

# WG5: Verification Overview

## Common Plot Reports

Flora Gofa

WG5

WG5



## Common Plot Report Preparation :WG5 Task 1.2

Data provided seasonally by all countries (when available)

Responsible for Report Preparation:

Adriano Raspanti

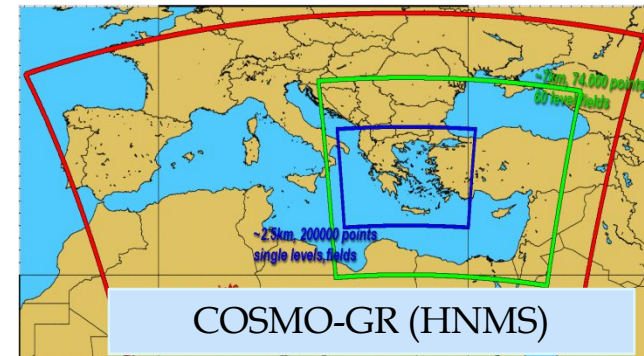
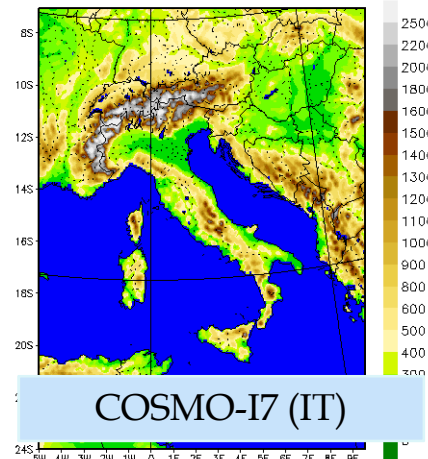
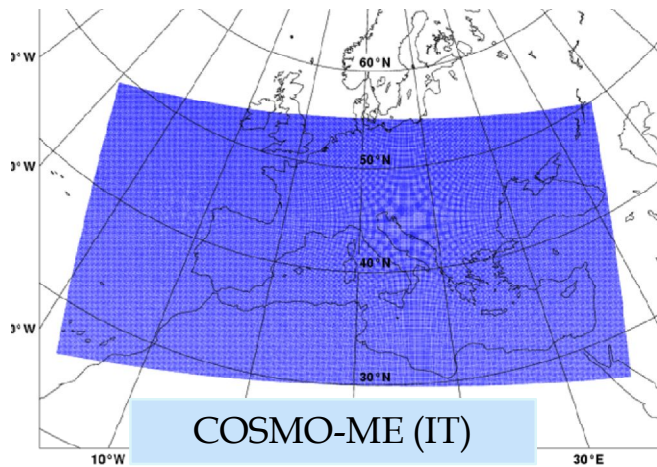
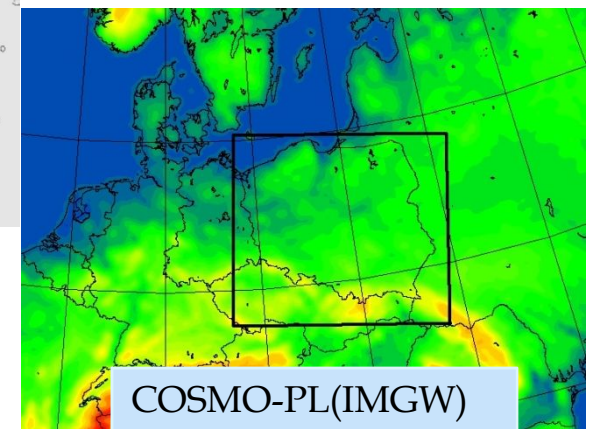
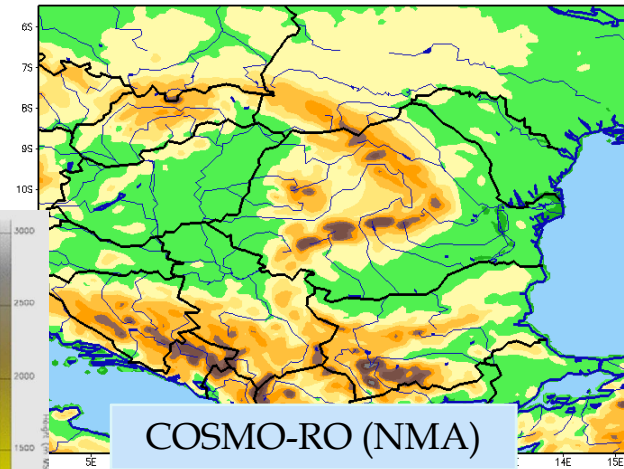
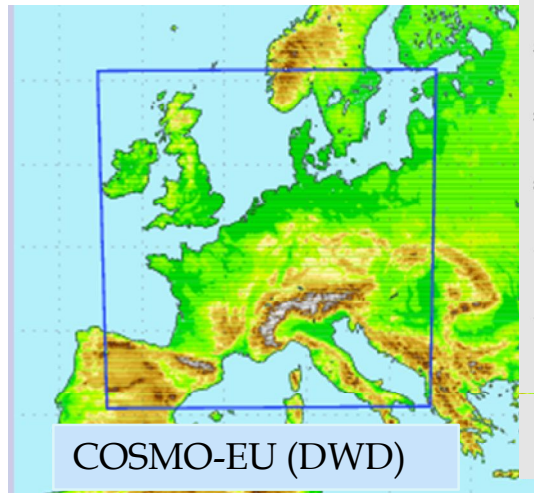
Maria Stefania Tesini

Flora Gofa

PD Precipitation plots from Elena Oberto presentation



# THE MODELS





## Standard Verification

- Period: JJA 2012, SON 2012, DJF2012/2013, MAM 2013
- Run: 00 UTC run
- Continuous parameters - T2m, Td2m, Mslp, Wspeed, TCC
  - Scores : ME, RMSE
  - Forecasts Step: every 3 hours
- Dichotomic parameters - Precipitation:
  - Scores: FBI-POD-FAR-TS with Performance Diagram
  - Cumulating: 6h and 24h
  - Thresholds: 0.2, 0.4, 0.6, 0.8, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, 20 mm/6h and mm/24h



