



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

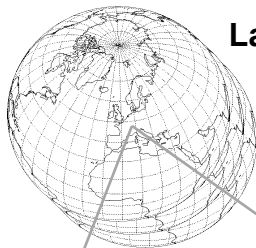
Verification highlights of the new MeteoSwiss models COSMO-1E and COSMO-2E

COSMO GM 2020 WG5 2020-09-07

Pirmin Kaufmann, Andreas Pauling, and Marco Arpagaus



COSMO-1E & COSMO-2E



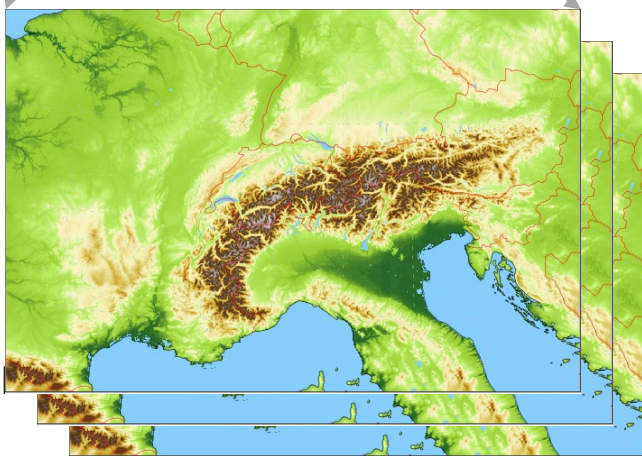
Lateral boundary conditions:
IFS ENS & HRES
18km / 0.2°
4x per day



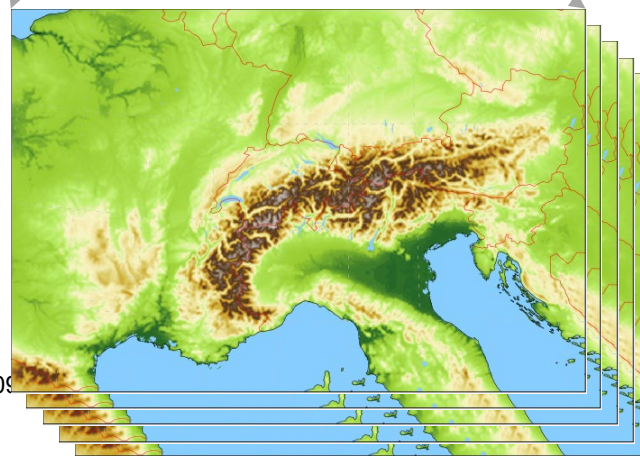
Lateral boundary conditions:
IFS ENS
18km / 0.2°
4x per day

ensemble data assimilation: LETKF at 1.1km

COSMO-1E: 33 hour forecasts, 8x per day
1.1km grid size (convection permitting)
11 ensemble members



COSMO-2E: 5 day forecasts, **4x** per day
2.2km grid size (convection permitting)
21 ensemble members

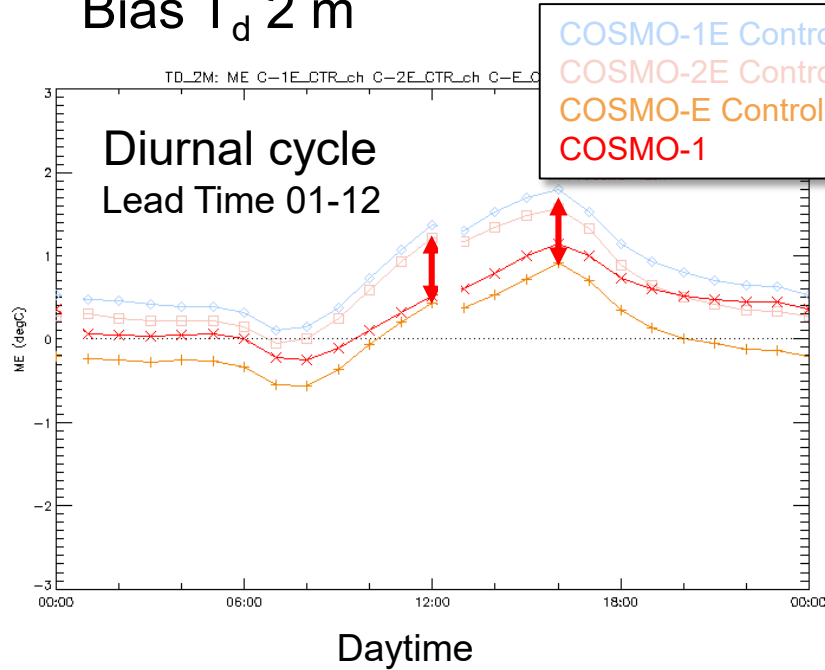


- COSMO version: 5.07
- Namelist settings: “Standard”, i.e. no “fundamental” differences to neither COSMO-E nor COSMO-D2-EPS
- Problem in pre-operational runs observed in early spring:
 - Td2m too high (too moist), especially in spring 2020
 - soil much wetter than for COSMO-E

