PT SNOWE-
final status

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Outlook

- PT SNOWE (goal, motivation)

- The SNOWE technology and organization of operational runs

- Tests of SNOWE

- Analysis of effects of implementation of SNOWE based on VERSUS conditional verification

- Conclusions

PT SNOWE goal

To develop the system of continuous calculations of snow WE on synoptic stations as block for DAS correction into COSMO-model.

To prepare the software and its description for continuous calculations of snow WE based on SYNOP measurements (Snow Depth, T, Td, Wind).

To test the SNOWE technology / analyze the effects of its implementation in COSMO-modeling.
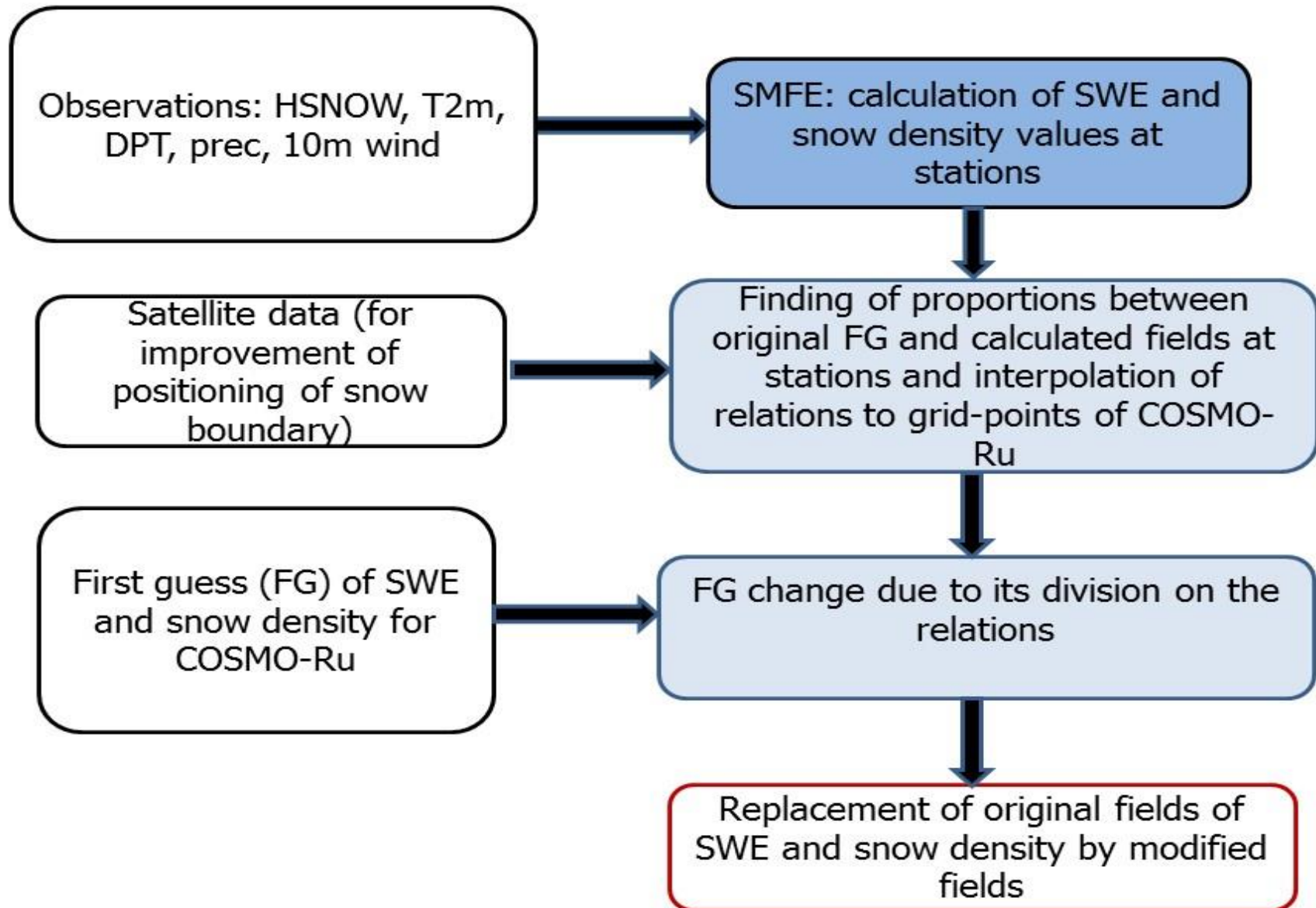
SNOWE motivation

- Atmospheric models need SWE and snow density values as initial fields.

- The only regular SYNOP measurements of snow depth are operational available data about snow cover (also satellite data of snow boundary position).

- The snow density values are in dependence on thermal history of the whole cold period. The values could be received through empirical relationships which allow converting snow depth into needed values or as results of SWE simulation during continuous DAS cycles with accumulation of errors. As result for the regions of long snow period the differences between calculated and measured SWE can be more than 1 m (100 kg/m2!). This leads to wrong calculation of heat budget components near snow boundary and wrong T2m forecasts (ME till 15 Degrees!) in this narrow zone (Kazakova E., Rozinkina I., COSMO Newsletter, 2011).