## Conditional Verification (focus on the next slides)

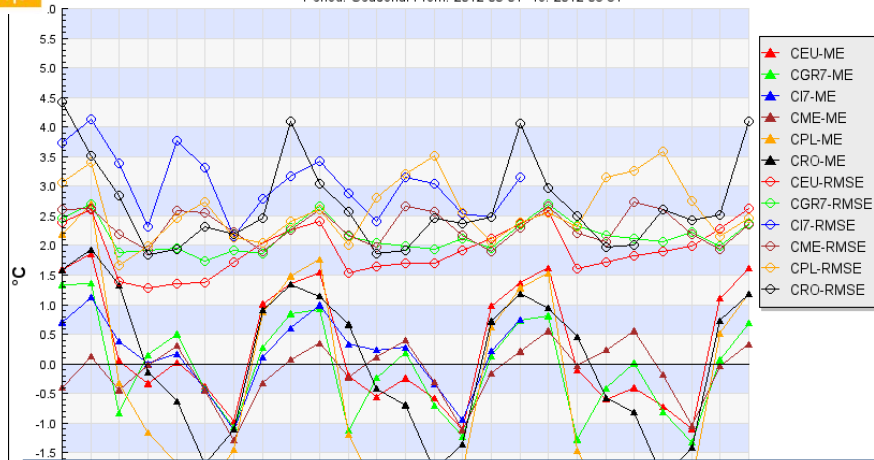
- 2mT verification with the following criteria (1 condition):
  - Total cloud cover  $\geq 75\%$  (overcast condition) (condition based on observations)
  - Total cloud cover  $\leq 25\%$  (clear sky condition) (condition based on observations)
- 
- 2mT verification with the following criteria (2 conditions):
  - Total cloud cover  $\geq 75\%$  (overcast condition) AND Wind Speed  $< 2.5$  m/s (condition based on observations)
  - Total cloud cover  $\leq 25\%$  (clear sky condition) AND Wind Speed  $< 2.5$  m/s (condition based on observations)



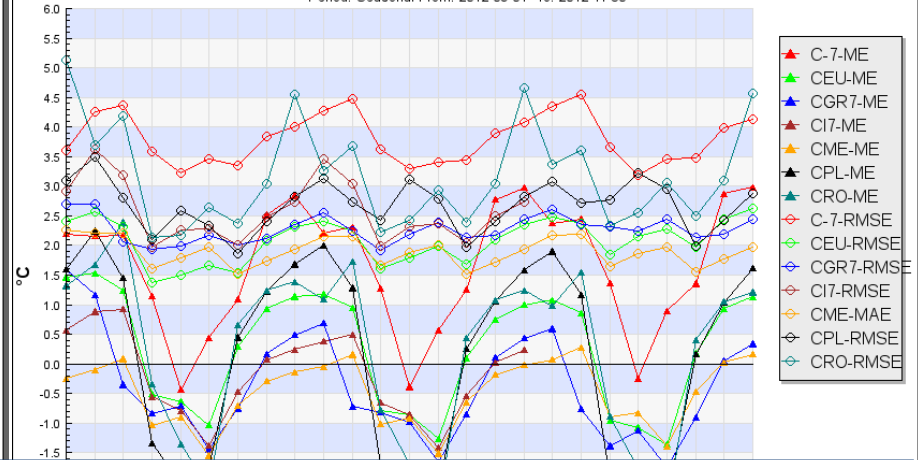
# 2MT IN SKY CLEAR CONDITIONS - JJA 2012 – MAM 2013



**Cross-Model: T2m - TCC less than 25**  
 Period: Seasonal From: 2012-06-01 To: 2012-08-31



**Cross-Model: T2m - TCC less than 25**  
 Period: Seasonal From: 2012-09-01 To: 2012-11-30



Clear diurnal cycle for all the models with a general tendency to underestimation in DJF and MAM (maybe poor sample) and amplitude of the error pronounced. RMSE between 2° and 4-5°.

