Schweizerische Eidgenossenschaft
Confédération suisse
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Eidgenössisches Departement des Innern EDI
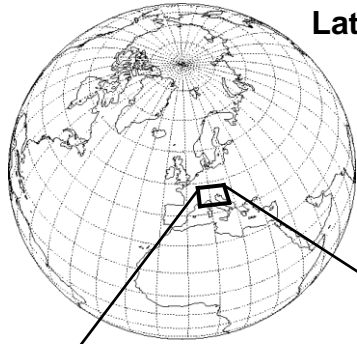**Bundesamt für Meteorologie und Klimatologie MeteoSchweiz**

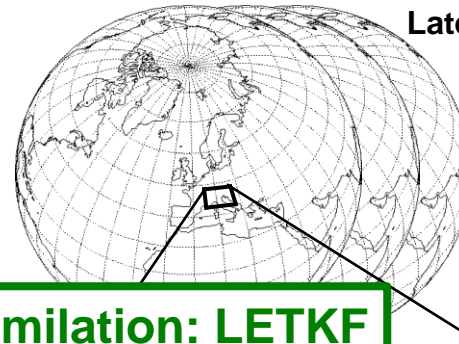# KENDA Experiments at MeteoSwiss

Daniel Leuenberger, MeteoSwiss

8.9.2014, COSMO-GM, Eretria, Greece

Next Generation MCH NWP System

Lateral boundary conditions:
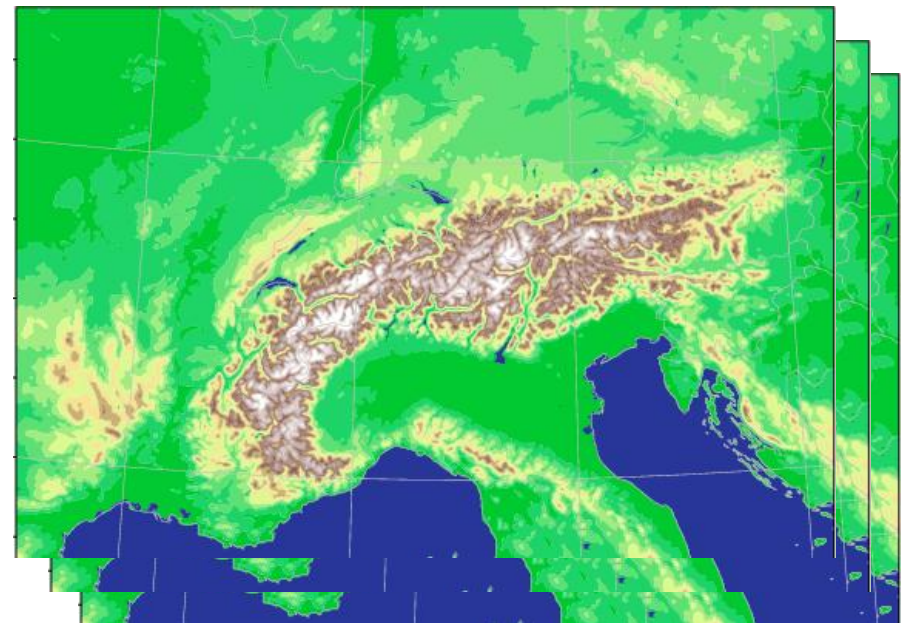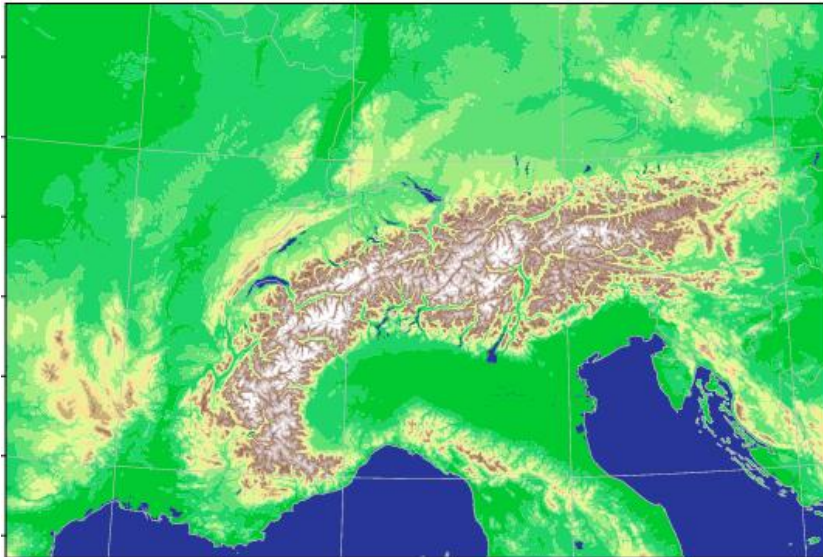**IFS-HRES**
10km
4x per day

