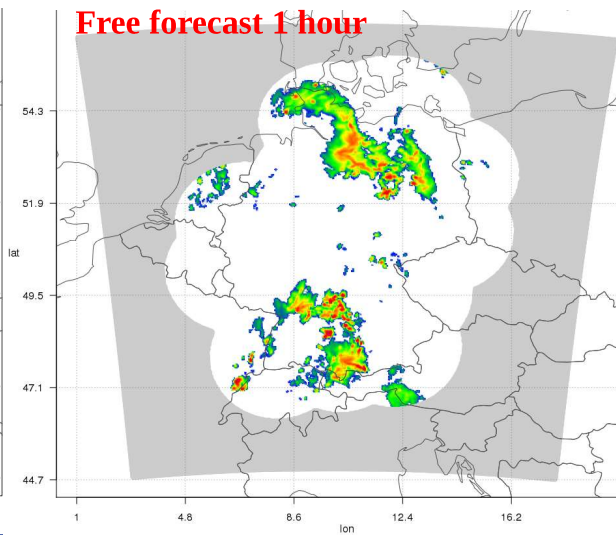
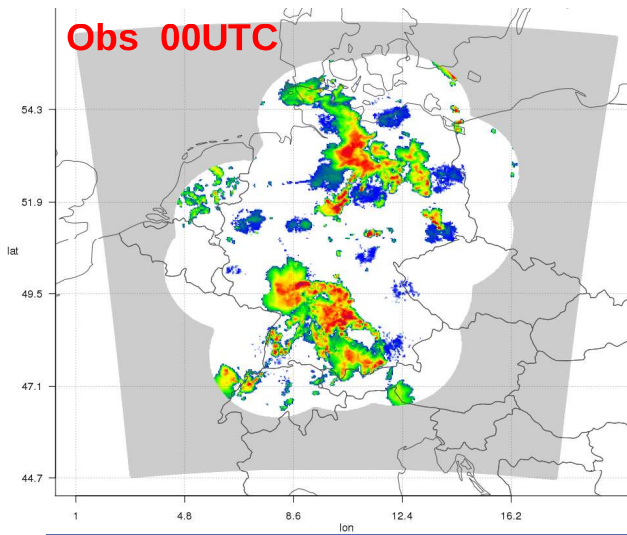
Analysis 23UTC



