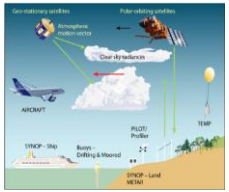
Centro Operativo per la Meteorologia C.O.MET.

Italian Air Force Meteorological Centre

PT CIAO Meeting, 04 September 2018

Operational Numerical Weather Prediction System

Observations:



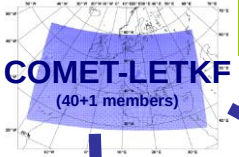
LETKF analysis ensemble (40+1 members) every 6h using RAOB (also 4D), PILOT, SYNOP, SHIP, BUOY, Wind Profilers, AMDAR-ACAR-AIREP, MSG3-MET78 AMV, Metop A-B scatt. winds, NOAA/Metop A-B AMSUA/MHS and NPP ATMS radiances+ Land SAF snow mask,
IFS SST analysis once a day

ECMWF Boundary Conditions

Ensemble Data Assimilation:

Operational since June 2011

7 km
49 v.l.



Ensemble Analysis

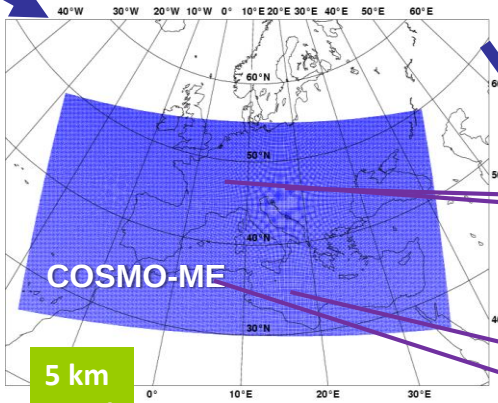
Deterministic Analysis

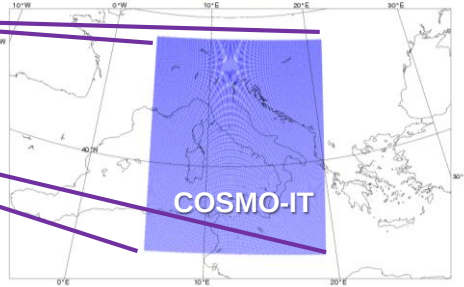
Local Area Modeling:

2.2 km
65 v.l.

IC through 6h
N**UDGING** of observations

- compressible equations
- explicit convection



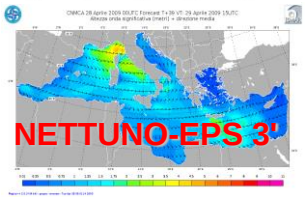


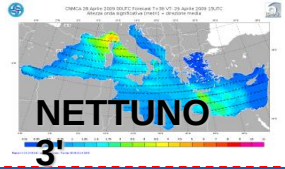
5 km
45 v.l.

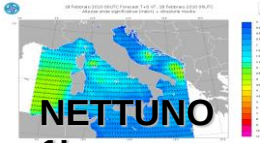
- compressible equations
- parameterized convection

Ensemble Prediction System:

7 km
45 v.l.



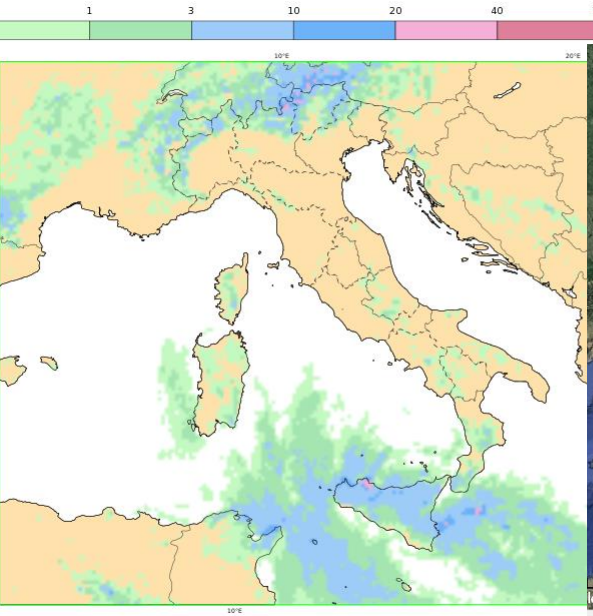




Comparison between Bechtold and Tiedtke convection schemes on low resolution model (COSMO-ME)

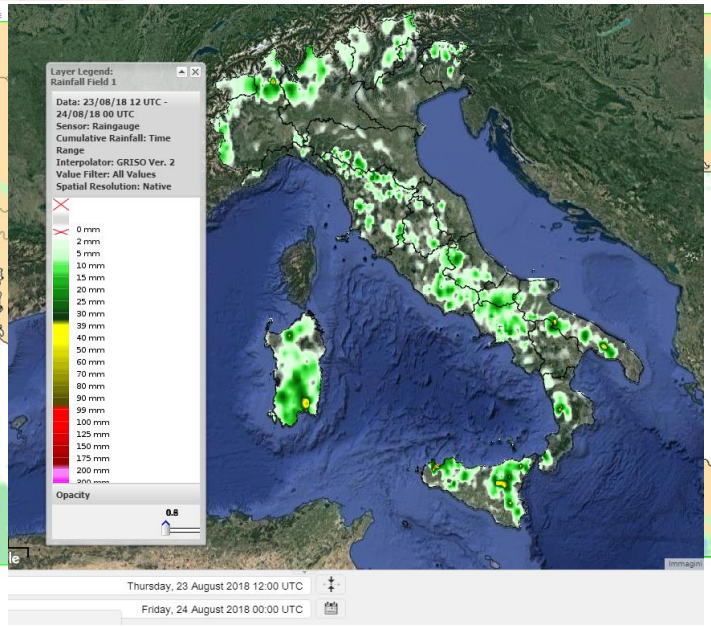
12-h Total Precipitation amount 23 August 2018 12-24 UTC

