Ensemble activities in COSMO

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CONSORTIUM FOR SMALL SCALE MODELING
COSMO

Ensemble activities in COSMO

- Development of convection-permitting ensembles
- Initial Condition perturbation: KENDA LETKF
- Physics perturbations:
  - Test SPPT
  - Test SKEB
  - Develop new intrinsically stochastic physics perturbations
- Lower boundary perturbations:
  - Soil moisture
- Verification (VERSUS package)
- Interpretation

CONSORTIUM FOR SMALL SCALE MODELING
COSMO

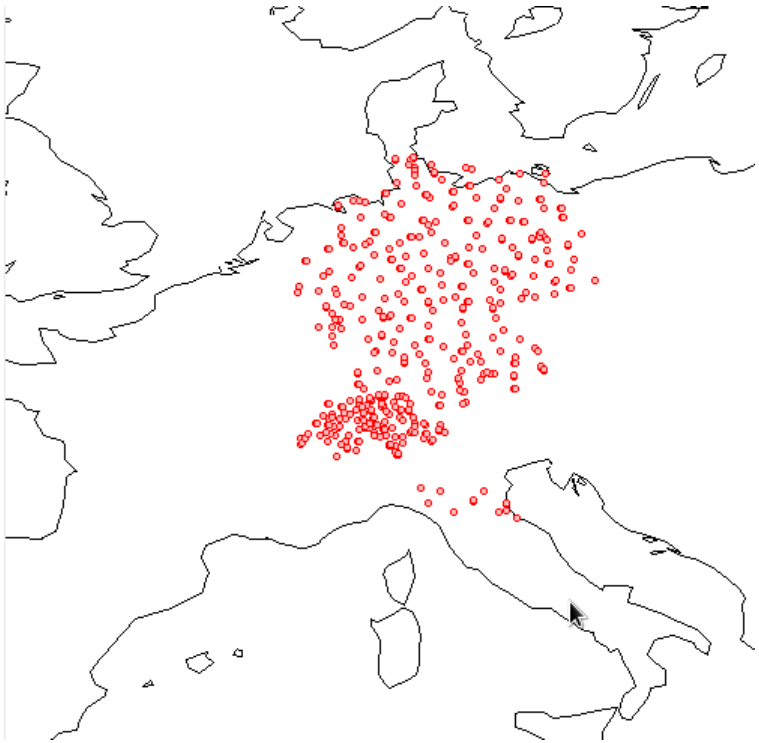
Ensemble activities in COSMO

- Consortium ensemble: COSMO-LEPS
- COSMO-DE-EPS at DWD
- Ensembles under development:
  - COSMO-E (MeteoSwiss) CP
  - COSMO-IT-EPS (Italy) CP
  - COSMO-ME-EPS (Italy) -> Mediterranean domain, sea state forecast
- Sochi Olympics: COSMO-S14-EPS and COSMO-RU2-EPS

CONSORTIUM FOR SMALL SCALE MODELING
COSMO

COSMO-LEPS: calibrated precipitation

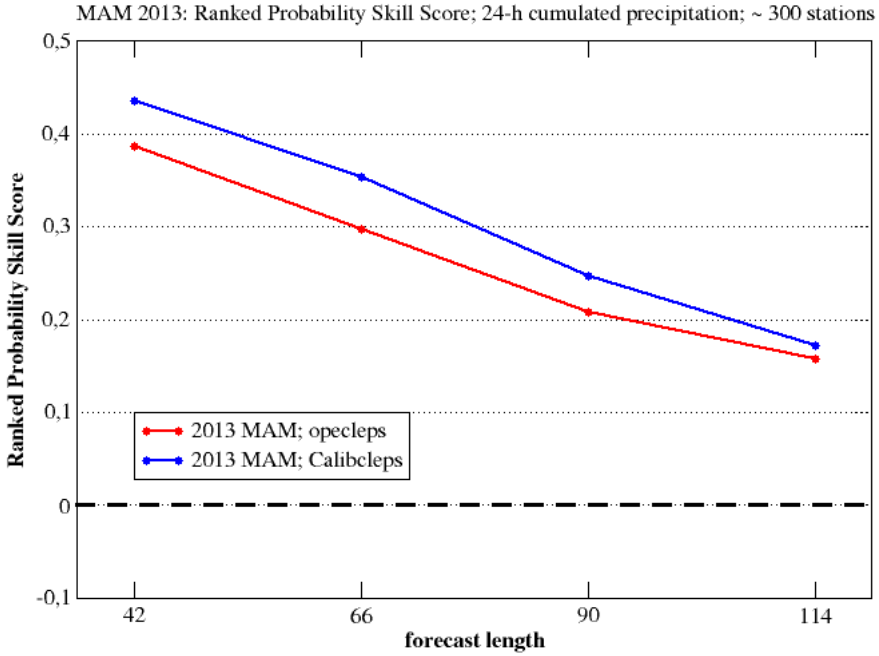
- For each COSMO-LEPS member, calibrated precipitation is operationally generated over Germany, Switzerland and Emilia-Romagna
- The calibration technique is based on CDF-based corrections, making use of COSMO-LEPS reforecast.

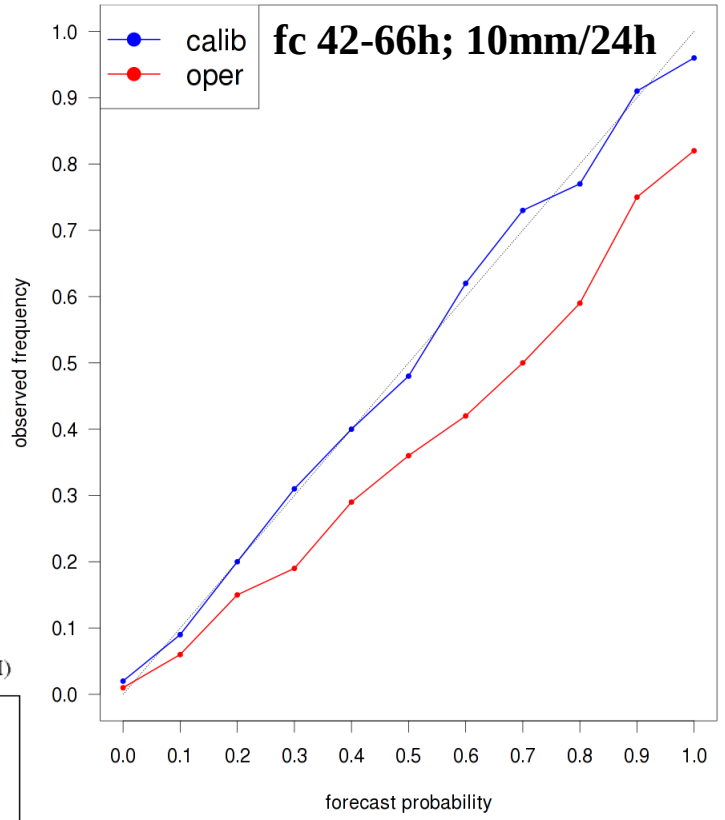


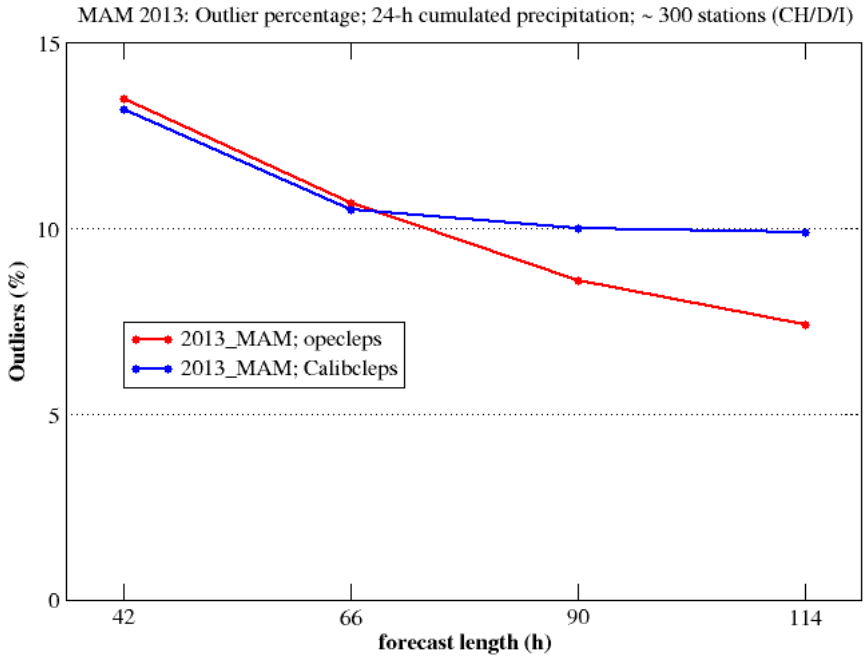
Verification:

- 24h cumulated precip (06-06 UTC)
- DJF 2012-13 and **MAM 2013**
- Germany, Switzerland, Emilia-Romagna
- nearest grid point; no-weighted fcst
- synop reports (about 300 stations/day)

opecleps vs calibcleps







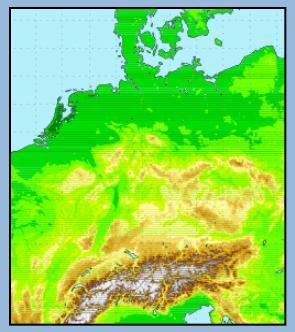
COSMO-DE-EPS

operational set-up:

- ➔20 members
- ➔grid size: 2.8 km

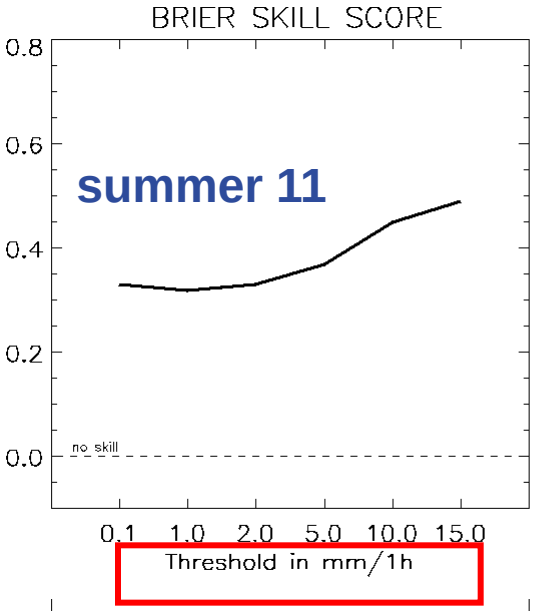
  convection-permitting
- ➔lead time: 0-27 hours,

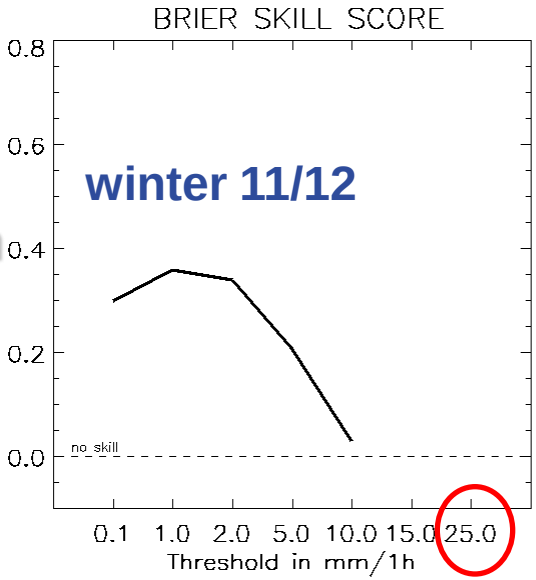
  8 starts per day (00, 03, 06,... UTC)

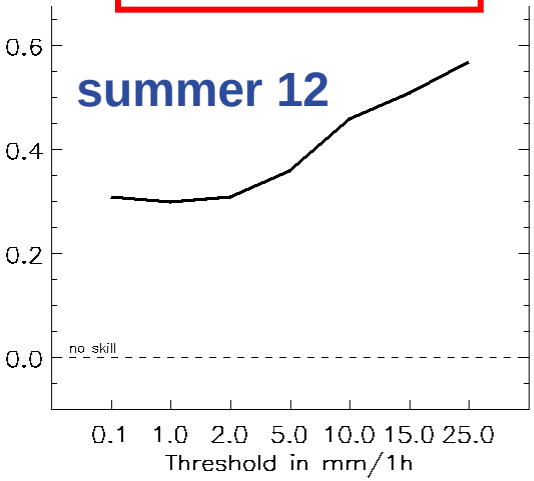


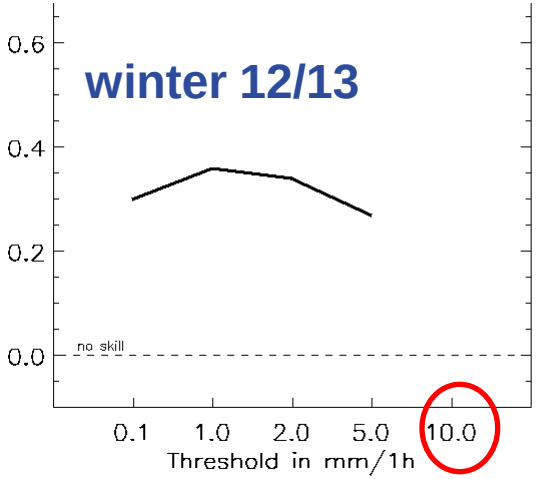
Brier Skill Score (reference: deterministic run of COSMO-DE)

hourly precipitation







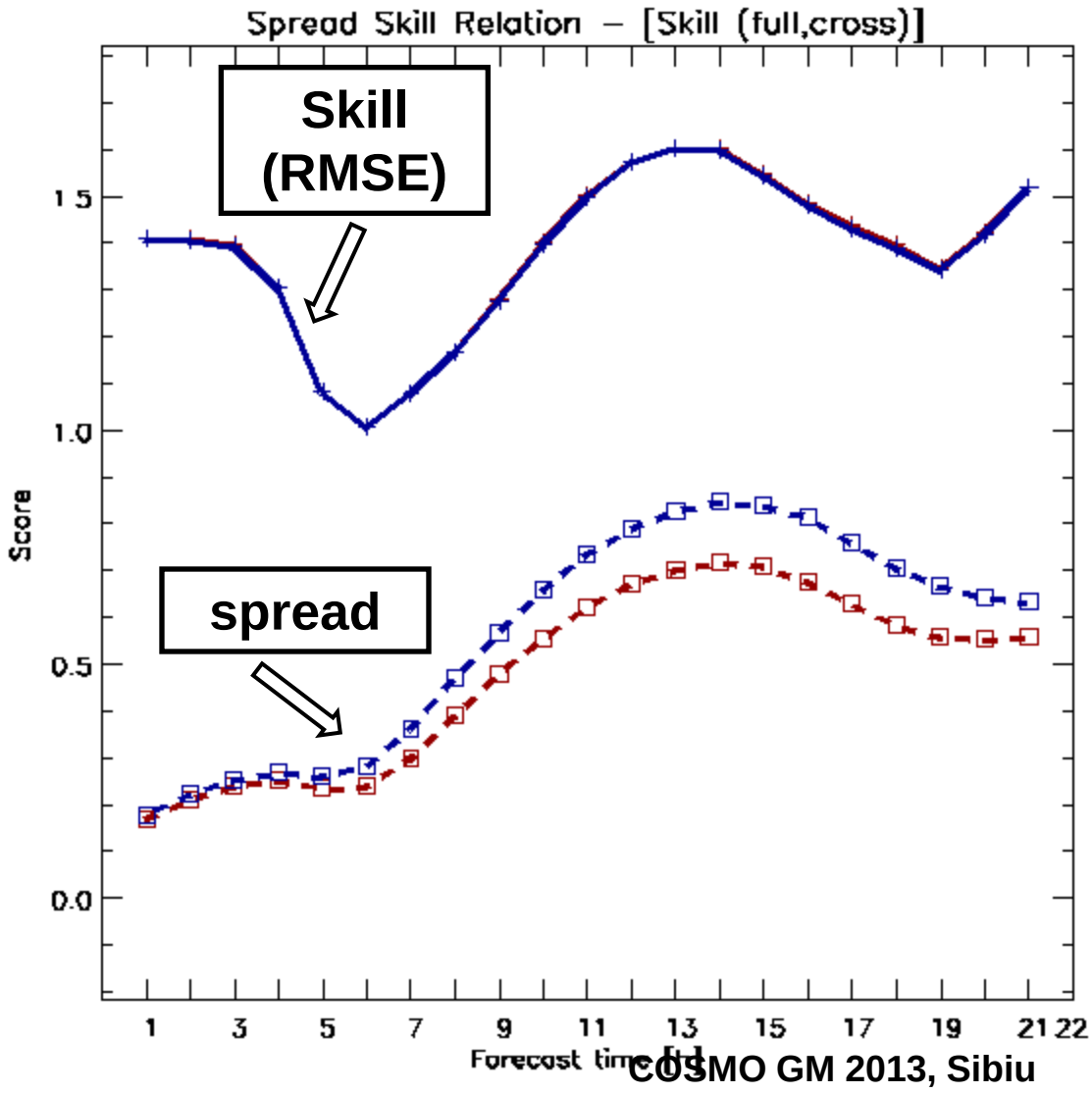


Perturbed soil moisture

± half the difference between C-EU and C-DE soil moisture in all layers but the lowest