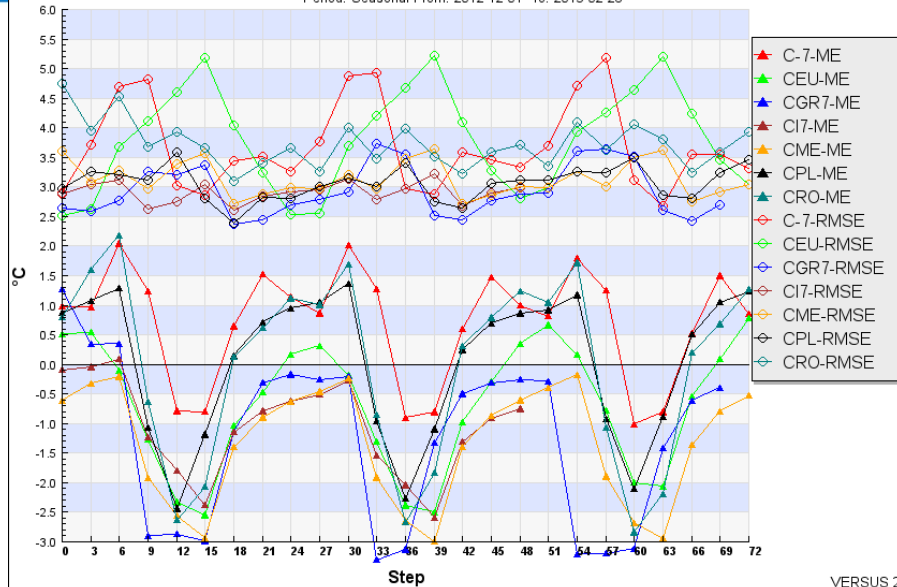
Step

VERSUS 2.0

Step

VERSUS 2.0

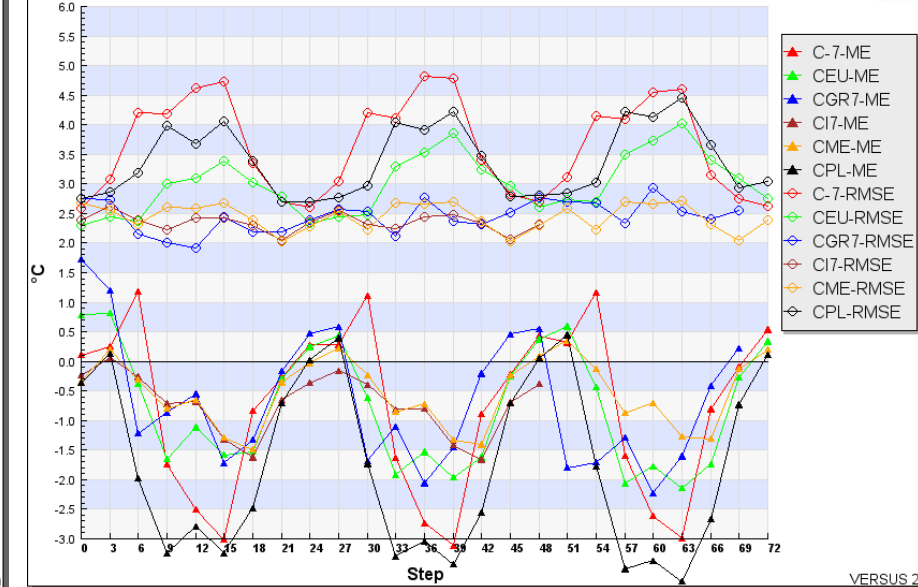
**Cross-Model: T2m - TCC less than 25**  
 Period: Seasonal From: 2012-12-01 To: 2013-02-28



Step

VERSUS 2.0

**Cross-Model: T2m - TCC less than 25**  
 Period: Seasonal From: 2013-03-01 To: 2013-05-31



Step

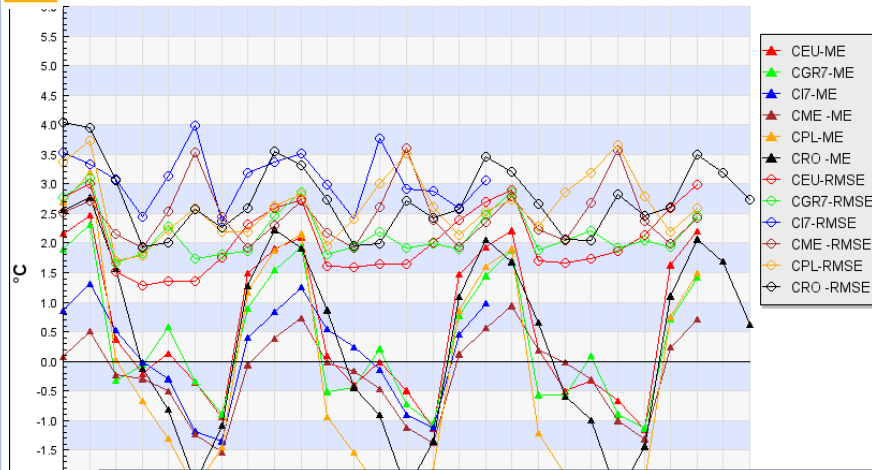
VERSUS 2.0



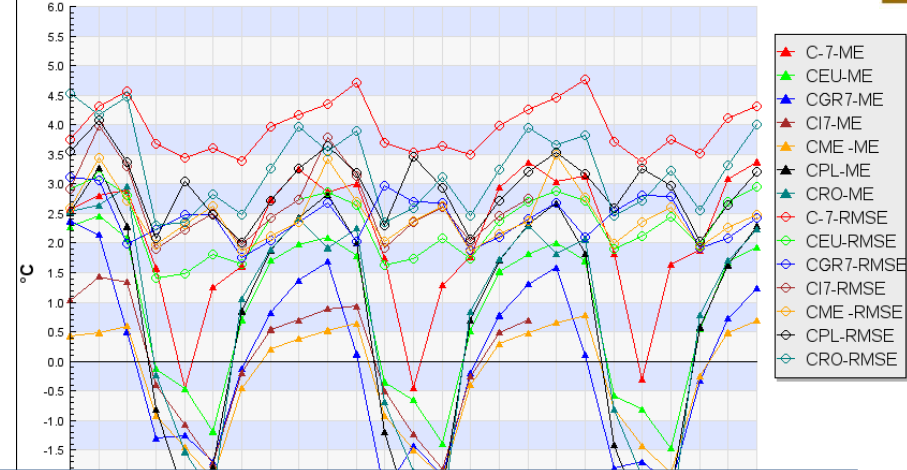
# 2MT IN CLEAR SKY CONDITIONS AND NO ADVECTION - JJA 2012 – MAM 2013



Cross-Model: T2m - TCC It 25 - WS It 2.5  
Period: Seasonal From: 2012-06-01 To: 2012-08-31



Cross-Model: T2m - TCC It 25 - WS It 2.5  
Period: Seasonal From: 2012-09-01 To: 2012-11-30

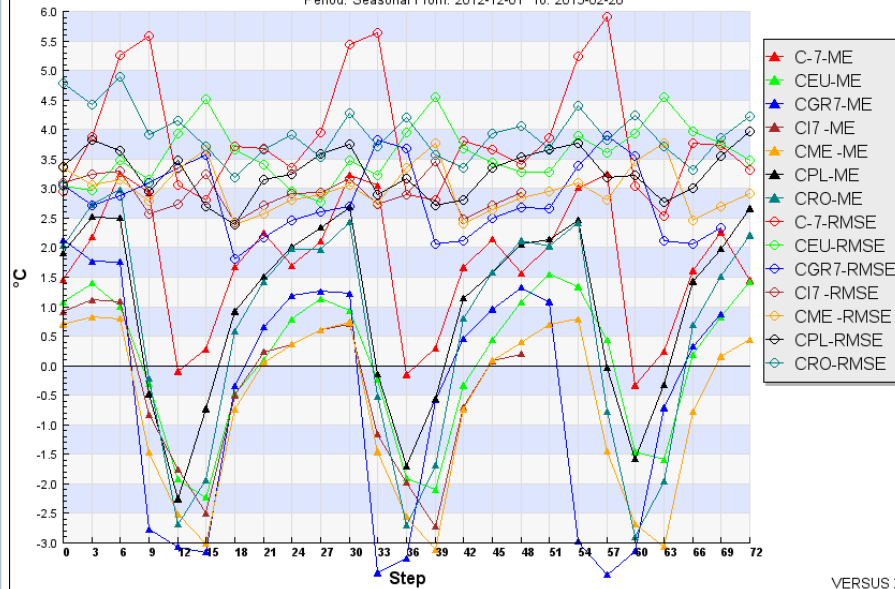


Clear diurnal cycle for all the models with a general tendency towards underestimation in DJF and MAM (maybe poor sample) during daytime and amplitude of the error pronounced. RMSE between 2° and 5° and with diurnal cycle too.