Lateral boundary conditions:
IFS-ENS
20km
2x per day

ensemble data assimilation: LETKF

COSMO-1: 24h forecasts, 8x per day
1.1km grid size (convection permitting)

COSMO-E: 5 day forecasts, 2x per day
2.2km grid size (convection permitting)
21 ensemble members

Results from last Experiment

- Compared deterministic LETKF analysis with nudging analysis and a cycle without observations and forecasts therefrom

- Large dry bias in all experiments, particularly in nudging experiment, large underprediction of precipitation in forecasts

- Too little spread at the boundaries, since IFS ENS with lead time 0-9h was used as LBC

- LETKF gave too little weigh to obs

New Experiment

- June 2014 Period (5.6.2014 – 11.6.2014)

- Slightly larger domain (COSMO-E setup)

- LBC: 24h-36h old ECMWF ENS perturbations centered around newest deterministic ECMWF forecast

- LETKF revision 10061

Analysis Setup I

- 1h update cycles
- **LETKF**
  - 40 members + deterministic analysis (**LETKF_DET**)
  - Adaptive covariance inflation, localisation and obs errors
- **LETKF_SPPT**
  - As **LETKF** but with SPPT
- **NUDGING**
  - As operational COSMO-2 analysis but without LHN and without assimilation of TD_2M
- **NO_OBS**
  - Same as NUDGING, but no assimilation of observations

Experimental Forecast Setup

- Deterministic forecasts started from the four deterministic analyses (LETKF_DET, LETKF_DET_SPPT,NUDGING and NO_OBS)

- Initialized at 00 and 12UTC, run out to +24h

- LBC from operational ECMWF forecasts

Boundary Patterns of Spread
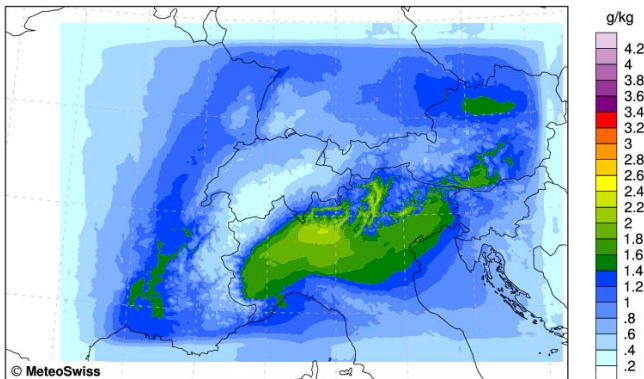
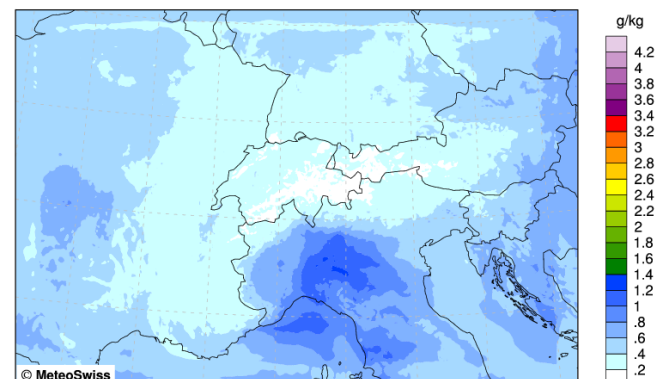Time-averaged spread at ca 500m above ground