m1	m2	m3	m4	m5	m6	...	...	m18	m19	m20
-	+.5*inc	-.5*inc	-	+.5*inc	-.5*inc	…	…	-.5*inc	+.5*inc	-

test period June/July 2012



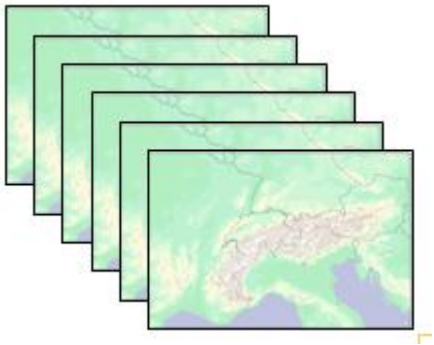
2m temperature

perturbed soil moisture

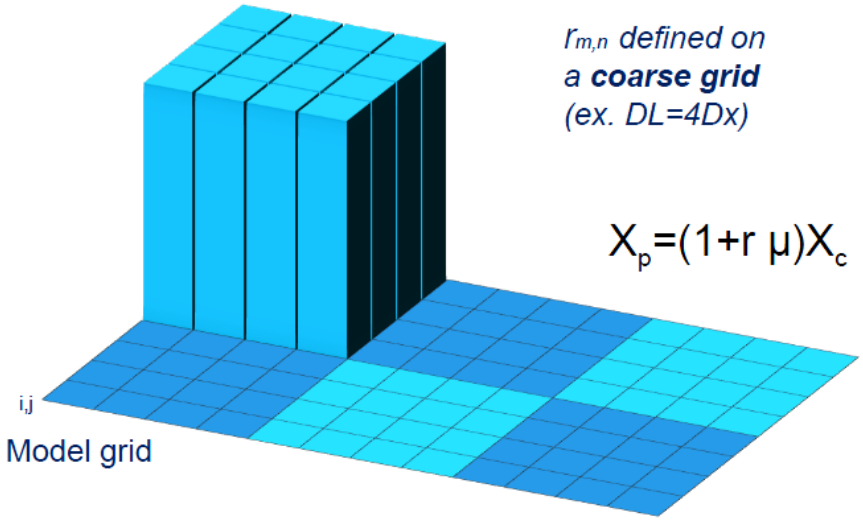
reference

COSMO-E

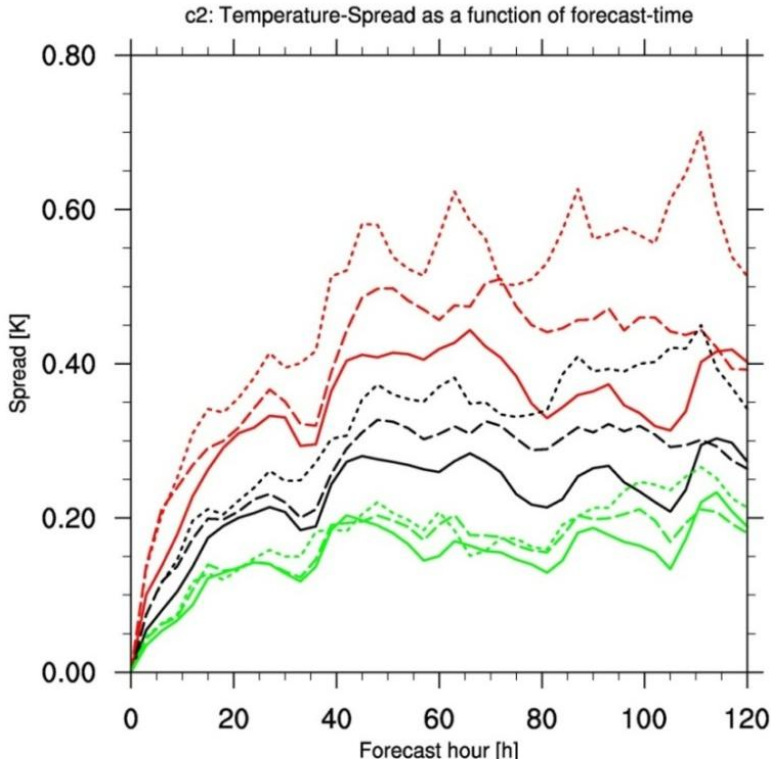
- Ensemble forecasts with convection-permitting resolution (2.2 km mesh-size)
- 21 members
- Twice a day up to +120h for Alpine area (15% larger than COSMO-2 domain)
- Range of possible scenarios and “best estimate”
- COSMO version 4.26



SPPT



Case 2012-08-01: T spread



@ 500 (solid lines), 700 (dashed), 850 (dotted) hPa

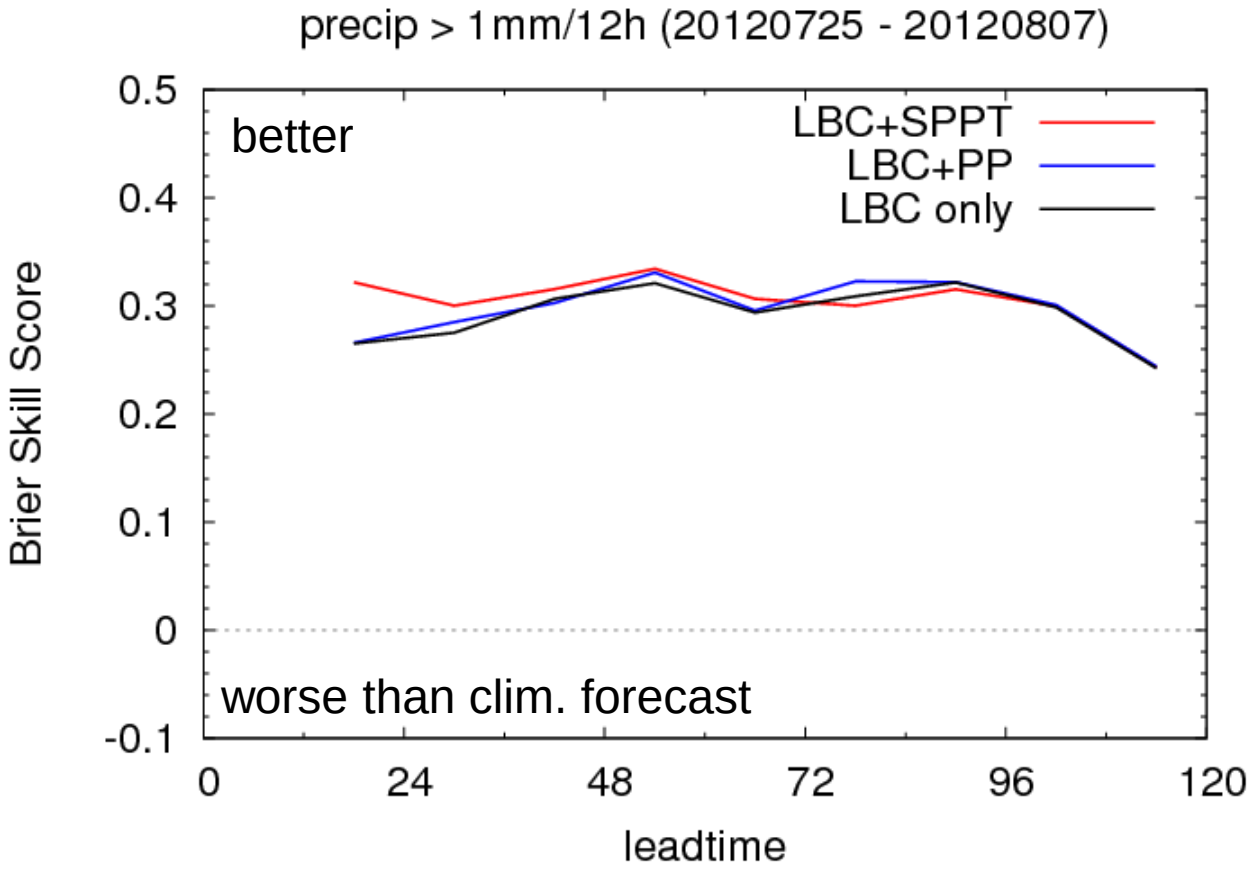
large stdv_rn=0.5, range_rn=1 (ex3)

stdv_rn=0.25, range_rn=0.75 (ex1)

stdv_rn=0.25, range_rn=0.75, dlat_rn=dlon_rn=0.5°, ninc_rn=90 (ex4)

