Verification of the COSMO 7 km model and new developments for the 2.2 km model with a special emphasis on precipitation

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Verification of COSMO model
| New developments for the 2.2 km version

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COSMO 7km, regional scale
Own assimilation cycle
2 daily 72h forecast

IFS/ECMWF, 20km, synoptic scale
4 daily updates

COSMO 2.2km, local scale
pre-operational in 2007
Own assimilation cycle
8 daily 18h forecast
Coarse scale verification (for precipitation)

- Verification with surface observations
- (as mean of 5 gridpoints of COSMO 7km model)
  - categorical verification (scores of 6h-sums)
  - diurnal cycle (hourly resolution)

Diurnal cycle of precipitation over Switzerland
for gridpoints < 800 m

**Winter 2005/2006**

full line: obs (ANETZ); dashed: COSMO

**Summer 2006**

full line: obs (ANETZ); dashed: COSMO
Coarse scale verification (for precipitation)

- Verification with surface observations (as mean of 5 gridpoints of 7km model)
  - categorical verification (scores of 6h-sums)
  - diurnal cycle

- Verification with raingauges (24h sums)
  - Gridded analyses vs model forecast
Flash flood August 2005

24h precipitation sums [mm] (21-22.8.2005, 06-06 UTC)

gridded observations
(Christoph Frei, Climate Services)  

COSMO forecast of
20.8.2005 00 UTC (+30 to +54h)

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Coarse scale verification (for precipitation)

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  - categorical verification (scores of 6h-sums)
  - diurnal cycle

- Verification with raingauges (24h sums)
  - Gridded analyses vs model forecast

- Verification with radar precipitation estimates
  - categorical verification
  - Weather-type dependant verification
Impact of prognostic precipitation
(introduced on 16 November 2004)

COSMO – Radar; northwesterly flow

2004

Emanuele Zala, MeteoSwiss
Precipitation in COSMO 7 km and 2.2 km
Experiments in Project Preview (flash floods)

12h-precipitation sums (+12 to +24h) of COSMO forecast of 05.06.2002 00 UTC

COSMO 2.2 km show much more finescale structures: are they realistic?

Silke Dierer, MeteoSwiss
Towards fine scale verification (for precipitation)

- Point-based verification ➔ double penalty problem
  - Consider non-localized statistics: frequency distribution, autocorrelation length
  - Consider fuzzy-localized statistics: looking at various spatial scales, apply different interpretation strategies
    ➔ Fuzzy verification

- COSMO Priority Project “Advanced interpretation and verification of very high resolution models”
  - Goal is to find the smallest area in which the benefit of running a very high resolution model is present (reliable scale)
  - Products for end-users (forecasters) designed for this scale
Fuzzy verification

- define scales of interest; consider “average” features within each box
- Beth Ebert build up a collection of existing fuzzy forecasting verification scores in a toolbox

Example: Fractions skill score
Compare fractional coverage in a box

- score depends on considered scale and threshold (defining an event)
A (Fuzzy) Verification testbed

Virtual truth
(Radar data, model data, synthetic field)

Perturbation Generator
Realizations of virtual model forecasts

Fuzzy Verification Toolbox
Realizations of verification results

Analyzer

Assessment of
• sensitivity
• sharpness

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<td>WNOISEMULT</td>
<td>Multiply by white noise</td>
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<td>XSHIFT</td>
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<tr>
<td>TSHIFT</td>
<td>Translation in time</td>
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<tr>
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<td>Smooth the field</td>
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Perfect forecast

observation = forecast

All scores should equal 1.00!

But, in fact, 5 out of 12 do not!

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Effect of „Leaking“ Scores

Some methods assume no skill at scales below window size!

An example: Joint probability method

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Not perfect!
Spatial Translation

Example:
Fractions skill score (Roberts, N., 2005)

• Fraction skill score shows a very reasonable behavior in case of translations.
Spatial Translation

$\Delta x = 7.5$ points
Scaling

scaling: 1.50

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Outlook

• Further study with the fuzzy verification testbed
  • Scaling, smoothing, ...

• Selection of some fuzzy verification methods
  • Fractions skill score, intensity-scale, ....

• Starting verification with real cases
  • Comparison of COSMO: 7 km vs 2.2 km

• Verification of MAP D-PHASE WWRP forecast demonstration project (August-November 2007)
  • Flash floods, ...
Thank you for your attention