COSMO-ME Tiedtke



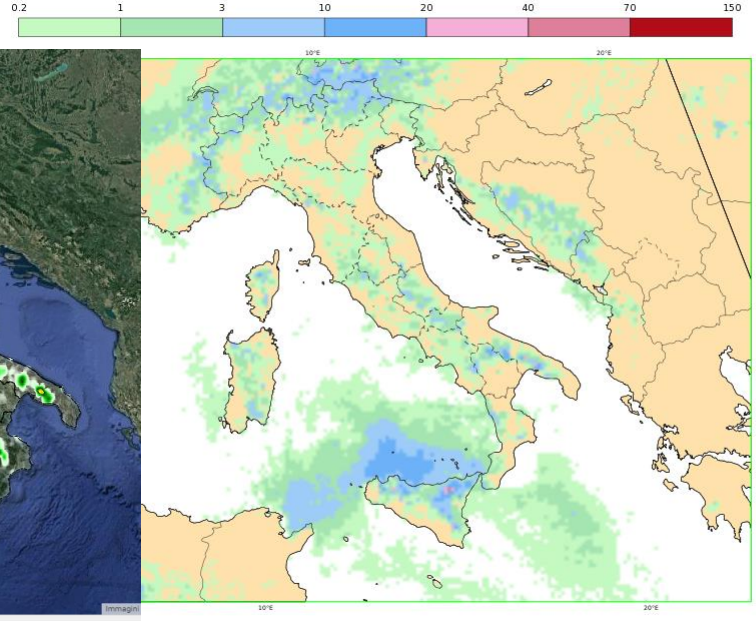
Tiedtke convection scheme doesn't allow to predict local convection pattern.

OBS



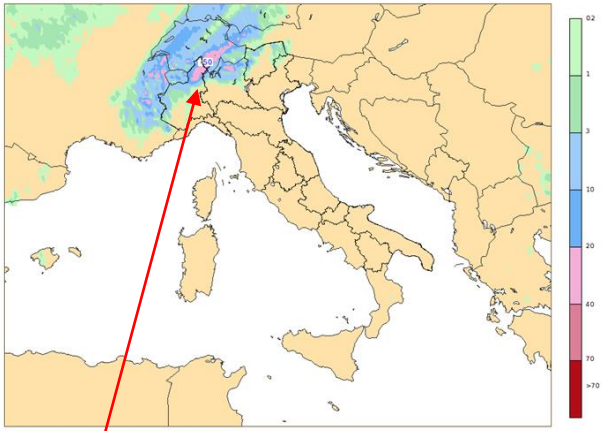
Observed total precipitation amount, provided by HR Raingauge Network Italian Civilian Protection Department

COSMO-ME Bechtold



Bechtold convection scheme allows to predict local convection pattern but with underestimation of total precipitation amount.

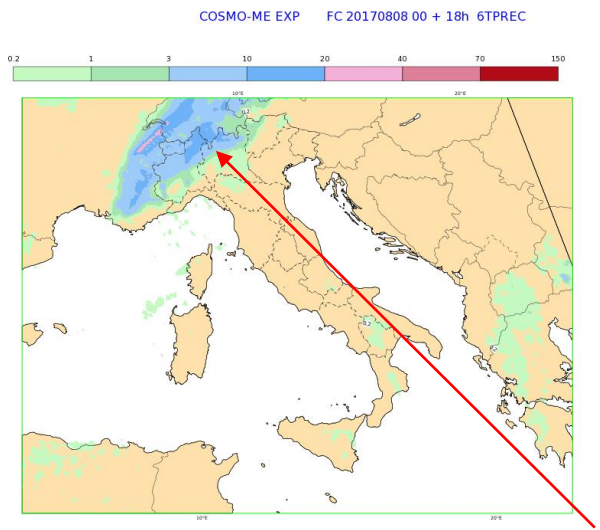
8 August 2017 (Tot. prec. 12-18 UTC)

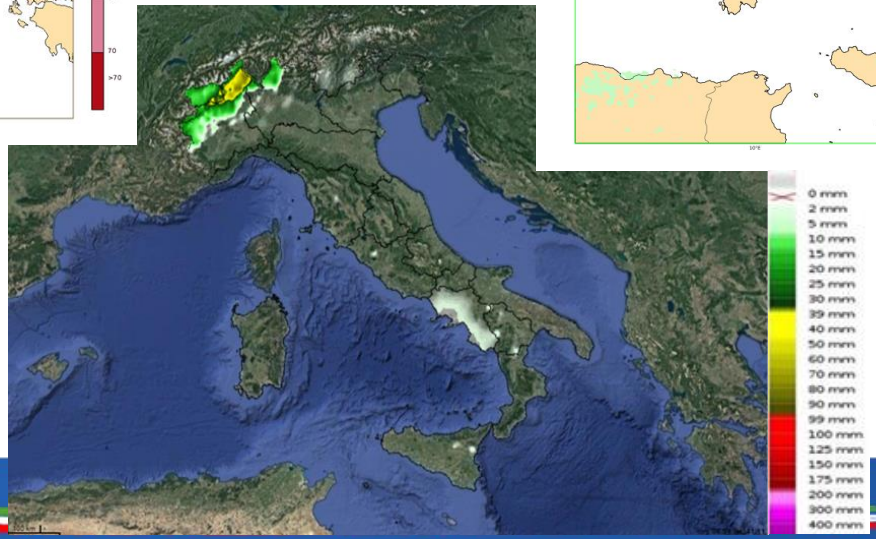


Left: COSMO-ME with Tiedtke scheme

Right: COSMO-ME with Bechtold scheme

Bottom: observed total precipitation amount, provided by HR Raingauge Network Italian Civilian Protection Department

