# **Overestimation of summer precipitation**

M.S.Tesini, E.Minguzzi (ARPAE)

### 03 August 2024, max of 3h precipitation



Sparse convection with weak synoptic forcing; this happened very often in summer 2024. Overall Icon forecast is not bad: the convection is realistic, and at the location is fairly correct. *"The forecast is very realistic, it's like looking at a radar map; but this huge amount of precipitation makes it very difficult to use the model"* 

# August 2024, max of 3h precipitation



Two days with weak synoptic forcing, but forecast quality is very different. The amount of precipitation is not always overestimated => difficult to use the model

# 18 September 2024, 24h precipitation



Cosmo-2I d+0 forecast

ECMWF IFS d+0 forecast

With strong synoptic forcing, Icon forecast are not biased. Model performance was very good in multiple events of very intense precipitation (*May 2023, September 2024, October 2024*)

# **Icon-2I** verification

In July/August 2024, precipitation was overestimated almost every day.

During Spring 2024, although convective conditions were already prevailing, Icon forecasts were not biased.

In Summer, model behavior changed abruptly.



*Max 3h precipitation in N. Italy "warning areas" (* $\approx$  2000 km2), forecast times +00/24



Operational (grayzone OFF)

Test (grayzone ON)



### "Grayzone": bubble plots

June-July 2024, 3h max precipitation in N. Italy "warning areas", forecast times +00/24

With "grayzone ON":

- precipitation reduced, but still overestimated
- less false alarms but more missing: overall scores are similar

## **Comparison with Icon-D2**



Jul-Aug 2024, 3h max precipitation in N Italy warning areas, forecasts +00/+24

All Icon configurations overestimate precipitation maxima, although Icon-D2 has a slightly lower bias (*different soil?*)

# Grayzone: 03 August 2024



Operational (grayzone OFF)



#### Observations (radar+rain gauges)

In this case, "grayzone" would reduce the precipitation maxima, but also disrupt the meteorological signal.

With grayzone ON, one wouldn't expect strong convection.

After long discussions, we had decided not to use "grayzone tuning" in operational forecasts.



Test (grayzone ON)

# **Proposed solutions**

A complete solution will probably require time and significant changes to Icon code. Meanwhile, we will test some configuration changes, to mitigate the problem for summer 2025

- "<u>Grayzone</u>": operational at DWD. Tested, but not implemented it effectively damps convection, but the overall improvement is controversial, and it depends on the specific conditions

- Use the two moments microphysics (computationally expensive, but scientifically sound)

Different setups for <u>shallow and deep convection</u> (*suggested by IMS*)
Disable latent heat release from the subgrid-cloud cover scheme (*lsgs\_cond*)
Change the range for maximum allowed shallow convection depth (*tune\_rdepth*)
Change the raindrop size distribution
New tuning by Yoav?

- <u>Updated</u> model version and input data

Icon 2024-10

Soil analysis taken from Icon-EU (presently: free to evolve)