- The proposed technology SNOWE permits to obtain the initial fields of SWE based on the proceeding of SYNOP data (Snow Depth + Meteorological parameters) during the whole snow period in couple with correction of FG of SWE based on the model simulations
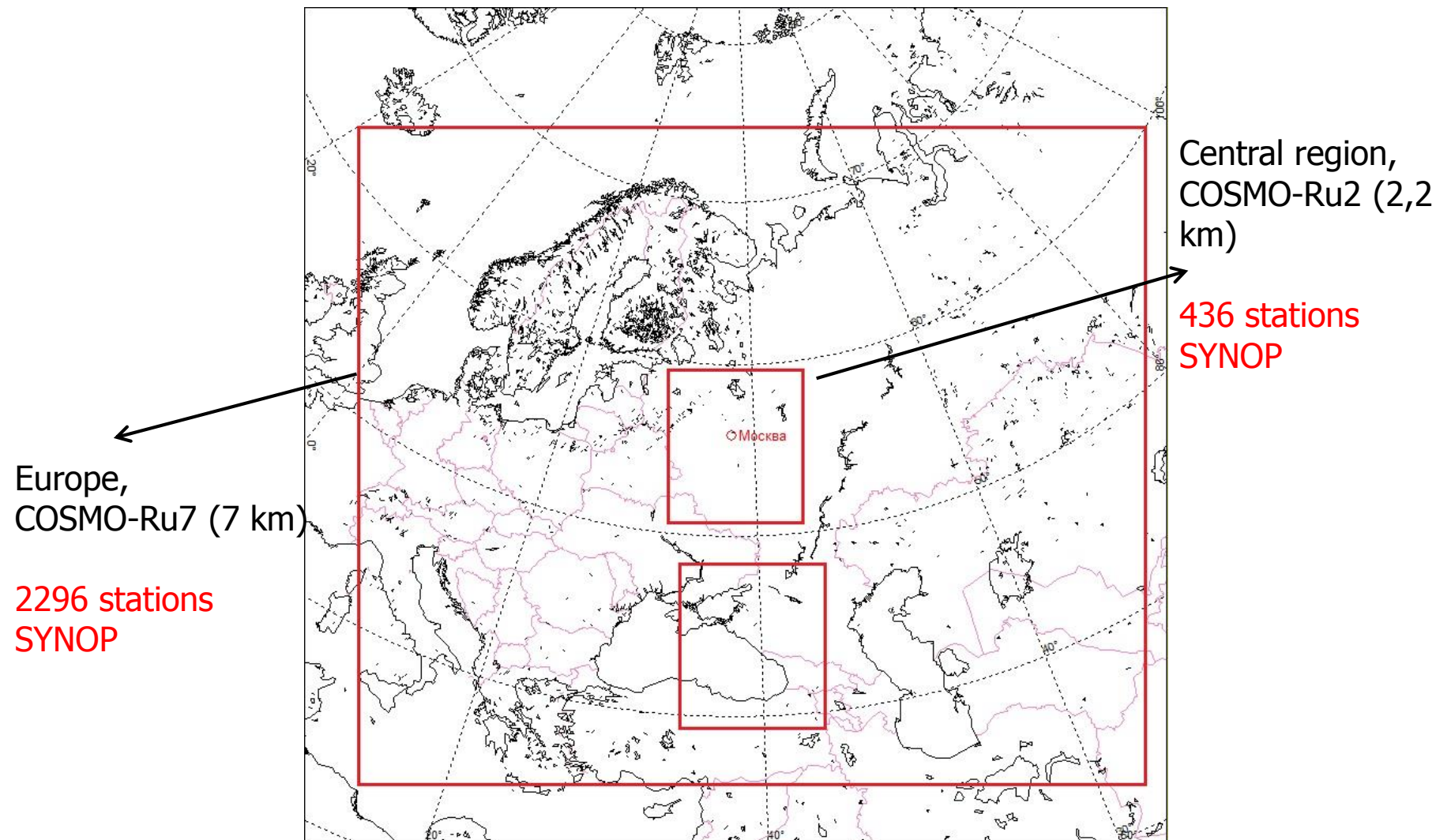
Main steps of the technology

1. 1D continuous SWE modeling for SYNOP points of measurements (snow model SMFE)

