COSMO model at the Israel Meteorological Service: Implementation and Verification

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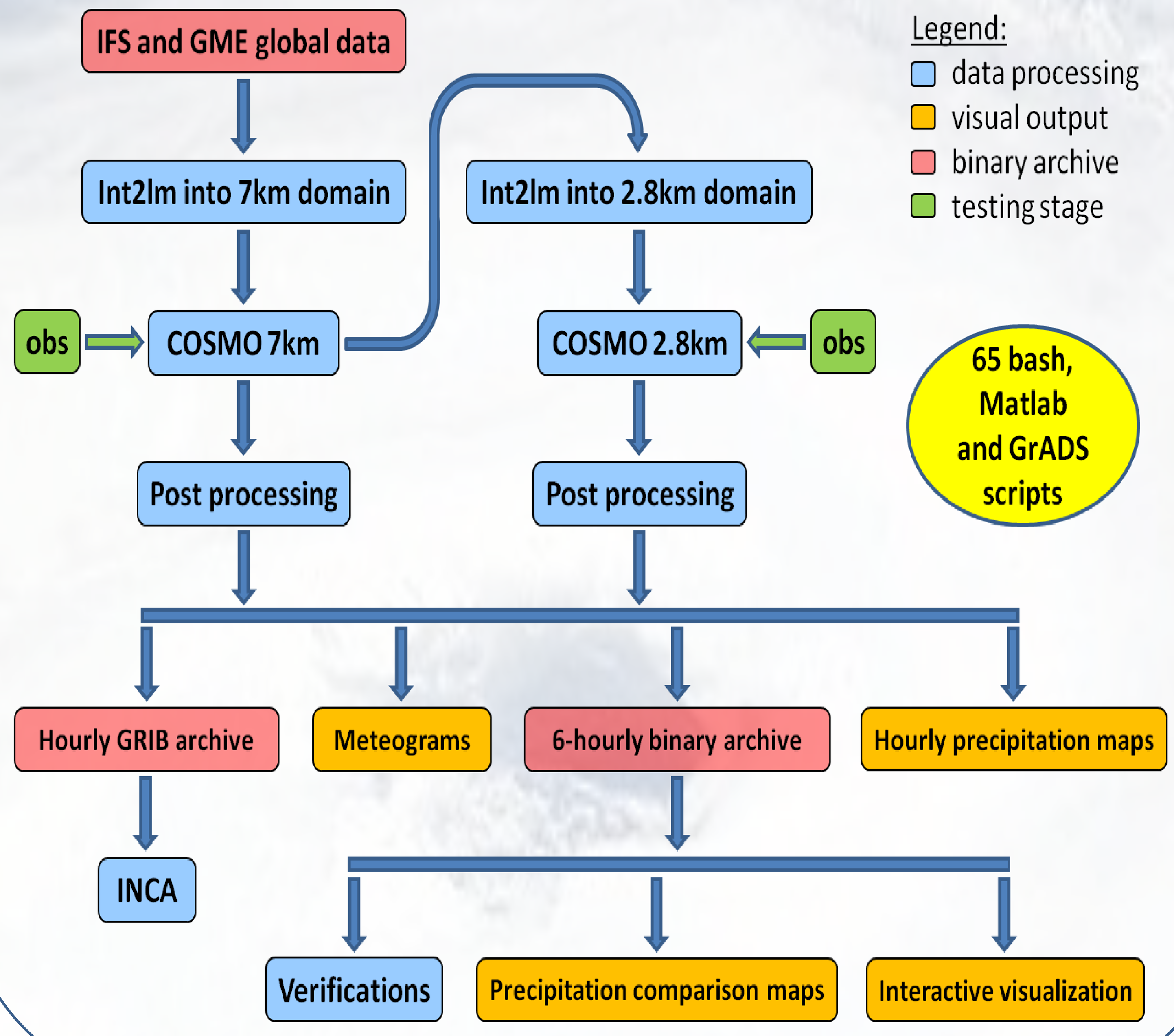
Abstract

COSMO model V4.26, 7-km and nested 2.8-km horizontal resolution, with 50 vertical levels, has been adopted for twice daily semi-operational testing at the Israel Meteorological Service (IMS). The model runs are performed using IFS (ECMWF) driving data over a "rotated" domain covering the eastern Mediterranean region.
COSMO model verification analysis was performed during the last year over Israel.