- spread largest at 850 hPa, lowest at 500 hPa
- larger random numbers produce larger spread and faster spread growth
- smaller correlation-lengths in space and time lead to smaller spread

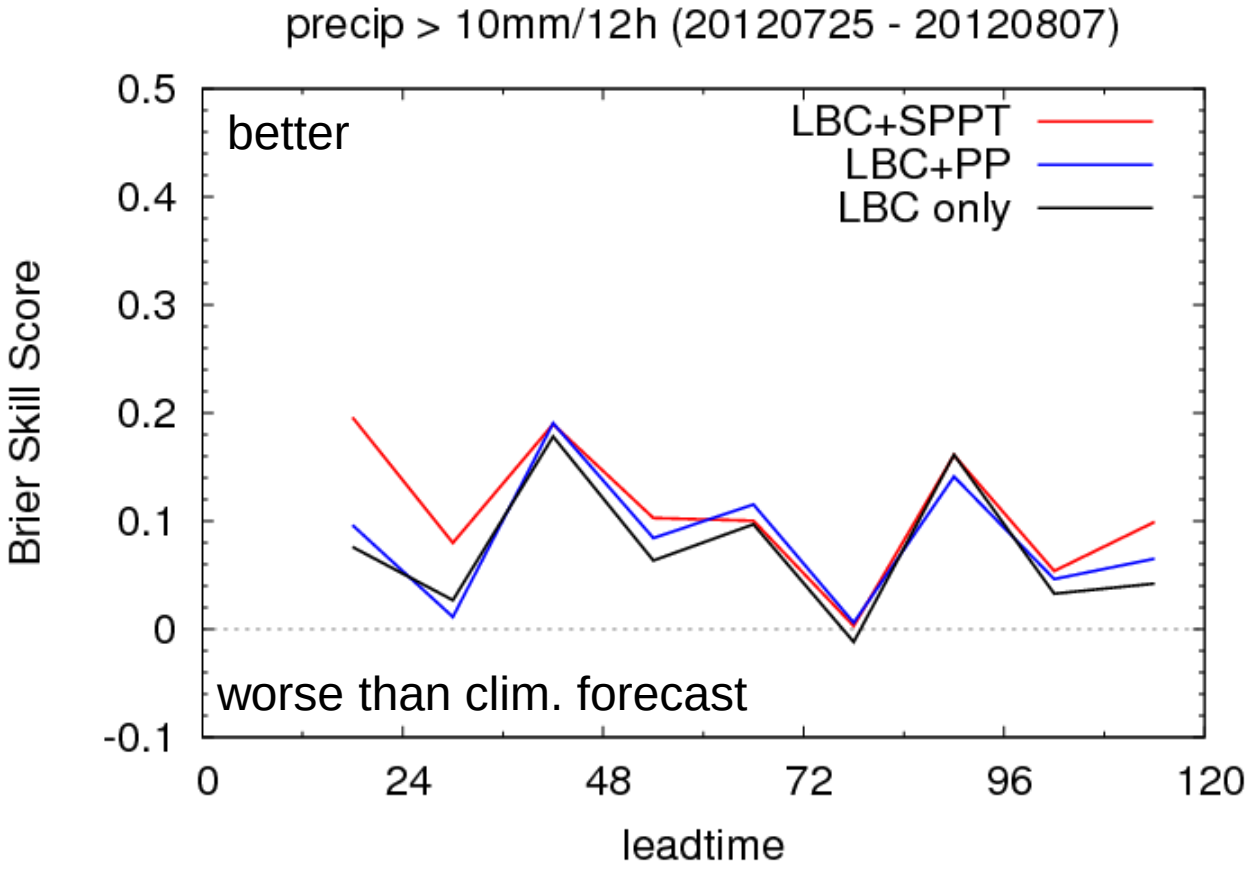
Brier Skill Score (ref=climatology)



Reference: forecast based on station climatology 2001-2010 (300 stations)

- all experiments clearly better than clim. forecast for all lead-times
- LBC+SPPT best until +72h, but differences very small

Brier Skill Score (ref=climatology)



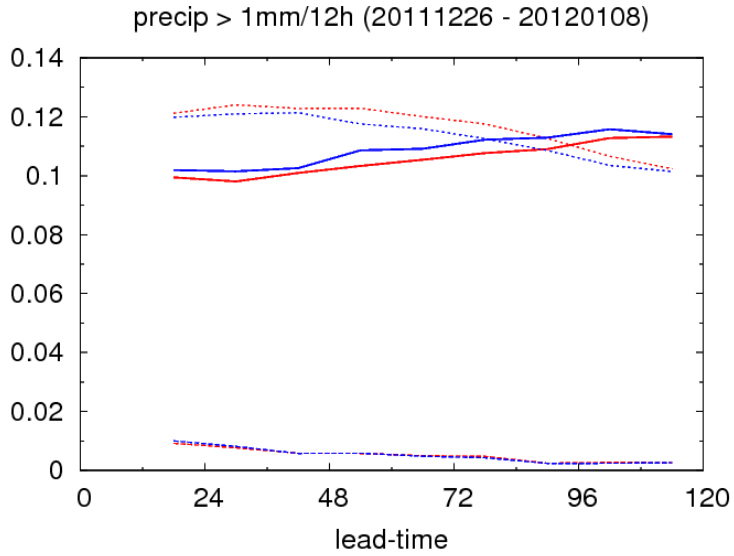
Reference: Forecast based on station climatology 2001-2010 (300 stations)

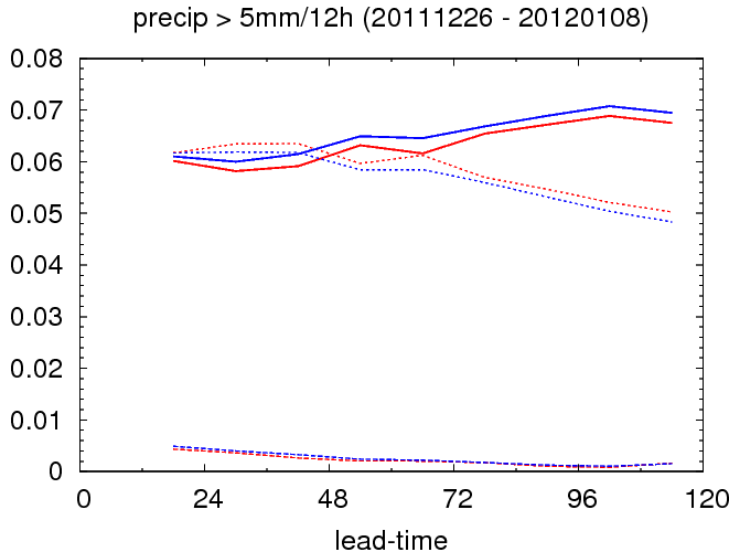
- daytime precip. only slightly better than clim. forecast
- LBC+SPPT best experiment