RSUS 2.0



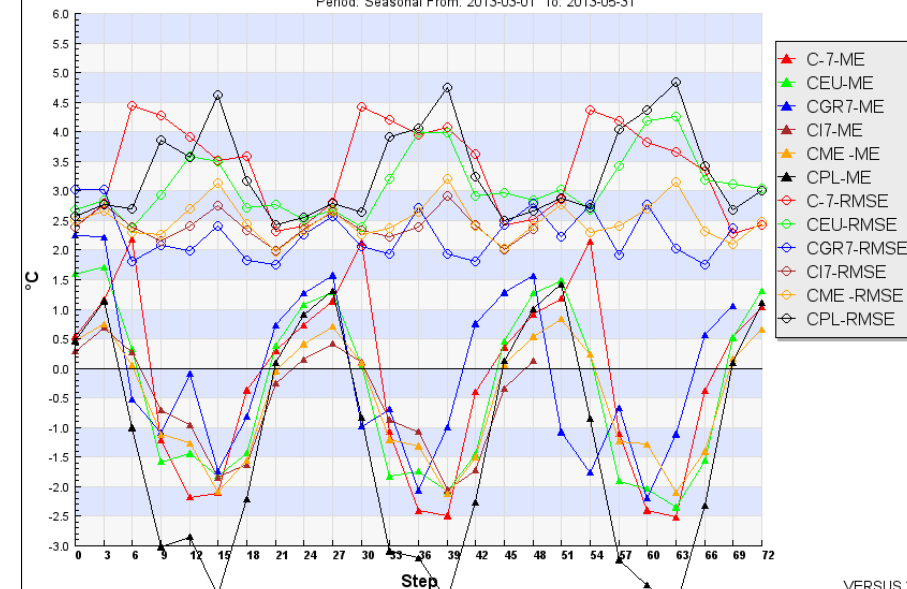
Cross-Model: T2m - TCC It 25 - WS It 2.5  
Period: Seasonal From: 2012-12-01 To: 2013-02-28



VERSUS 2.0

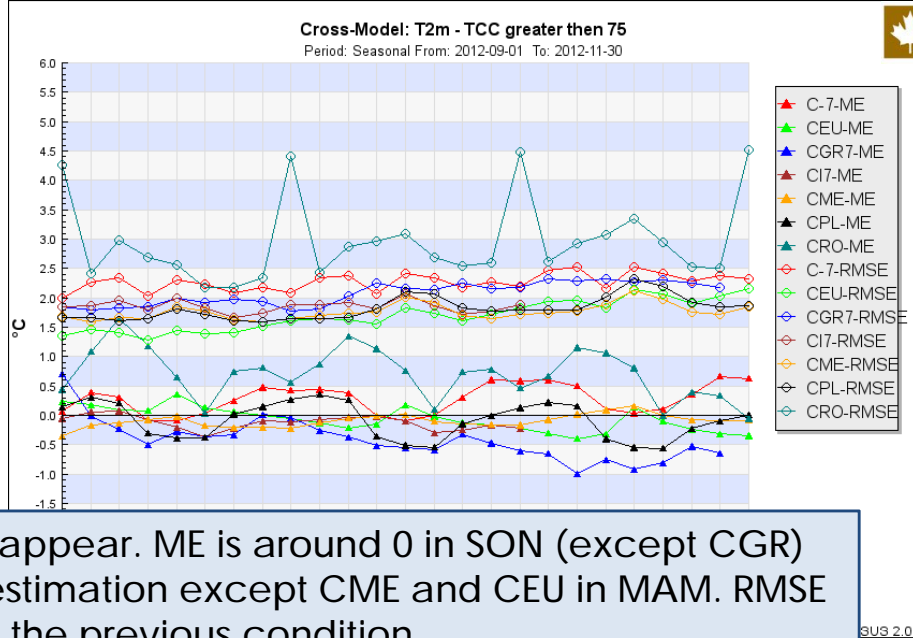
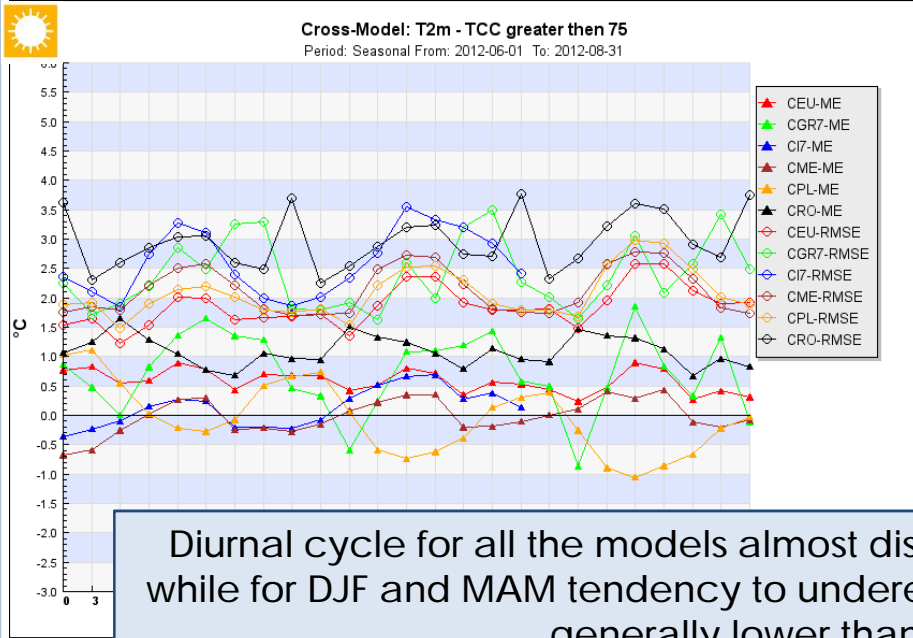


