Cloud Cover FSS Evaluation

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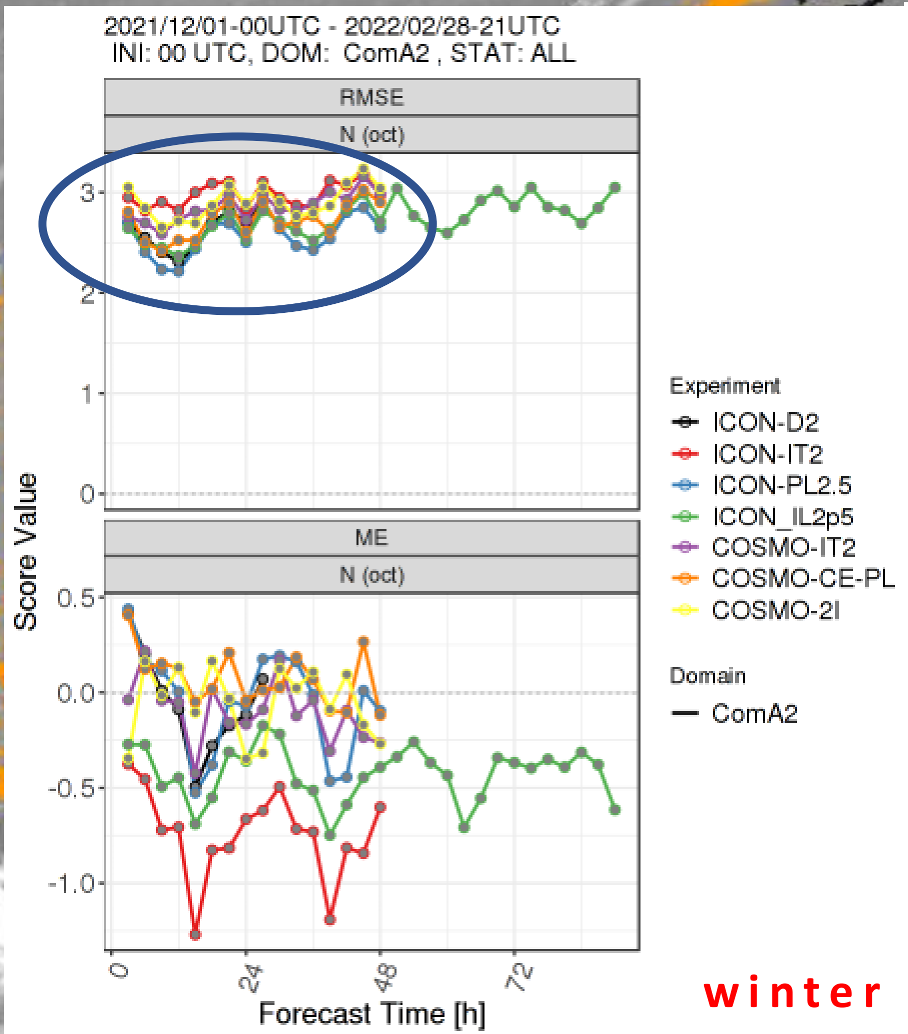
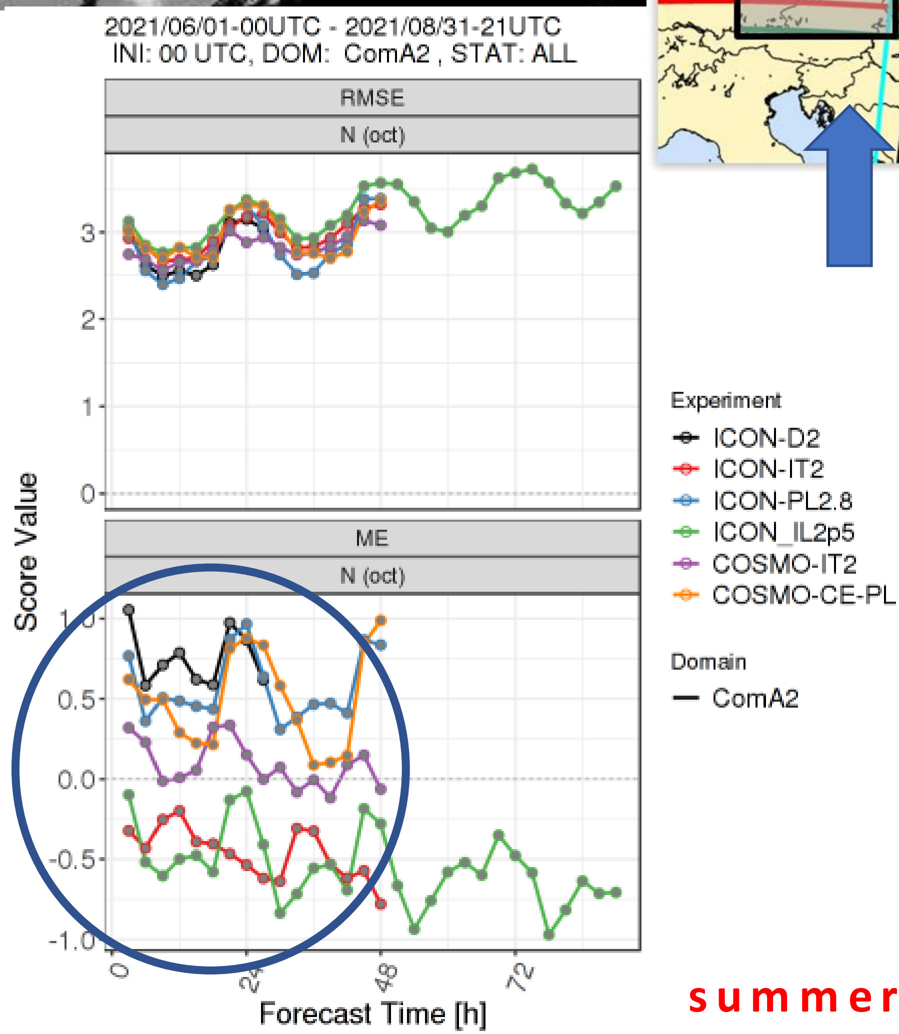
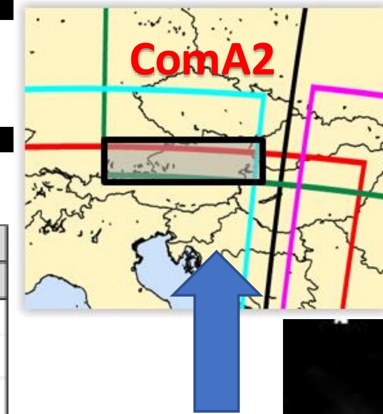
skill of cloudiness forecasts