Obs 00UTC

Free forecast 1 hour

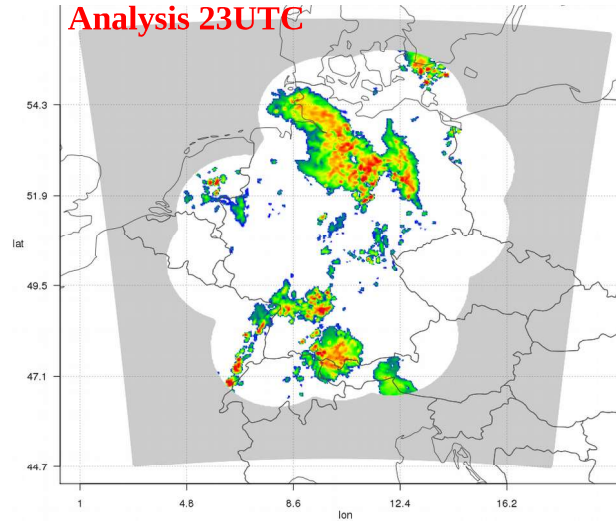
Free forecast 1 hour



Case study

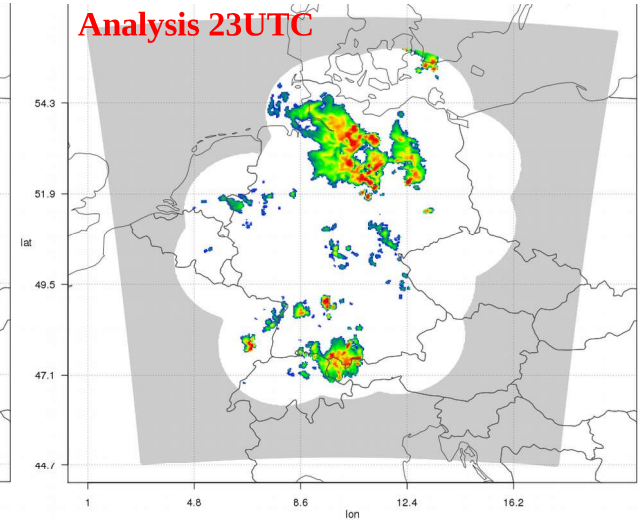
with qr qs qg update

Analysis 23UTC

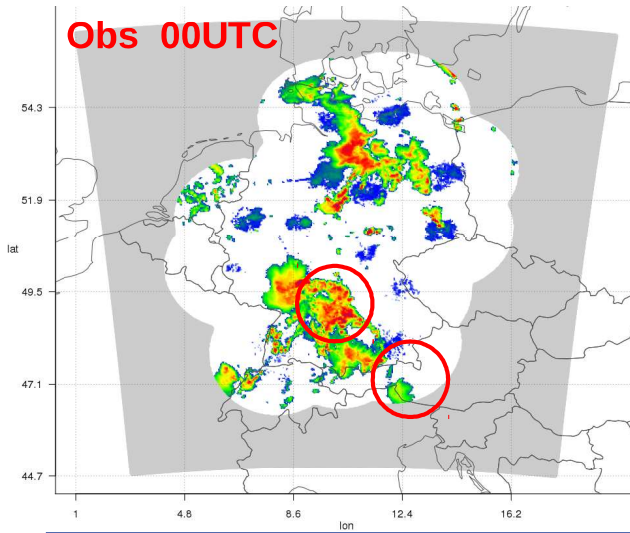


without qr qs qg update

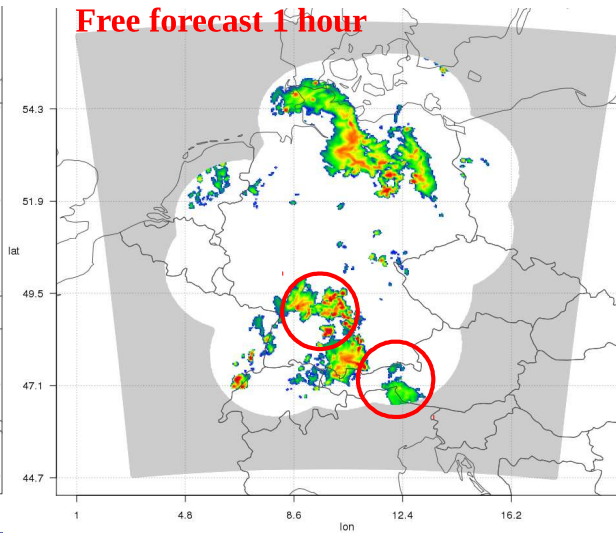
Analysis 23UTC



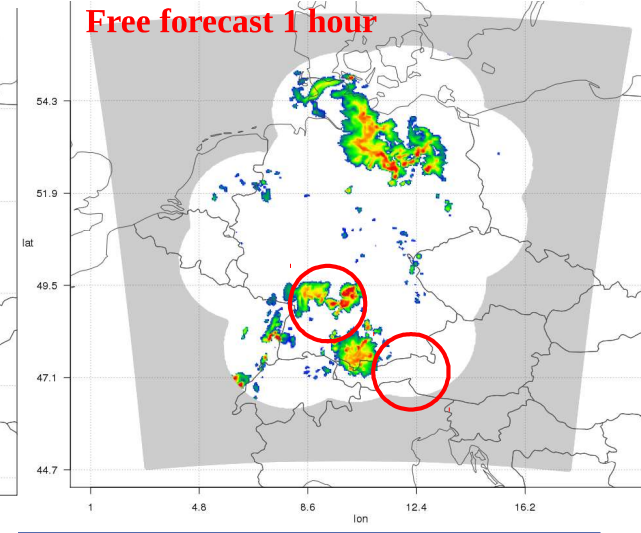
Obs 00UTC



Free forecast 1 hour



Free forecast 1 hour



Case study

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

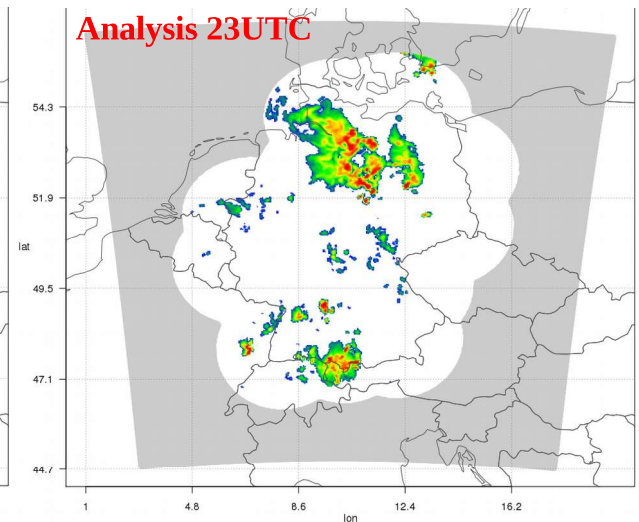
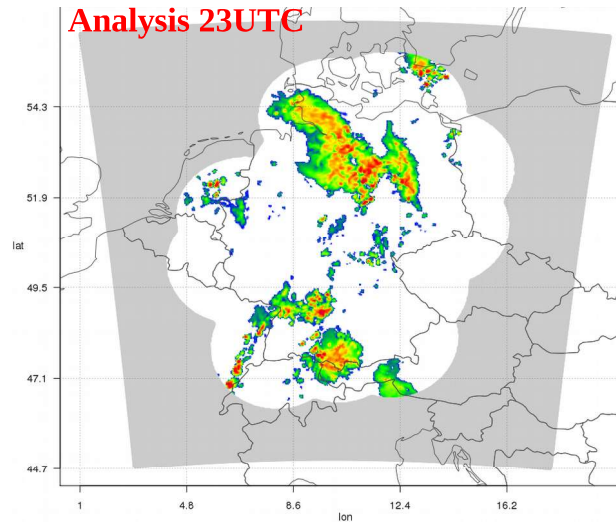


with qr qs qg update

without qr qs qg update

Analysis 23UTC

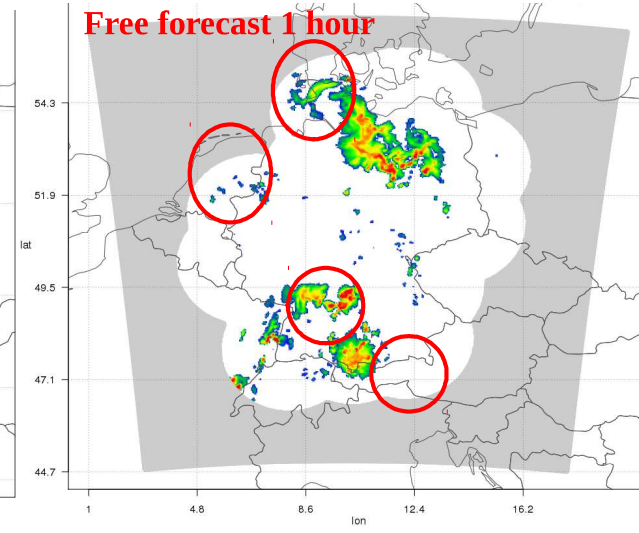
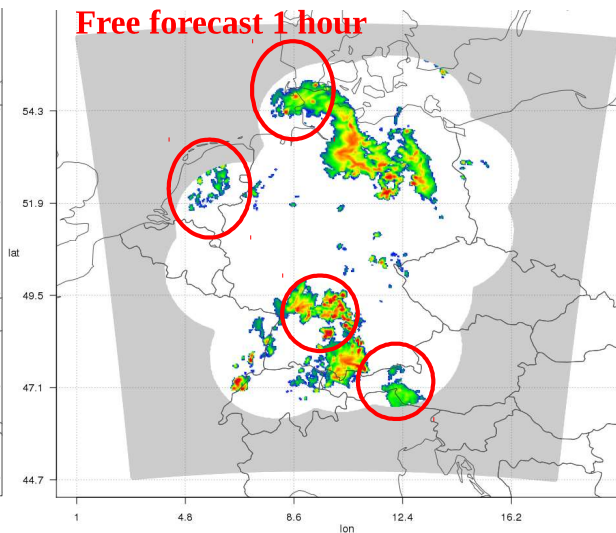
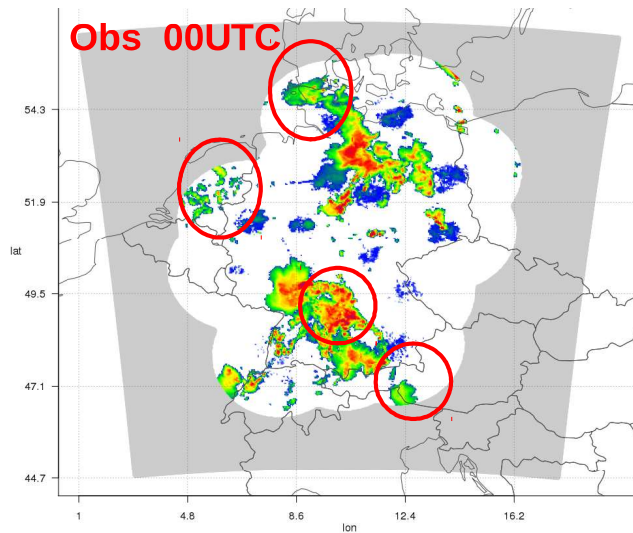
Analysis 23UTC



Obs 00UTC

Free forecast 1 hour

Free forecast 1 hour



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Kobra Khosravian

Long-term experiment

Summer time:

Date: 20190602-20190623 (**22 days**)

- ❖ 1st experiment: assimilation using **conventional data and radar reflectivity with qr, qs and qg** update
- ❖ 2nd experiment: assimilation using **conventional data and radar reflectivity without qr, qs and qg** update
- ❖ 3rd experiment: assimilation using only **conventional data without qr, qs and qg** update