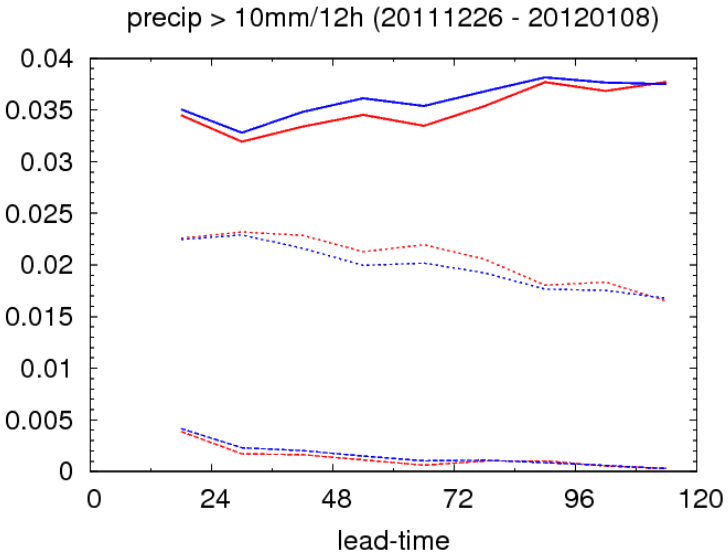
BC-EPS experiments

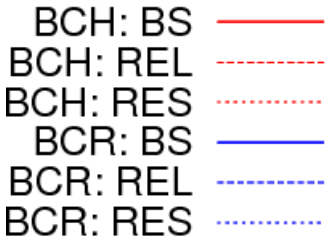
- ECMWF provide 2 BC-EPS data sets for 3 periods:
  - current resolution T_L639 (~32 km) → BCR
  - high resolution T_L1279 (~16 km) → BCH
- winter storm period 2011-12-26 – 2012-01-08 run with COSMO-E (without SPPT)
- first results show slightly better scores with BCH in surface verification (500 stations)

Brier score 12h sum of precipitation









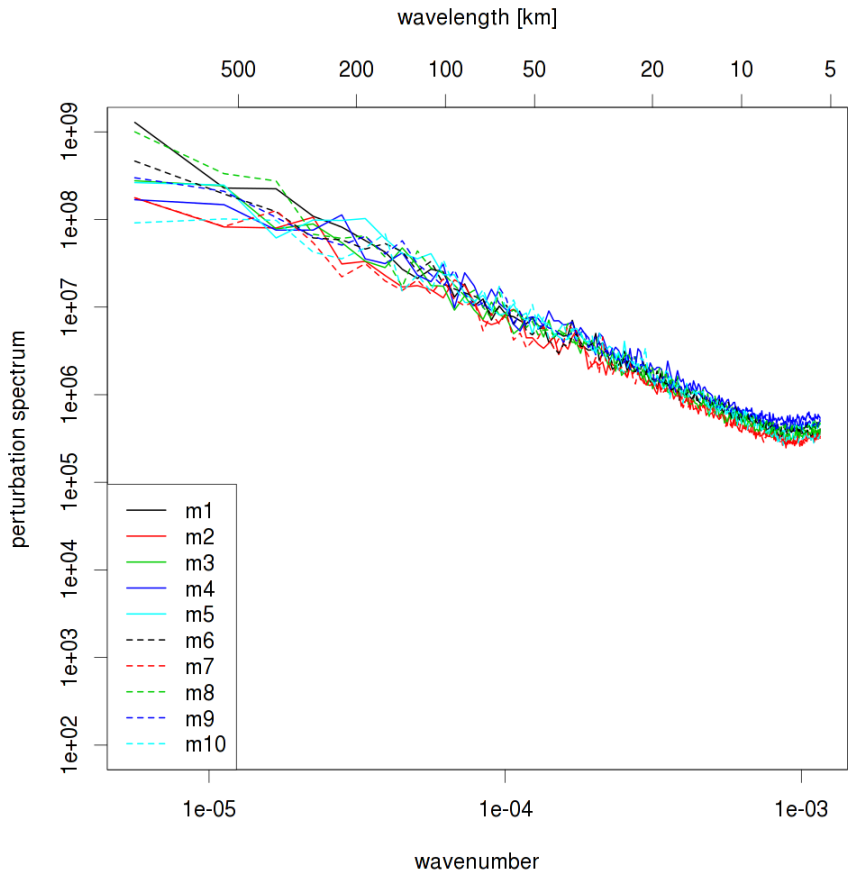
- BCH shows better scores
- mainly thanks to better resolution

COSMO-IT-EPS
testing KENDA ICs

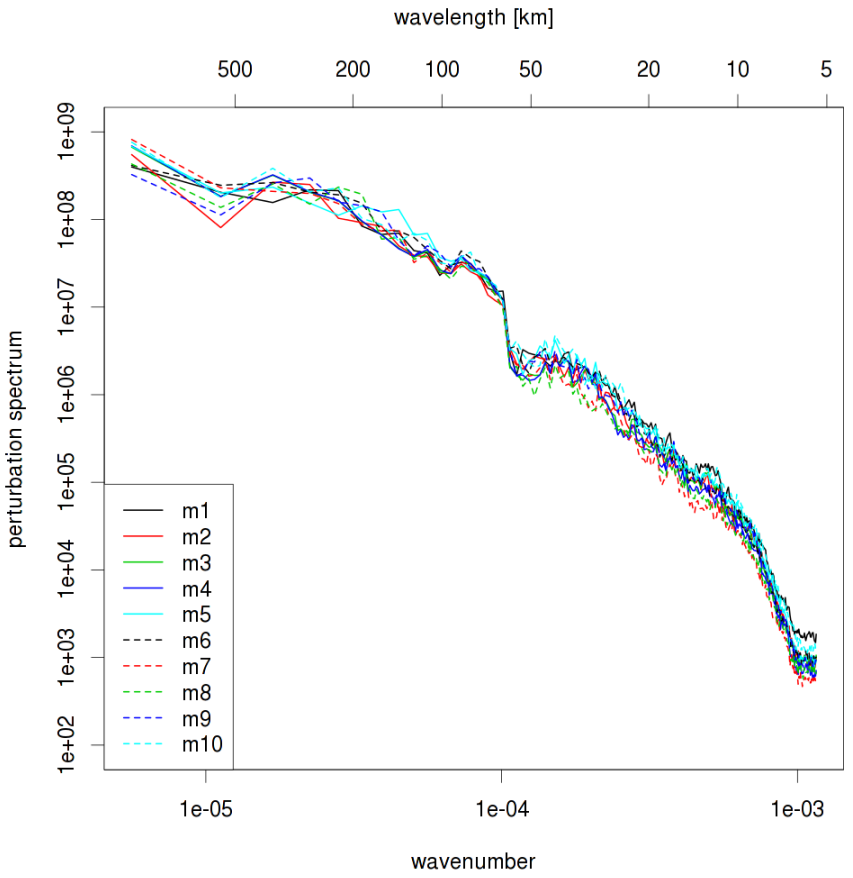
- DA cycle:
  - 3-hourly cycles, 36 hours
  - 10 members
  - BCs from COSMO-LEPS (also ICs for cold start)
  - no model perturbations
  - observations: TEMP SYNOP ACARS AMDAR
- Forecast:
  - 10 members
  - 36h forecast range
  - parameter perturbations
  - BCs from COSMO-LEPS