- Cloud cover is not just of interest in its own but also has a **major impact on other parameters**, such as temperature and solar radiation.
- Highly **variable in terms of time and location** therefore difficult to forecast.
- Substantial part of the **diurnal variability** in cloud cover is due to sub-grid **scale variations in vertical motion and humidity fields**, which have low predictability.
- Deterministic forecast **skill for TCC lags** behind other parameters Unlike accum precipitation, TCC observed at surface stations is a near-instantaneous quantity.
- Spatial **representativeness mismatch** between forecasts and SYNOP observations. The area covered by visual observation typically varies between 10 and 100 km around a station, depending on visibility and topography
- **Geographically**, the skill in forecasting total cloud cover decreases substantially from the mid-latitudes towards the subtropics and tropics. At lower latitudes, a larger portion of the vertical motion field is due to convective processes, which have lower predictability.
- **Enhance** TCC **performance** by using time-averaged values as well as ensemble predictions

Verification against SYNOP

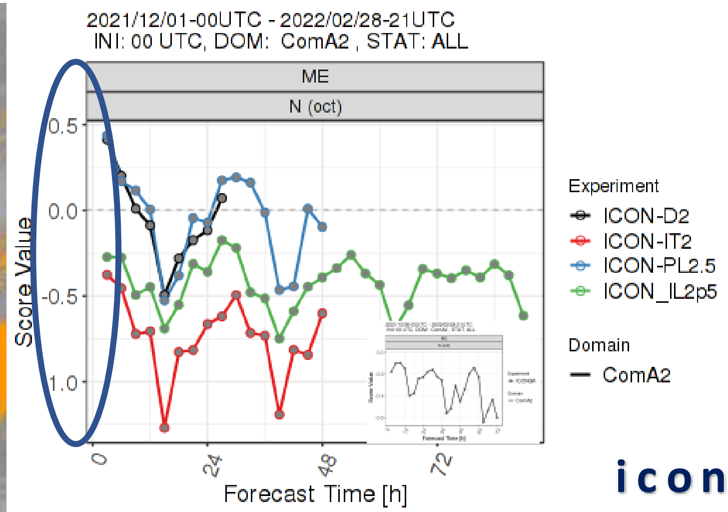


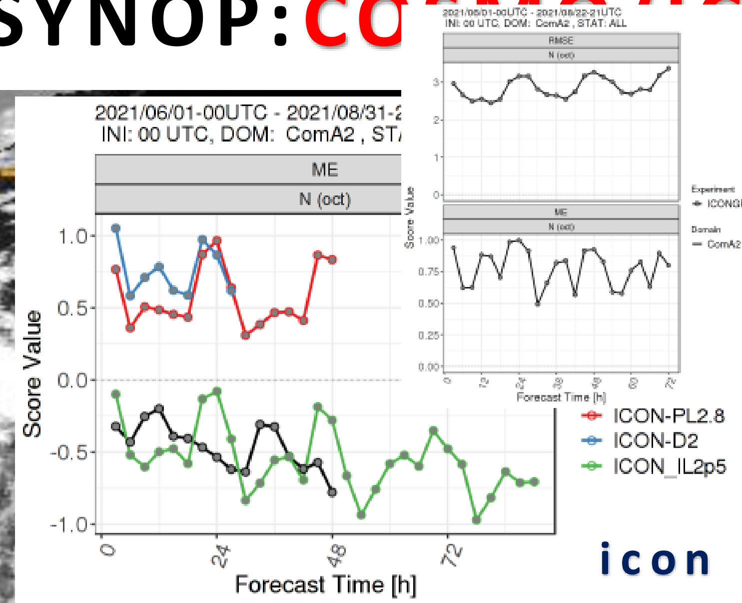


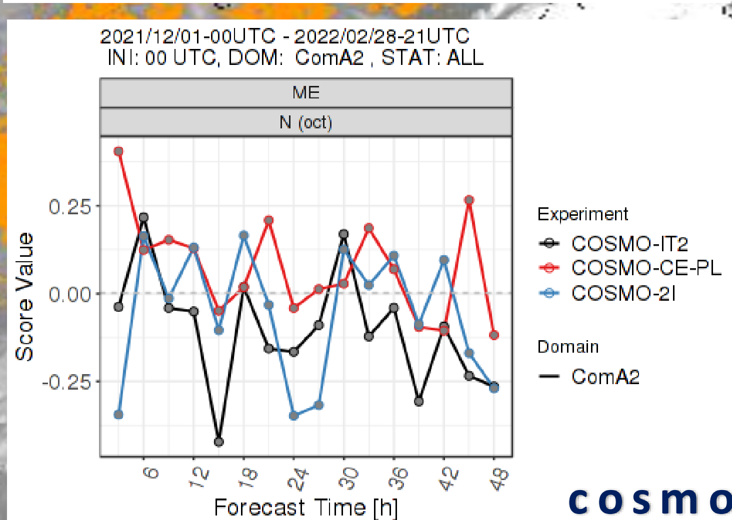


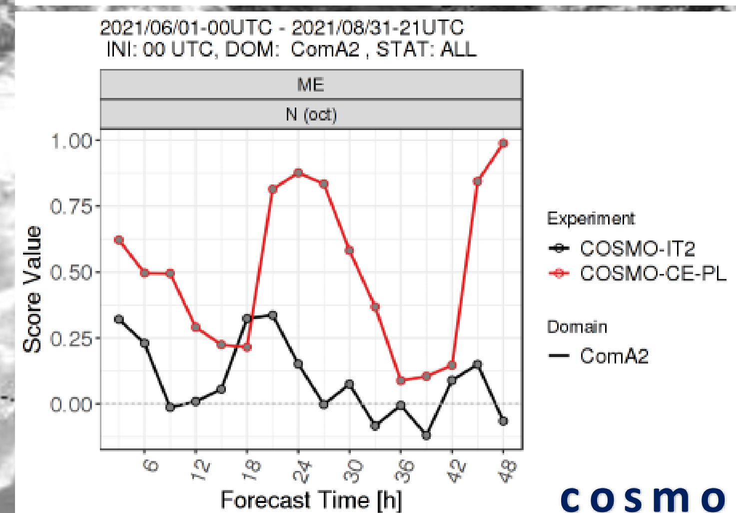
- Large errors, already in forecast day 1 (2.5-3oct)
- Mainly in the summer, higher error during nighttime, more obvious with ICON-LAMs
- Underestimation of cloudiness by most models mainly over afternoon in winter, partial overestimation in summer mainly during night hours

Verification against SYNOP: COSMO/ICON





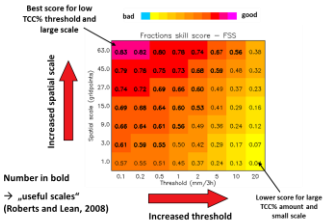


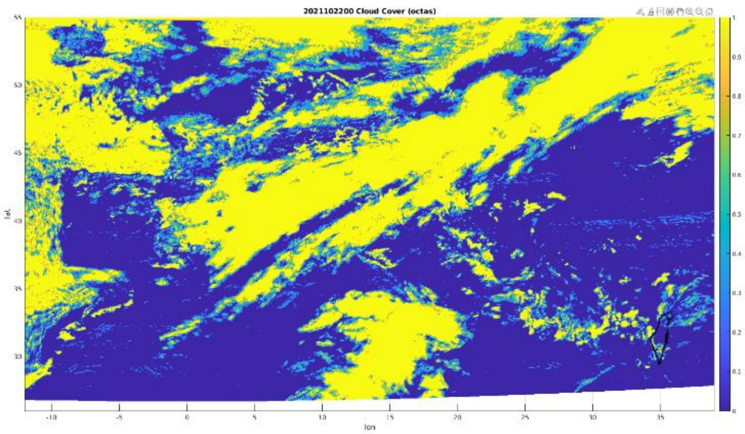


- During winter, great underestimation of ICON models during afternoon
- Strong overestimation in summer by COSMO models, while for ICON behaviour is ambiguous

description of satellite based verif

- Models:
  - COSMO2I, COSMO I2, ICON-PL2.5, ICON-IL-2p5, ICOND2, ICONEU, ICONGR2.5, COSMOGR4
- Period: more organized from Feb-Jun 2022 **with many gaps**
- Scores: FSS (more scores could follow in next phase)
- Cumulation: 3h
- Areas: ComA2, Mediterranean





Domain: lon1=-12; lon2=39;
lat1=26; lat2=55;

Interpolated resolution: 0.025 degrees.