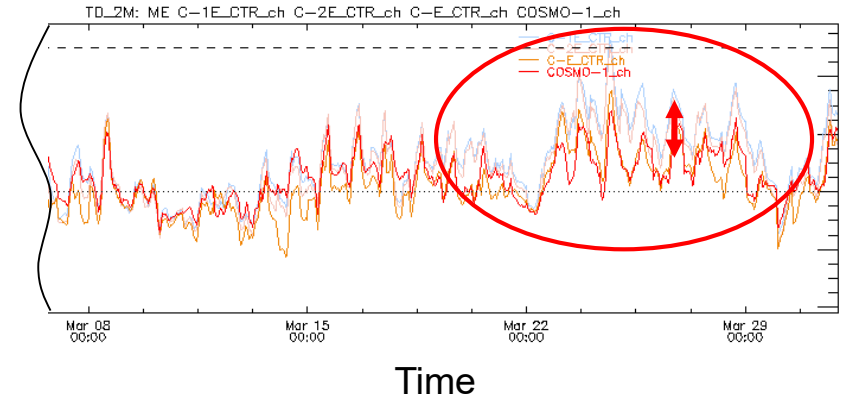


Problem (!): Td2m in March 2020

Bias T_d 2 m



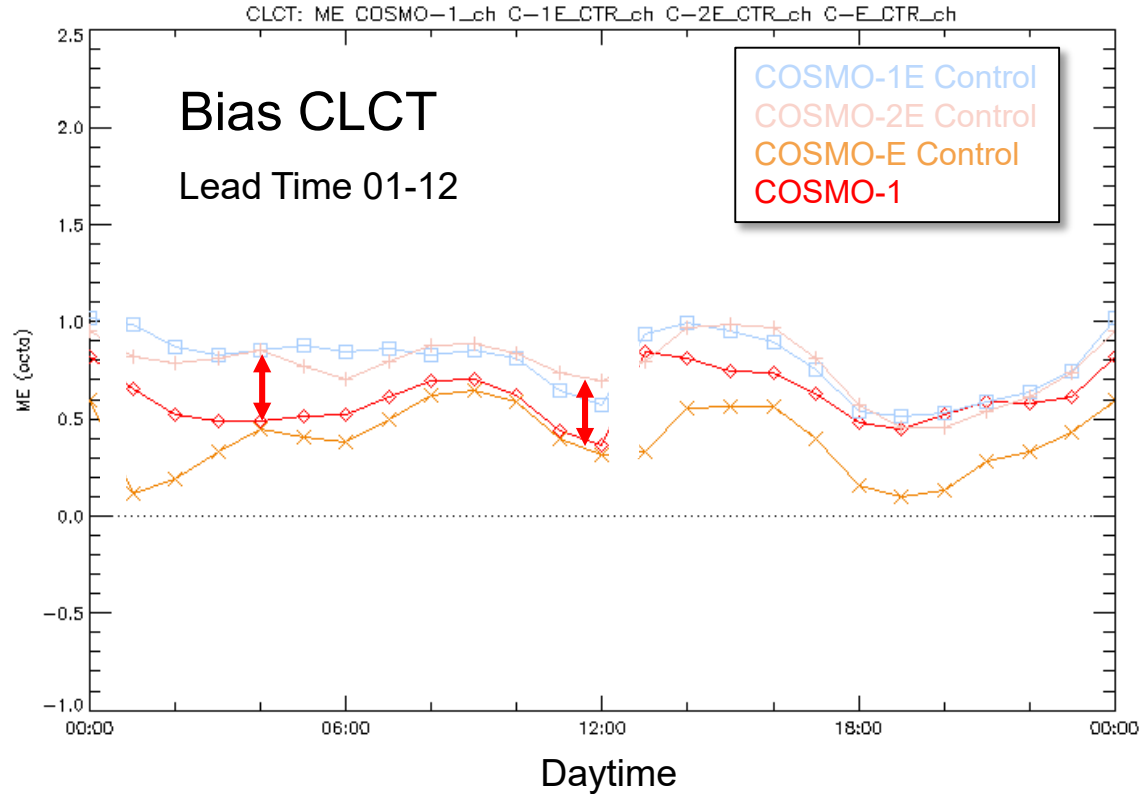
Time series





Cloud Cover March 2020

Increased T_d leads to increased cloud coverage



- Use of namelist settings recommended by WG3b based on paper by Jan-Peter Schulz and Gerd Vogel («Improving the Processes in the Land Surface Scheme TERRA: Bare Soil Evaporation and Skin Temperature», Atmosphere 2020, 11, 513; <https://doi.org/10.3390/atmos11050513>; see <http://www.cosmo-model.org/content/tasks/workGroups/wg3b/docs/TERRAsettings.pdf> for the list of namelist settings)