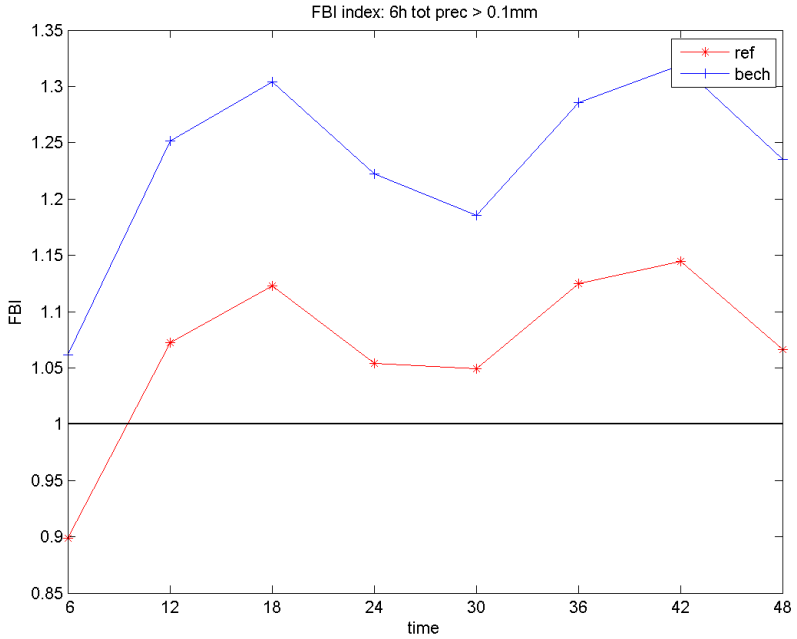


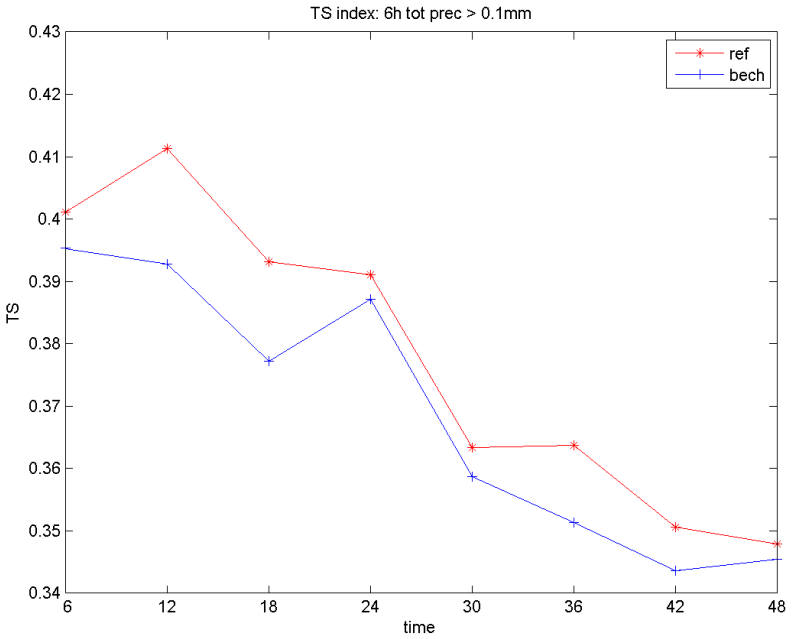


COSMO-ME with Tiedtke scheme estimates quite well total precipitation amount in this case.

COSMO-ME with Bechtold scheme underestimates total precipitation amount in this case.

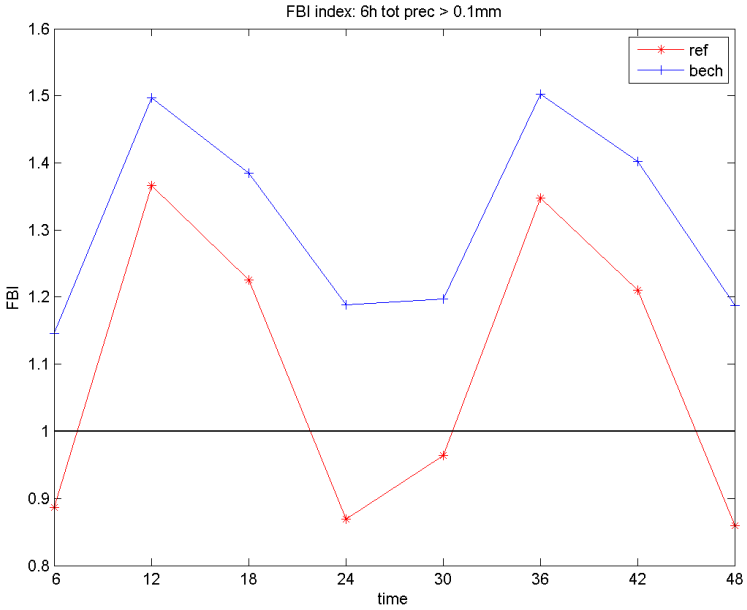
FBI and TS values for the event: «6h tot. prec. > 0.1 mm» (01.09.2016-28.02.2017)

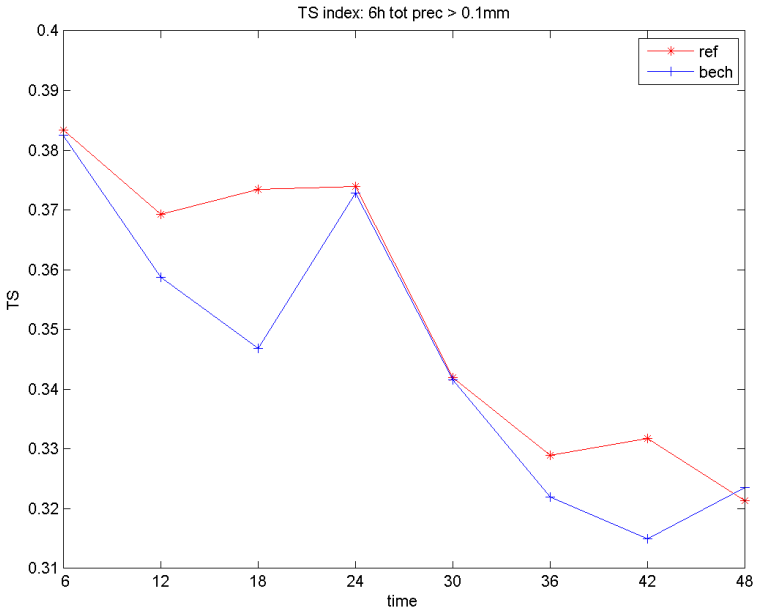




In autumn-winter period, Bechtold scheme over forecasts precipitation events with threshold of 0.1 mm (FBI>1). Better FBI values for Tiedtke scheme. In this case, Tiedtke scheme predicts the event with an higher percentage of success (higher values of TS for Tiedtke).