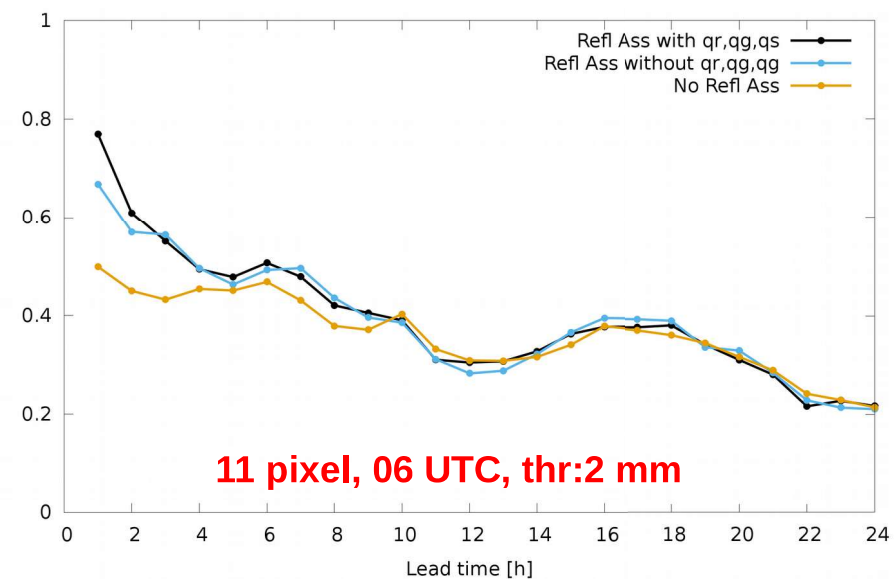
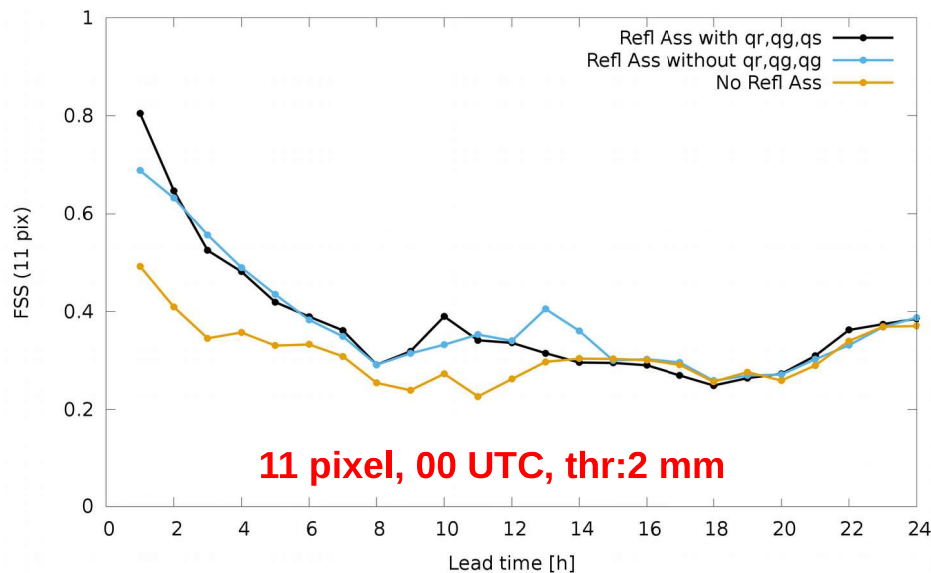
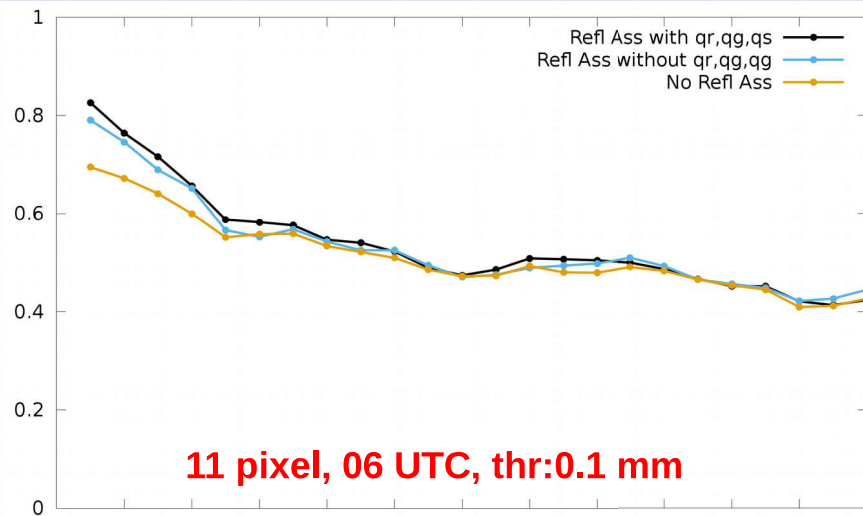
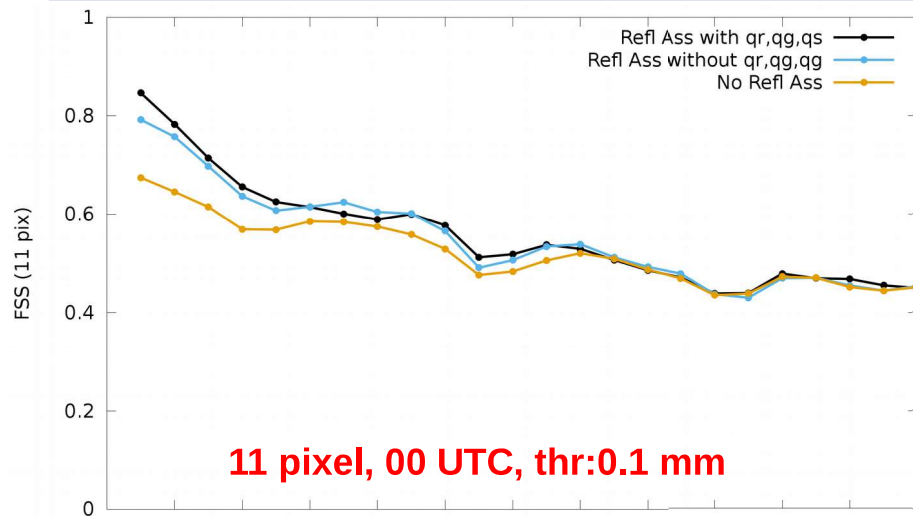
Setting of radar reflectivity assimilation:

- Using **5** radar beams (**1.5, 3.5, 5.5, 8 and 12** degree)
- h_loc: **16 km**
- v_loc: **0.07 Lnp (vertically increasing)**
- Obs_error: **5 dbz**

Precipitation verification_over Germany domain



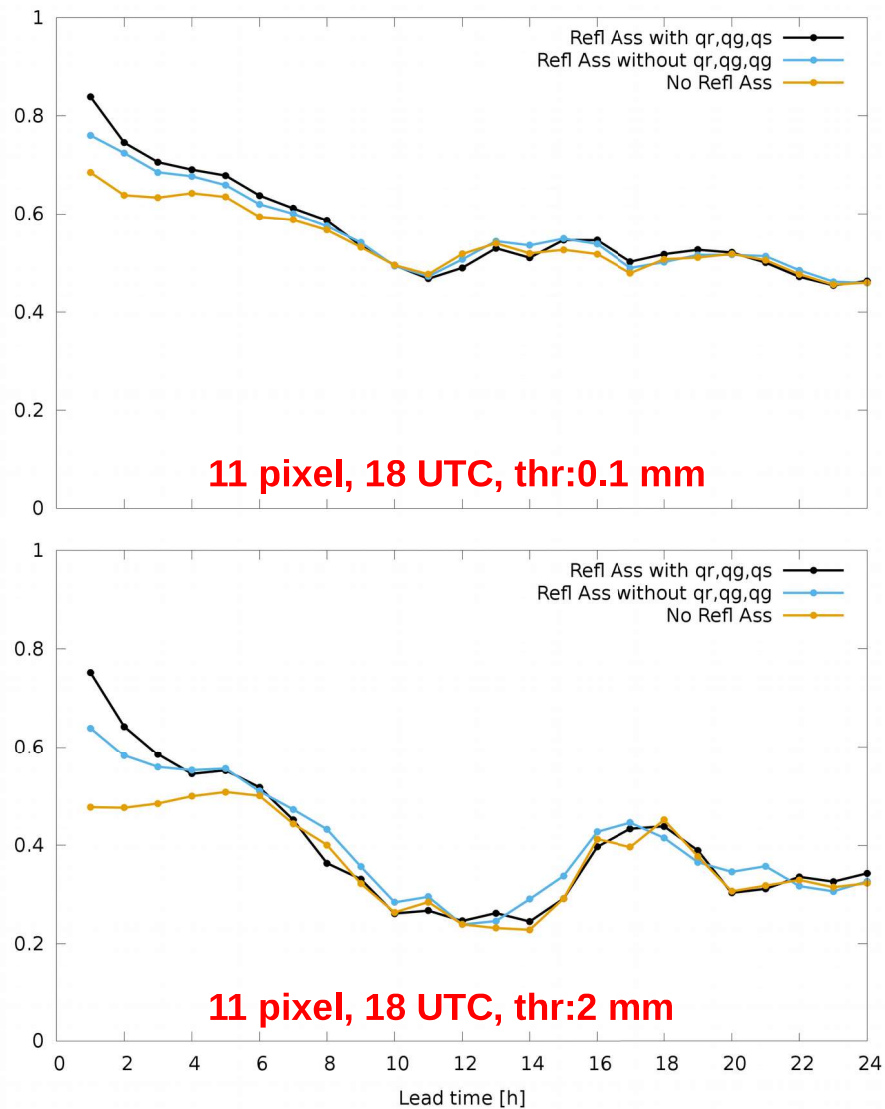
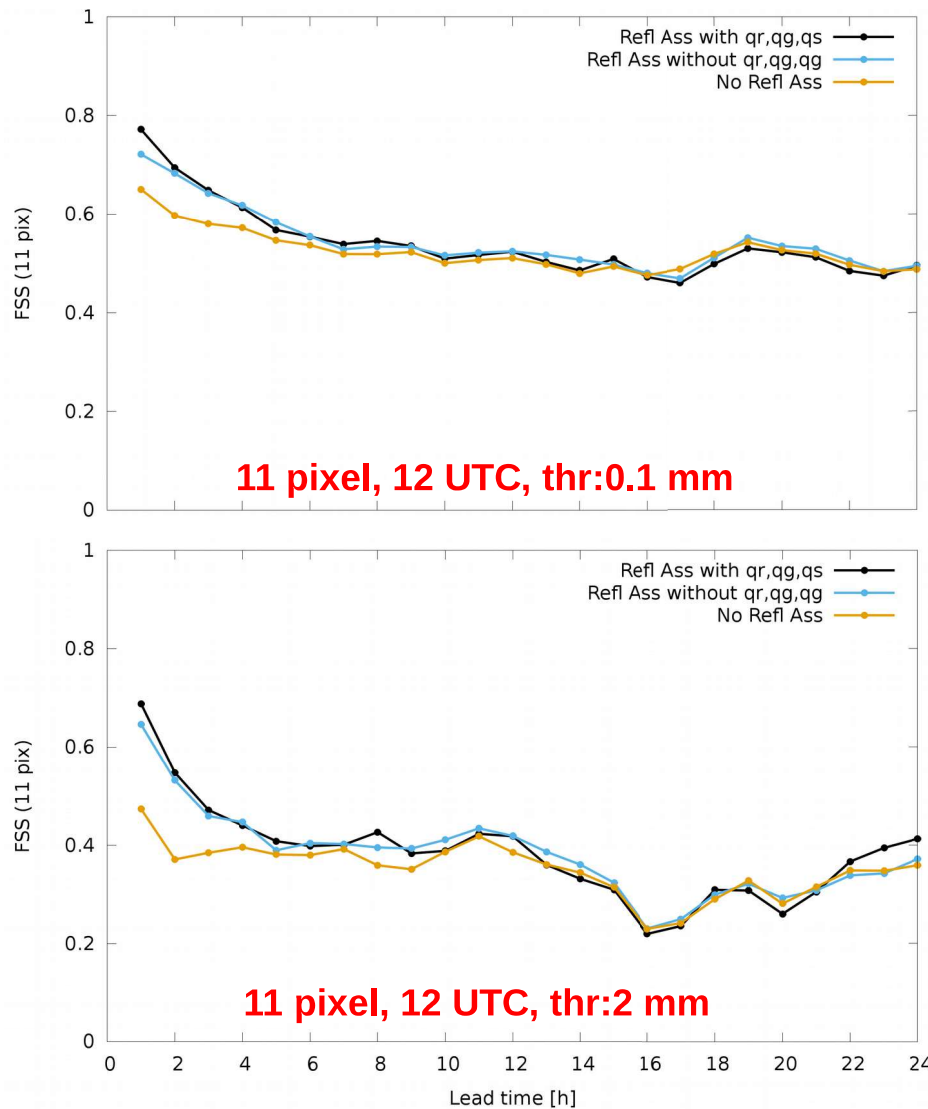
ref ass with hydro — ref ass without hydro — without ref ass — Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Precipitation verification_over Germany domain