U
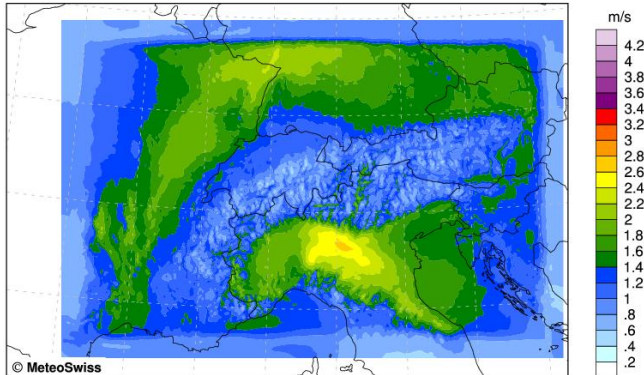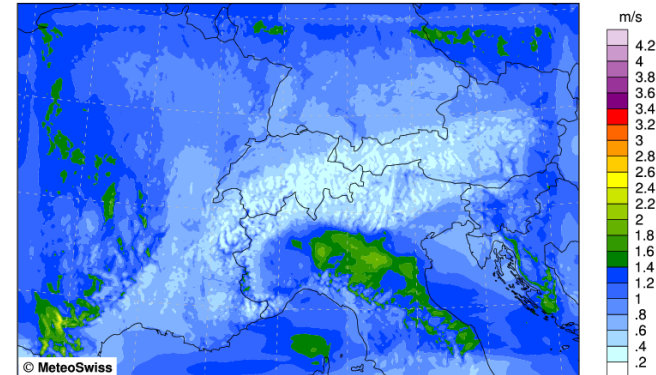
QV

Old experiment (2012)   New experiment (2014)