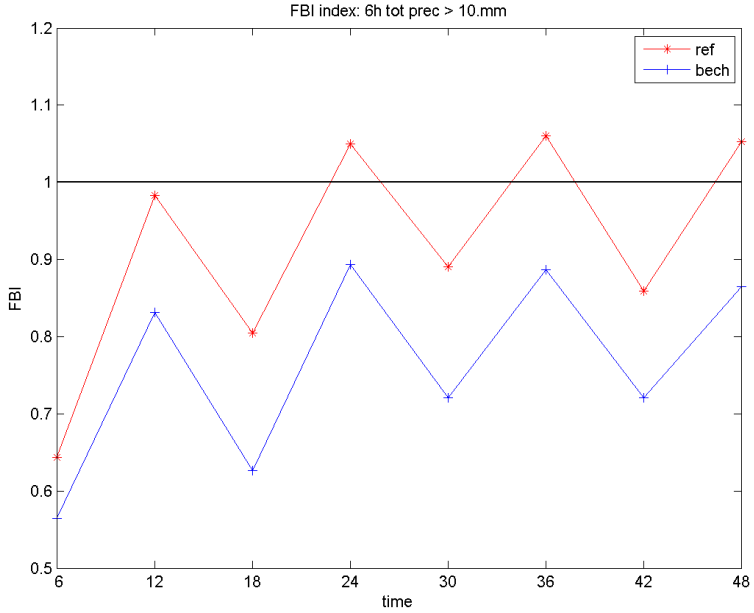
FBI and TS values for the event: «6h tot. prec. > 0.1 mm» (01.03.2017-30.08.2017)

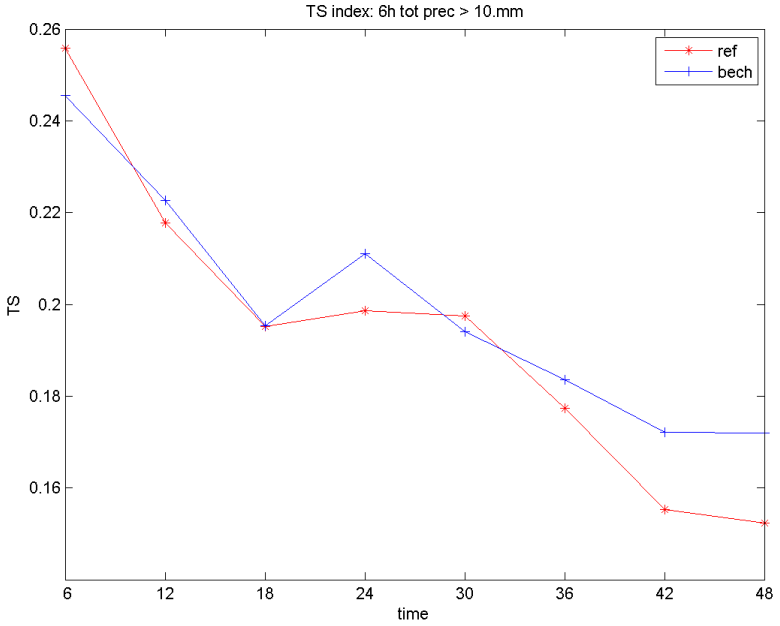




In spring-summer period, Bechtold scheme over forecasts precipitation events with threshold of 0.1 mm (FBI>1). Better FBI values for Tiedtke scheme. In this case, Tiedtke scheme predicts the event with an higher percentage of success (higher values of TS for Tiedtke).

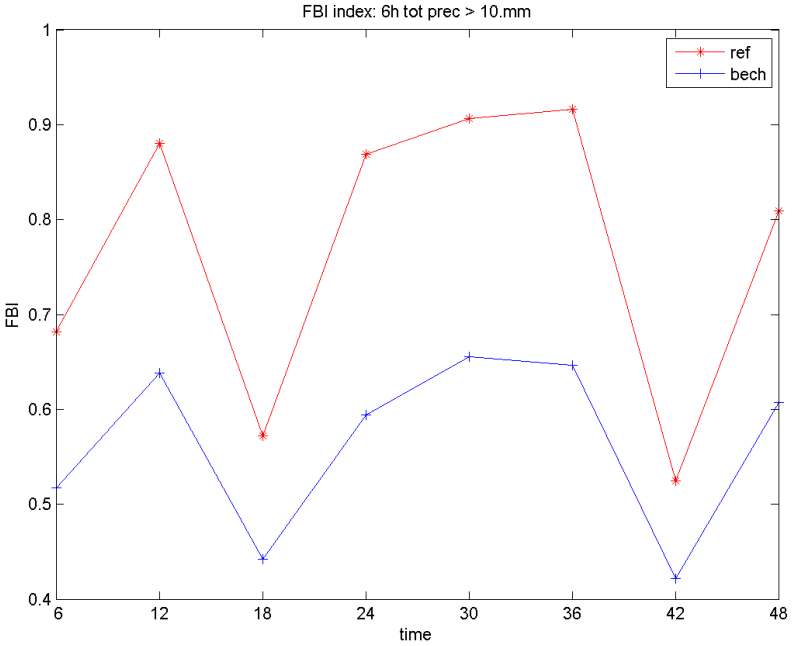
FBI and TS values for the event: «6h tot. prec. > 10.0 mm» (01.09.2016-28.02.2017)

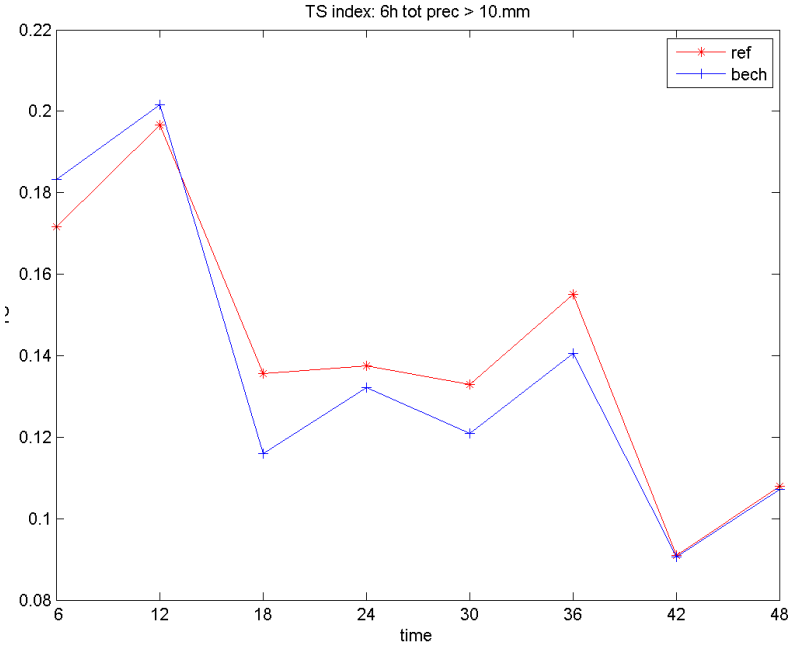




In autumn-winter period, Tiedtke scheme better estimates precipitation events with a threshold of 10.0 mm, but it has (for most of forecast steps) a lower percentage of success (lower values of TS).