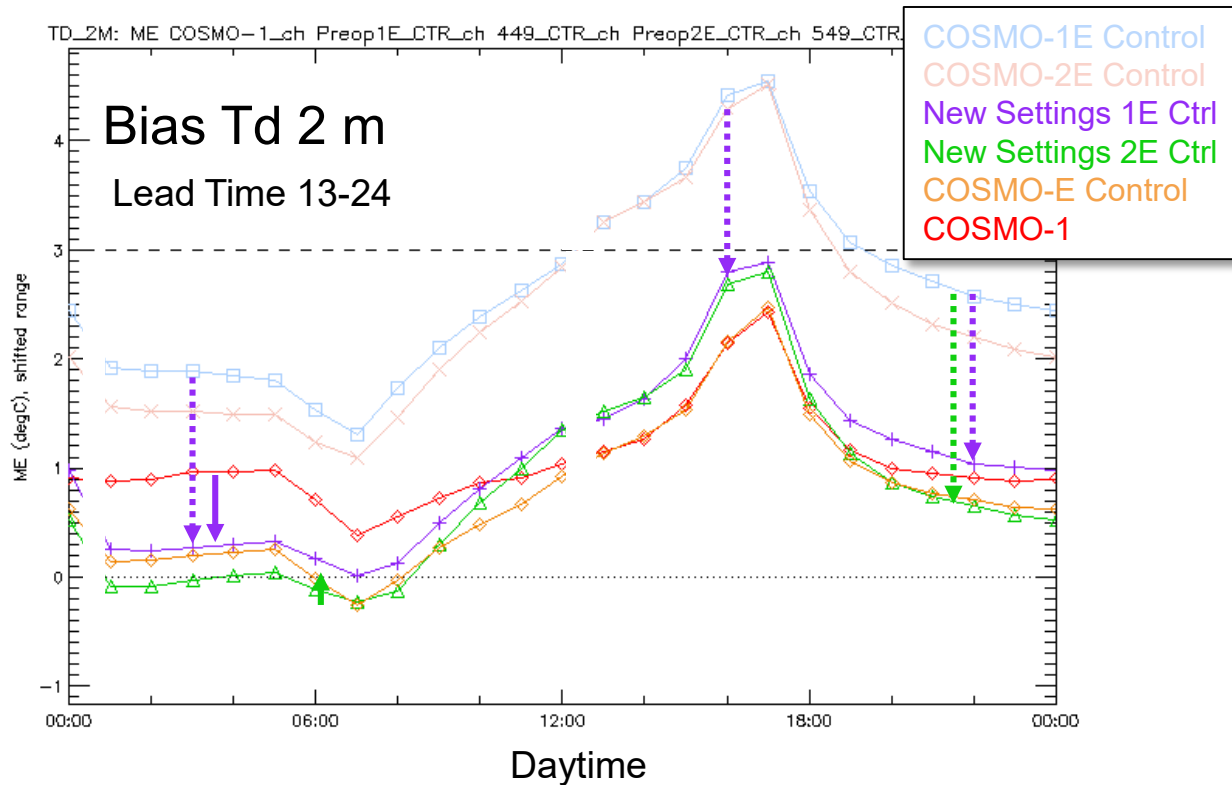
Schulz & Vogel: main changes

- improved bare soil evaporation
 - less evaporation for medium-wet to wet soil conditions, thereby leading to smaller Td2m and larger T2m values as well as to a larger diurnal temperature range
 - more evaporation for medium-dry to dry soil conditions, thereby leading to larger Td2m and smaller T2m values as well as to a smaller diurnal temperature range
- skin layer temperature (new; to simulate vegetation canopy effect)
- interception reservoir activated (new)
- a few more smaller changes; *still unsatisfactory: plant transpiration*



2 m Dewpoint Spring 2020 (15 d)