Innovation statistics from TEMPS (T)
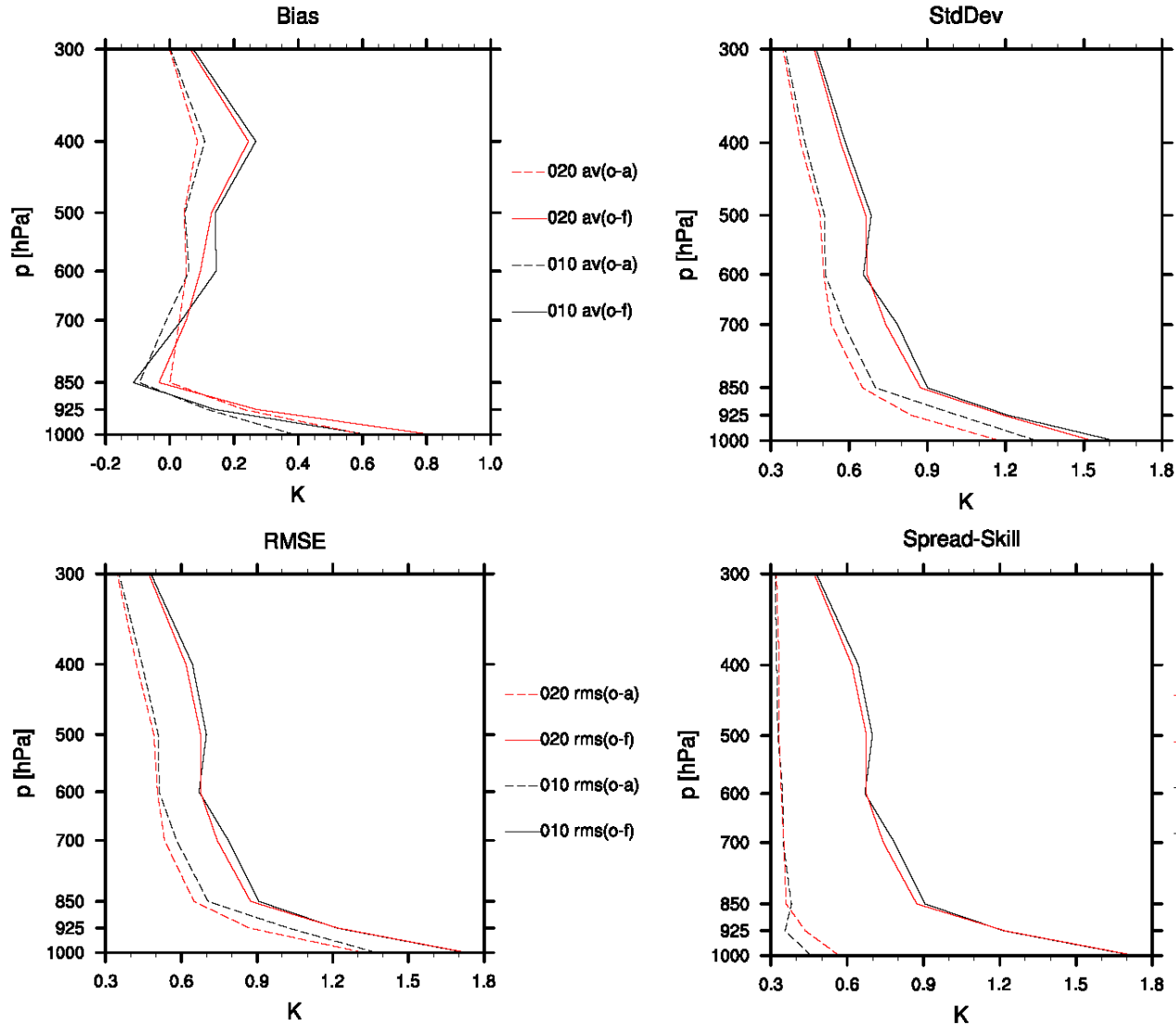
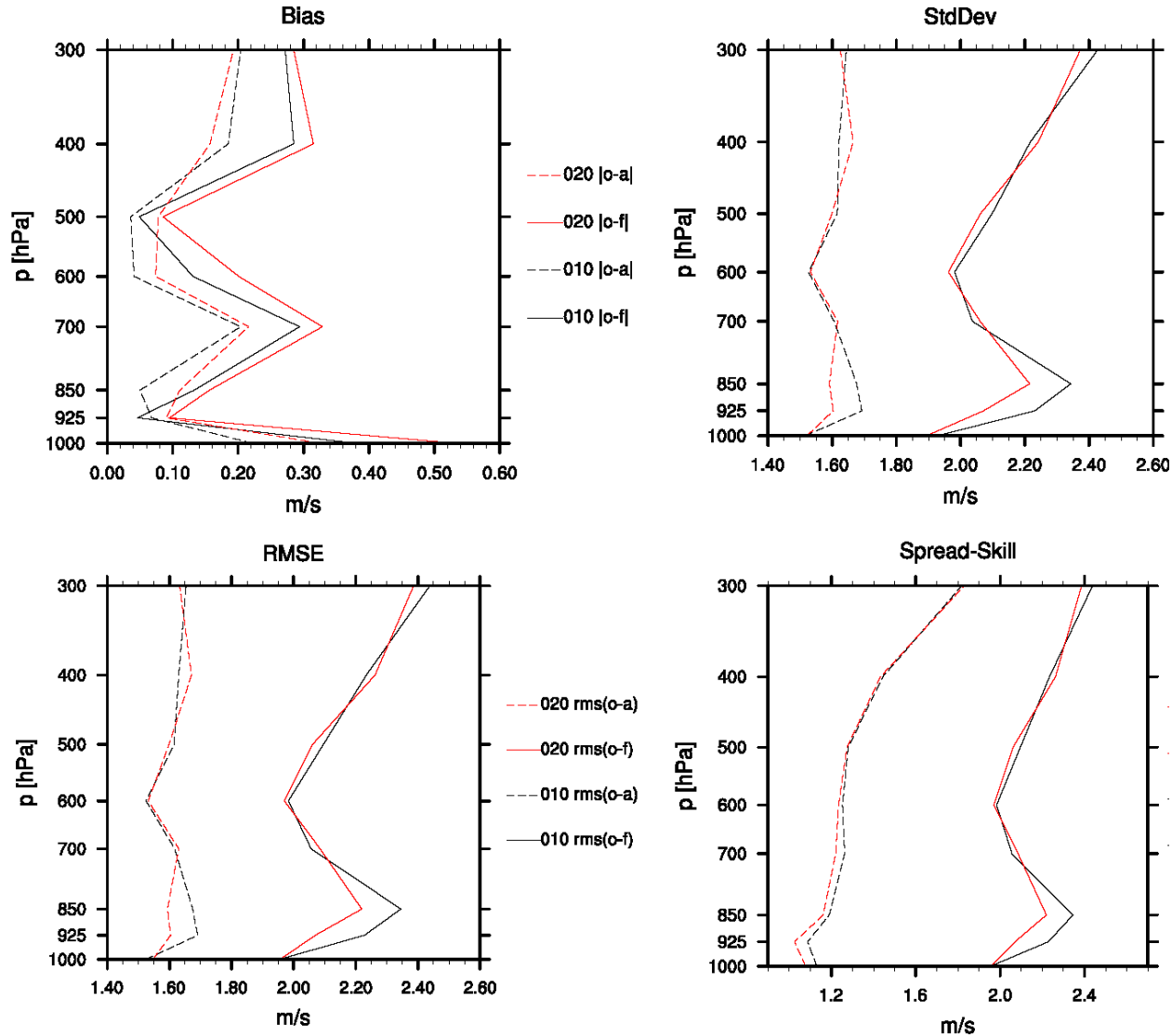# Innovation statistics from TEMPS (RH)