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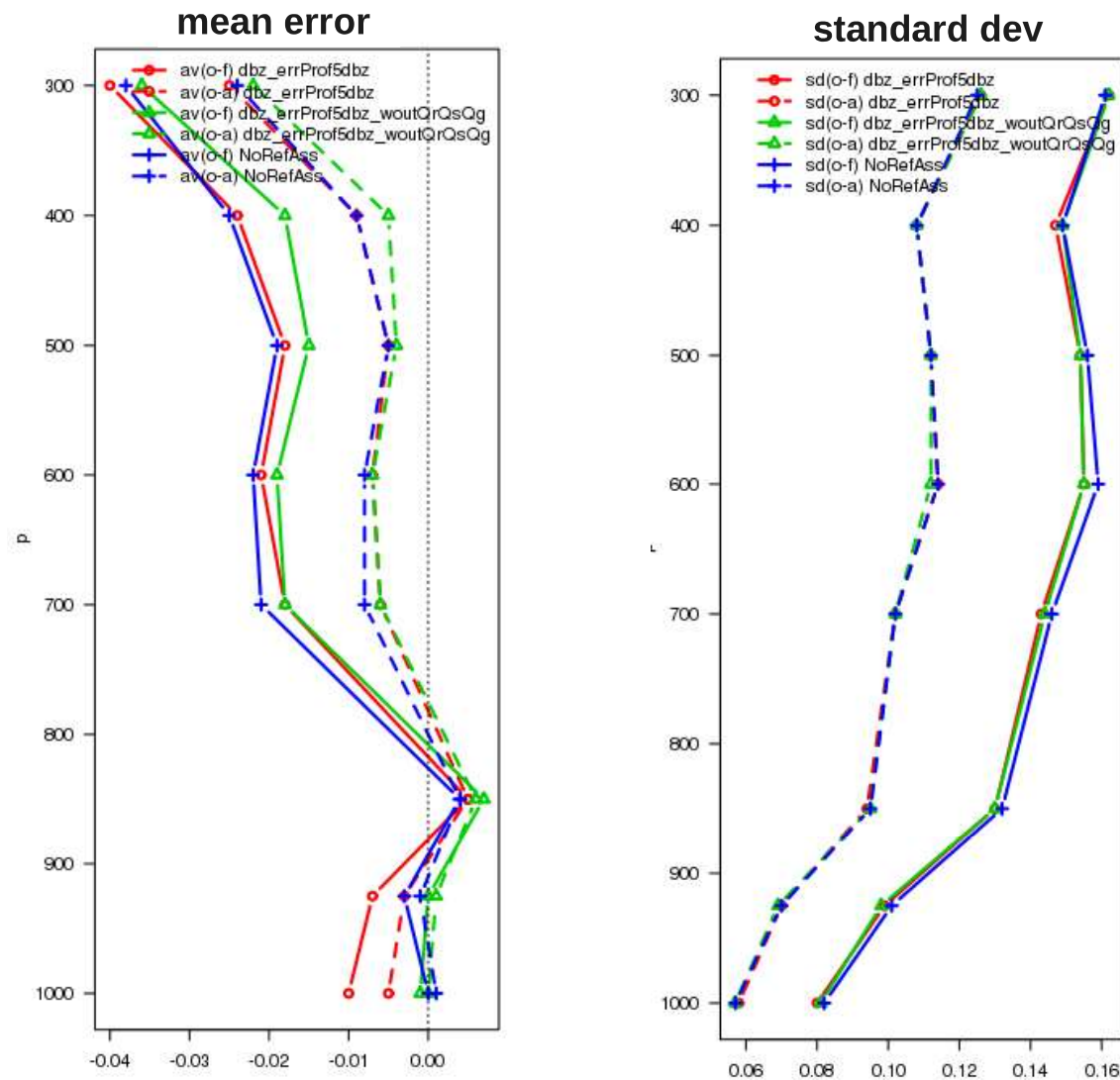


Observation error statistic (SYNOP, AIREP, TEMP and PILOT)