Adaptation Method: *4km 15min CMA fields average 3 time steps: -15min, 0, +15min multiply by 8 to get an estimation of the cloud cover in octas*

Calculated TCC fields provided by P.Khain (thanks!)

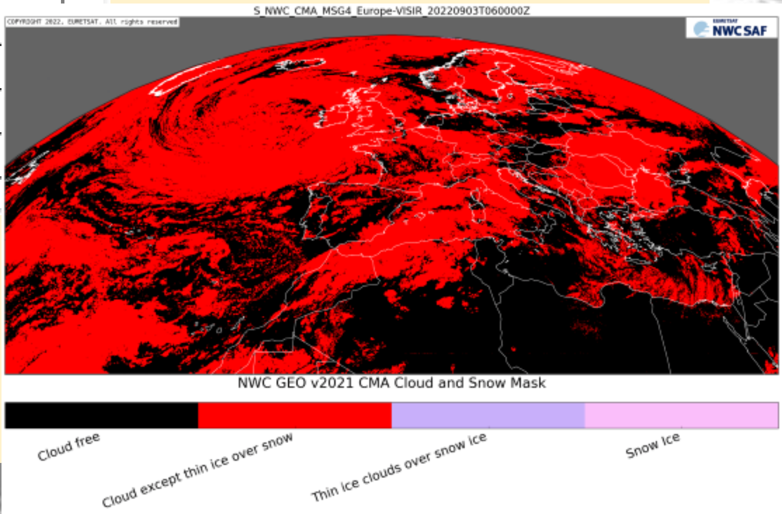
Necessary to organize forecast field adaptation by each service

Verification against (adapted) NWCSAF

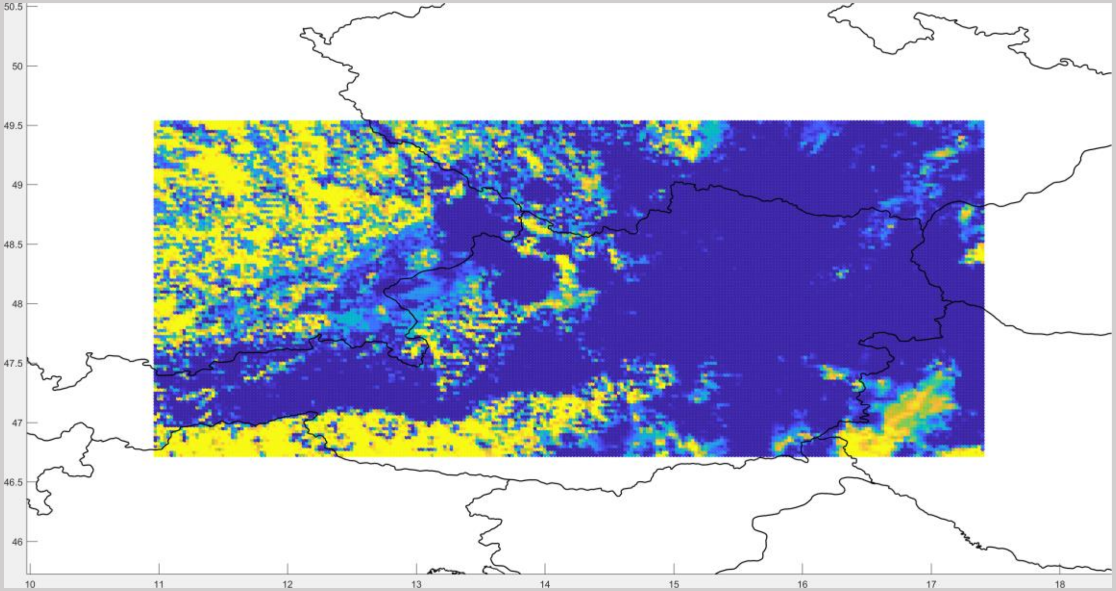
NWCSAF – Cloud Mask (CMA)

Cloud mask (CMA), developed within the SAF NWC, aims to support nowcasting applications.
Allows identifying cloud free areas where other products (e.g. land or sea surface temperatures, snow/ice cover) may be computed.
Allows identifying cloudy areas where other products (cloud types and cloud top temperature/height) may be derived.
The central aim of the CMA is to delineate all cloud-free pixels with a high confidence.