Innovation statistics from TEMPS (U/V)
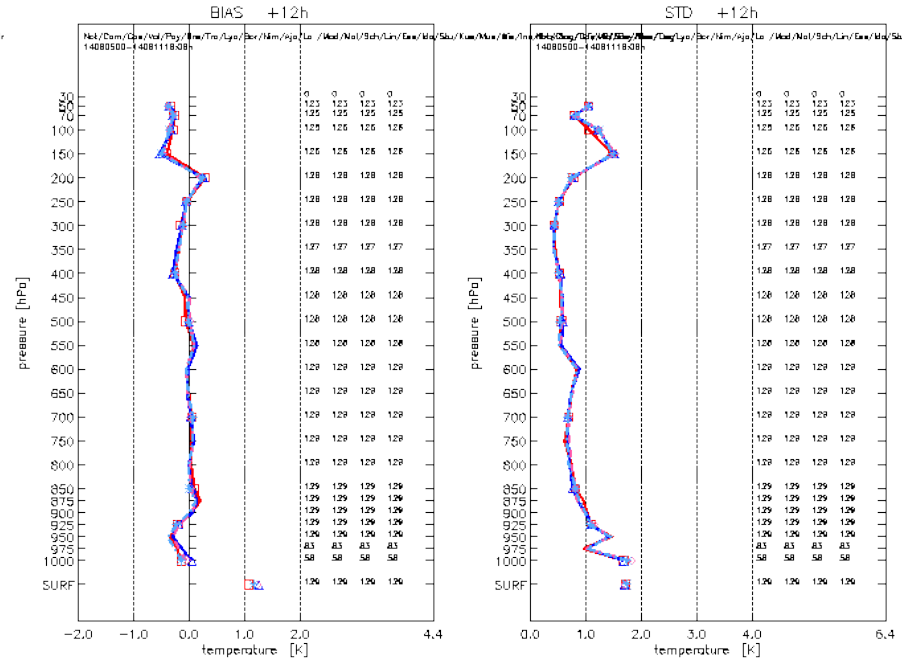
Forecast Verification (TEMP T)

Analysis

+12h Forecast
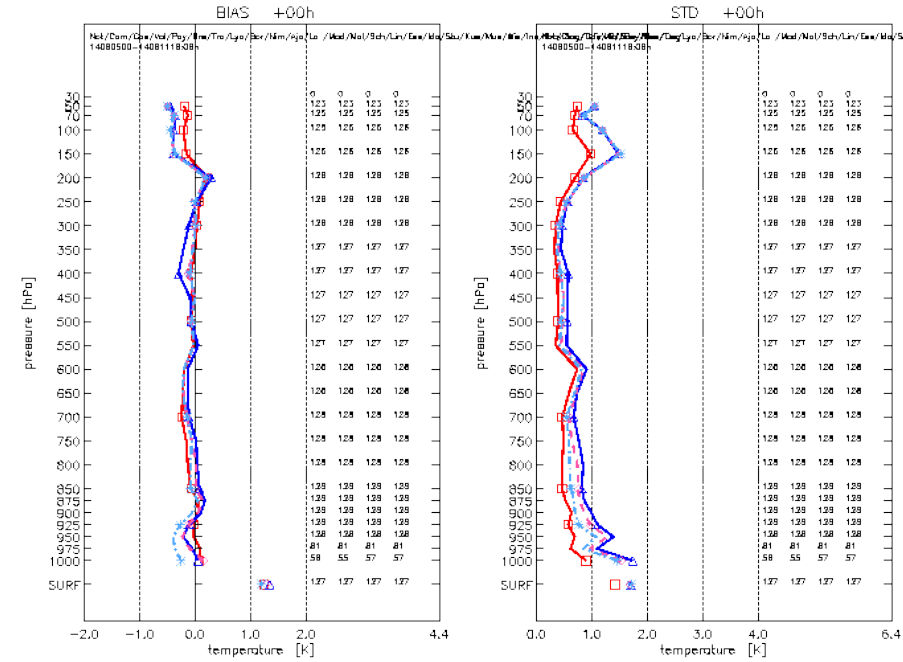
Bias

StdDev

Bias

StdDev

NUDGING   **NO_OBS**   **LETKF**   **LETKF_SPPT**

Forecast Verification (TEMP RH)