2. OA of results of SMFE based on FG (GME/ICON)

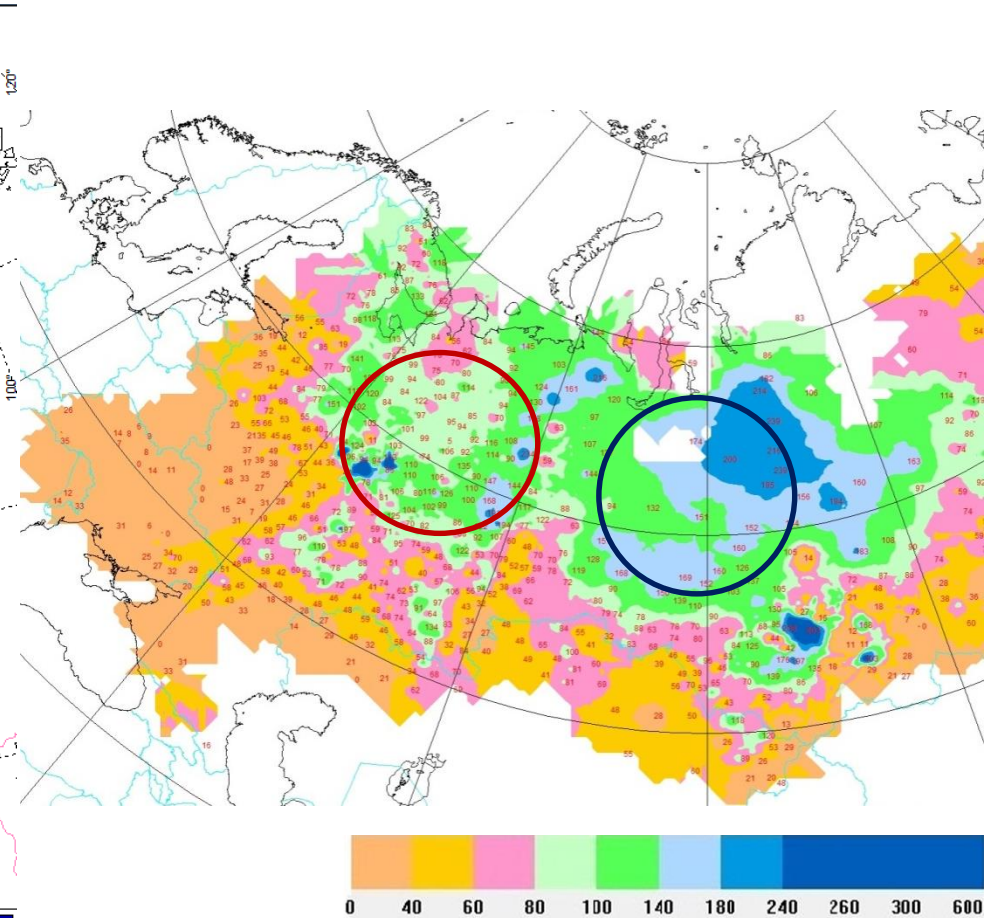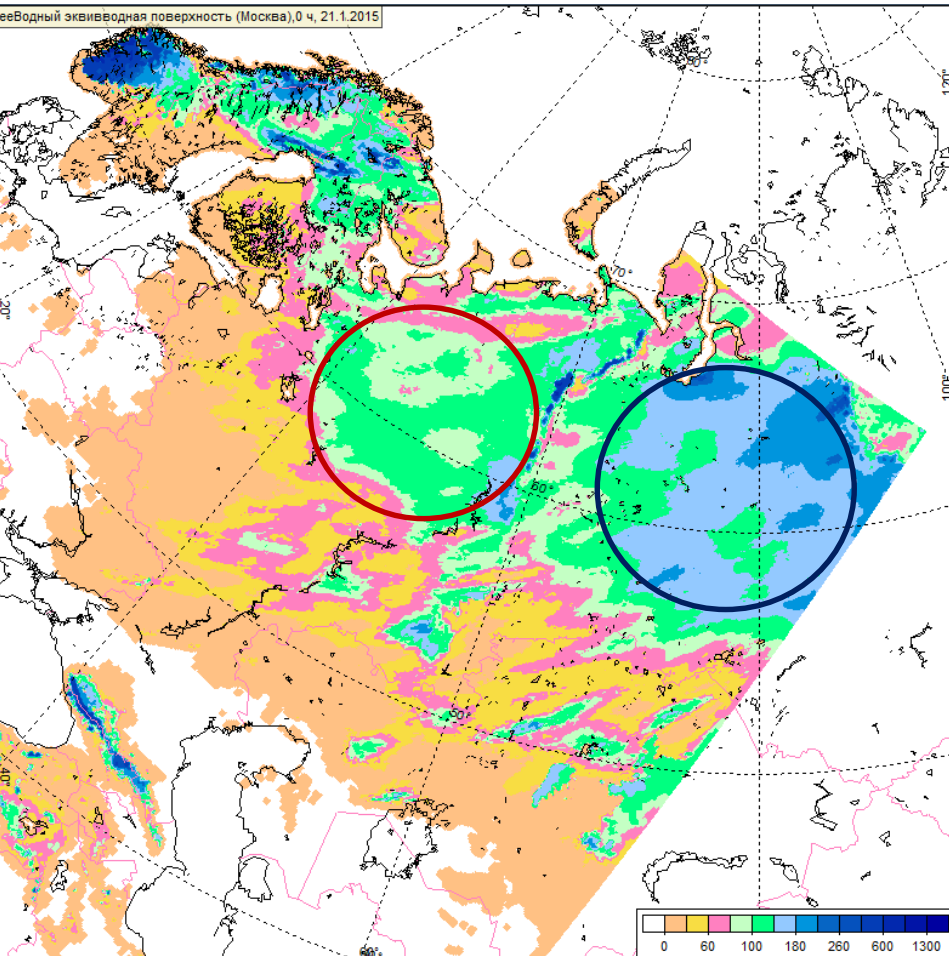3. Correction (replacing) of initial data of SWE from GME/ICON

SNOWE technology

COSMO-Ru domains for SNOWE quasi-operational experiment (winter 2014/15)

Central region, COSMO-Ru2 (2,2 km)

436 stations SYNOP

Europe, COSMO-Ru7 (7 km)

2296 stations SYNOP

SWE fields. 20 January 2015

COSMO-Ru7 SWE initial field (new technology)   SWE measurements

SWE fields. 20 January 2015
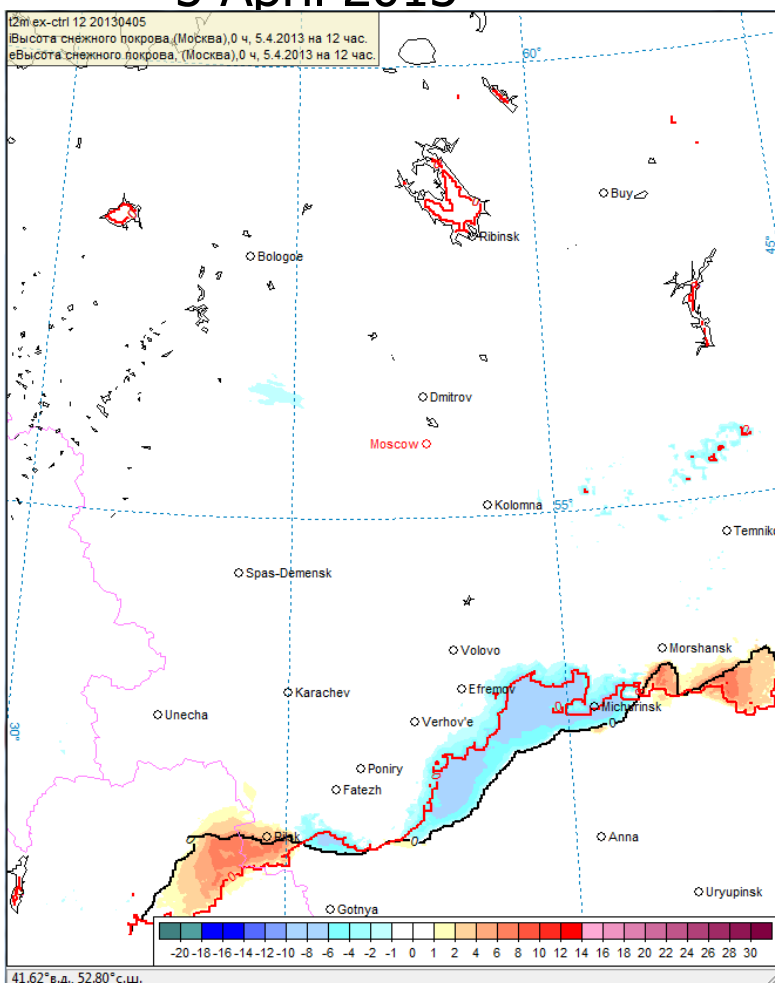
COSMO-Ru7 SWE initial field (reference)