2012102512 - T level 50

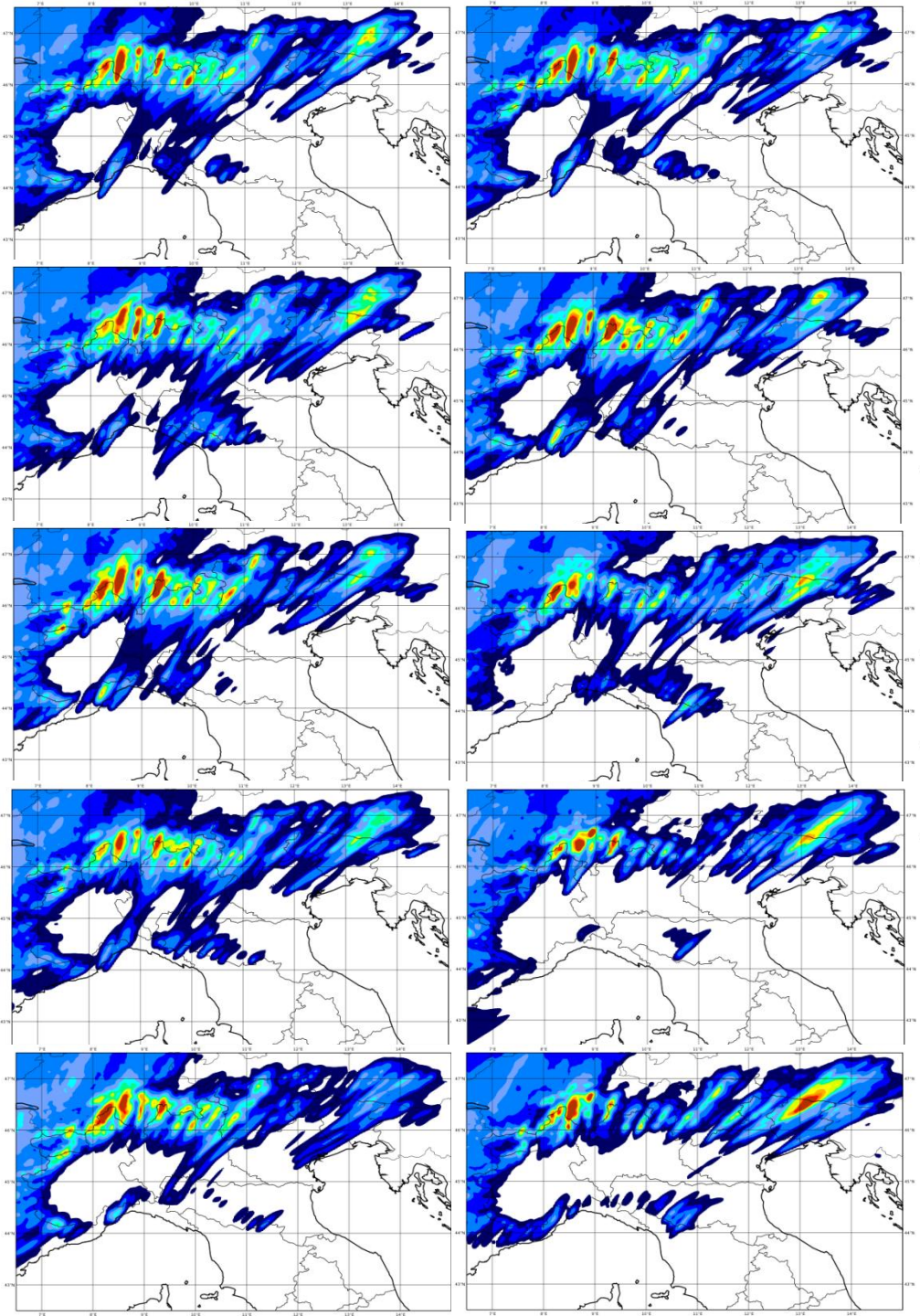
KENDA analyses

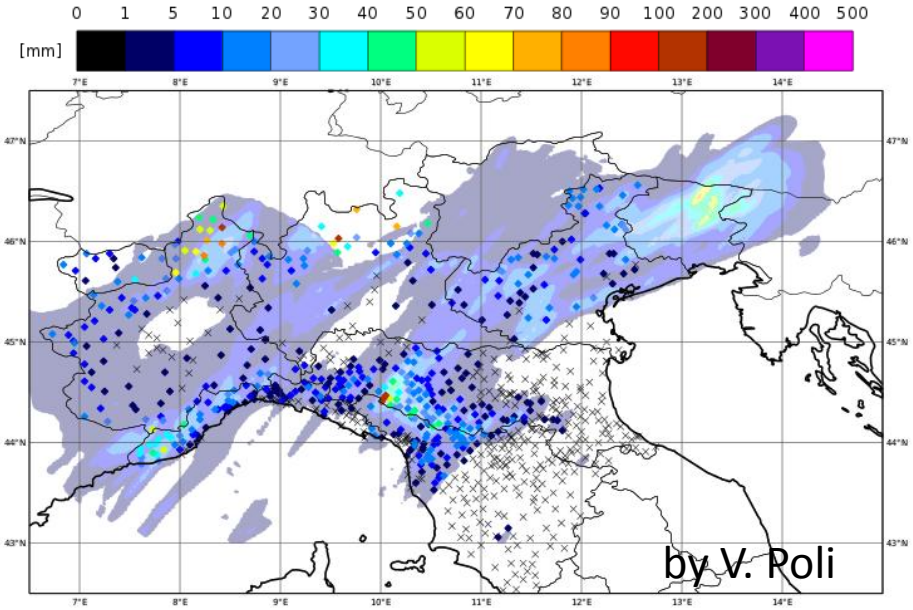


COSMO-LEPS downscaled analyses



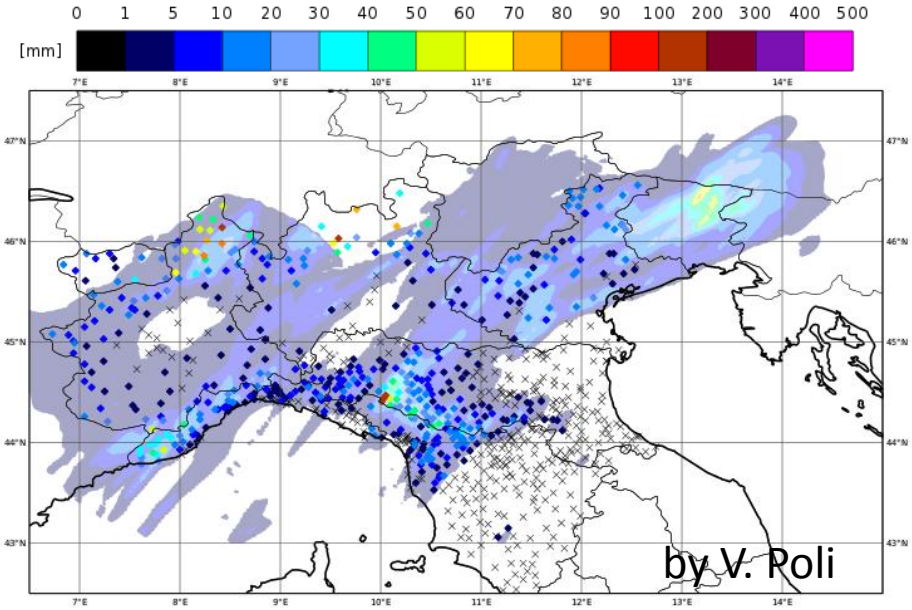
downscaling ICs
fc + 12 h





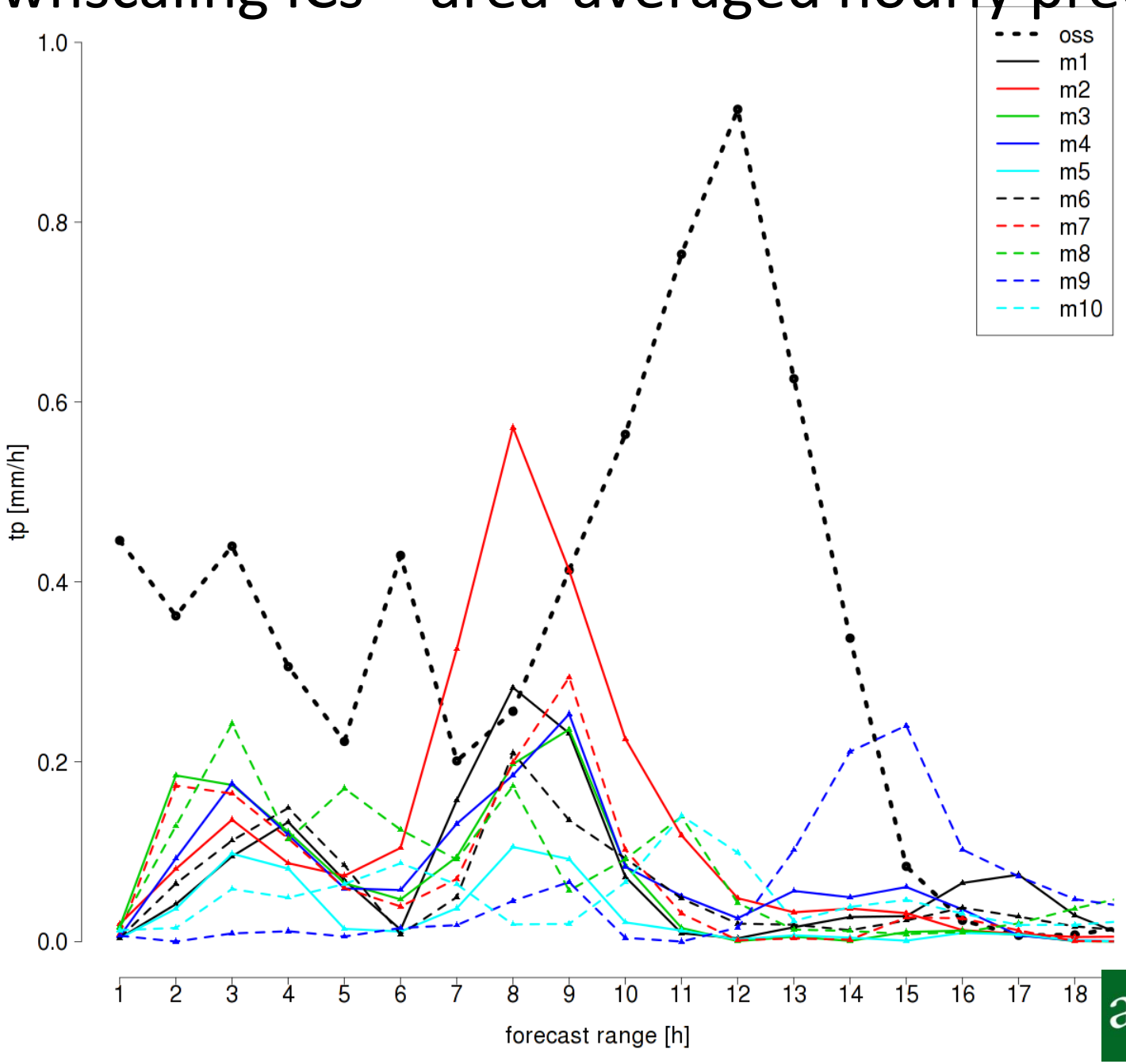
20120926 12-24 UTC

kenda ICs
fc + 12 h

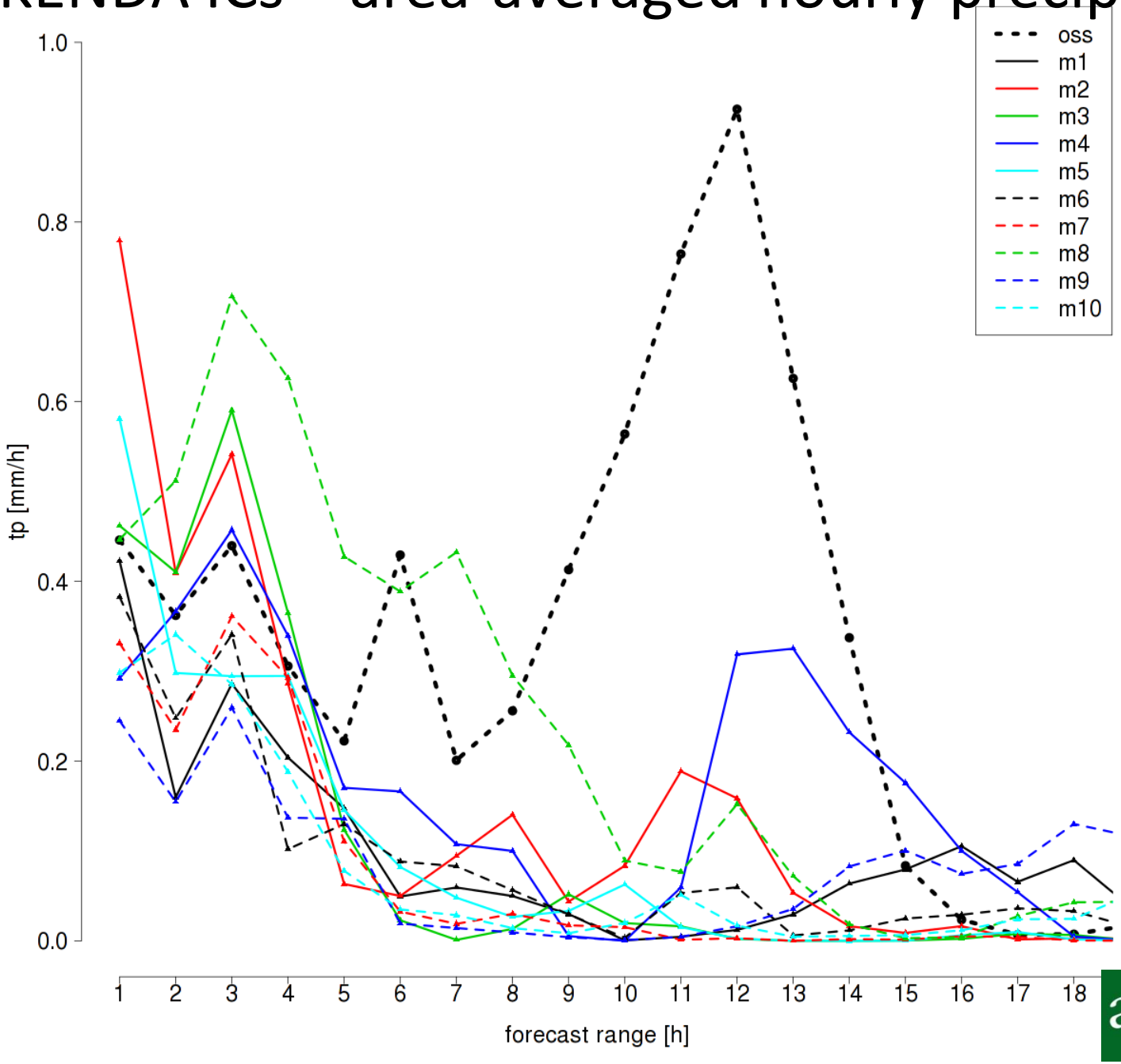


20120926 12-24 UTC

Downscaling ICs – area-averaged hourly precip.

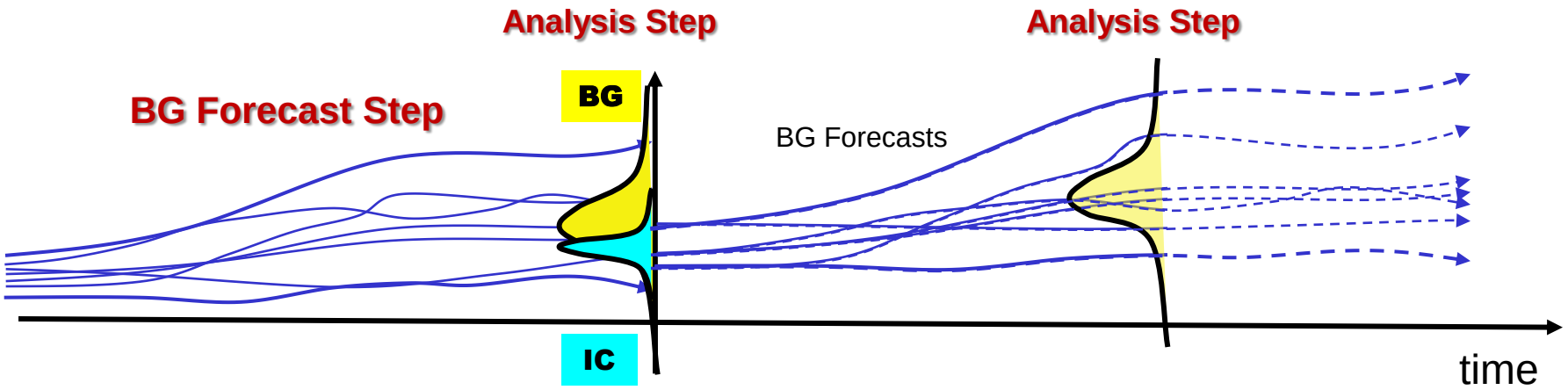


KENDA ICs – area-averaged hourly precip.



Toward a probabilistic forecast system: the COSMO-ME EPS

The implementation of a short range EPS based on COSMO-ME is straightforward "extending" the forecast members integration



A first implementation of COSMO-ME EPS has being tested at CNMCA in the framework of MYWAVE project (→ short range sea state EPS based on COSMO-ME EPS: ***NETTUNO EPS***)

The main characteristics of COSMO-ME EPS are:

- Domain and resolution: COSMO model is integrated on the same domain of the CNMCA-LETKF system.
- IC and BC: initial conditions are derived from the CNMCA-LETKF system. Lateral boundaries conditions are from IFS deterministic run perturbed using ECMWF-EPS.
- Model error: stochastics physics perturbation tendencies will be evaluated.
- Forecast range: the 40+1 COSMO forecast members are running up to 48 hours in order to produce the wind forecast to be given as input to the NETTUNO system at 00 UTC.