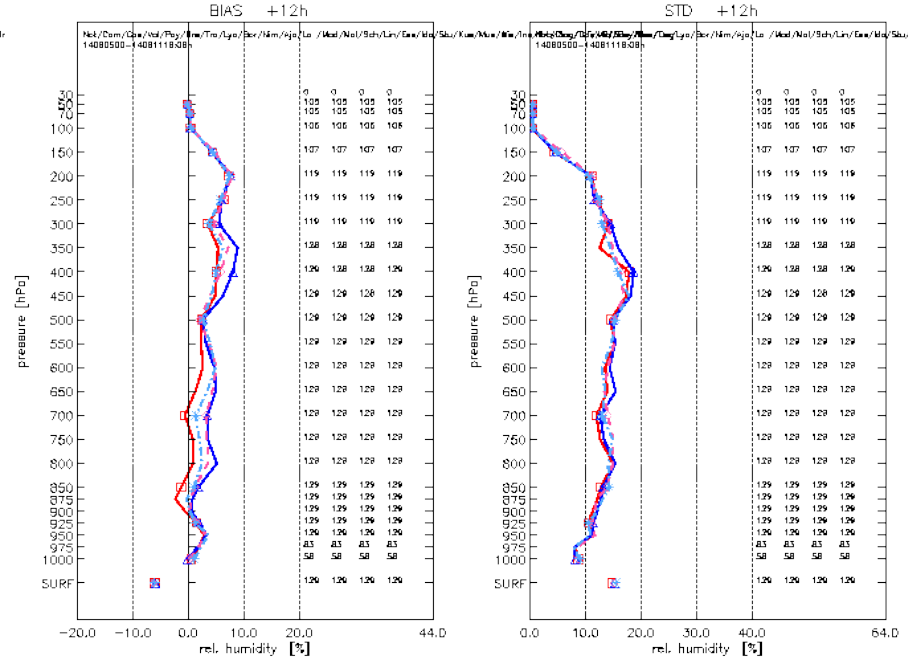Analysis   +12h Forecast
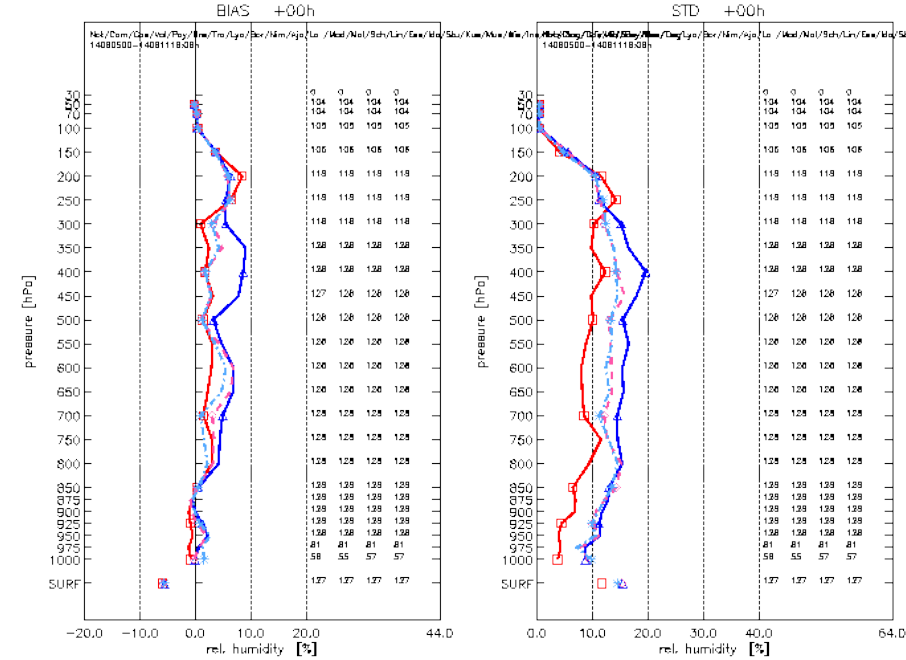
Bias   StdDev   Bias   StdDev

NUDGING   NO_OBS   LETKF   LETKF_SPPT

Forecast Verification (TEMP WS)

