COSMO Priority Task **CIAO**

Testing the Bechtold scheme over south Italy in raining days

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COSMO GM
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Introduction

CIRA is involved in the PT CIAO – SUbTask2:

SubTask2: tests of COSMO-B in deterministic mode

CIRA is working on the definition of a new COSMO-LM configuration at very high resolution, running over a domain including the CIRA facilities, where several weather instruments are currently available.

CIRA is currently involved in the PT_AEVUS, PP_CALMO-MAX and PT_CIAO for the testing of this new configuration.

Days considered, characterized by heavy precipitation:

- 3 to 6 November 2017
- 18 March 2018

The domain considered

The domain is centered over Campania region in southern Italy. This area includes three airports, i.e. Capua (military airport “O. Salomone”), Naples (Capodichino civil airport), and Pratica di Mare (military airport “de Bernardi”).

Pratica di Mare

Naples

CIRA

Domain:**12.45° – 14.30°E; 40.85° - 41.65° N**

Rotated North Pole: **-166°; 41°**

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Model version and set-up

Currently we are using v5.04h, since the official COSMO version with Bechtold scheme (v5.05) was not yet available at the time of beginning of simulations.

- Model versions:
  - **int2lm_150611_2.02**
  - **cosmo_170901_5.04h + RTTOV libraries Version 12**
- Forcing data: ECMWF IFS (resolution of 0.075°)

- COSMO-LM (5 km): **0.045°, 67 x 50 points; 60 vertical levels, time step 45 s.**
- COSMO-LM (1 km): **0.09°, 260 x 138 points; 60 vertical levels, time step 10 s.**

Model set-up

- Orography: GLOBE; Landuse: GLOBCOVER; Soil: DSMW; Albedo: MODIS dry sat
- Model configuration was provided by Andrea Montani, and adjusted to the current computational domain.
- loldtur = .TRUE. (old ijk-version of the turbulence and soil model) since testing the new COSMO-ICON physics (namely the modified prognostic TKE turbulence and the modified version of TERRA) at DWD was not yet successful.

The following simulations have been performed for each day considered:

- Bechtold scheme
- Tiedtke scheme
- Bechtold scheme and lshallowconv_only=.TRUE. (only for 1 km resolution)

Results have been compared with data provided by CIRA instrumentation.

Results for 3-6 November 2017 – 5 km resolution

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Temperature (°C)

	OBS	Tiedtke	Bechtold
Average	**14.4**	15.4	15.5
Max	**24.0**	19.8	19.9
Min	**9.5**	10.8	11.0
Av. Bias	-	1.0	1.1
Max Bias -	-	-4.7	-4.8
Max Bias +	-	3.2	3.2

Observed T2m values provided by the visibilimeter (average, maximum and minimum daily), along with the values provided by the model (nearest grid point).

Average, maximum positive and negative bias (model minus observation).

Results already shown at ICCARUS 2018

Precipitation (mm)

	OBS	Tiedtke	Bechtold
3th Nov	**0**	0	0
4th Nov	**0**	0	0
5th Nov	**33**	23	1
6th Nov	**20**	18	24
Total	**53**	41	25

Observed Precipitation value provided by the disdrometer along with the values provided by the model (nearest grid point).

Results for 18 March 2018 (new test case)

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Temperature (°C)

	OBS	Tiedtke – 5km	Becht-5km	Tiedtke – 1km	Becht -1km	Becht -1km lshallow only
Average	**9.3**	11.2	11.3	10.8	10.8	10.8
Max	**13.7**	13.5	13.5	13.0	14.3	14.3
Min	**5.3**	7.9	7.7	7.4	7.7	7.7
Av. Bias	-	2.0	2.0	**1.5**	1.6	1.6
Max Bias +	-	3.9	3.9	**3.3**	3.8	3.8
Max Bias -	-	-1.1	-0.6	**-1.3**	-1.4	-1.4

Observed temperature value (visibilmeter) vs COSMO values (nearest grid point).

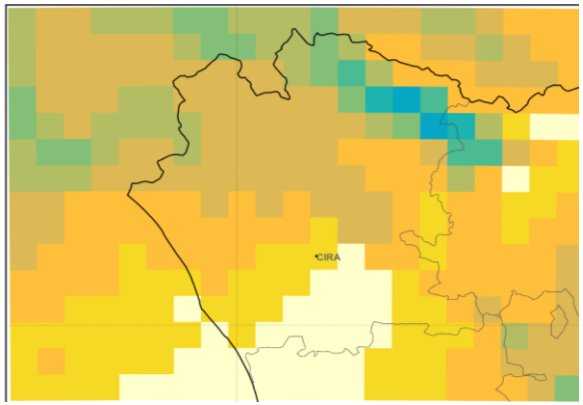
Precipitation (mm)

	Nearest p.	3x3	5x5
OBS	**14.2**	**14.2**	**14.2**
Tiedtke 5 km	0.7	2.1	3.1
Bechtold 5 km	0.1	0.1	0.4
Tiedtke 1km	0.3	0.3	0.1
Bechtold 1 km	0.1	0.0	0.0
Bechtold 1 km lshallow only	0.1	0.0	0.0