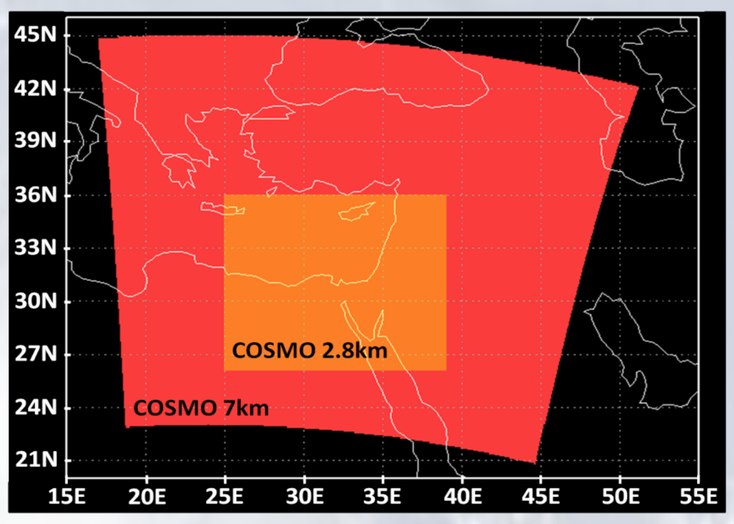
Main findings:

1. Precipitation forecasts perform well in deep winter cyclones, but are less accurate in local unorganized convective situations.
2. The near surface fields are well predicted in mountainous areas, but are less accurate in coastal plains (comparing to IFS).
3. COSMO forecasts of the near surface fields show spin-up of 6-12 hours, implying that initialization of soil fields from IFS might be problematic.
4. COSMO verification against IFS analyses was also performed. This verification suffers from "built-in" advantage at the early forecast ranges. Here, we show that verification vs. analyses is reliable for forecast ranges > ~ 24h.