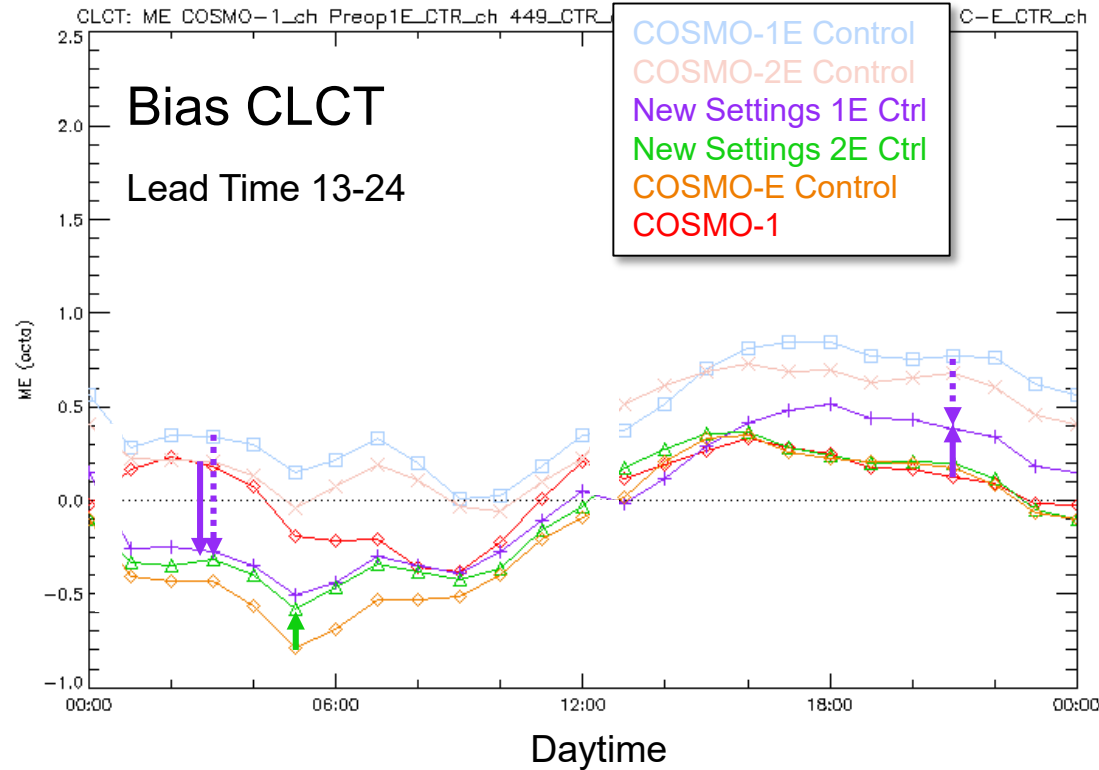
T_d bias almost
back to normal
(afternoon) or
even improved
(night, morning)





Cloud Cover Spring 2020 (15 d)

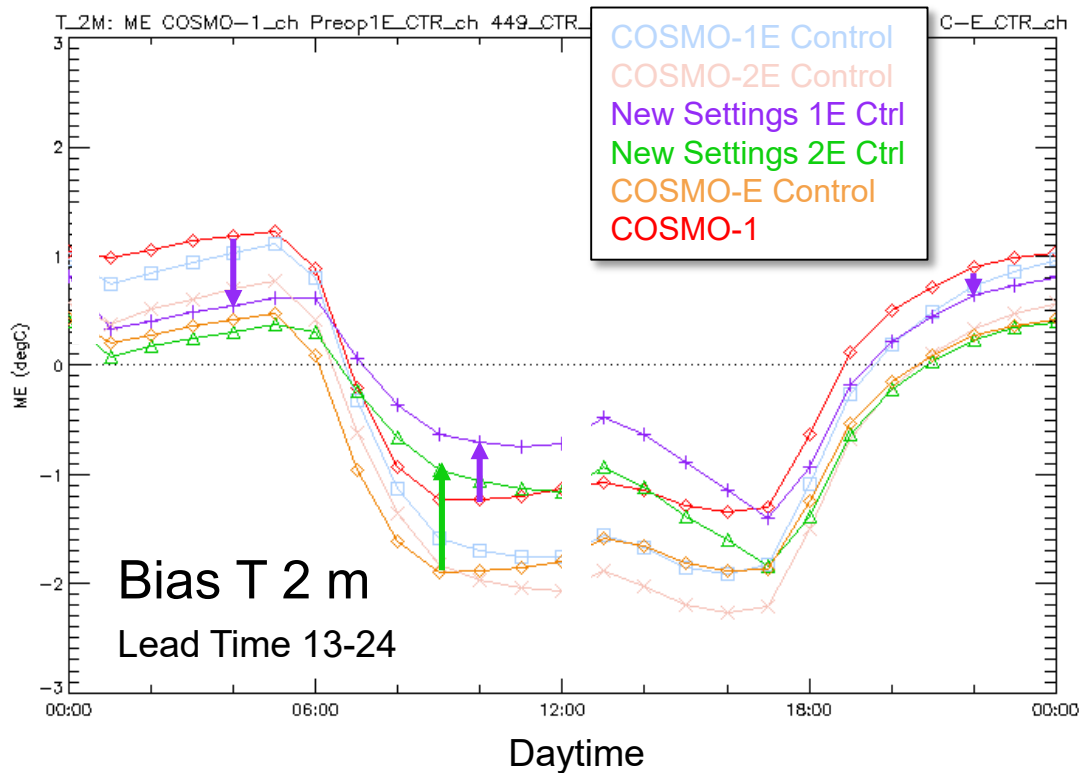
Cloud
coverage bias
improved or at
least less
deteriorated