Cross-Model: T2m - TCC It 25 - WS It 2.5  
Period: Seasonal From: 2013-03-01 To: 2013-05-31



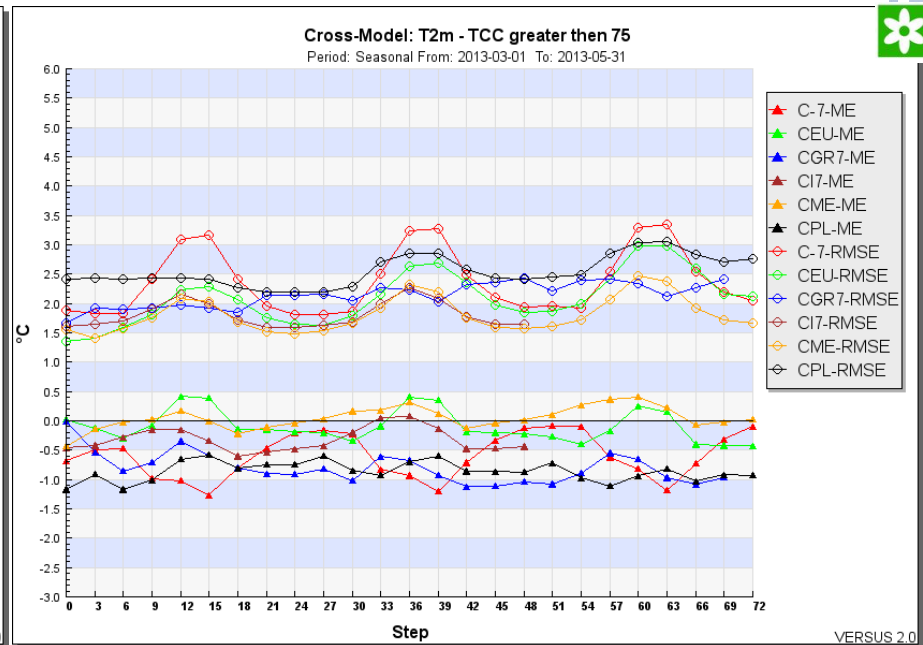
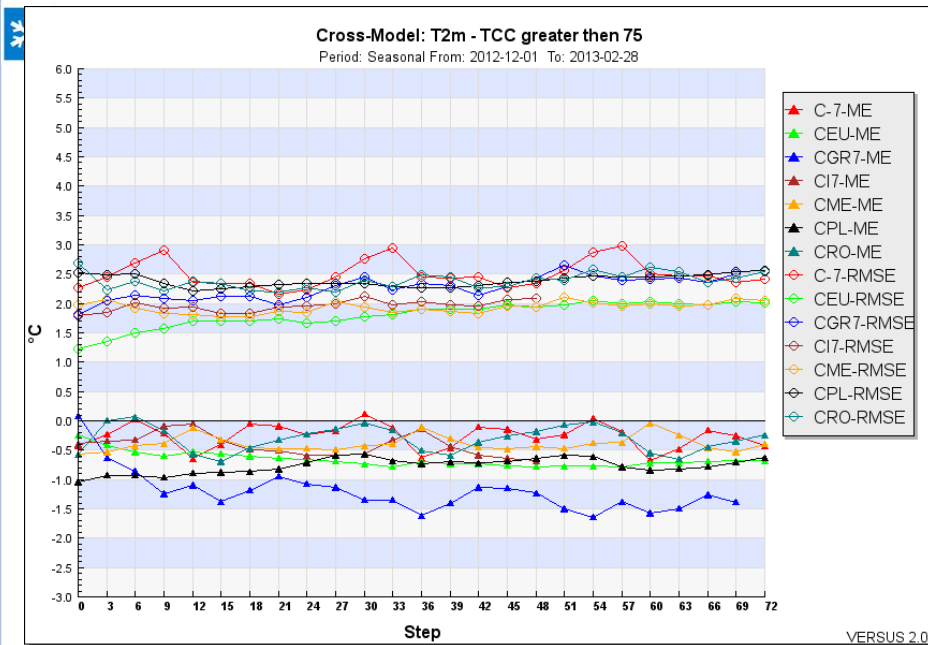
VERSUS 2.0

# 2MT IN OVERCAST CONDITIONS - JJA 2012 – MAM 2013



Diurnal cycle for all the models almost disappear. ME is around 0 in SON (except CGR) while for DJF and MAM tendency to underestimation except CME and CEU in MAM. RMSE generally lower than the previous condition.

