



Fuzzy verification on Common Area 2

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Cistema Nazionale per la Protezione dell'Ambiente





WHAT IS COMMON AREA 2



W10.963, S46.597, E17.437, N49.550









DESCRIPTION OF THE VERIFICATION

- Models:
 - COSMO 2I, COSMO IT, COSMO PL* (replaced by COSMO CE PL* from SON 2021), ICON PL*, ICON IL, ICON IT, ICON GR, ICON D2 -> D0 and D1
 - COSMO 1E, ICON 1E -> D0
- Observation: OPERA database by EUMETNET
- Resolution (forecast and observation): 0.025°, lat-lon
- Period: JJA 2021, SON 2021, DJF 2022, MAM 2022





* Do not cover the entire area



Plot explanation





- O: Score
- **O**: Day and timesteps
- **O**: Thresholds
- O: Models
- **O**: Spatial scales





JJA 2021





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FSS – D0 - 1T

- 0.2 mm: All the ICON models (except for ICON PL) have very good performances when compared to the COSMO ones (apart from COSMO 1E that performs similarly to the ICON ones).
- 5.0 mm: same behaviour as 0.2 \bullet mm/3h. Best model ICON 1E, worst model COSMO PL.

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FAR and POD – D0 - 1T



scoring worse than many of the COSMO models.





COSMO 1E performing better than the other models.

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FSS – D0 - 3T



- 0.2 mm: COSMO 1E behaves as well as the ICON models. Poor results for ICON PL
- 5.0 mm: COSMO 2I and IT perform as well as the ICON models at greater scales. Low results for ICON GR.
- Great improvement at small scales for all models if compared to 1 timestep.



FAR and POD – D0 - 3T



High FAR for both COSMO and ICON 1E



JJA2021 - POD at 0.2 and 5.0 mm - d0 - 3t



Low POD for ICON GR at higher threshold





- The ICON models in general perform better than the COSMO ones.
- ICON PL has generally lower performances if compared to the other ICON models. It's comparable to the COSMO models.
- COSMO 1E has generally higher performances if compared to the other COSMO models. It's comparable to the ICON models.
- JJA 2021 is the only season where we can see a great improvement from small to large scales for the 5 mm/3h threshold.









SON 2021





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FSS – D0 - 1T



- 0.2 mm: ICON GR is the best, COSMO CE PL is slightly worse. All the other COSMO and ICON models are very close to each other.
- 5.0 mm: All the models (COSMO and ICON) are very close to each other.



FAR and POD – D0 - 1T







Good results for ICON GR given by medium-low FAR and high POD. ICON 1E has very high POD, but also very high FAR.



SON2021 - POD at 0.2 and 5.0 mm - d0 - 1t





FSS – D0 - 3T



- 0.2 mm: All the models are very close to each other, with ICON GR slightly better and COSMO CE PL slightly worse.
- 5.0 mm: All very close except for ICON PL and ICON IL which are slightly worse.
- General improvement at small scales for all models if compared to 1 timestep. This is more visible for the smaller scales.



FAR and POD – D0 - 3T





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Conclusions - SON 2021

- Very good performance for ICON GR, especially at lower thresholds driven by medium-low FAR and high POD.
- Poor performance of ICON PL and ICON IL at 5 mm/3h driven by low POD and medium FAR.
- Models look closer to each other if compared to the other seasons.







DJF 2022





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FSS – D0 - 1T



- 0.2 mm: COSMO 2I and COSMO 1E perform as well as the ICON models. ICON IT has a poor performance with scores close to COSMO IT.
- 5.0 mm: COSMO 2I has very good performances, sometimes better than the ICON models. Poor performance for ICON PL and COSMO CE PL.



FAR and POD – D0 - 1T



High FAR for COSMO and ICON IT bringing to low FSS. Very similar behavior for higher threshold.



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DJF2022 - POD at 0.2 and 5.0 mm - d0 - 1t



Low POD for COSMO and ICON IT. High values for COSMO and ICON 1E at 5 mm/3h.

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FSS – D0 - 3T



- 0.2 mm: very different behavior
 between the two COSMO Italian
 models: 2I (good) and IT (bad).
 ICON IT is closer to COSMO IT.
- 5.0 mm: COSMO 2I behaves better than the ICON models. Best ICON models: IL and GR.
- Improvement more visible at smaller scales as usual.



FAR and POD – D0 - 3T



Low FSS for many models driven by high FAR at 02 mm/3h. Very close FAR for all models at 5 mm/3h.



DJF2022 - POD at 0.2 and 5.0 mm - d0 - 3t



Low FSS for COSMO and ICON IT also caused by low POD at 0.2 mm/3h.