Humidity_D2 domain

ref ass with hydro — ref ass without hydro — without ref ass —

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

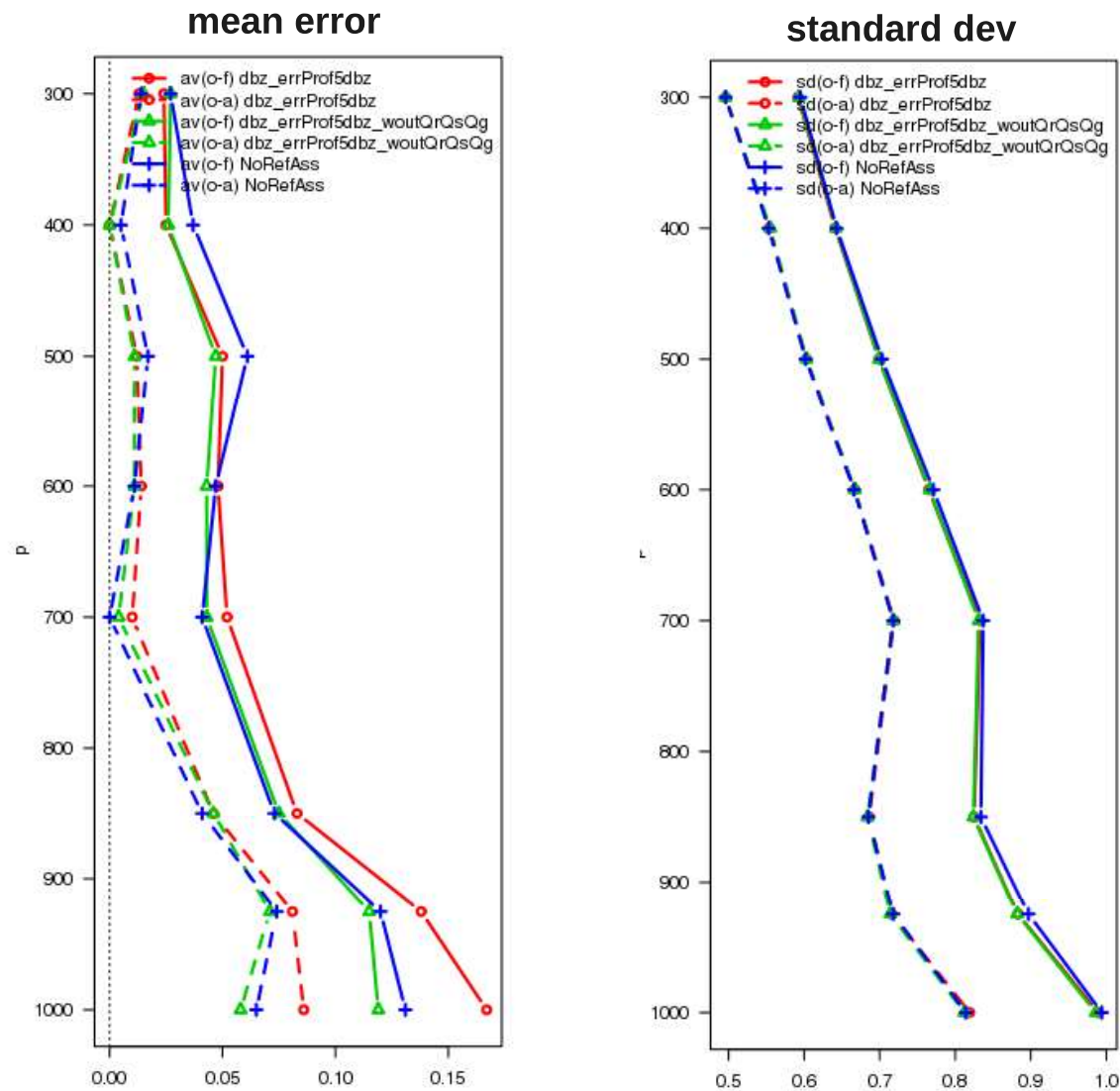


Observation error statistic (SYNOP, AIREP, TEMP and PILOT)

Temperature_D2 domain

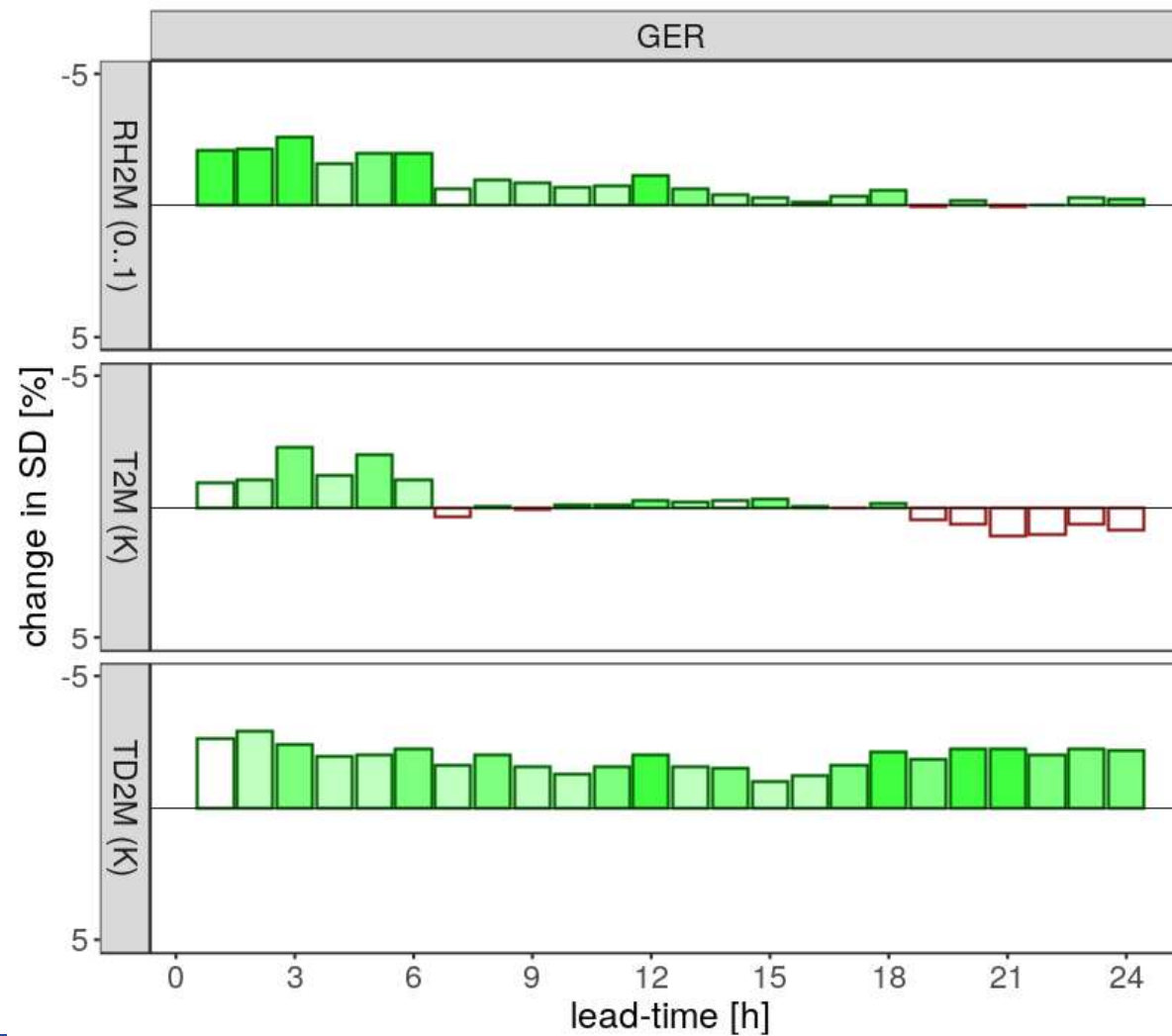
ref ass with hydro — ref ass without hydro — without ref ass —

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Verification against SYNOP observation

ref ass with hydro better ■ ref ass without hydro better ■



Long-term experiment

Winter time:

Date: 20181208-20181225 (**18 days**)

- ❖ 1st experiment: assimilation using **conventional data and radar reflectivity with qr, qs and qg** update
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- ❖ 3rd experiment: assimilation using **only conventional data without qr, qs and qg** update