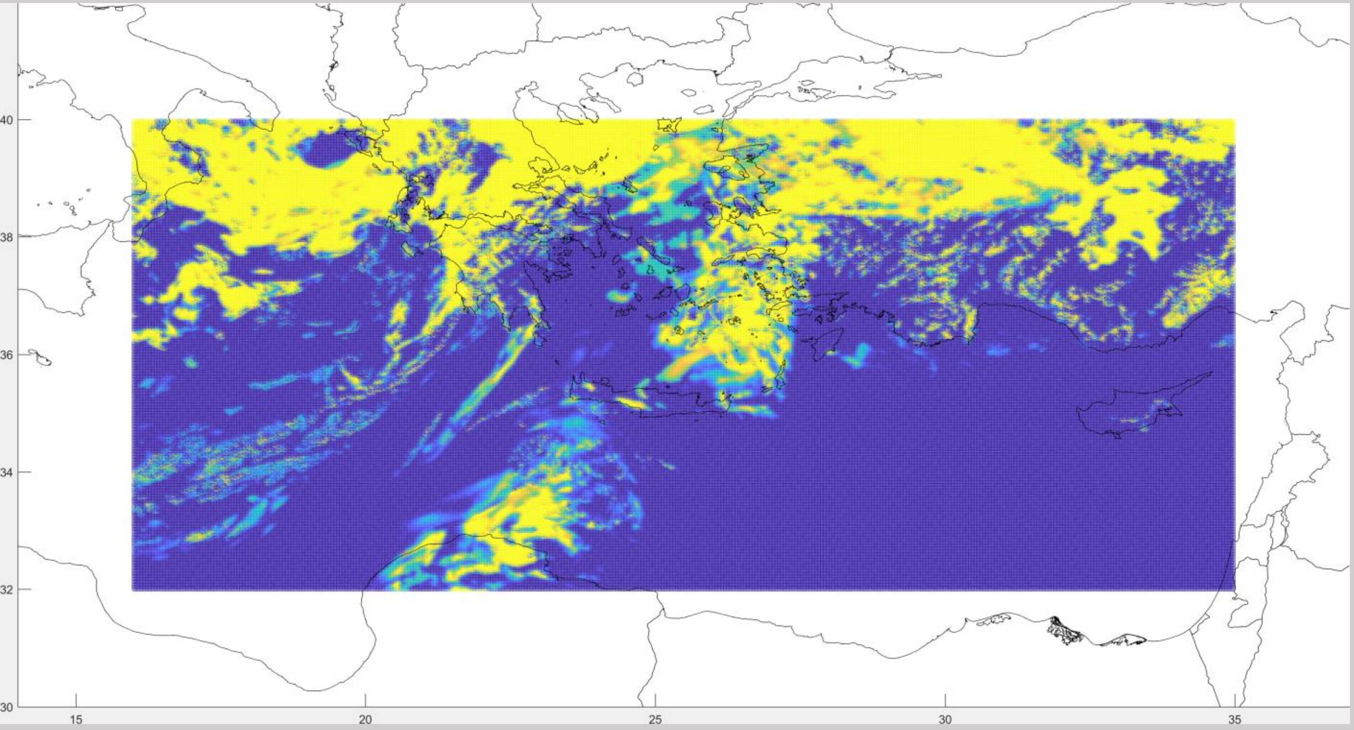
FillValue	Non-processed	containing no data or corrupted data
0	Cloud-free	no contamination by snow/ice covered surface, no contamination by clouds ; but contamination by thin dust/volcanic clouds not checked
1	Cloud	cloud (except thin ice cloud over snow)
2	thin cloud over snow	thin ice cloud over snow
3	Snow/Ice contaminated	