COSMO work flow in IMS



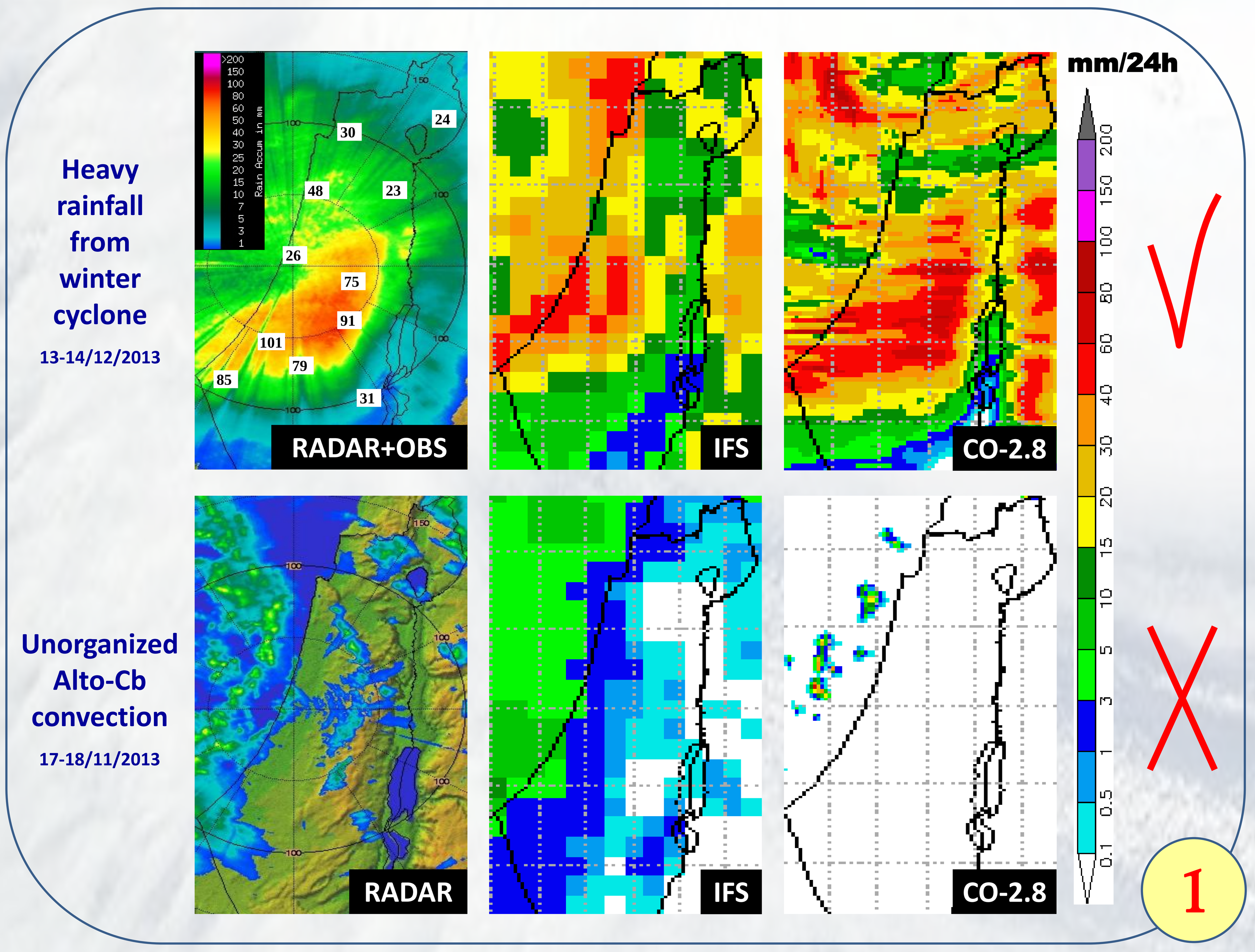
Model domains



Main characteristics

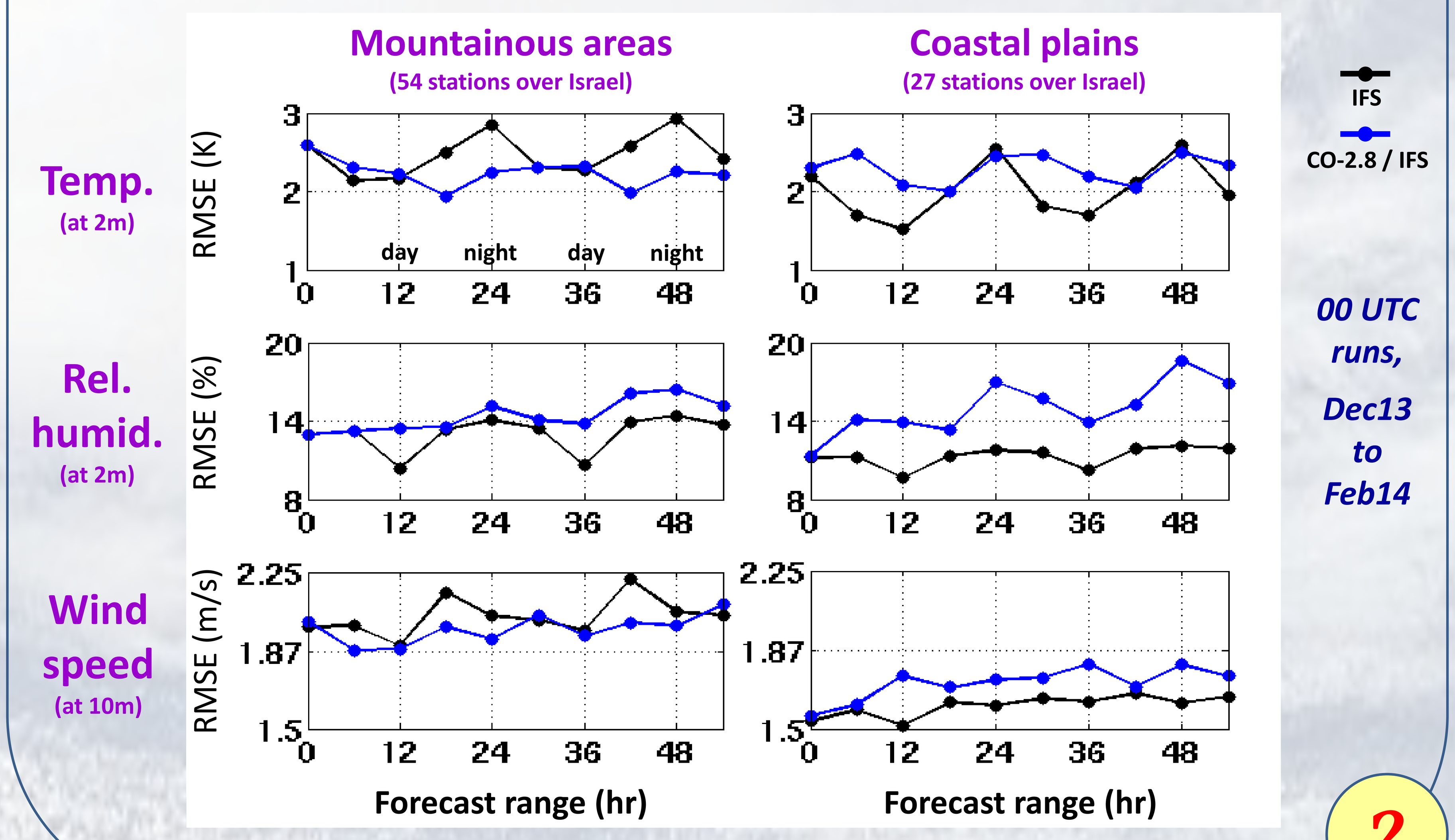
	COSMO-7km	COSMO-2.8km
Domain Size	401 X 353 X 50	561 X 401 X 50
Lateral Boundary Conditions	IFS/GME 3-h intervals, on frame	COSMO-7km 1-h intervals, whole domain
Forecast range	78h	54h
No. of processors	256	319
Run time	1:40h	
Hardware	SGI Linux Cluster 1024 AMD cores	
Time step	60 sec	25 sec
Time-integration	Runge-Kutta	
Moist convection	Tiedtke (1989)	"Shallow" Tiedtke
Graupel scheme	no	yes