2 m Temperature Spring 2020 (15 d)

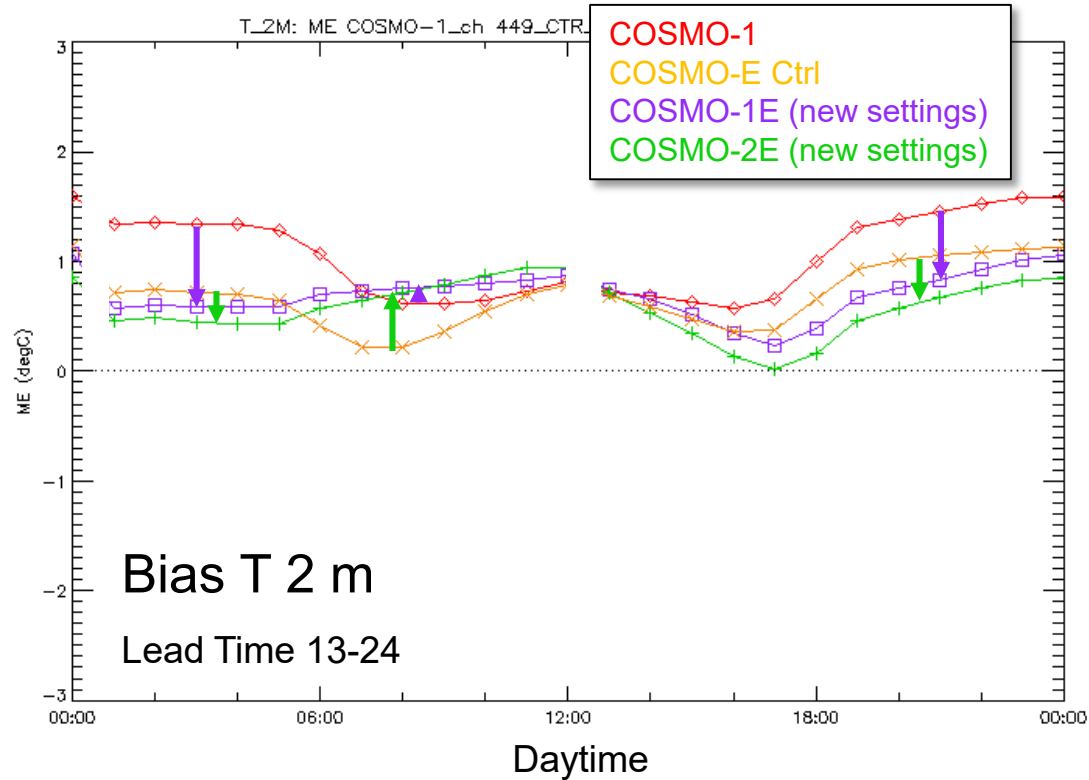
T 2m bias
mostly
improved
instead of
deteriorated





Summer 2 m Temperature Forecast

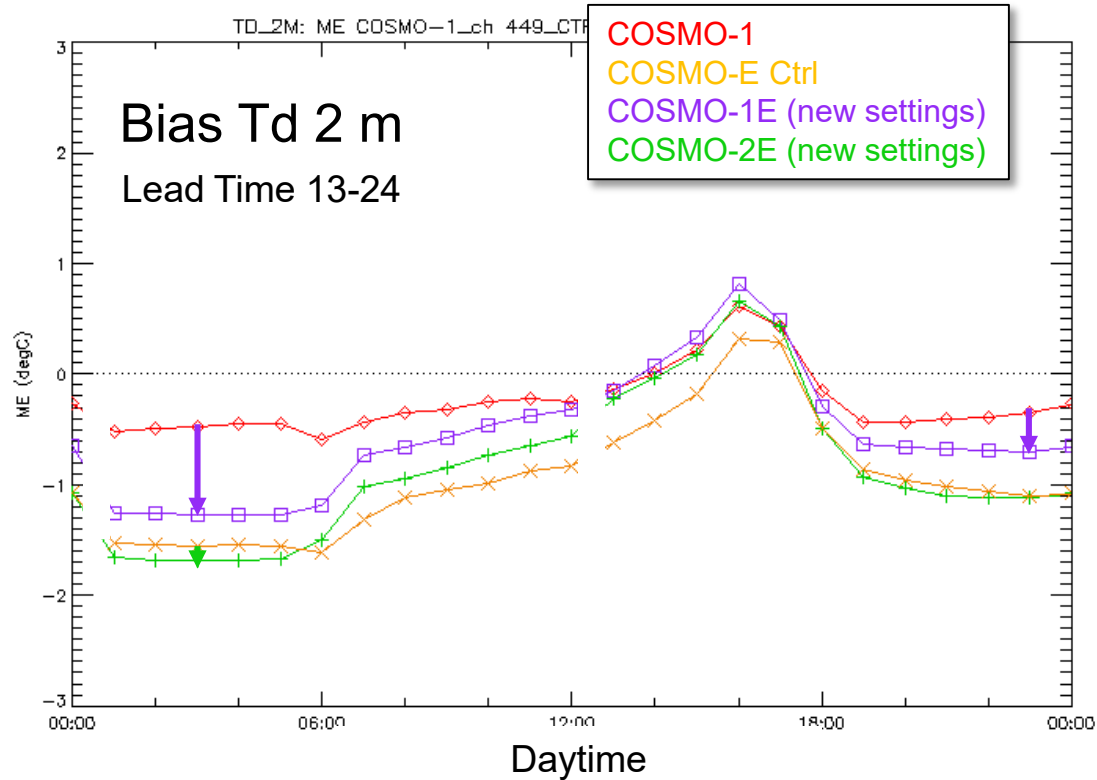
Considerably
smaller bias late
afternoon and
night ↓, some
degradation
during few
morning hours ↑