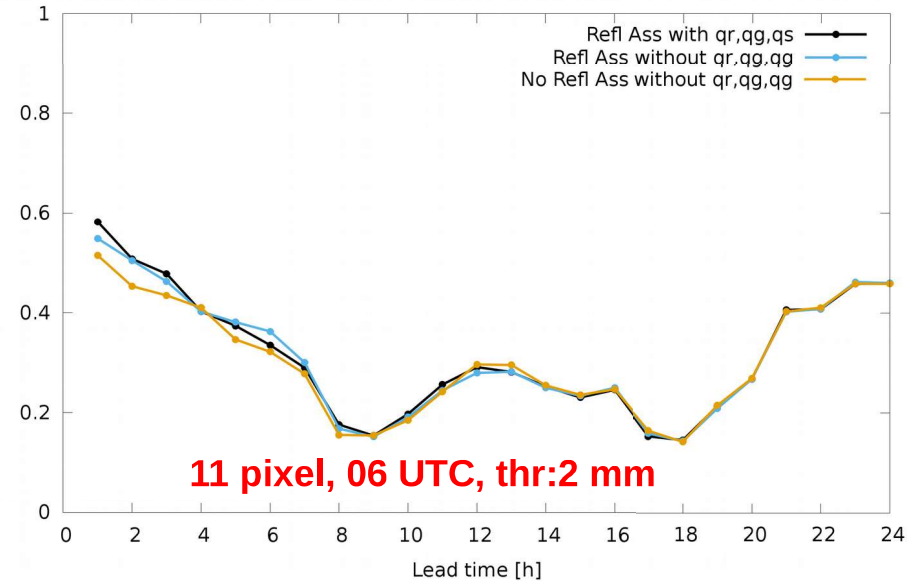
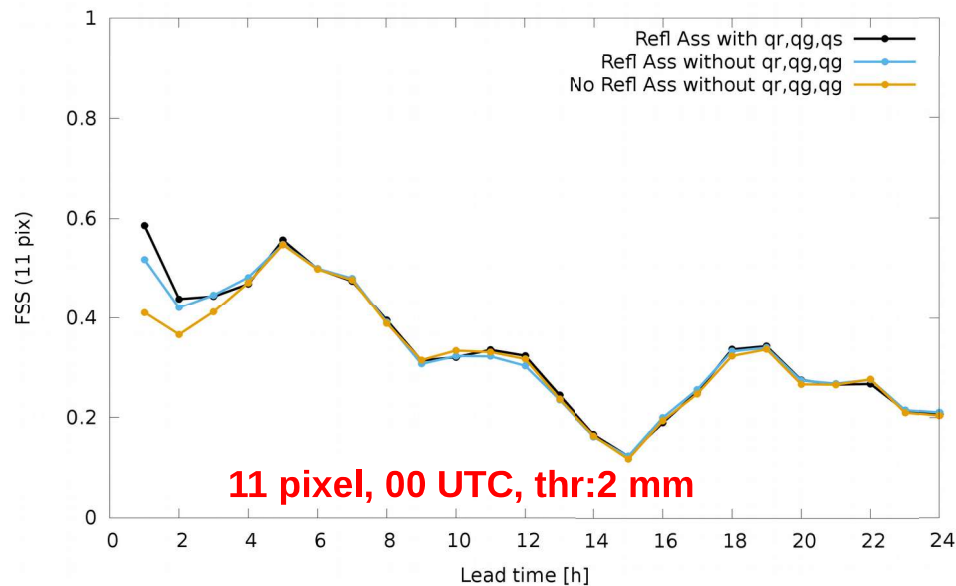
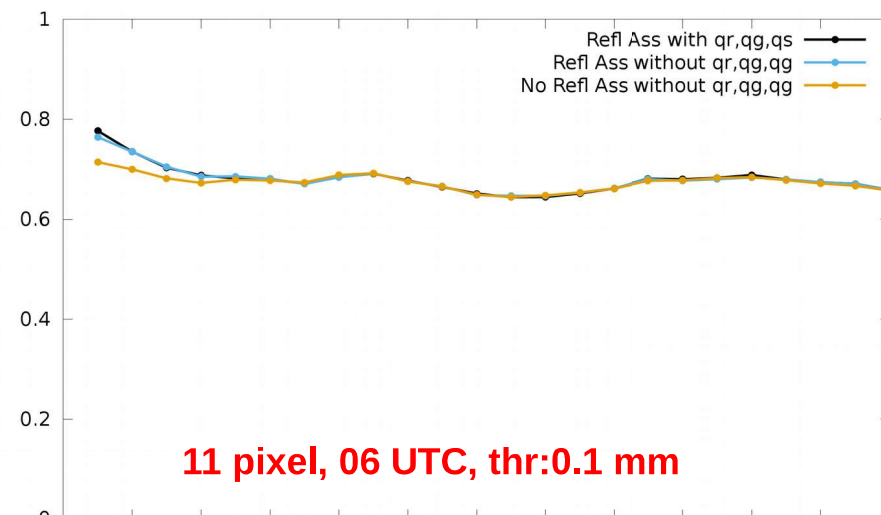
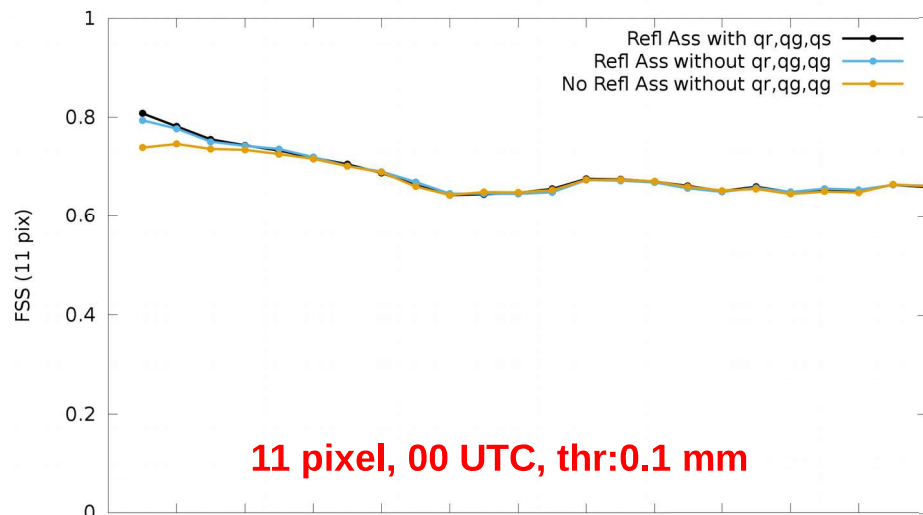
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Precipitation verification_over Germany domain