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- Great difference among the Italian models with COSMO 2I behaving better, especially at 5 mm/3h and COSMO and ICON IT very close to each other and not performing well.
- FAR at 5 mm/3h is very similar for all the models. No difference between COSMO and ICON.
- COSMO CE PL and ICON PL performance is similar to the other models at 0.2 mm/3h and decreases at 5 mm/3h.







MAM 2022





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FSS – D0 - 1T



5.0 mm: unusual bad performance for ICON IL. Unusual good performance for COSMO IT. COSMO 1E performs as well or better than the ICON models as (quite) usual. Great worsening of ICON GR if compared to 0.2 mm/3h.



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FAR and POD – D0 - 1T



Very low FAR for ICON GR at 0.2 mm/3h drives it to good FSS.



POD results are generally worse than other seasons. Good scores for ICON and COSMO 1E and ICON D2.





FSS – D0 - 3T



- 0.2 mm: the ICON models perform better than the COSMO ones. Best performance for ICON GR. COSMO 1E comparable to the ICON models.
- 5.0 mm: Very bad performance for ICON IL. Great worsening of ICON GR if compared to 0.2 mm/3h.Very good scores for COSMO 1E, better than many ICON models. Relevant improvement for COSMO 2I and IT if compared to 0.2 mm/3h.
- Almost no improvement for ICON IL from 2D to 3D at 5 mm/3h.



FAR and POD – D0 - 3T



All the models are very close to each other. Very high FAR for ICON IL at 5 mm/3h.



MAM2022 - POD at 0.2 and 5.0 mm - d0 - 3t



At the larger spatial scales, the POD results almost overlap. Very low POD for ICON GR at 5 mm/3h.

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Conclusions - MAM 2022

- Very good performance for ICON GR at 0.2 mm/3h, then it decreases due to lower POD.
- At 5 mm/3h threshold ICON IT, GR and D2 have very good FAR, but just ICON D2 has also high POD, resulting in best FSS.
- MAM 2022 has the lower skills for the lower threshold, while is comparable to the others for 5 mm/3h.





General conclusions

- The ICON models seem to have an overall good performance over the COSMO ones.
- Among the COSMO models, COSMO 1E seems to generally have better performances. It is almost always comparable to ICON 1E.
- COSMO CE PL and ICON PL always have very low POD. In the past years this was partially balanced by very low FAR. This year this is not always true.
- ICON GR usually very good FSS at 0.2 mm/3h and not so much at 5 mm/3h
- COSMO IT and 2I (Italian models) usually have poorer performances if compared to ICON IT
- FOR THE FUTURE: feasibility study to produce boxplot-like plots to enhance the difference between COSMO and ICON models.







Possible example of boxplot – JJA 2021









- CONS: maybe not enough points to get statistically relevant calculation for mean value and quantiles. (Also, increasing short supply of COSMO models)
- Do you think this would still be useful?
- Any ideas on how to improve it?

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THANK YOU FOR YOUR ATTENTION!











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Fractions skill score (Roberts and Lean, MWR, 2008)

We want to know

How forecast skill varies with neighbourhood size

The smallest neighbourhood size that can be used to give sufficiently accurate forecasts

Does higher resolution NWP provide more accurate forecasts on scales of interest (e.g., river catchments)

Compare forecast fractions with observed fractions (radar) in a *probabilistic* way over different sized neighbourhoods

















SON2021 - POD at 0.2 and 5.0 mm - d1 - 1t Cumulation: 3h. Area: Common Area 2. 1.0 △ 0.2 mm ○ 5.0 mm COSMO 2I
 COSMO IT 0.8 ICON IT COSMO CE PL D1 PLOTS (1T) SON 2021 ICON PL ICON IL ICON GR 0.6 D SON2021 - FSS at 0.2 and 5.0 mm - d1 - 1t 0.4 SON2021 - FAR at 0.2 and 5.0 mm - d1 - 1t Cumulation: 3h. Area: Common Area 2. Cumulation: 3h. Area: Common Area 2 1.0 △ 0.2 mm 0.1 △ 0.2 mm o 5.0 mm ○ 5.0 mm 0.2 COSMO 21 COSMO 2I
 COSMO IT COSMO IT 0.8 œ ICON IT 0 ICON IT COSMO CE PL COSMO CE PL 0.0 ICON PL ICON PL ICON IL ICON IL ICON GR 2.8 8.4 25.2 47.6 92.4 182 0.6 14 ICON GR 9 õ ICON D2 Spatial scale [Km] FAR FSS 0.4 4.0 0.2 0.2 0.0 2.8 8.4 14 25.2 47.6 92.4 182 0.0 Spatial scale [Km] 2.8 8.4 25.2 47.6 92.4 182 14 35 Spatial scale [Km] PIEMONT EZIONA

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