Summer 2 m Dewpoint T Forecast

Drawback:
Degradation of
COSMO-1E Td
at night
→ Assimilate
Td in the future



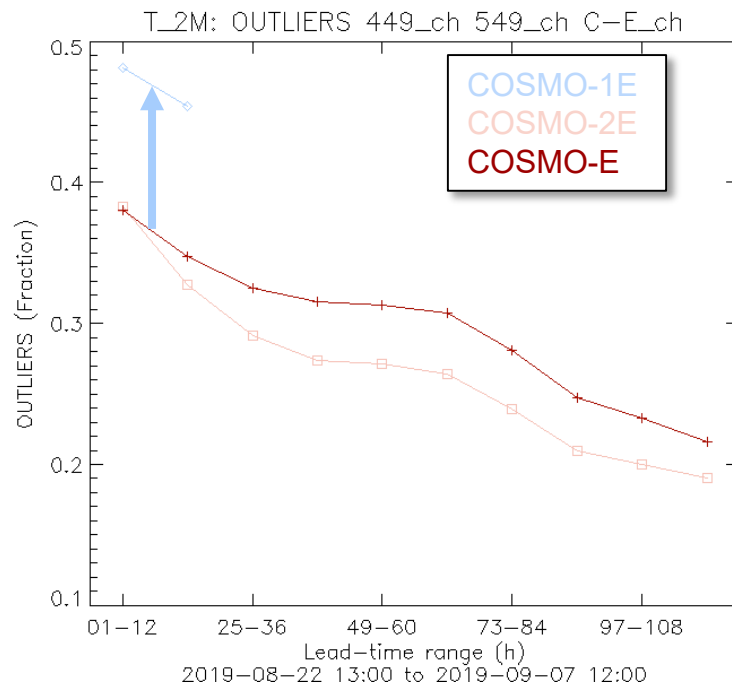
Higher resolution versus higher number of ensemble members – can the smaller COSMO-1E ensemble with 11 members beat the bigger COSMO-2E ensemble with 22 members?



Ensemble Verification: “Outliers”