evaluation areas



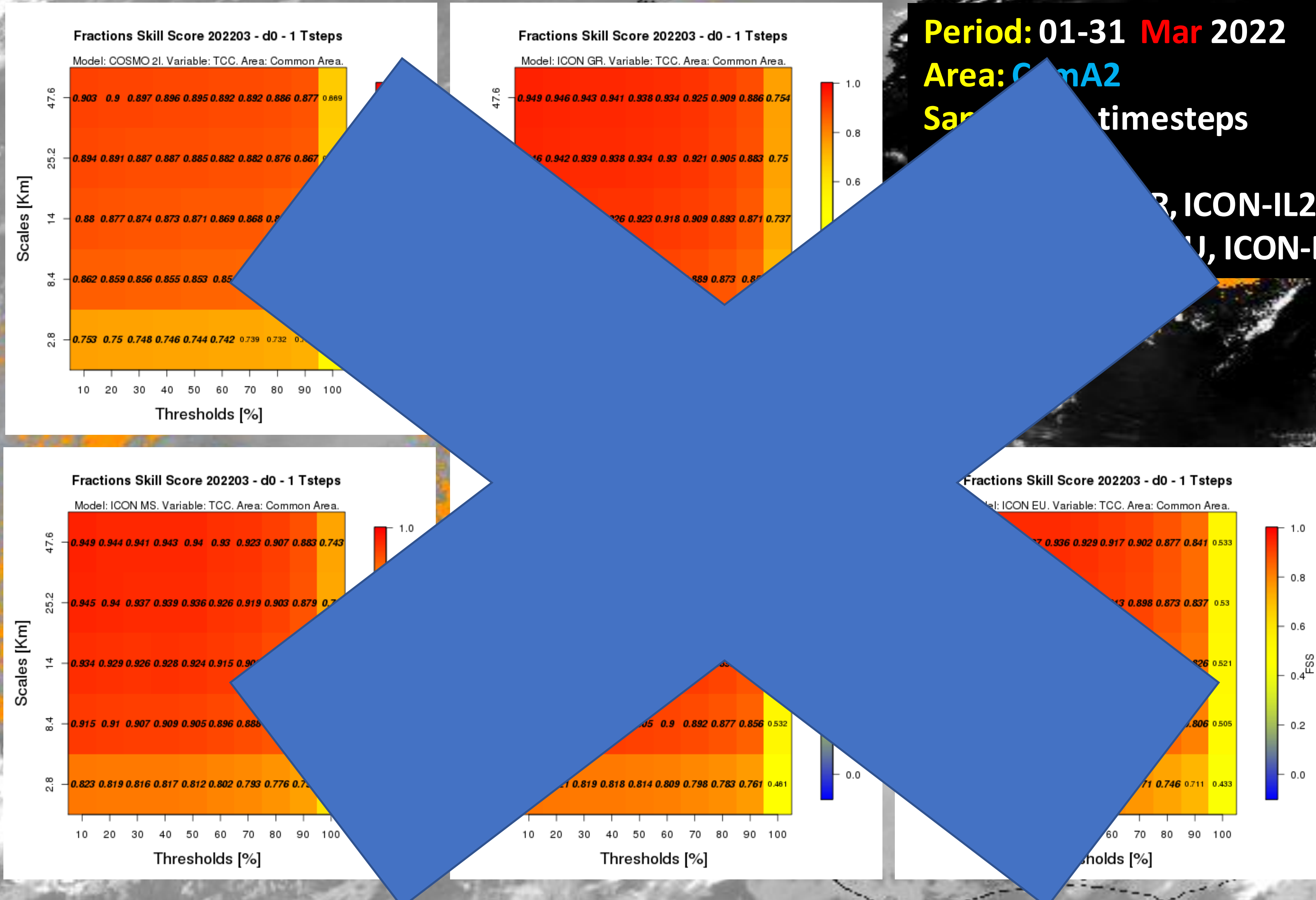
ComA2
restricted, mountainous
Lon: 16.000-17.424
Lat: 46.725-49.550



Med1
Extended, over water
Lon: 16.00-35.00
Lat: 32.00-40.00

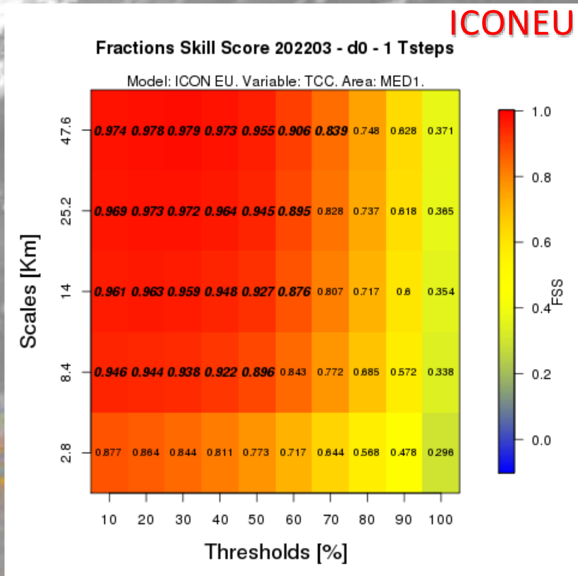
Period: 01-31 Mar 2022
Area: C mA2
Sa timesteps