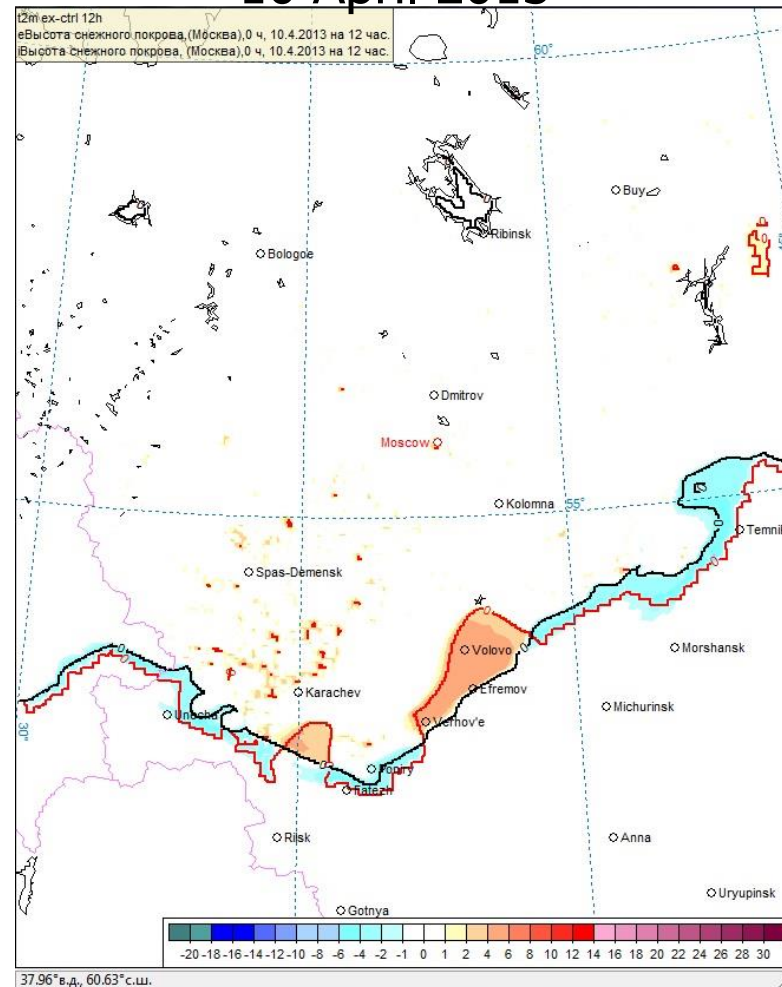SWE measurements
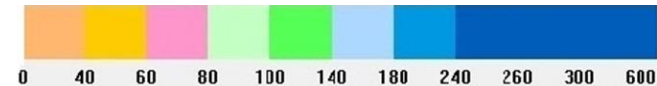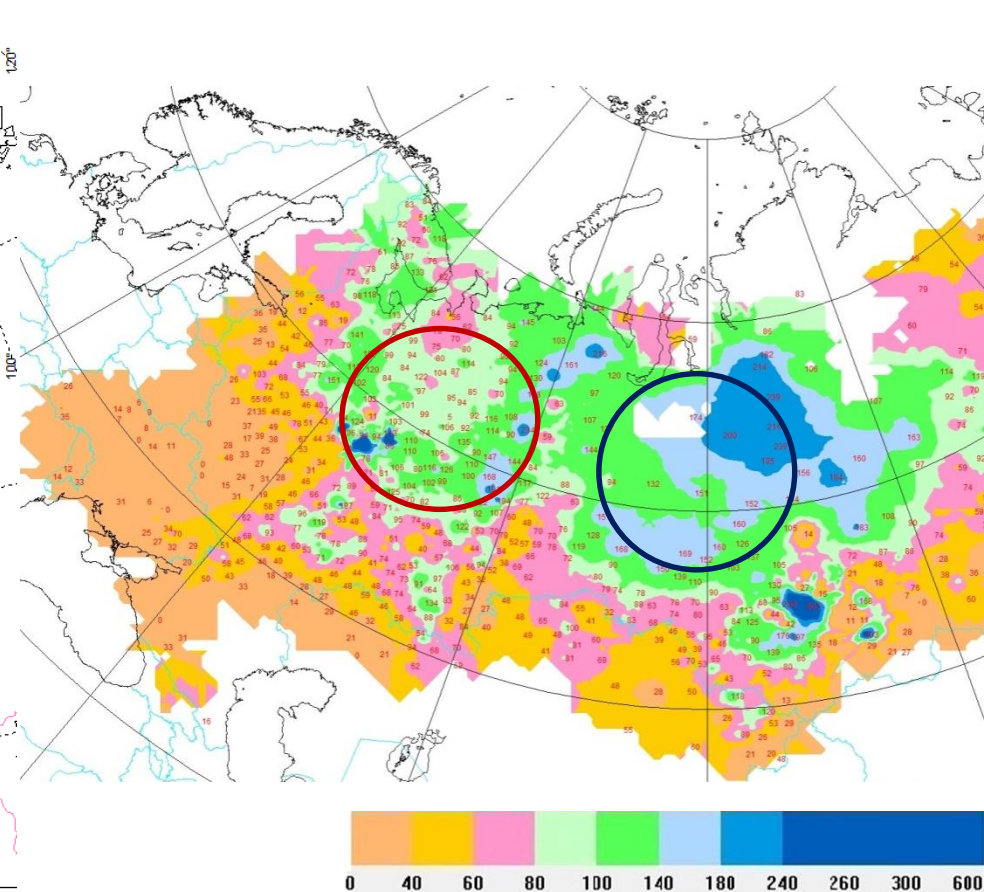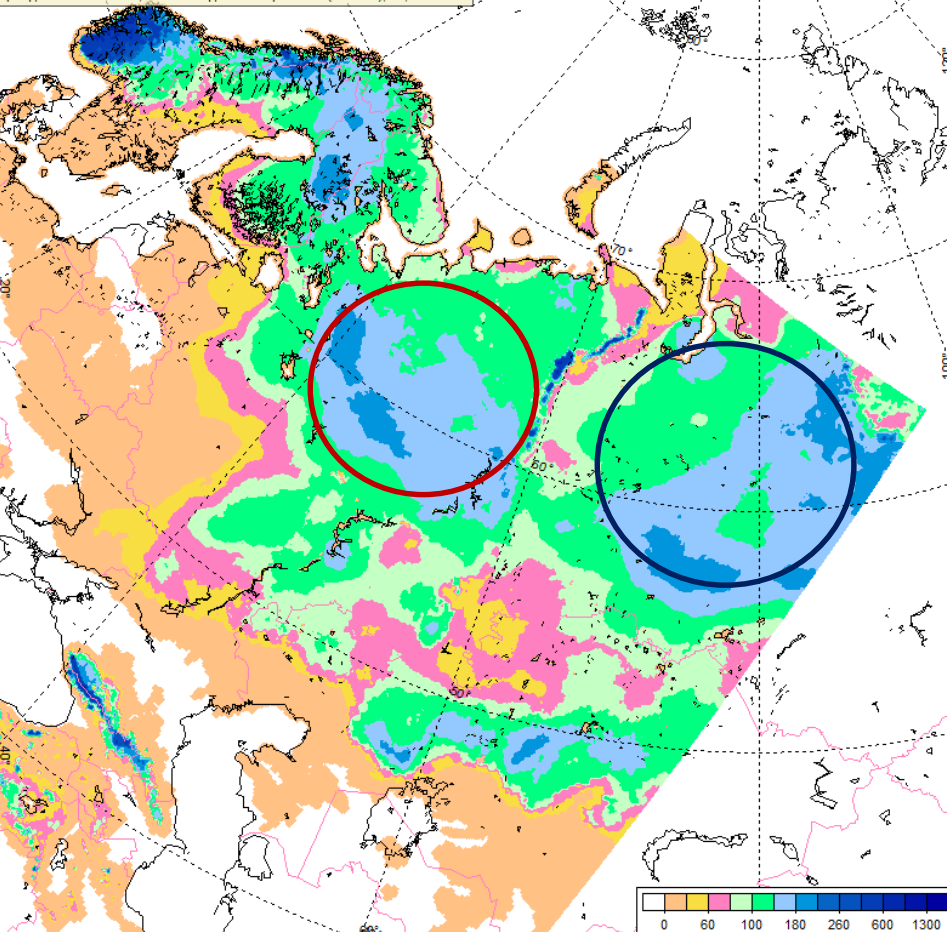
Impact of snow initial fields replacement