The smaller ensemble size of COSMO-1E leads to a larger number of outliers

Example: T 2 m, summer 2019

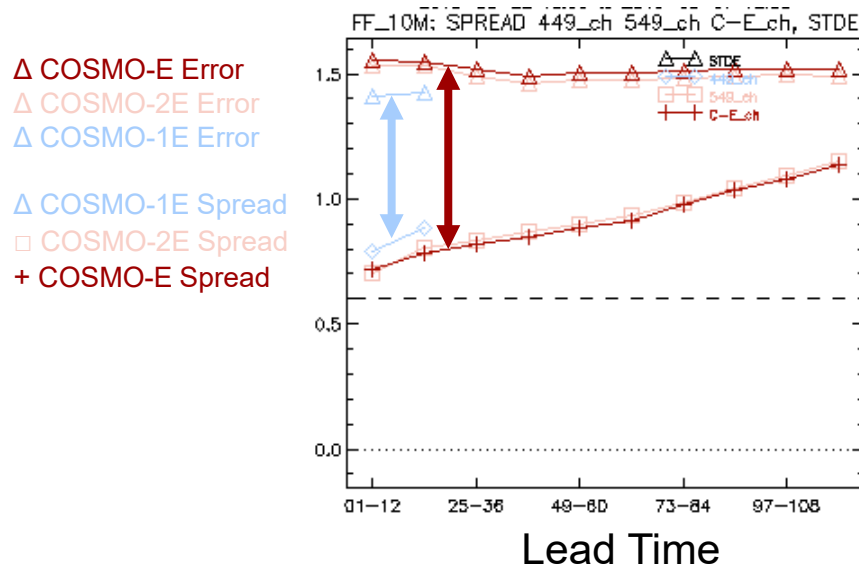




Example: wind speed, summer 2019

© MeteoSwiss, 2020-09-07

15

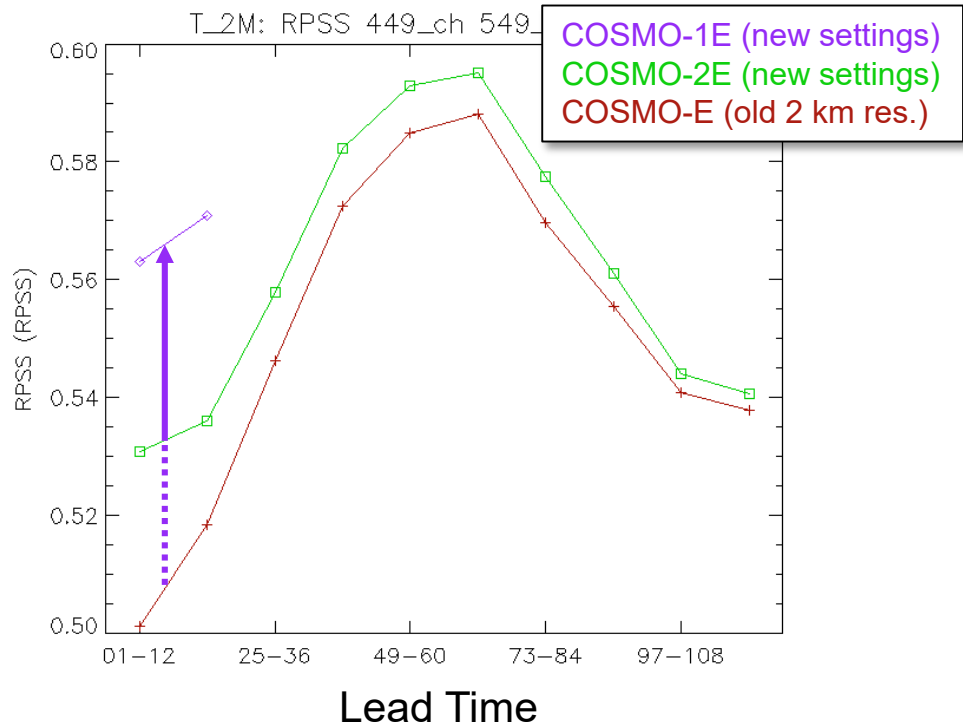




Ranked Probability Skill Score RPSS

The RPSS of
COSMO-1E is better
for most parameters
and most seasons

Example: RPSS T2m,
Autumn 2019

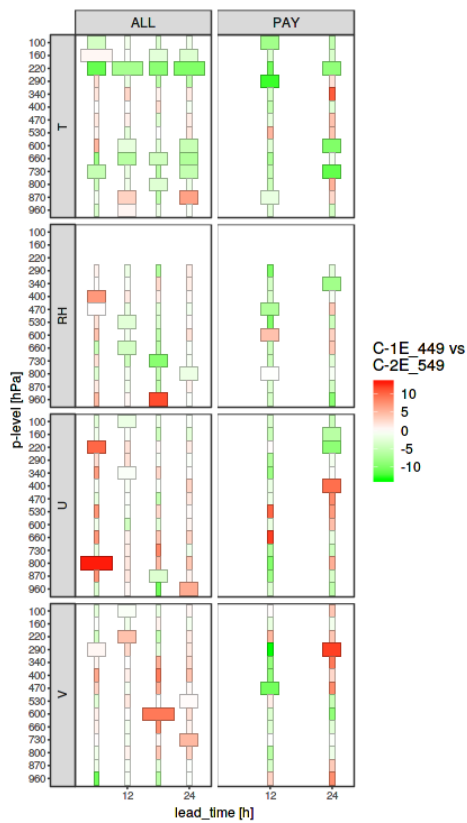




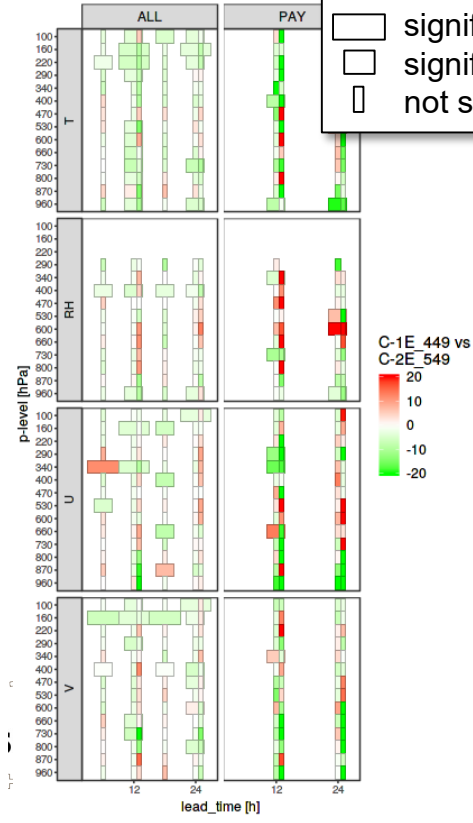
Profile Verification: CRPS COSMO-1E vs COSMO-2E