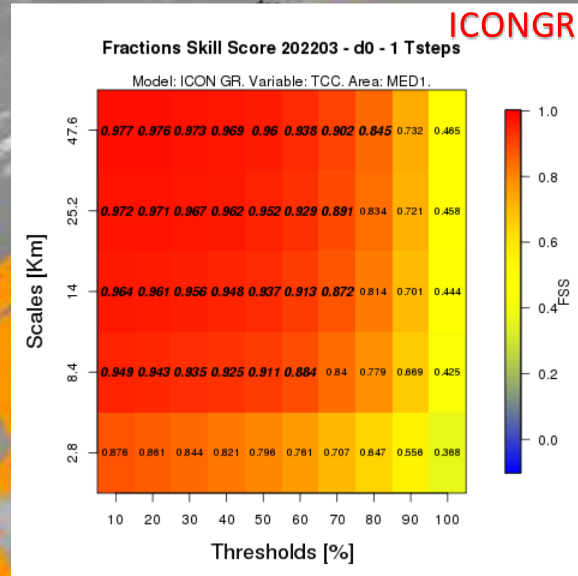
R, ICON-IL2p5,
U, ICON-D2

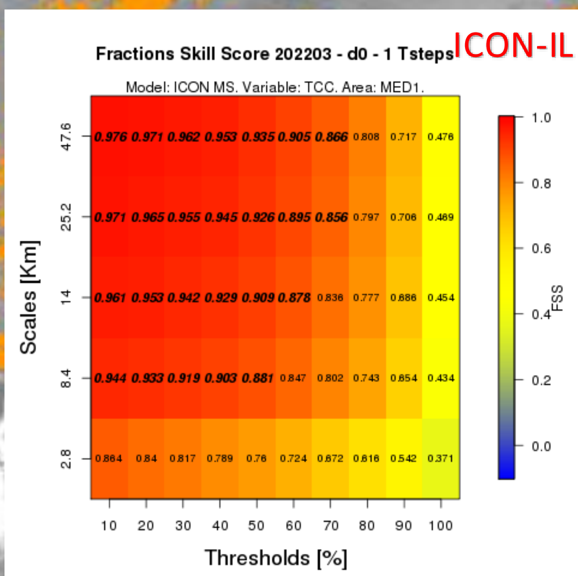


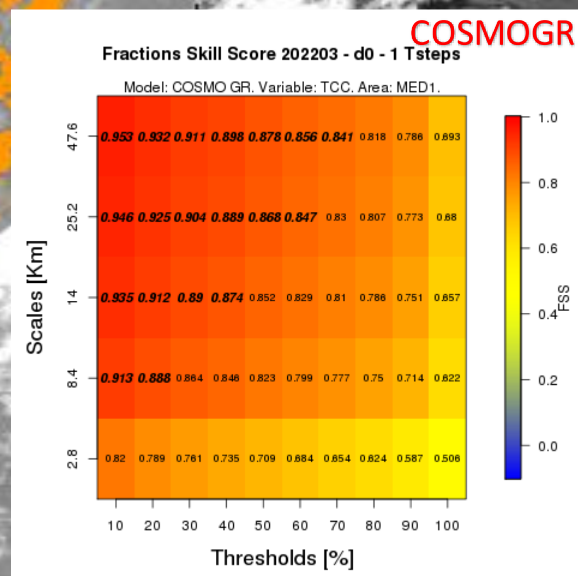
!!! TCC for all scales and! thresholds are equally USEFUL!!!

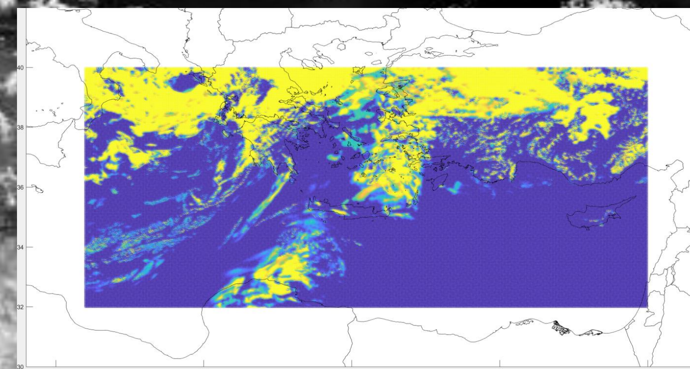
Period: 01-31 Mar 2022
Area: Mediterranean
Sample: 3h timesteps/all
Index: FSS
Models: ICONGR, COSMOGR, ICONEU, ICON-IL2p5