SUG 2.0



VERSUS 2.0

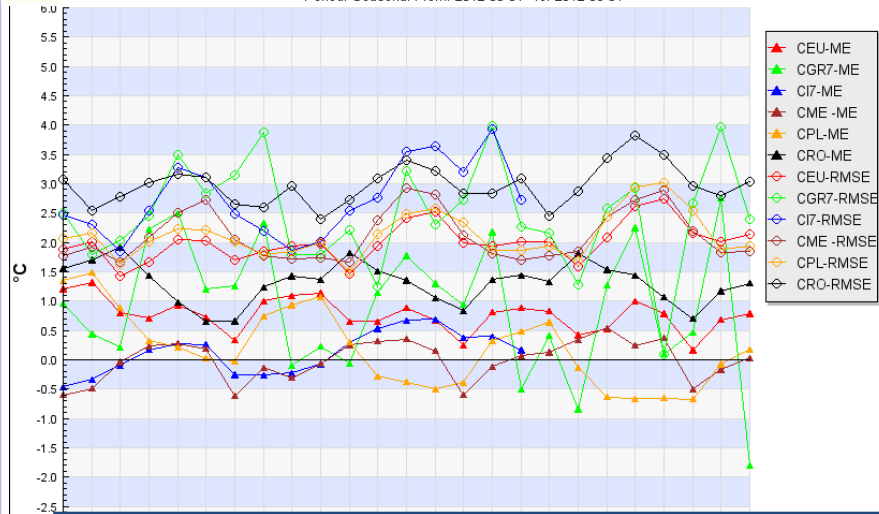
VERSUS 2.0



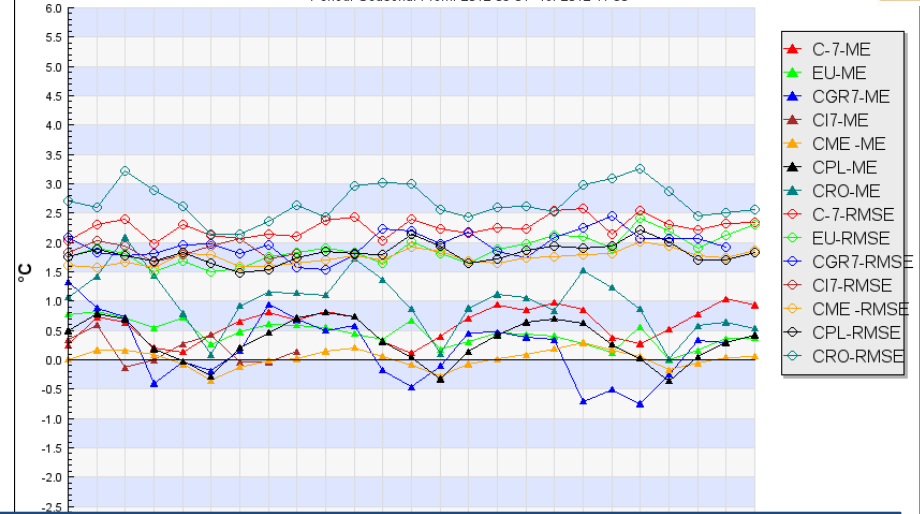
# 2MT IN OVERCAST CONDITIONS AND NO ADVECTION - JJA 2012 – MAM 2013



Cross-Model: T2m - TCC gt 75 - WS It 2.5  
Period: Seasonal From: 2012-06-01 To: 2012-08-31



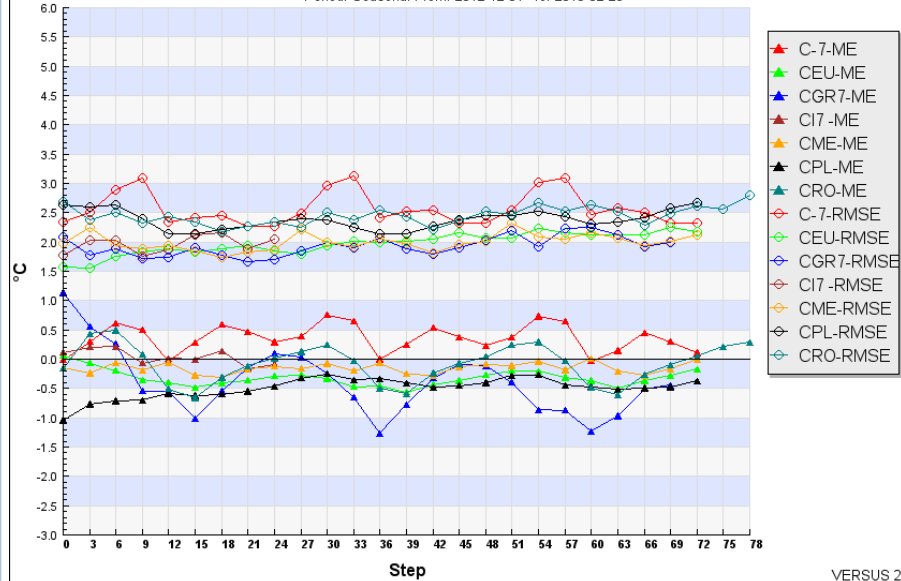
Cross-Model: T2m - TCC gt 75 - WS It 2.5  
Period: Seasonal From: 2012-09-01 To: 2012-11-30



ME is in general around with tendency to underestimation in DJF and MAM. RMSE generally lower in DJF and MAM than the other seasons



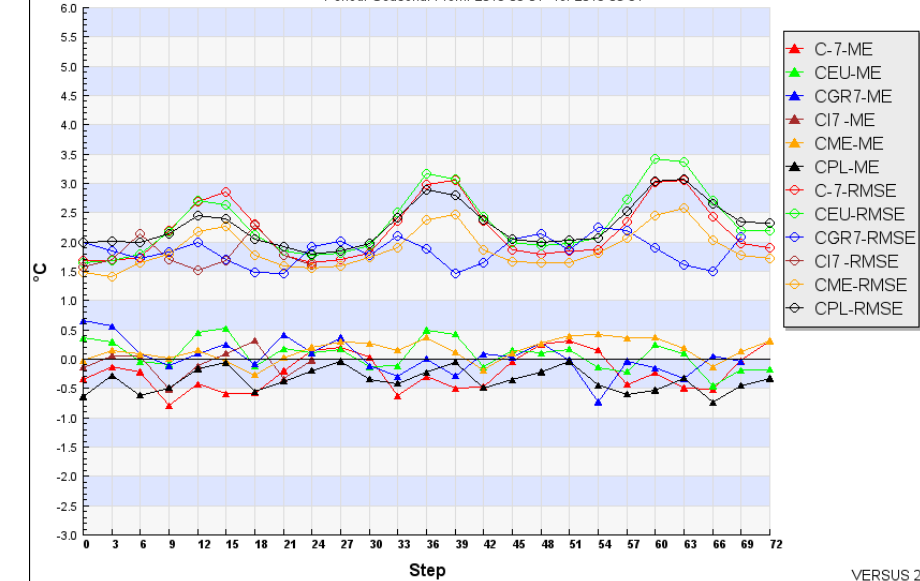
Cross-Model: T2m - TCC gt 75 - WS It 2.5  
Period: Seasonal From: 2012-12-01 To: 2013-02-28