FBI and TS values for the event: «6h tot. prec. > 10.0 mm» (01.03.2017-30.08.2017)





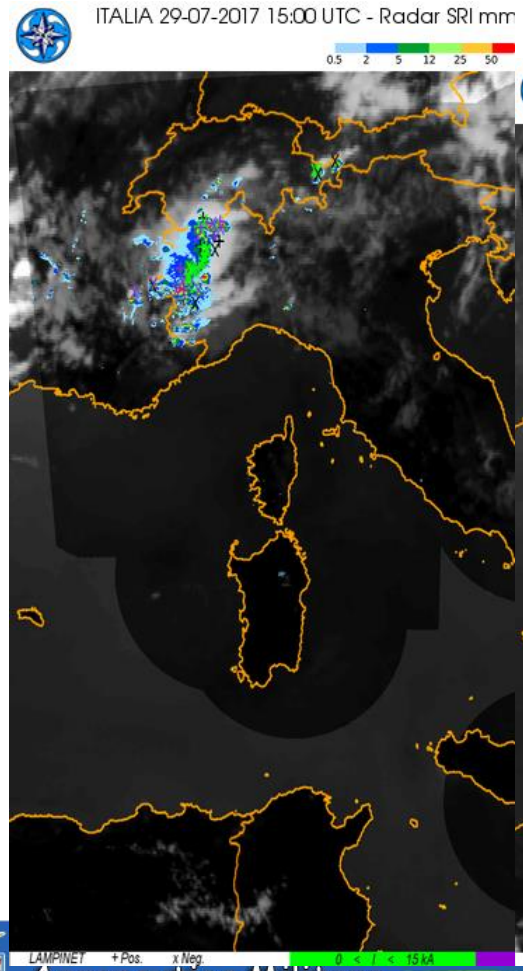
In spring-summer period, Tiedtke scheme better estimates precipitation events with a threshold of 10.0 mm and it has (for most of forecast steps) an higher percentage of success (higher values of TS).

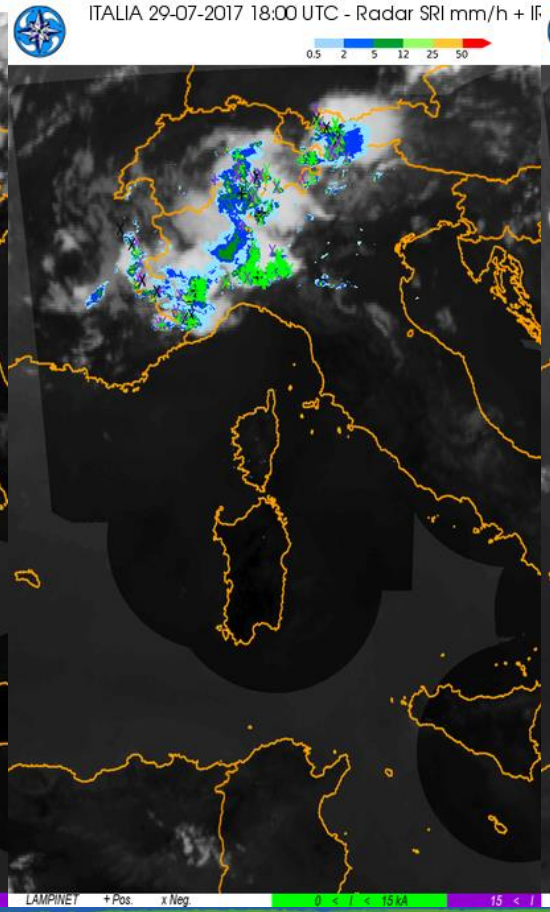
Results from comparison between Tiedtke and Bechtold COSMO-ME

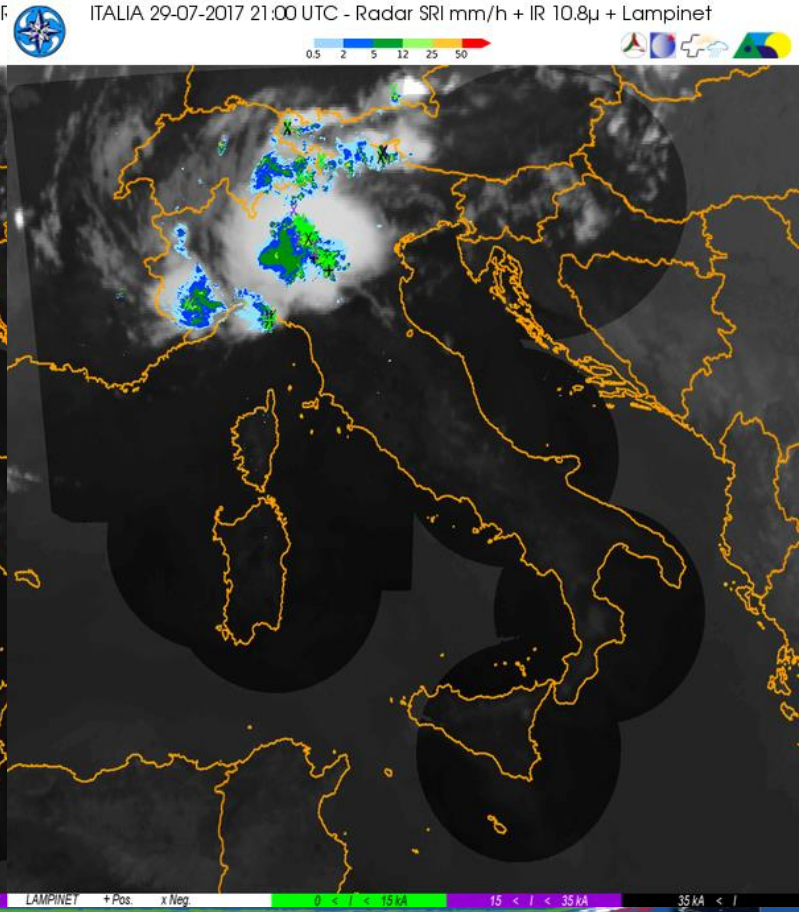
- In COSMO-ME, the switching from Tiedtke scheme to Bechtold scheme mainly affects forecasts of total precipitation amounts.
- COSMO-ME with Bechtold scheme underestimates high-thresholds total precipitation amounts, over predicts light precipitation events and under predicts heavy precipitation events.
- In general, COSMO-ME with Tiedtke scheme better estimates total precipitation amounts in the case of severe events.
- COSMO-ME with Bechtold scheme is more capable to highlight the local/isolated convection events. This is useful for operational forecasters, considering the poor performances of Tiedtke scheme in these cases. We are going to run COSMO-ME with Bechtold scheme operationally in the next few weeks.
- Further tuning/improvements of Bechtold scheme for high-thresholds is needed.