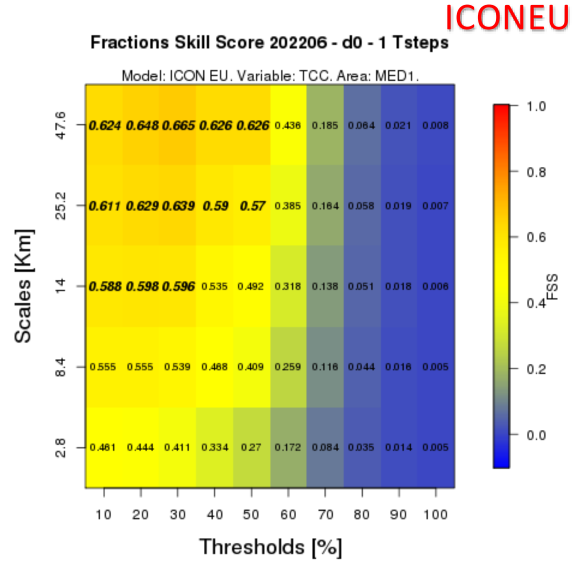


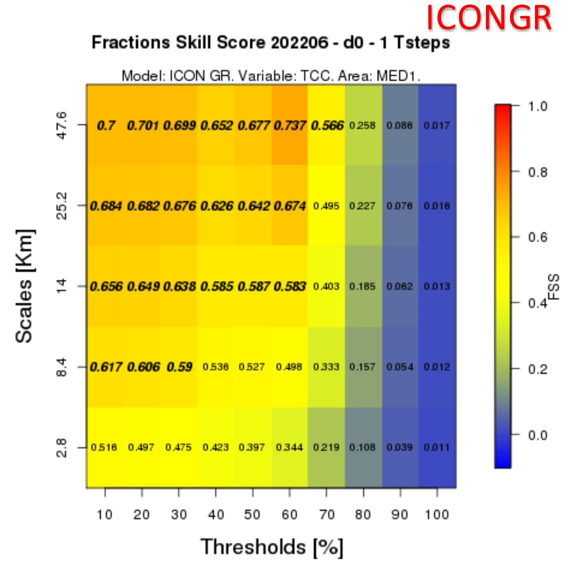




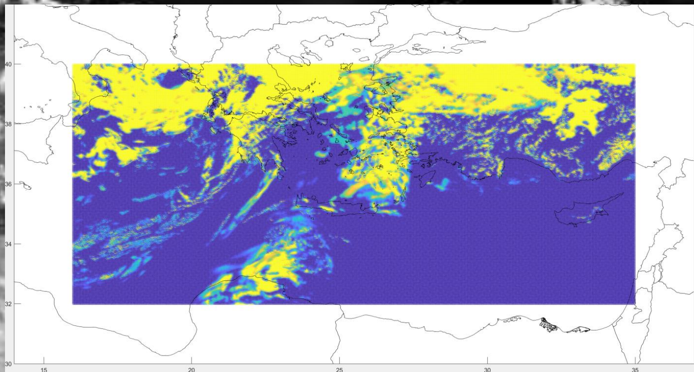


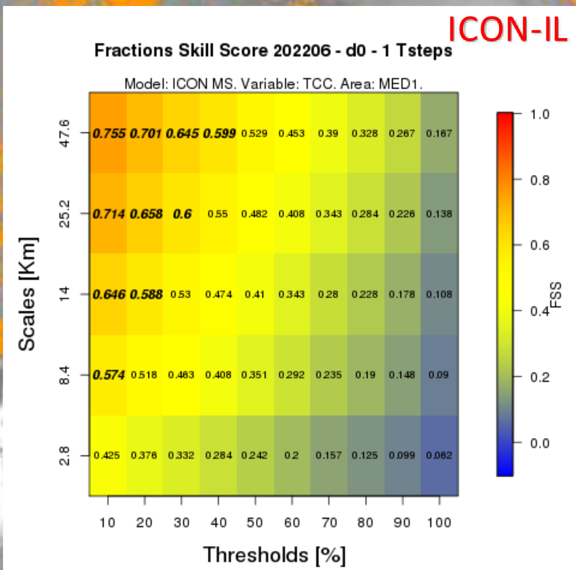
For scale higher than 8km and for lower thresholds, performance is very good for all models ICONGR as all other ICON-LAMs performs clearly better than COSMOGR for smaller thresholds while COSMOGR gives higher scores than all ICON models when observed we have almost total cloudiness

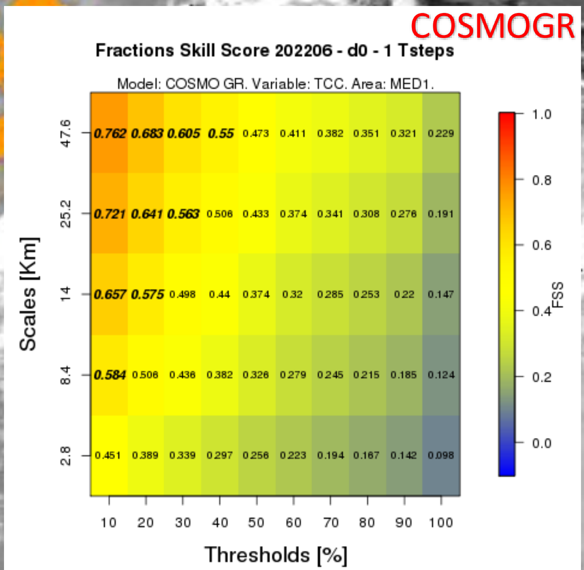




Period: 01-31 Jun 2022
Area: Mediterranean
Sample: 3h timesteps
Index: FSS
Models: ICONGR, COSMOGR
ICONEU, ICON-IL2p5







Striking change of performance during June compared to March month. Useful scales for windows averaged higher than 14km and for less than 30% cloudiness. Improved performance of ICON-LAMS compared to COSMO in low TCC% but much worse for high TCC%.

preliminary considerations

- Fuzzy verification for TCC seem to be meaningful when obs/fcs exceed a certain threshold, giving as granted that the most common situation is to have low values.
- For TCC this condition is not granted in small domains and becomes rare in winter, since in most days you will have the most of the sky occupied by high values, while rare are the amount of gridpoints with lower values. And this sort of situation is not an exception (as a day with extreme heavy precipitation in the winter).
- Consequently, there is no "hierarchy" among the expected values.
- FSS analysis acceptable when you verify sunny days with a few clouds, but not in overcast or almost overcast days where the hierarchy is completely overturned.
- COSMO seem to outperforms ICON model in warm periods of the year.

Next try is (?):

Use only an extended area among fewer models (redefinition of areas as with CP)
Fair weather provides the necessary sparsity of a cloudiness event
For winter, the event 1-TCC% could be tested
Useful to check more indices as POD, FAR and BIAS
Analyze for various periods of day separately
Check more spatial verification methods (already at HNMS we are testing SAL)
Continue?

Thank you all

….and see you on Monday!