VERSUS 2.0



Cross-Model: T2m - TCC gt 75 - WS It 2.5  
Period: Seasonal From: 2013-03-01 To: 2013-05-31



VERSUS 2.0



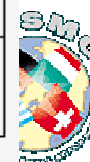
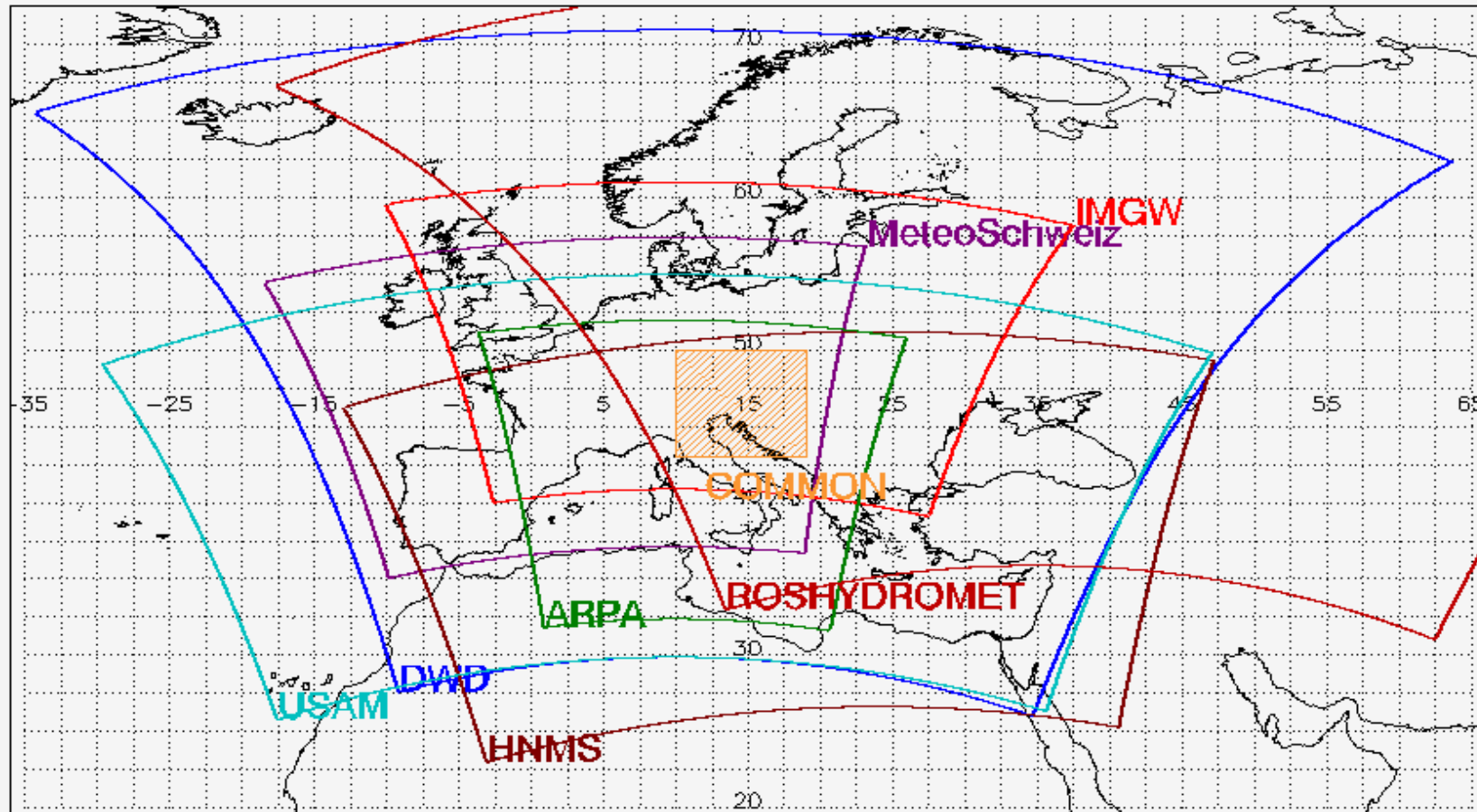
## Standard Verification on Common Area