Comparison between Bechtold and Tiedtke convection schemes on high resolution model (COSMO-IT). Just shallow convection is now parameterized (not deep and mid-level convection)

Thunderstorm Cell - July, 29 2017

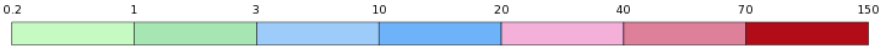


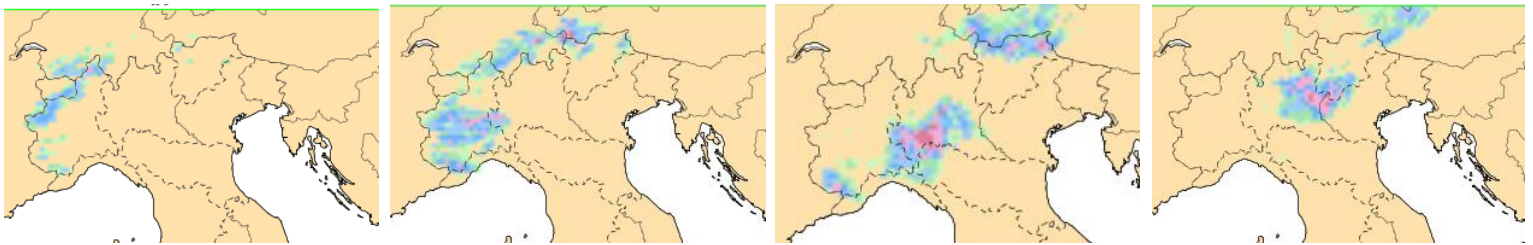




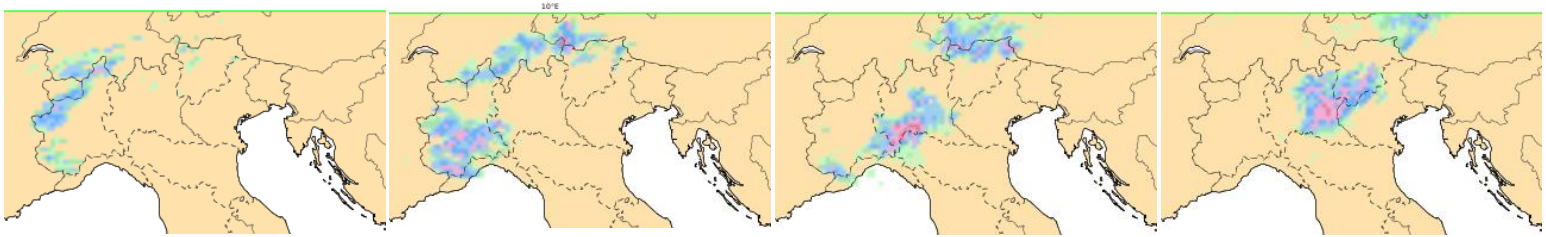
Thunderstorm Cell - July, 29 2017

COSMO-IT 2.8km





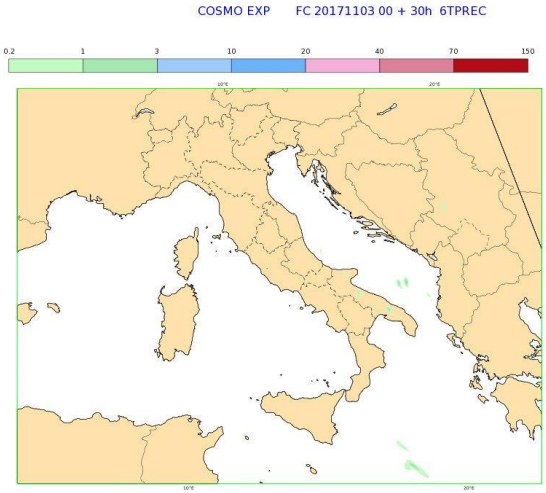
+15h +18h +21h +24h



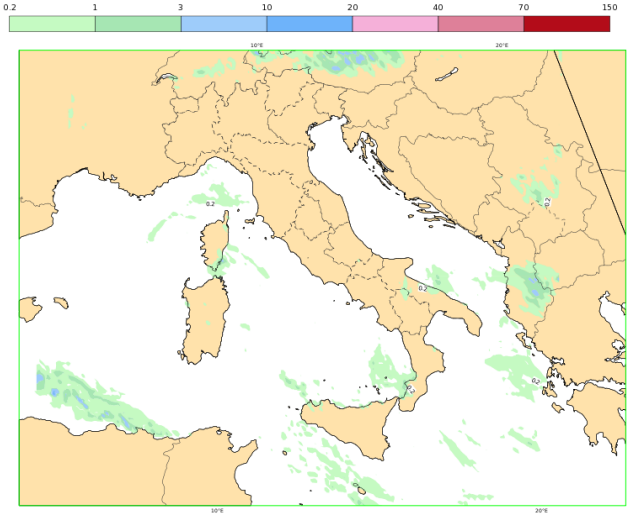
COSMO-IT 2.8km Bechtold shallow conv. Scheme

Light Precipitation: case study 00-06UTC November 04, 2017

2.2km COSMO-IT



Tiedtke shallow convection scheme

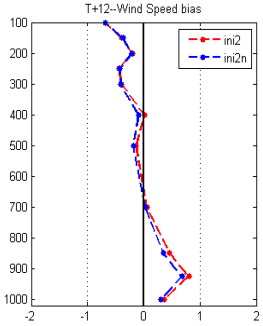


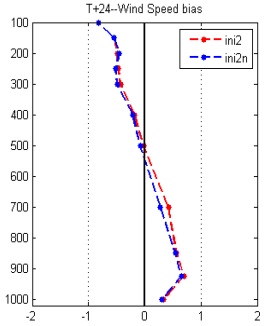
Bechtold shallow convection scheme

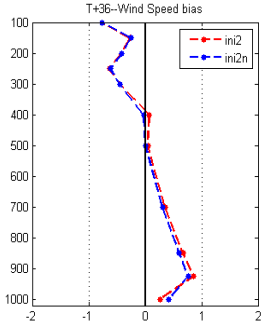
In general, Tiedtke shallow convection scheme is
«less wet» than Bechtold shallow convection scheme.