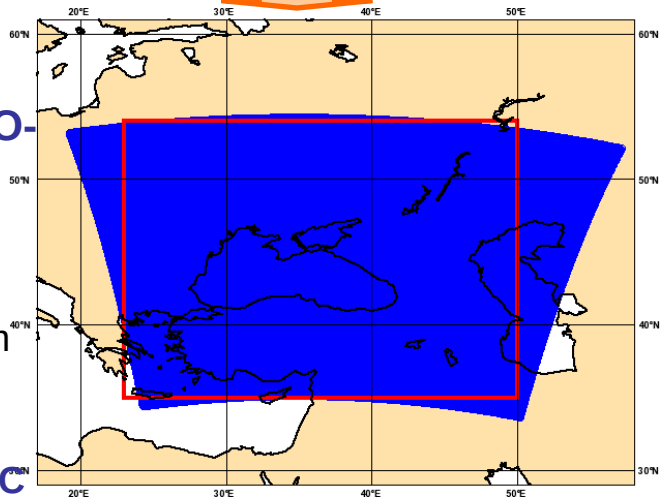
L. Torrisi, F. Marcucci

CORSO PP: Task 3

TL: A. Montani and E.Astakhova

ECMWF EPS forecasts

Clustering+ COSMO-LEPS for Sochi 2014



FDP

COSMO-S14-EPS

Δx~7 km
40 ML
fc+72h

ARPA-SIMC

All 10 forecasts for Sochi-mini Probability fields for the entire domain

RHMC

Preparation of epsgrams
Visualization
Operational dissemination
Forecasters' feedback

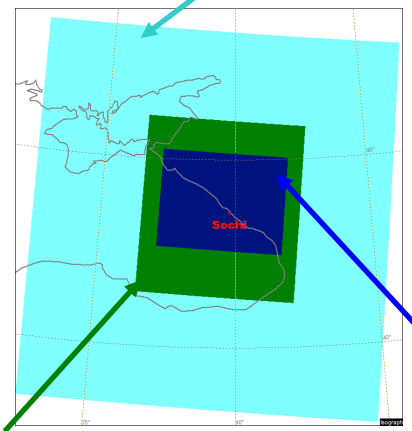
ICs&BCs

RDP

COSMO-RU2-EPS

Δx~2.2 km
50 ML
fc+48h

RHMC



RHMC

Visualization
Case studies
Verification

Integration domain

Sochi-mini

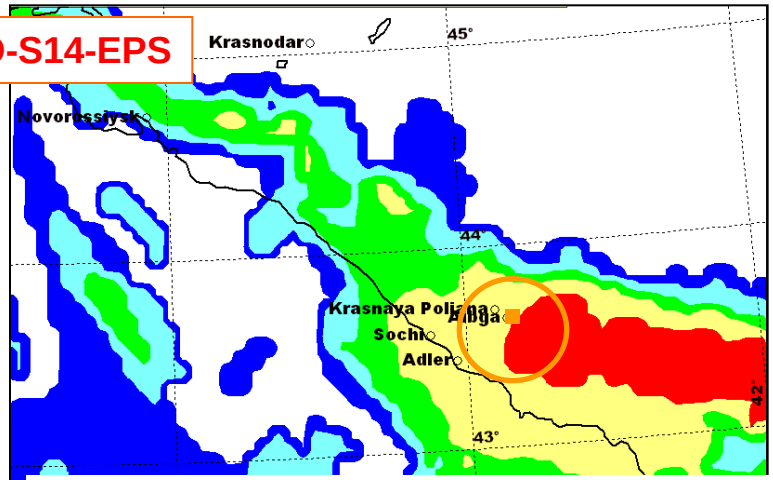
COSMO GM2013. E.Astakhova,D.Alferov,A.Montani etal

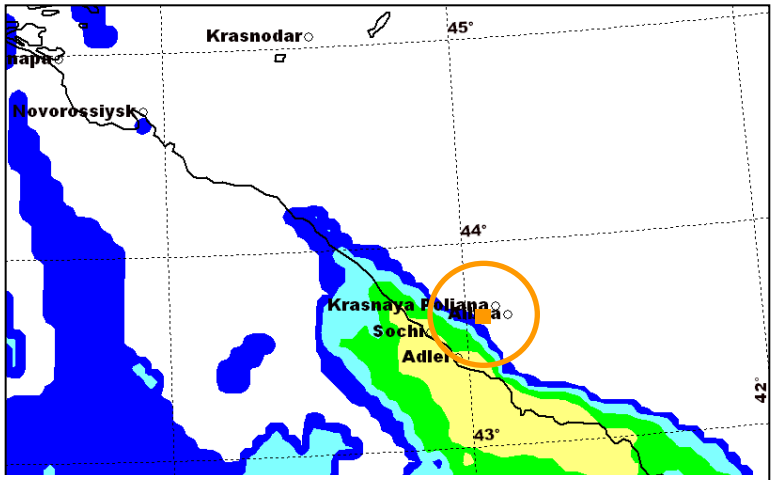
Probabilities of total precipitation and rain >10 mm / 12 h

Total pr — 12 UTC 07.01.2013 - 00 UTC 08.01.2013 — Rain

COSMO-S14-EPS

7 km



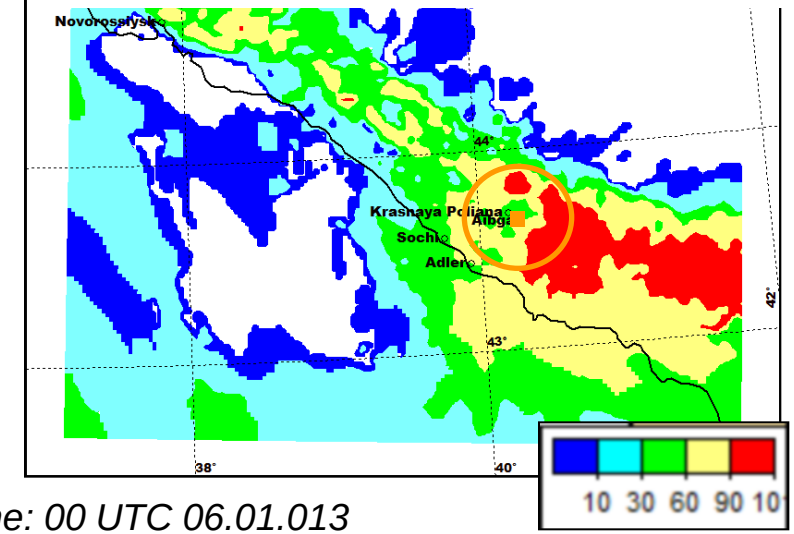


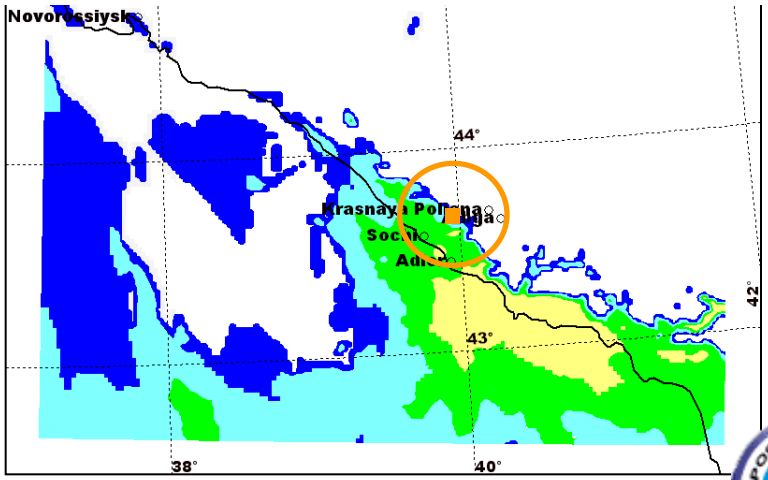
Both systems differentiate between snow and rain!

Snow is predicted in the mountain cluster!

COSMO-I

2.2 km





Initial time: 00 UTC 06.01.013

Aibga

COSMO GM2013. E.Astakhova,D.Alferov,A.Montani etal

Thank you!