Precipitation forecasts



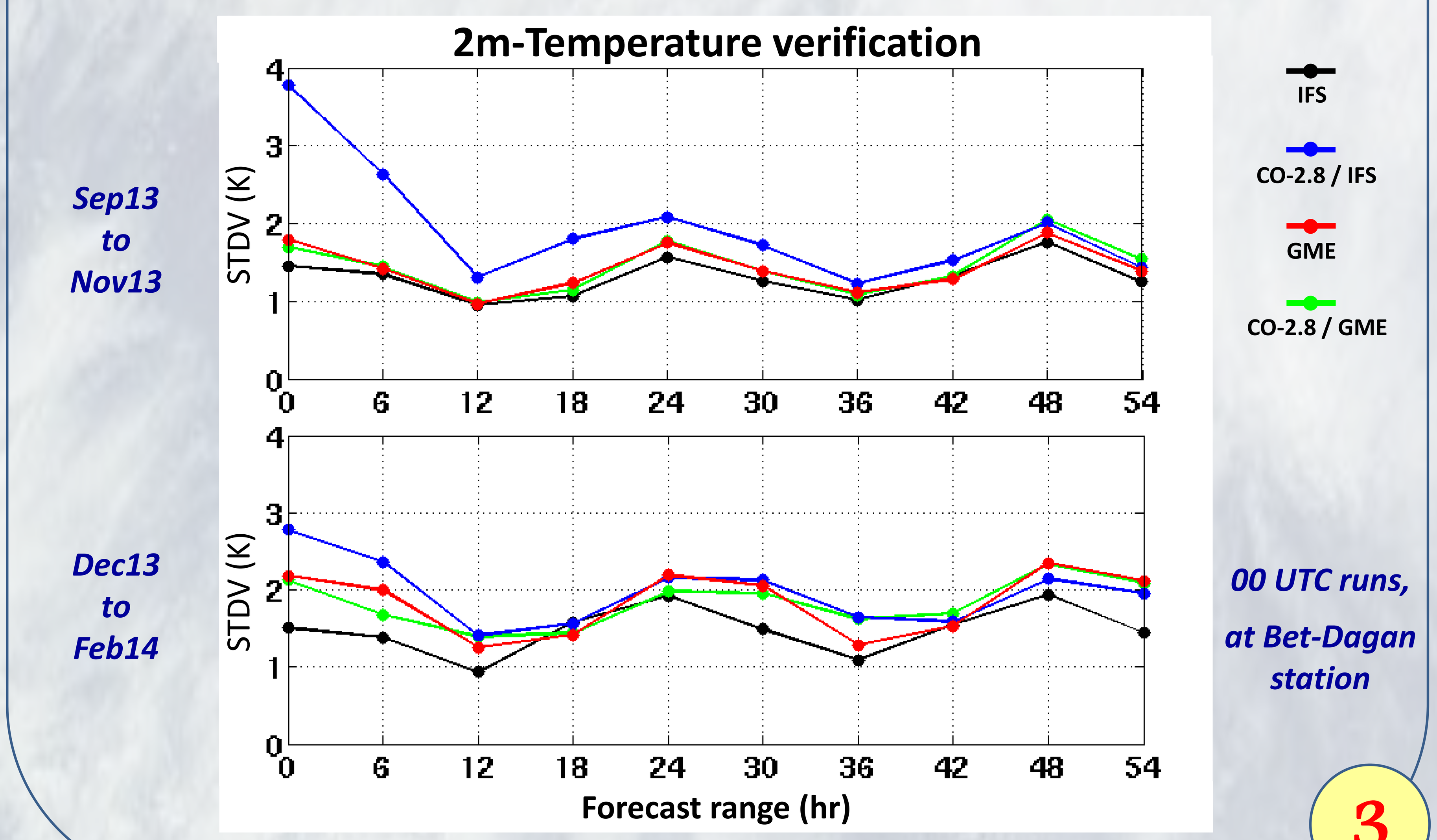
Surface fields in coastal plains and mountainous regions

- Generally, CO-2.8 / IFS "beats" IFS in mountainous areas and "loses" to IFS in coastal plains.
- Temperature and wind speed usually depend directly on the height. Because of better resolution, CO-2.8 / IFS predicts these fields better than IFS. On contrary, relative humidity does not depend directly on height.
- The high RMSE in rel. humidity of CO-2.8 / IFS is due to strong negative bias of -10% at night (not shown here).



Spin-up problems

- CO-2.8 / IFS shows significant temperature (at 2m) errors during the first 6-12 hours of forecast (in contrast to CO-2.8 / GME).
- Bad interpolation of "soil fields" from IFS ?!
- Possible solutions: Applying int2lm-2.0 (with improved soil interpolation from IFS) ? Assimilation cycle / warm start ?



Verification vs. analyses for upper-air fields

- Generally, CO-2.8 / IFS shows better results than CO-2.8 / GME.
- Strong dependence on the type of the analysis (IFS or GME). "Built-in" advantage when verifying against the own driving-model analysis. Generally, the results are reliable after forecast range of about 24h.