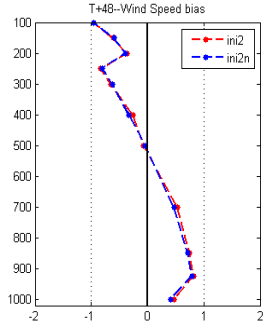
Tiedtke vs Bechtold Shallow Convection

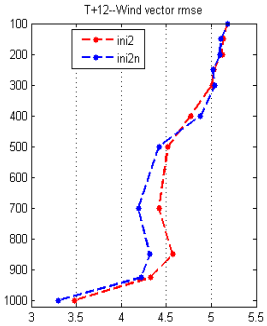
COSMO-IT 00UTC FC from 04 Nov to 31 Dec 2017 with 6h nudging assimilation

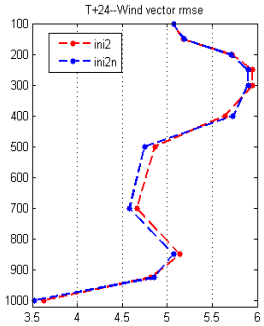


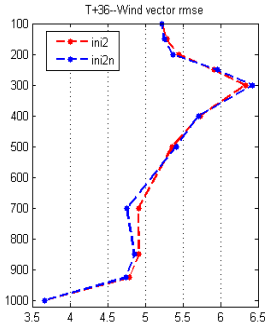


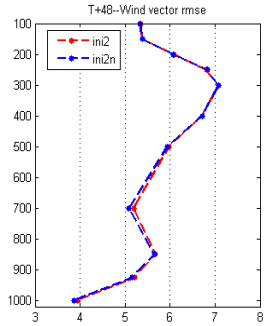






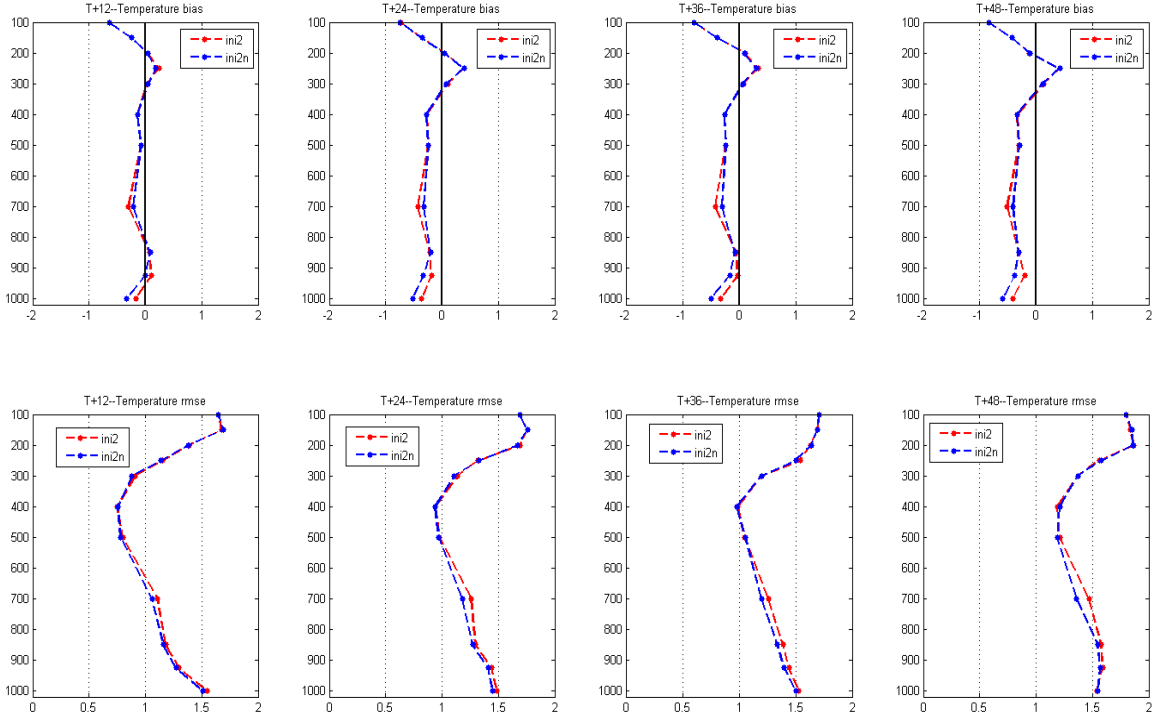






Tiedtke vs Bechtold Shallow Convection

COSMO-IT 00UTC FC from 04 Nov to 31 Dec 2017 with 6h nudging assimilation



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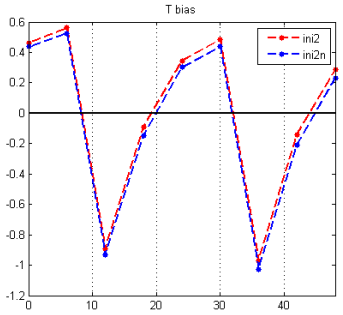
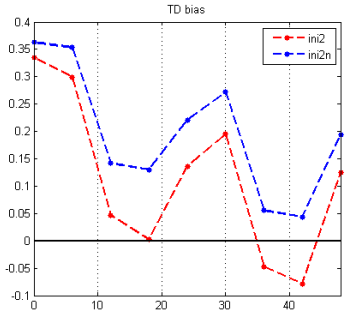
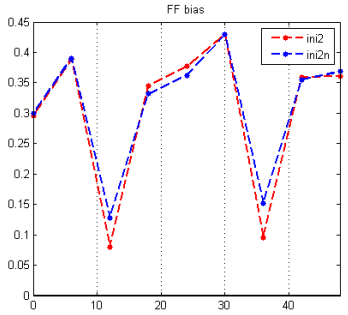
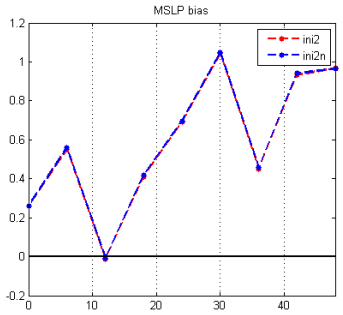
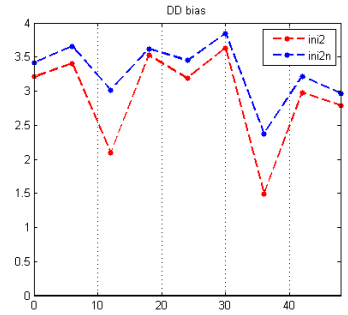
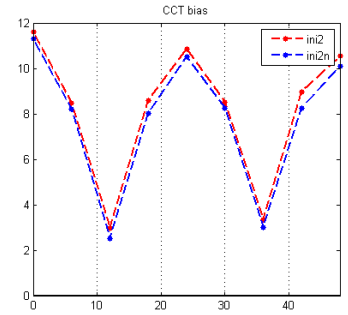