ΔT2m (ex – oper) forecast at 12 UTC. Start – 00 UTC
Lines – snow boundary forecast at 12 UTC: black– operational version, red– experiment

5 April 2013

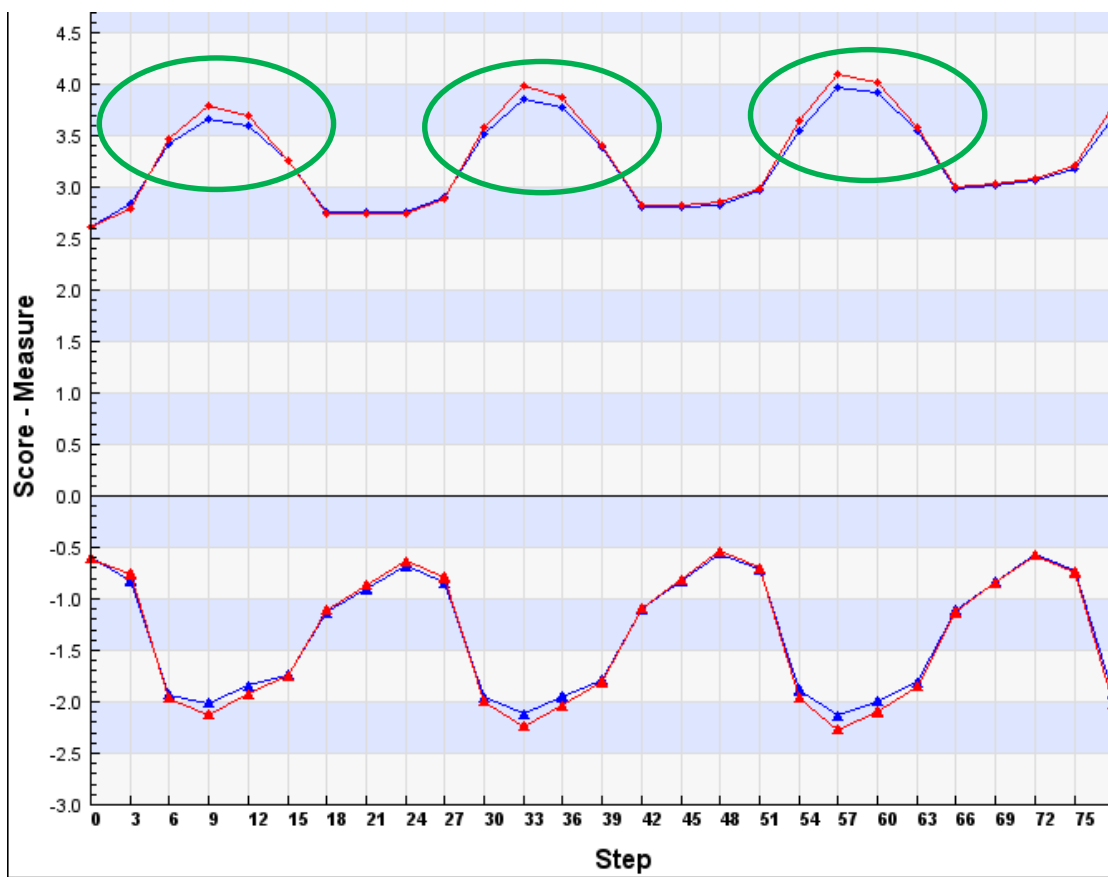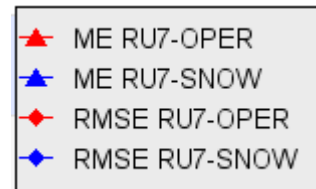10 April 2013