aggregated over all initial times and all forecast ranges > 0h

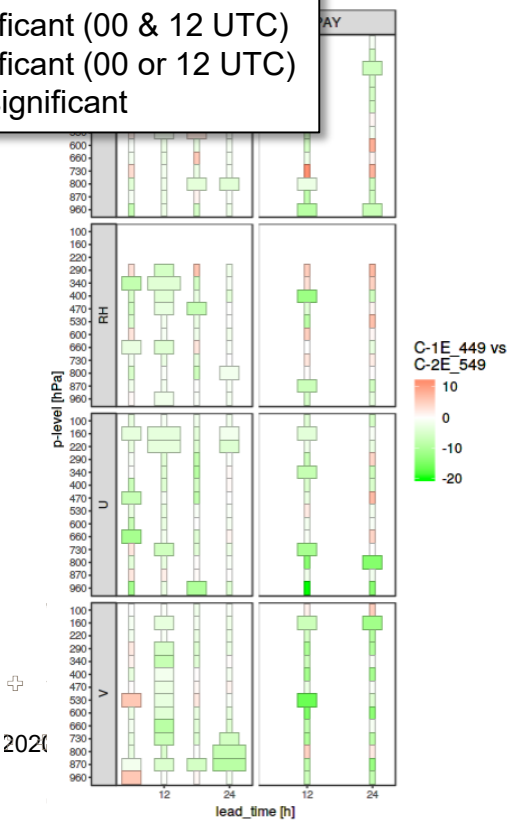
Summer



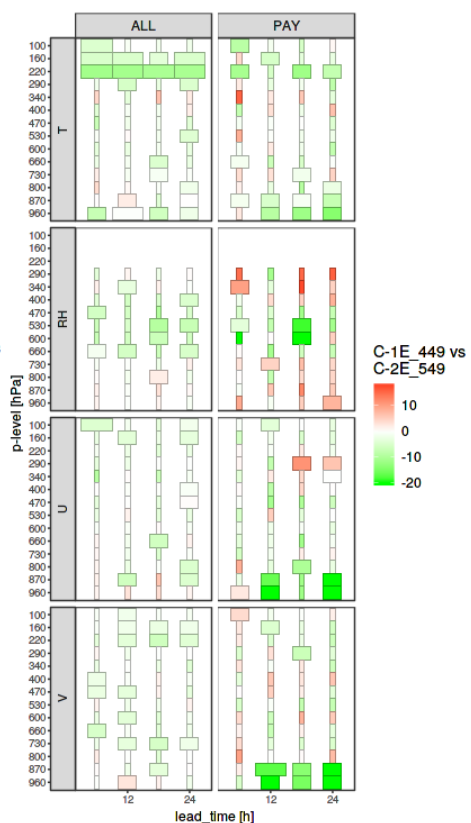
Autumn



Winter



Spring





Verification Summary

- COSMO-1E CTRL at short lead times is **slightly better than** (profile) or **as good as** (surface) COSMO-1
- COSMO-1E CTRL at long lead times is **as good as** (profile) or **slightly better than** (surface) COSMO-1
- COSMO-1E **better than** COSMO-2E and COSMO-E
- COSMO-2E **as good as** (profile) or **slightly better than** (surface) COSMO-E



Overall Summary

- **Overall**, the **majority** of performance differences are **positive**, showing some **improvement** of the new models versus the old ones.
- Other **important benefits** of the new models are the availability of **probability information on the 1.1 km scale** and the possibility to **assimilate new measurements** in the near future.
- The problem of the first preoperational version with a large **dew point bias in spring** has been **successfully ameliorated** with a retuned configuration using the J.P. Schulz and G. Vogel (Atmos. 2020) scheme.



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

MeteoSwiss

Operation Center 1
CH-8058 Zurich-Airport
T +41 58 460 91 11
www.meteoswiss.ch

MeteoSvizzera

Via ai Monti 146
CH-6605 Locarno-Monti
T +41 58 460 92 22
www.meteosvizzera.ch

MétéoSuisse

7bis, av. de la Paix
CH-1211 Genève 2
T +41 58 460 98 88
www.meteosuisse.ch

MétéoSuisse

Chemin de l'Aérologie
CH-1530 Payerne
T +41 58 460 94 44
www.meteosuisse.ch

MeteoSwiss

© MeteoSwiss, 2020-09-07

P. Kaufmann, A. Pauling, and M. Arpagaus

20