



VERSUS verification overview

Ulrich Damrath and all users of VERSUS



Ulrich Damrath & ...: COSMO GM Eretria 09/2014

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Standard verification: T2m Tdew, mslp, TCC, wind speed and precipitation

- Stations over various domains
- ✤ All stations over the common domain

Conditional verification

✤ ALL over various domains: Seasonal CV for T2m depending on

- observed wind speed below and above 2 ms⁻¹
- observed and forecasted cloud cover
- ✤ soil type
- ✤ roughness length
- ✤ All stations over the common domain: Seasonal CV for T2m depending on
 - Observed and forecasted cloud cover







	DWD	МСН	USAM	ARPA-SIMC	HNMS	IMGW	NMA
	C-EU	C-7	C-ME	C-17	C-GR	C-PL	C-RO
Model Version	5.0	5.0	5.0	4.28	4.11	4.08	4.13
Resolution	~7km	~7km	~7km	~7km	~7km	~7km	~7km
Driving Model	GME	IFS	IFS	IFS	IFS	GME	GME
Soil Moisture Analysis	yes	по	по			по	
Assimilation cycle	yes	yes		yes	yes	yes	





Verification domains













- Typical *quantitative* errors over various domains
 - Total cloud cover (TCC)
 - Temperature 2m
 - Conditional verification results for temperature 2m
 - Goal-setting:
 - Demonstration of typical bias values over different regions
 - Dependency of temperature bias on TCC







































• Typical *quantitative* errors

- Typical daily cycle of bias:
 - > Overestimation of TCC during night, more pronounced over Southern parts of Europe and area with continental climate and for Greece station for forecast day 2 and 3
 - > Underestimation of TCC or bias near zero during day

*****Trend:

- No noticable trend except for COSMO-EU (since 11/2011) and COSMO-ME (since MAM 2013)
- With reduction of minimal diffusion coefficient for COSMO-EU: more realistic simulation of low stratus during winter months, but stronger overestimation during daytime
- General rule: No advantage whithout disadvantage!





























COSMO-EU: T2m (depending on cloud cover) CONSORTIUM FOR SMALL SCALE MODELING **Deutscher Wetterdienst** over Germany (Winter 2012/2013) Wetter und Klima aus einer Hand





2

-2

0 3 6 9

ME

1900

Score-Measure

DWD



COSMO-EU: T2m (low cloud covers)

over Germany









COSMO-EU: Time series of COSI

over Germany







SMO Summary concerning T2m ^{Deutscher Wetterdienst} Wetter und Klima aus einer Hand





Typical *quantitative* errors Ο

Diurnal cycle of bias: *

CONSORTIUM FOR SMALL SCALE MODELING

- > During Winter:
 - general underestimation of T2m with weak diurnal cycle
 - for low cloud covers remarkable diurnal cycle with bias near zero during nicht and strong negative bias during first half of afternoon
- > During Summer
 - Remarkable diurnal cycle with specific properties for each region
 - Mostly warm bias during night and near zero or moderate negative during day
- Trend (can be really identified only for COSMO-EU)
 - > After change in minimal diffusion coefficient diurnal amplitude is not so strong as before, especially for Spring and Autumn.
 - > Time series over the common area is not long enough to see any trends.







- Typical *qualitative* errors over the common domain
 - Mean surface level pressure
 - Wind 10m
 - Precipitation in intervals of 6 hours
 - Goal-setting:
 - Demonstration of differences of forecast quality depending on operational model configuration (boundary conditions, location of model domain, other aspects)





Common domain







Integration areas and the common domain











Stations over the common domain Deutscher Wetterdienst Wetter und Klima aus einer Hand







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$$RMSE(scaled) = \frac{RMSE(FCT) - RMSE(\min)}{RMSE(\max) - RMSE(\min)}$$

$$Skill(ETS) = \frac{ETS(FCT) - ETS(\min)}{ETS(\max) - ETS(\min)}$$





RMSE of MSLP











RMSE of MSLP



















RMSE of T2m











FBI of 6h-precipitation (> 0.2 mm)

over the common domain









FBI of 6h-precipitation (> 5 mm)











Skill (against COSMO-EU) of 6h-

precipitation (> 5 mm)

Deutscher Wetterdienst Wetter und Klima aus einer Hand



over the common domain

Mean Skill (ETS-ETS(CEU)/(1.-ETS(CEU)) over the region of Common area for 00-UTC run up to 72 h in intervals of 06 hours Precipitation, Threshold: 5 mm/06 hours (Height of bars sign the ETS for each model.)









• Typical *qualitative* errors over the common domain

- * The effect of IFS-BC's on mean surface level pressure is obvious.
 - Compared to GME COSMO is able to develop an own regime for mslp with better quality.
 - Systematic anomalies in the diurnal cycle occur during afternoon. This may be dependent on reduction problems caused by bias of T2m or an unsufficient modelling of the diurnal pressure wave (A minor but not necessary reason – amplitude ~1 hPa.).
- This effect can also be detected for forecasts quality of wind 10m but a bit attenuated compared to mslp.
- ✤ Most important effect on forecast quality for T2m is the soil moisture assimilation.
- Precipitation in intervals of 6 hours
 - FBI's for low precipitation amounts seem to be natural when verifying against SYNOPobservations.
 - For higher precipitation amounts the end of the flagpole seems to be reached for deterministic runs of COSMO – ensembles are needed for more accuracy!
- A readers version of this talk containing all verification results for the last three years is available. This version contains more than 1000 graphics with differently grouped verification results.

Please contact your WG5 member.





Final remarks



Parts of verification scores (schematically)



General behaviour of forecast errors:

- Dominant error growth with forecast time
 - Elements with small parts of diagnostics or parameterisation
- Dominant diurnal cycle of errors
 - Elements with larger parts of diagnostics or parameterisation
- Measurement errors should be recognised, but the lack of representativeness of measurements should be kept in mind and cannot elimated when using SYNOP observations
- From external sources and own experiences: There are opportunities for improvements.



Be strong: ICON is coming!!!