T2m forecasts

RMSE and ME for COSMO-Ru7 (European region)
24 Feb – 31 March 2015

Standard verification
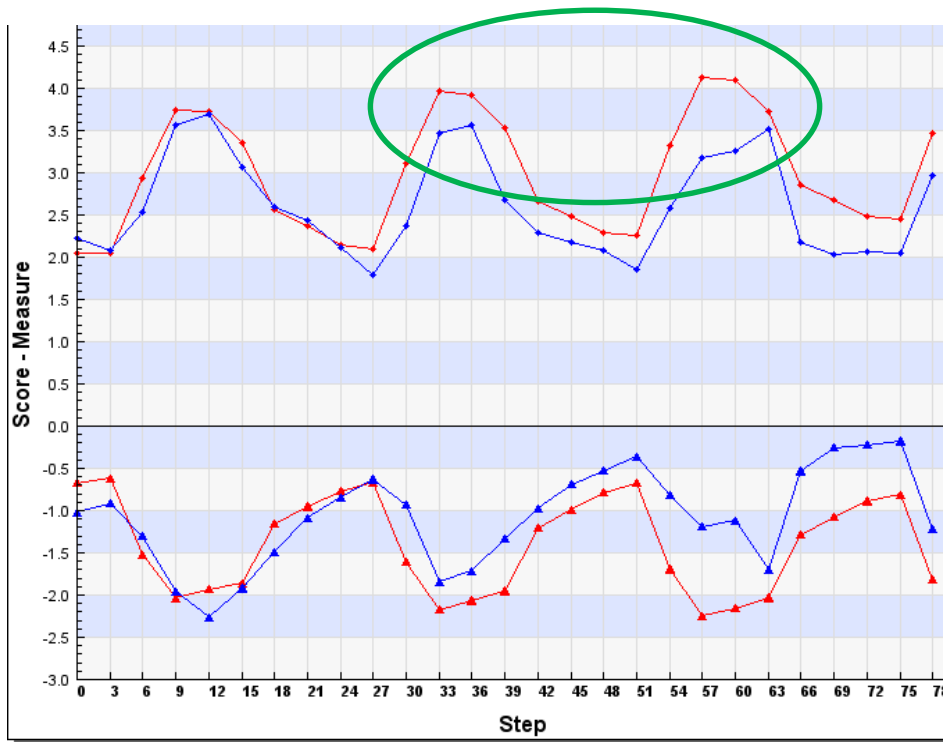
Verification for ~800 stations

Conditional verifications are needed, as the greater effect will be observed only in a narrow zone close to the snow boundary

T2m (°C) RMSE and ME for Europe region
24 Feb – 31 March 2015

Conditional verification: *T2m > 0˚C*

Condition: positive observed temperatures

T2m (°C) RMSE and ME for COSMO-Ru7 (European domain) 24 Feb – 31 March 2015

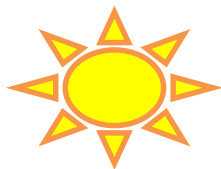*Conditional verification: clear sky of cloudy weather*
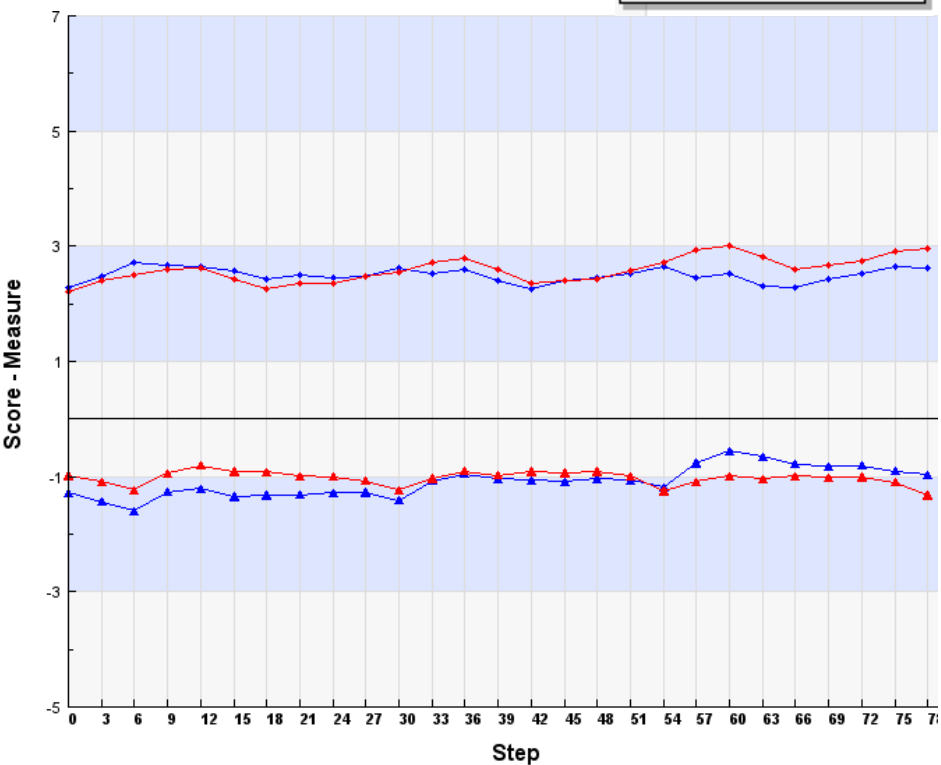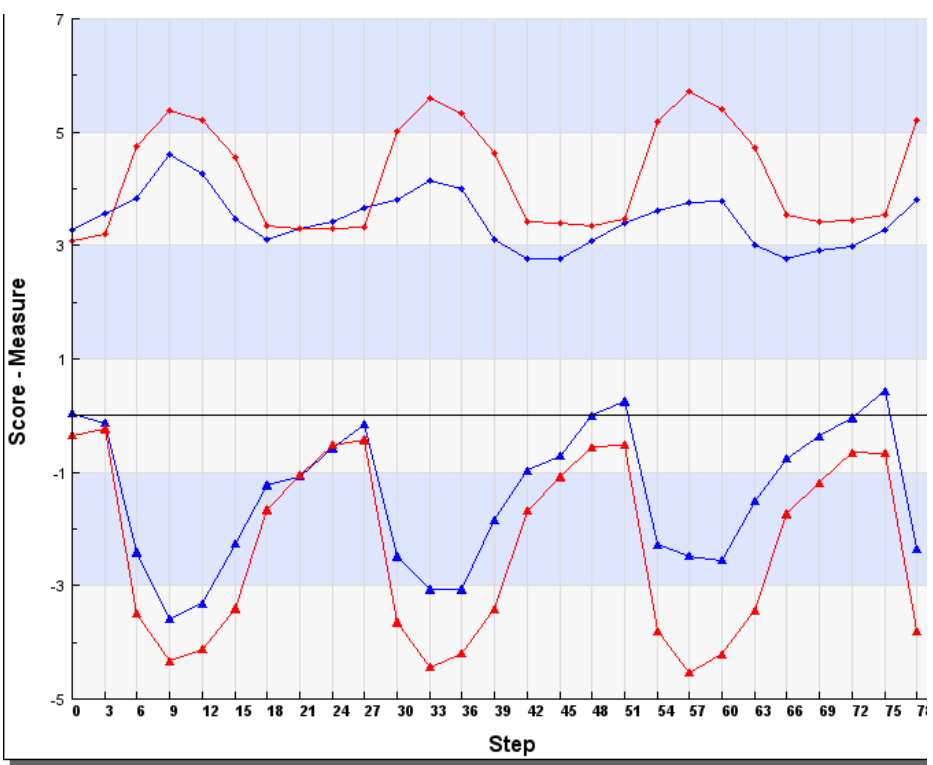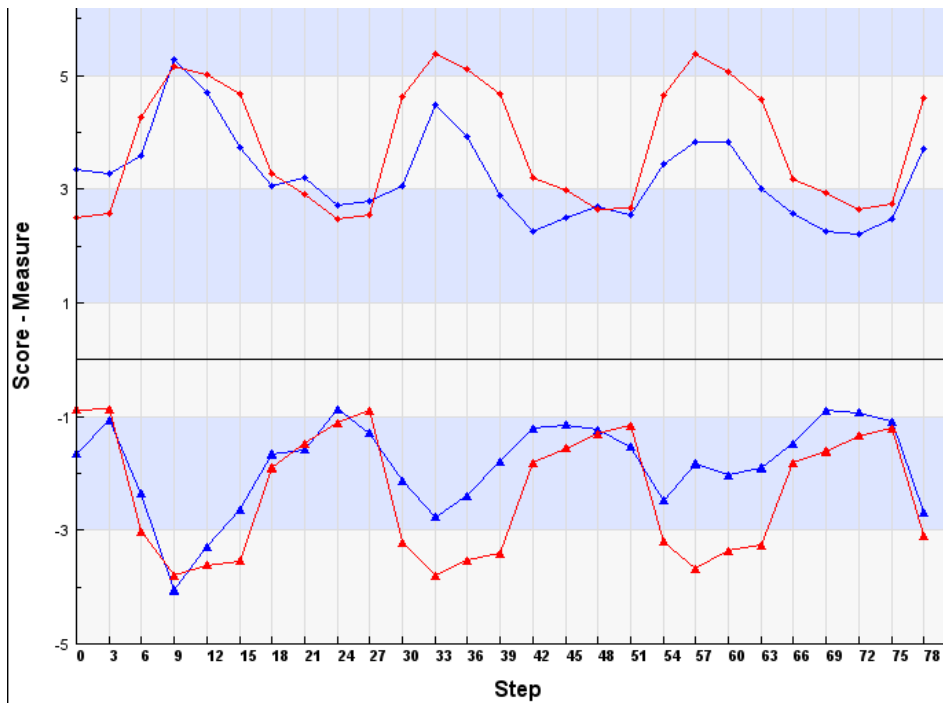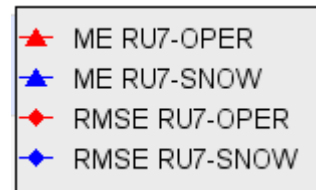