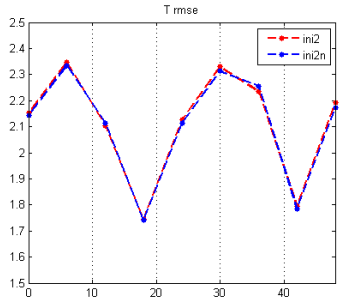


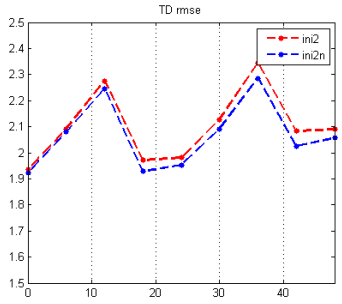


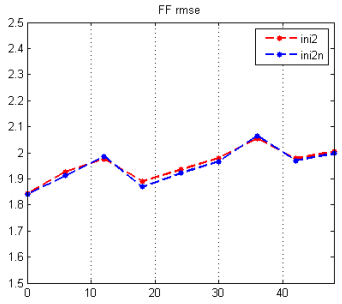


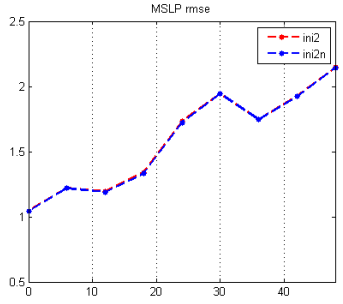
Tiedtke vs Bechtold Shallow Convection

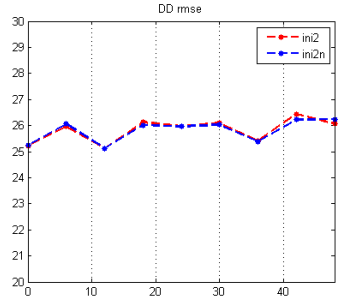
COSMO-IT 00UTC FC from 04 Nov to 31 Dec 2017 with 6h nudging assimilation

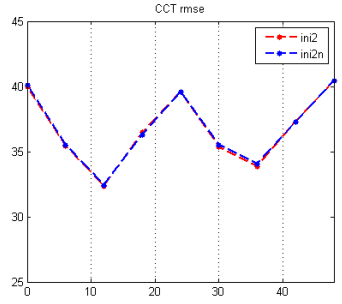






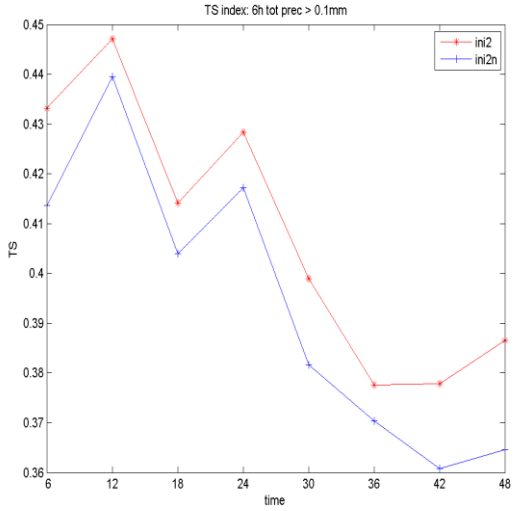


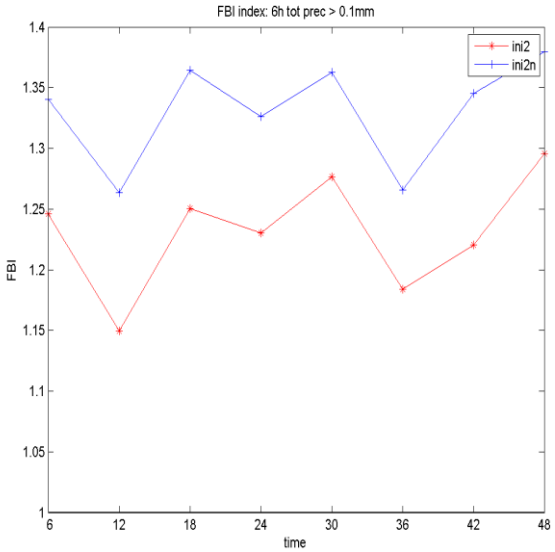




Tiedtke vs Bechtold Shallow Convection

COSMO-IT 00UTC FC from 04 Nov to 31 Dec 2017 with 6h nudging assimilation





In general, Bechtold shallow convection scheme can predict light precipitation episodes that Tiedtke is not able to forecast, but Bechtold scheme tends to spread light precipitation areas. For this reason, Bechtold scheme has more false alarms than Tiedtke. So Tiedtke scheme provides better values of TS/FBI indexes on small precipitation thresholds.

Tiedtke vs Bechtold Shallow Convection

COSMO-IT 00UTC FC from 04 Nov to 31 Dec 2017 with 6h nudging assimilation

Summary of verification results for Bechtold scheme:

<u>upper levels</u>

- clear improvement in temperature and wind

<u>surface</u>

- a slight improvement in dew point RMSE and a worsening in dew point and wind direction bias

Bechtold shallow convection scheme seems to lead to a better performance in forecasting the light precipitation events, even though it is not clear from objective verification.

Any question?