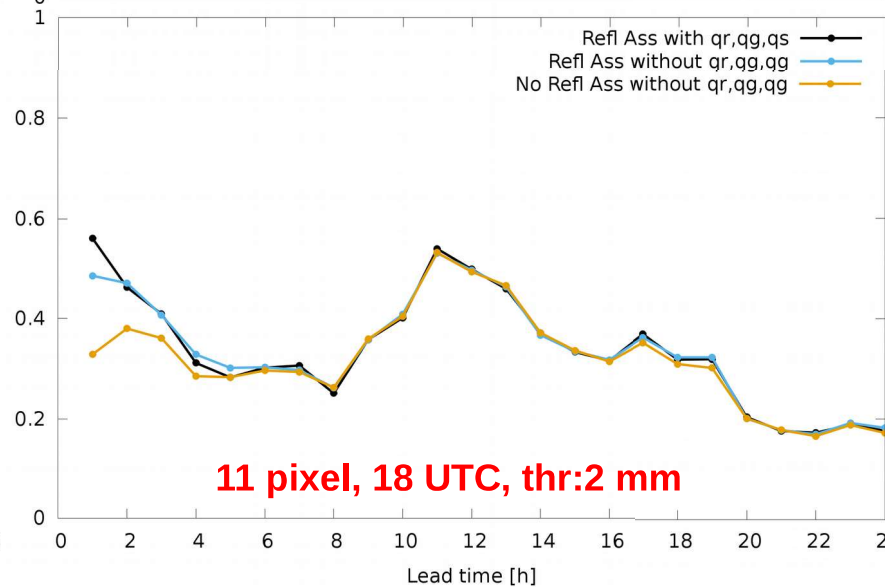
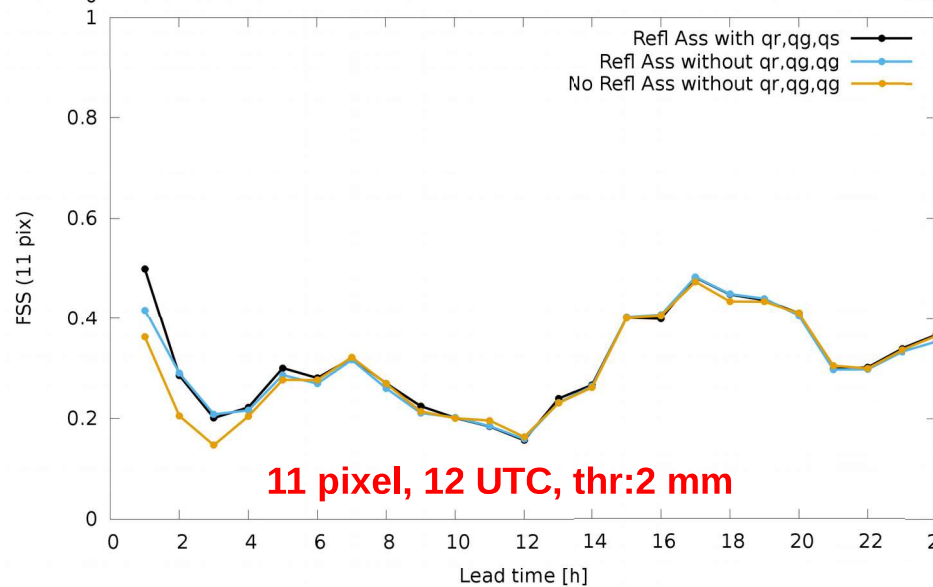
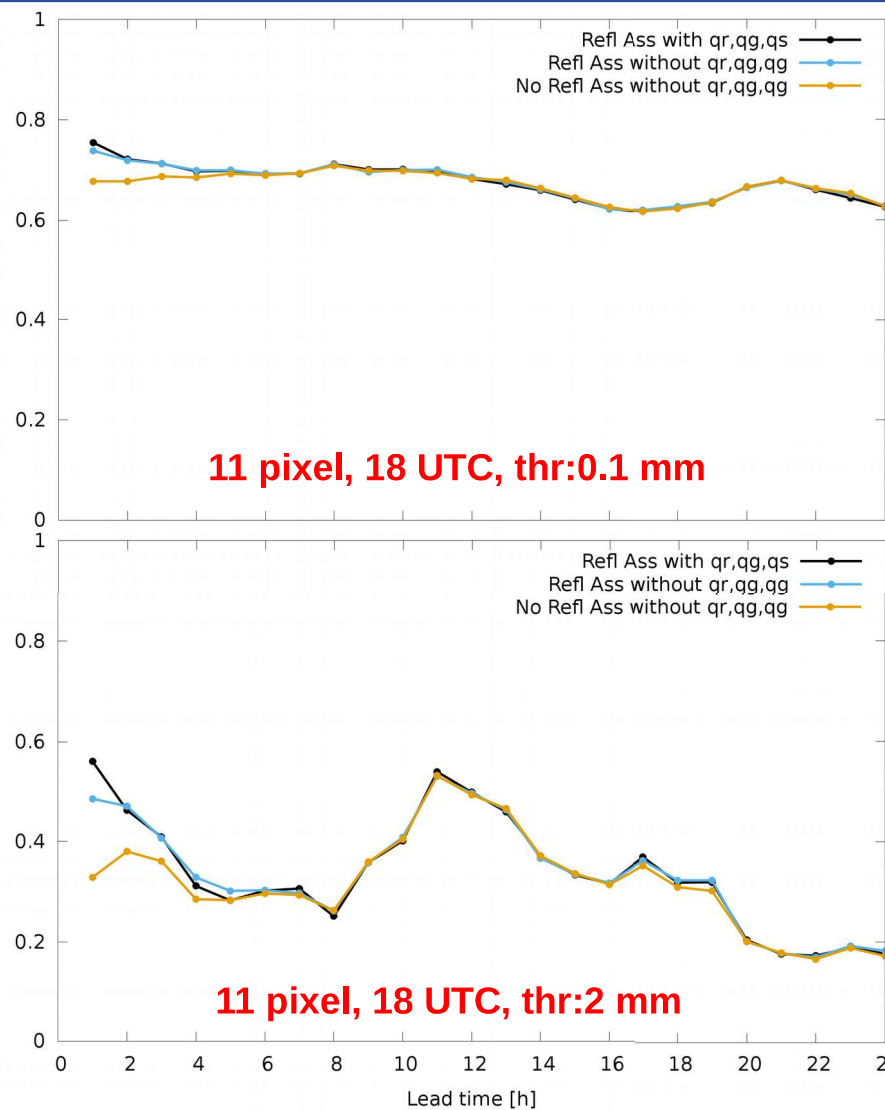
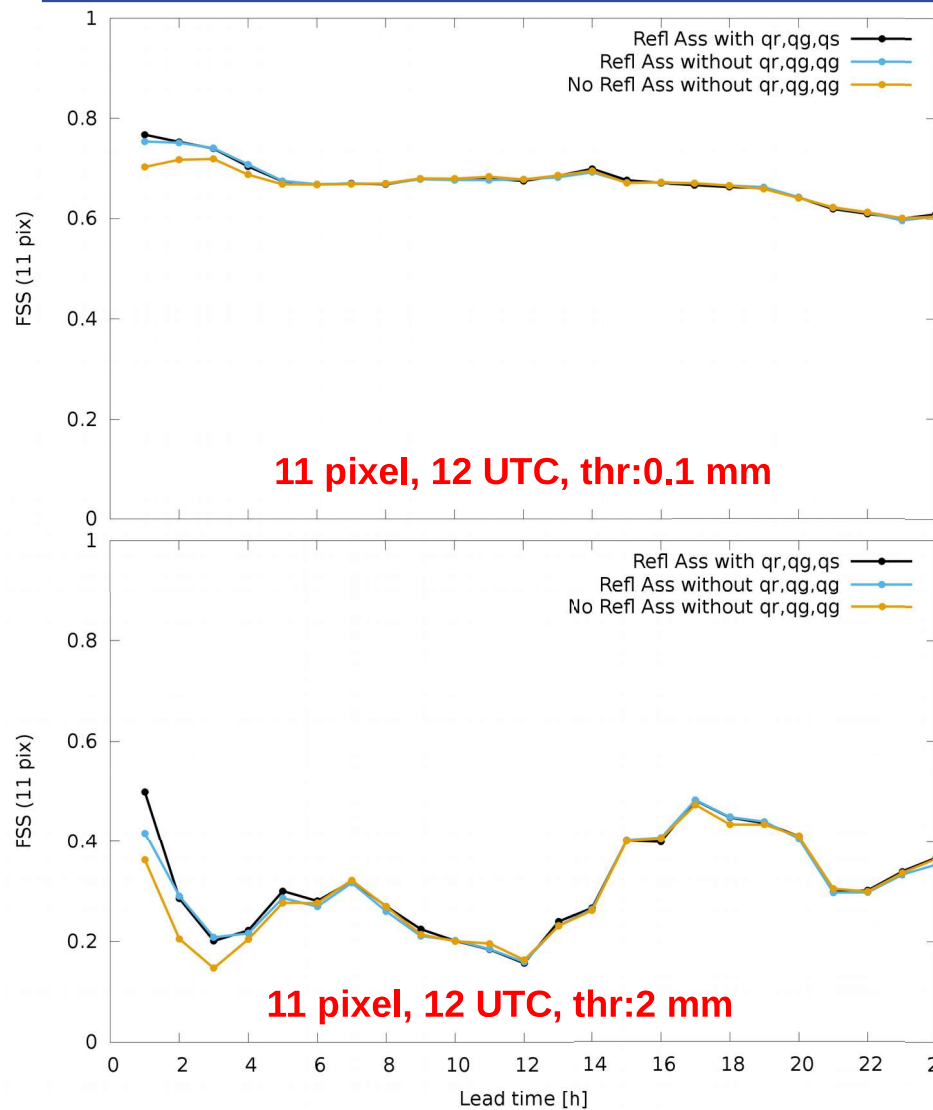
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Precipitation verification_over Germany domain