Analysis   +12h Forecast
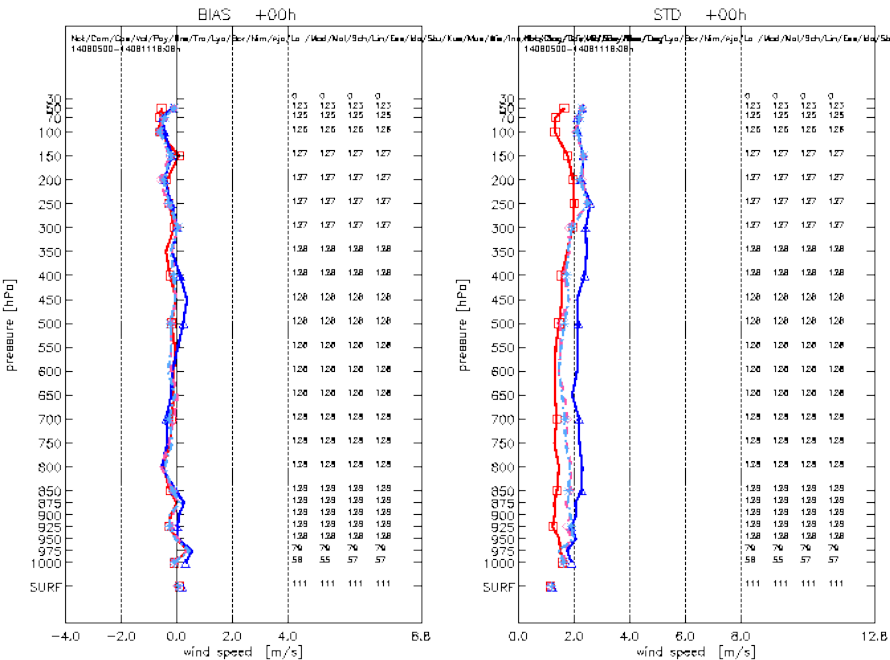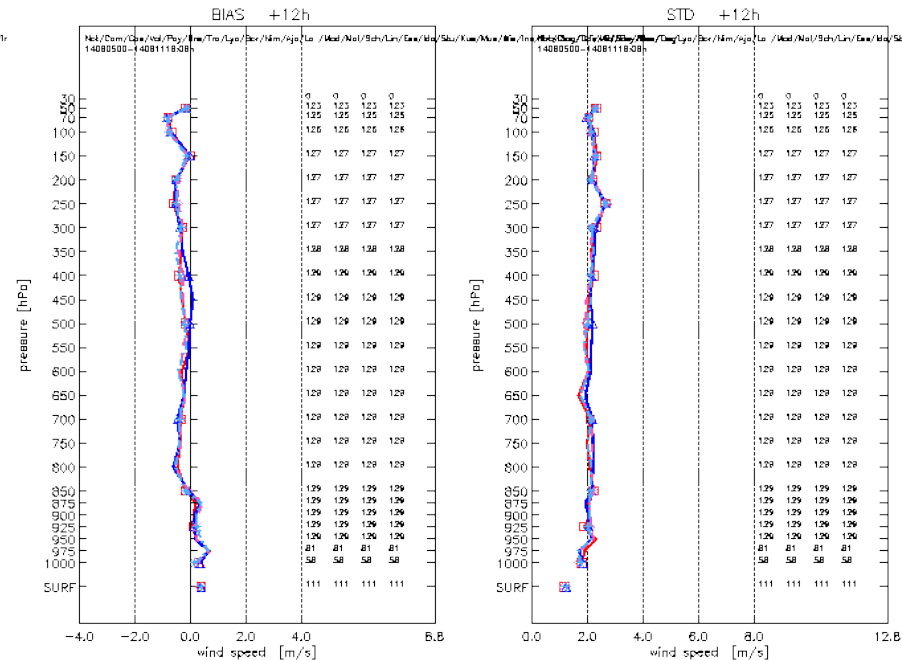

Bias   StdDev   Bias   StdDev

NUDGING   NO_OBS   LETKF   LETKF_SPPT

Forecast Verification (TEMP WD)