Condition: prognostic and observed total cloud ≤ 25%

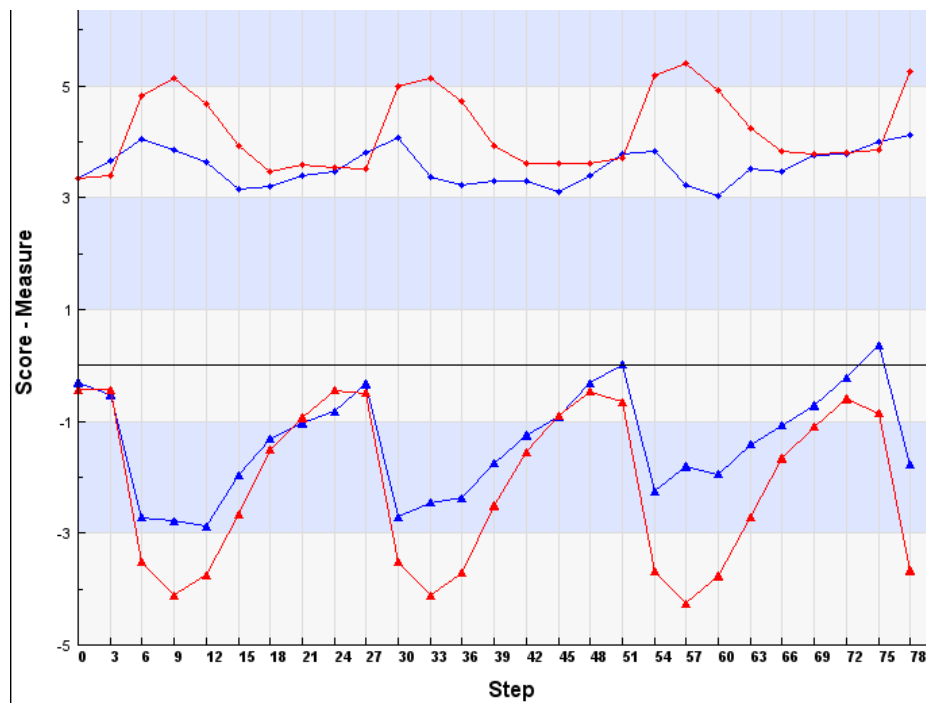Condition: prognostic and observed total cloud ≥ 75%