ref ass with hydro — ref ass without hydro — without ref ass — Deutscher Wetterdienst
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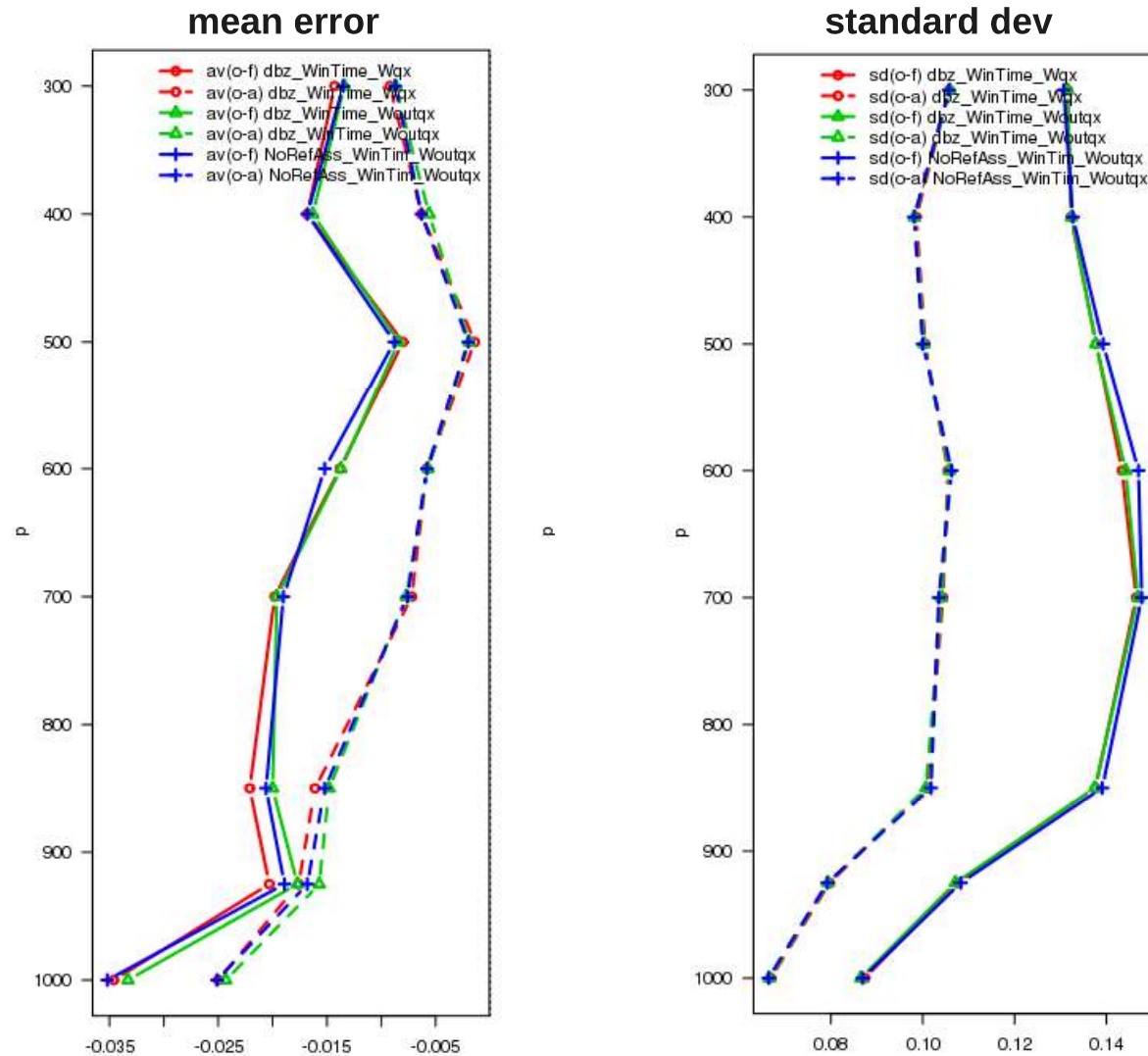


Observation error statistic (SYNOP, AIREP, TEMP and PILOT)

Humidity_D2 domain

ref ass with hydro — ref ass without hydro — without ref ass —

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

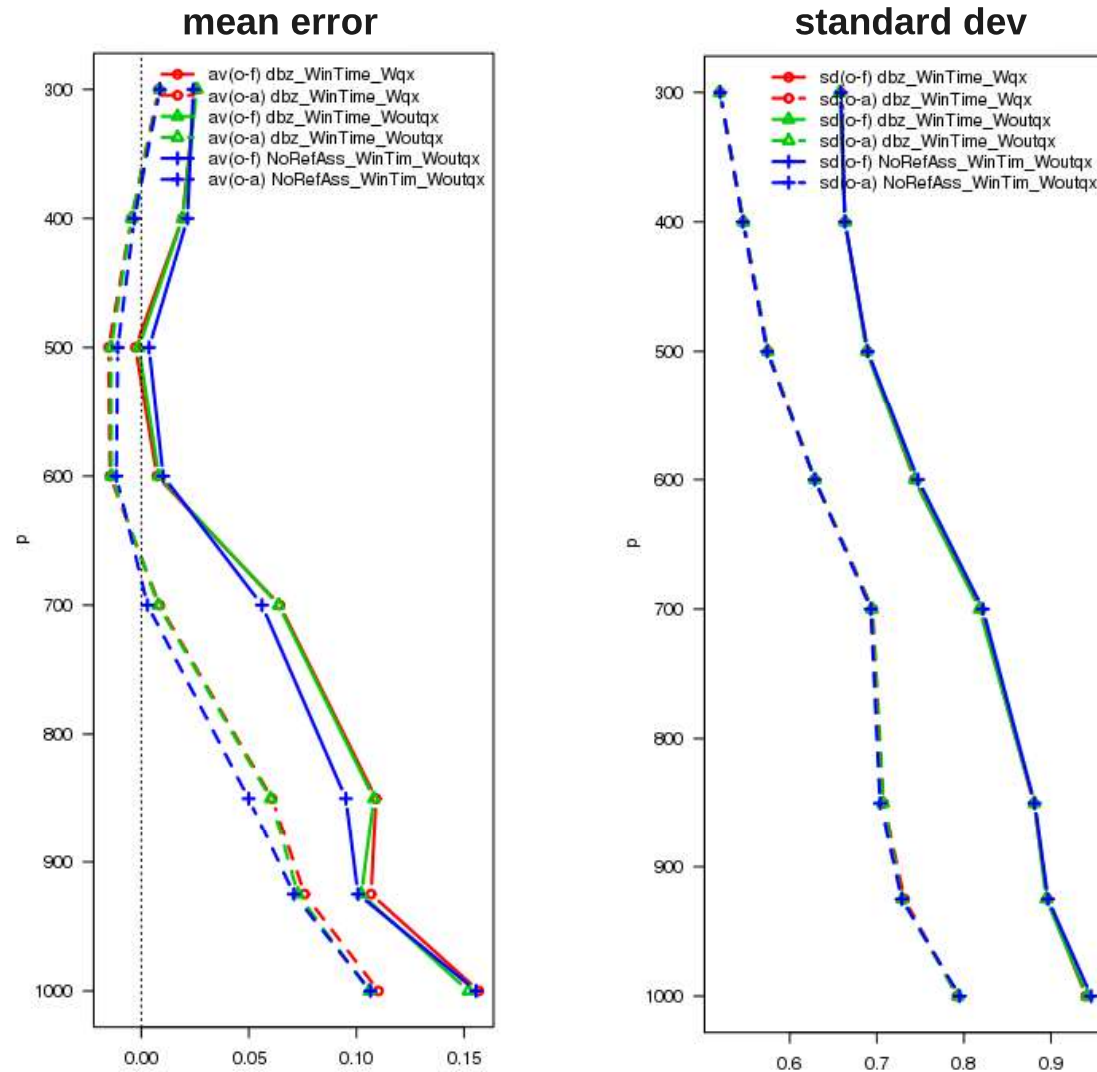


Observation error statistic (SYNOP, AIREP, TEMP and PILOT)

Temperature_D2 domain

ref ass with hydro — ref ass without hydro — without ref ass —

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Updating the hydrometeors (q_r , q_s and q_g) can have a

- Significant impact on radar reflectivity assimilation
- Positive impact on free forecast which can remain between 2 and 6 hours
- Higher impact on forecast of summer time precipitation compared to the winter time precipitation which may relate to the type of precipitation
- Positive impact on temperature and humidity assimilation at the surface

Final conclusion still needs more experiments

Thank you for your attention