Analysis

+12h Forecast
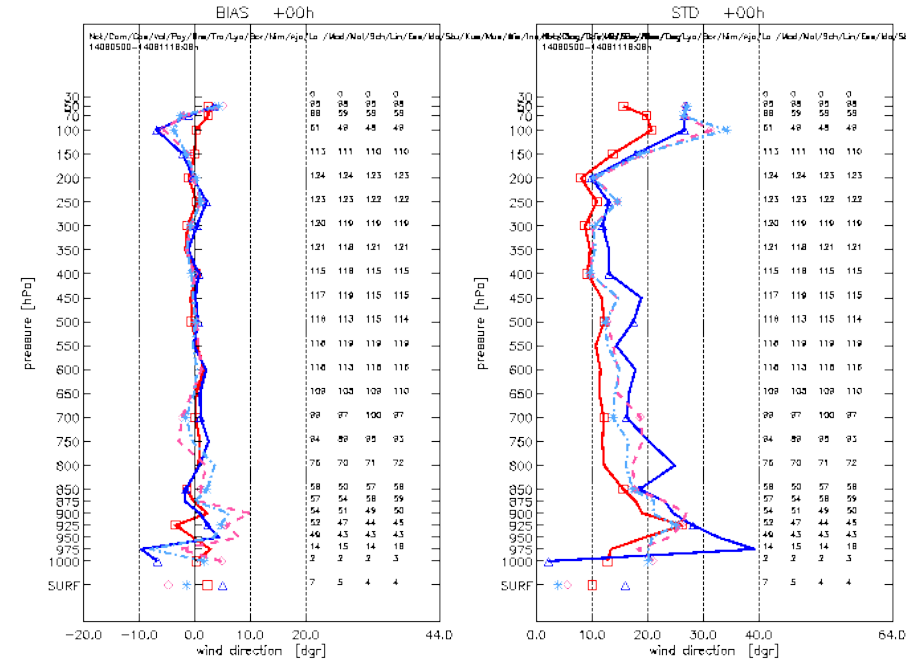
Bias

StdDev

Bias

StdDev

NUDGING **NO_OBS** **LETKF** **LETKF_SPPT**

Time-averaged QPF (Leadtime 0-6h)

Findings (Analyses)

- LETKF performs better in new experiment than in old

- +24h LBC perturbations improve boundary effects, still too little spread?
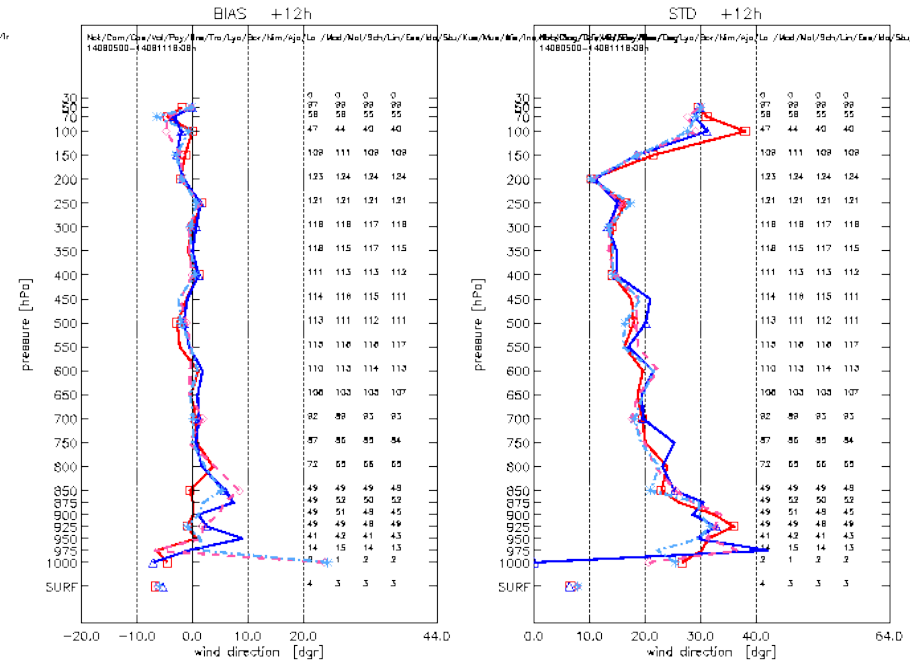
- Generally, LETKF lacks spread, not only in near-surface layers!

- TEMPS: more RH rejected obs than T or WIND. Is this responsible for bad RH statistics?

- SPPT slightly increases near-surface T spread, improves LETKF analyis. Effect is small but goes in right direction

Findings (Forecasts)

- Nudging analysis closer to obs than LETKF analysis

- LETKF analysis closer to obs than NO_OBS «analysis»

- After +12h very similar performance in all forecasts (we are in a LAM…)

- Forecasts started from LETKF_SPPT underpredict precipitation

Next Steps

- Start regular, real-time assimilation cycle

- Test 1km deterministic analysis (add support for necessary ivctypes!)

- Try to increase spread! (RTTP, RTPS, revisit LBC spread)

- Include Td2m (and T2m?) in LETKF (add soil moisture perturbations)

- Include LHN in LETKF

Thank you for your attention