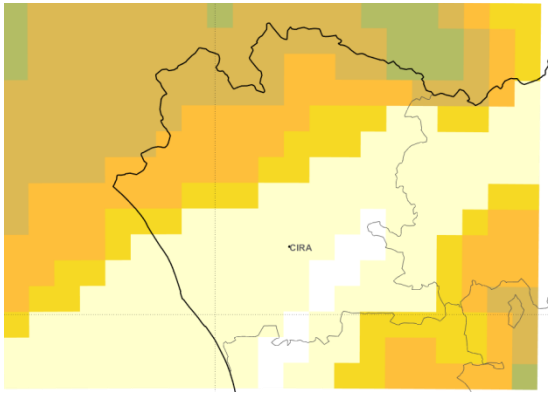
Observed precipitation value provided by the disdrometer vs COSMO values (nearest grid point, box 3x3 and box 5x5).

Precipitation distribution for 18 March 2018

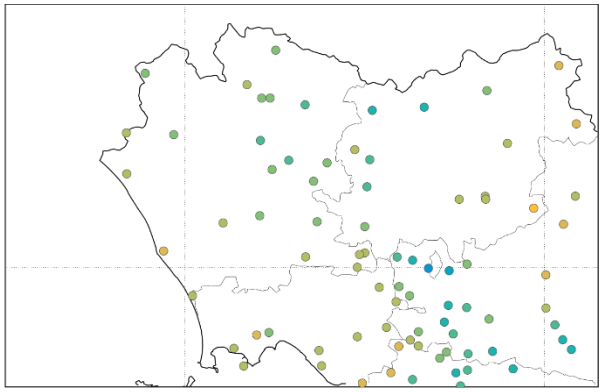
Tiedtke 5 km

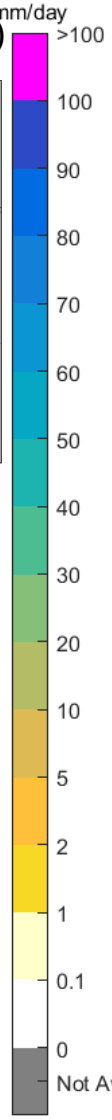


Bechtold 5 km

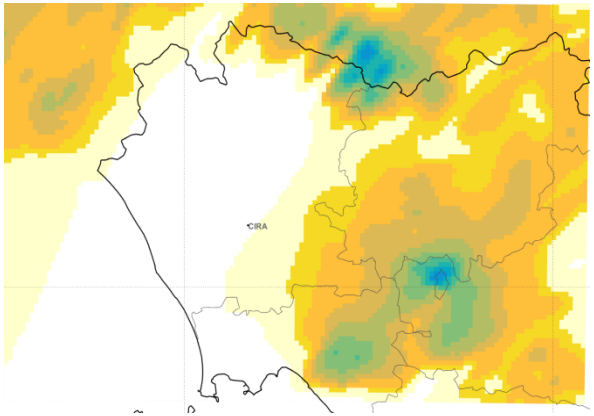


OBS (courtesy of ANCE Campania)

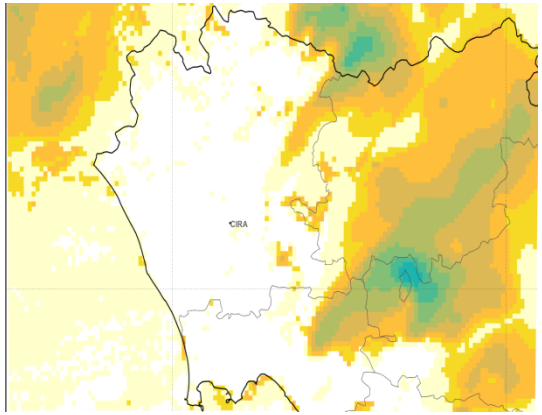




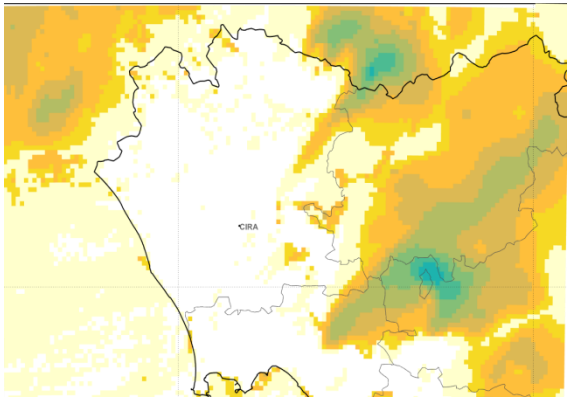
Tiedtke 1 km



Bechtold 1 km



Bechtold (shallow only)1 km



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Conclusions

- Increase of resolution provides improvements in T2m representation.
- Tiedtke scheme performs better in terms of temperature, especially at 1 km.
- Precipitation at CIRA site is always underestimated, with both schemes and at both resolutions.
- No relevant differences are recorded if only shallow convection is parameterized with Bechtold scheme.
- A better distribution of precipitation over the whole domain is recorded at 5 km especially with Tiedtke scheme.

THANKS !

Suggestions are welcome.