T2m (°C) RMSE and ME for COSMO-Ru7 (European domain) 24 Feb – 31 March 2015

Conditional verification: clear sky

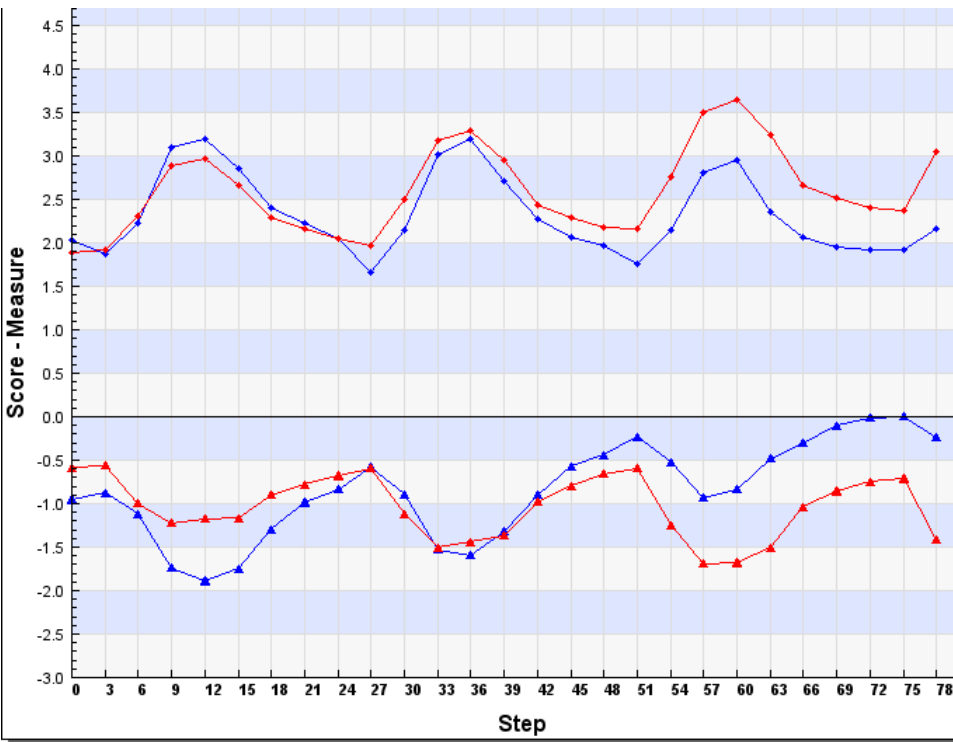Condition: prognostic total cloud ≤ 25%+ positive observed temperature

Condition: prognostic total cloud ≤ 25%+ negative observed temperature

T2m (°C) RMSE and ME for COSMO-Ru7 (European domain) 24 Feb – 31 March 2015

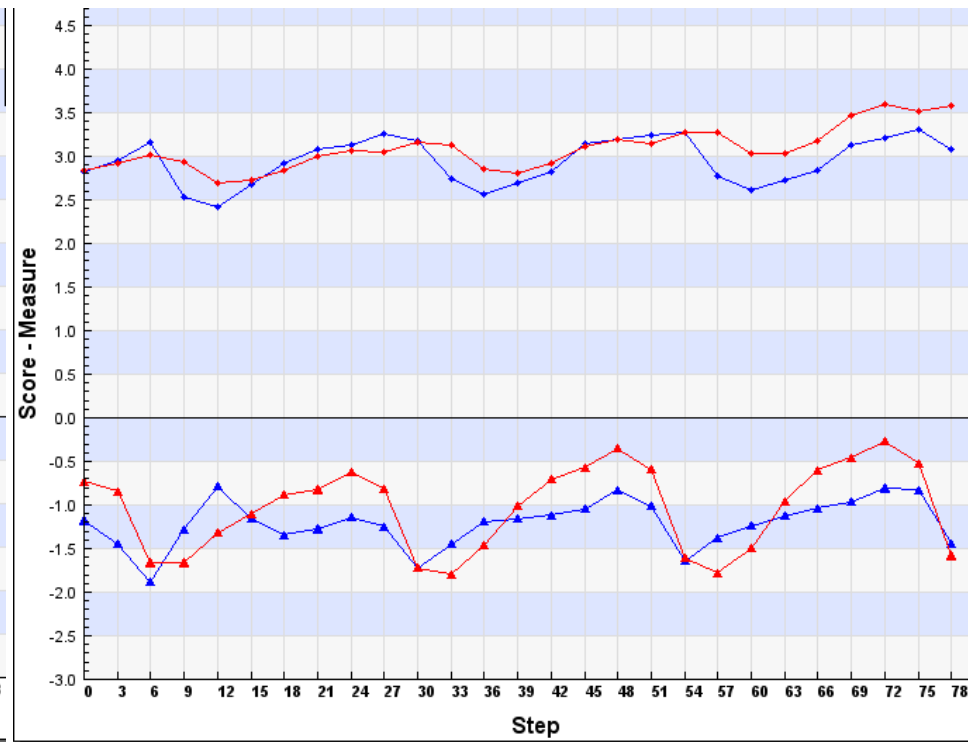*Conditional verification: cloudy weather*

Condition: prognostic total cloud ≥ 75%+
positive observed temperature

Condition: prognostic total cloud ≥ 75%+
negative observed temperature

Results from T2m conditional verifications

- ME and RMSE values for T2m for COSMO-Ru7 (Europe area) were reduced (RMSE decreased to 0,5-1,5°C and ME to 0,5-1,0°C);

- Improvement has a tendency to grow through the lead time to 3^d day of the forecast;

- Improvement in T2m forecasting with the use of the technology is observed both for positive and negative T2m;

- Significant improvement of RMSE and ME is observed for clear sky (RMSE reduced to 2°C).

- Peculiarities for cases with dependence meteorological parameters on snow depth, for total cloud cover, wind speed, albedo, heat fluxes were also found.

Conclusions

- The SNOWE technology was realized in operational technologies COSMO-Ru for 2014-2015 winter

- The implementation of SNOWE technology showed the positive impact for SWE forecasts as well as for T2m forecasts near the snow boundary

- The more realistic forecast of SWE based on the SNOWE corrected initial data provides more realistic speed of movements of snow boundary during the forecast time

- The largest improvement (2-3°C after averaging and till 7°C for particular cases) is observed for T2m forecasts in the cases clear sky conditions and for cases of thin snow cover

- Some influence is indicated for TCC and 10m wind speed forecasts.

Thank you for your attention!