**NEW!**

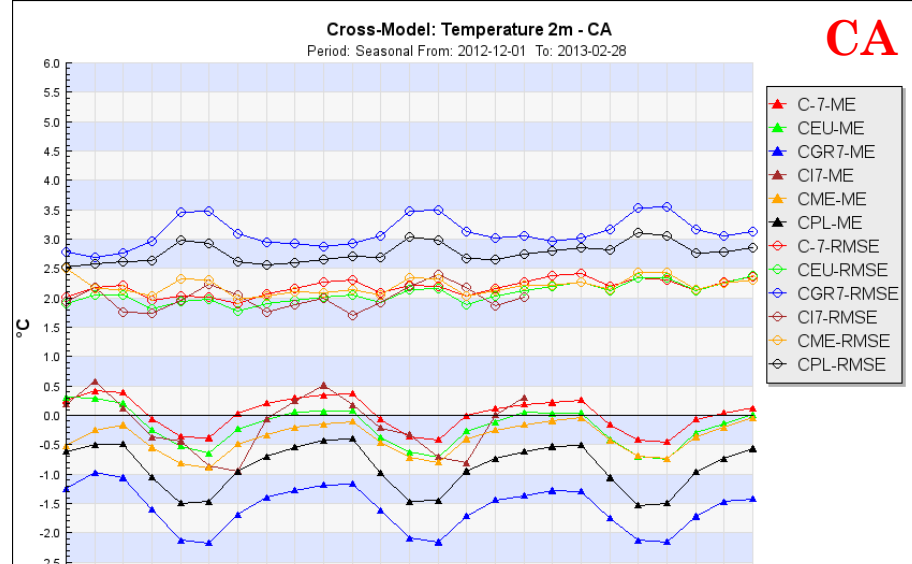
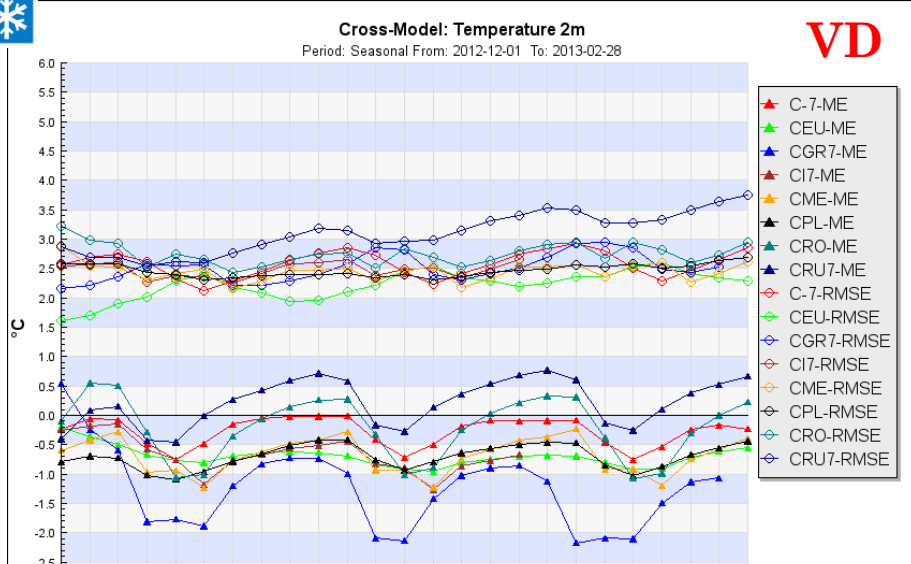
- Period: DJF2012/2013, MAM 2013
- Run: 00 UTC run
- Continuous parameters - T2m, Td2m, Mslp, Wspeed, TCC
  - Scores : ME, RMSE
  - Forecasts Step: every 3 hours
- Dichotomic parameters - Precipitation:
  - Scores: FBI-POD-FAR-TS with Performance Diagram
  - Cumulating: 6h and 24h
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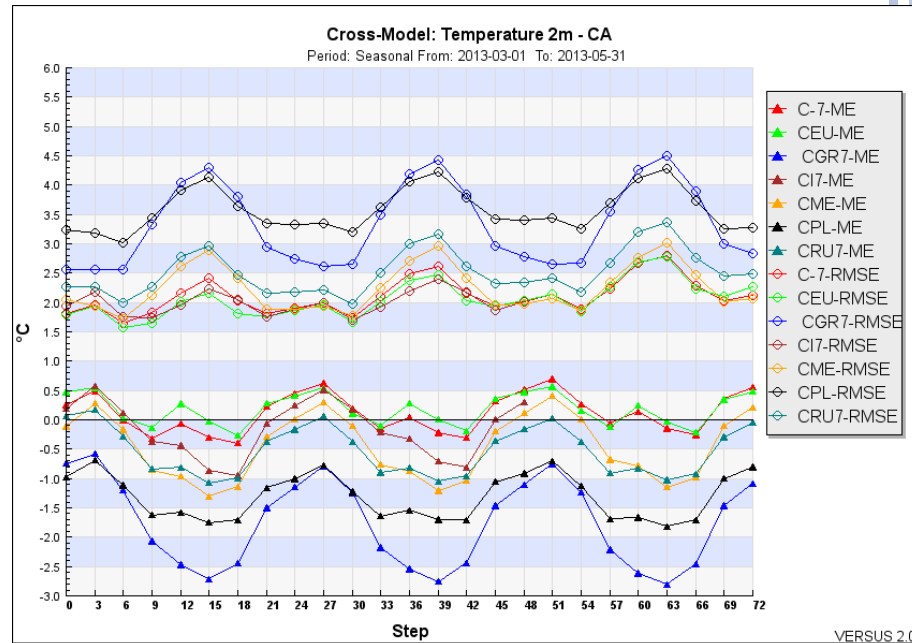
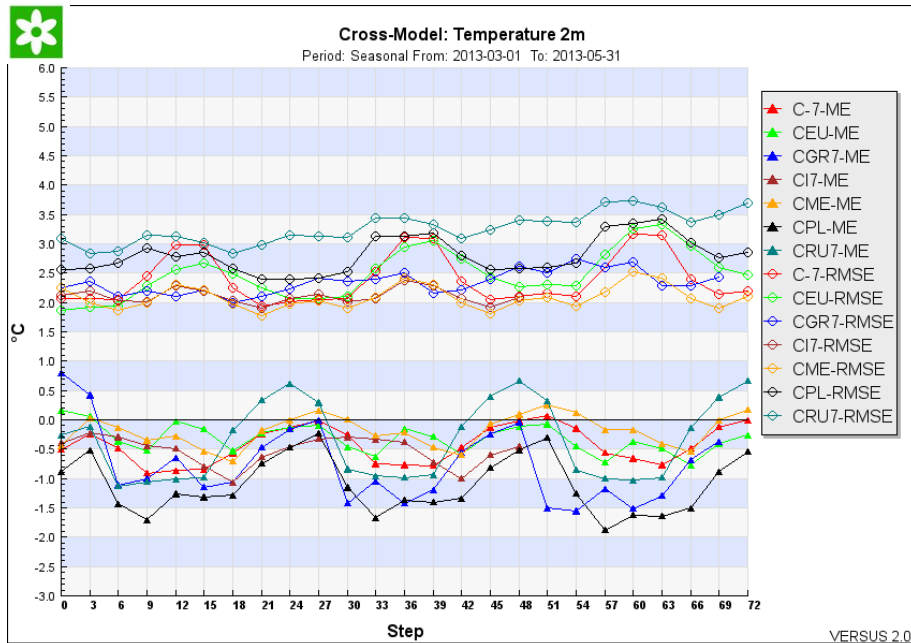
## Standard Verification on Common Area



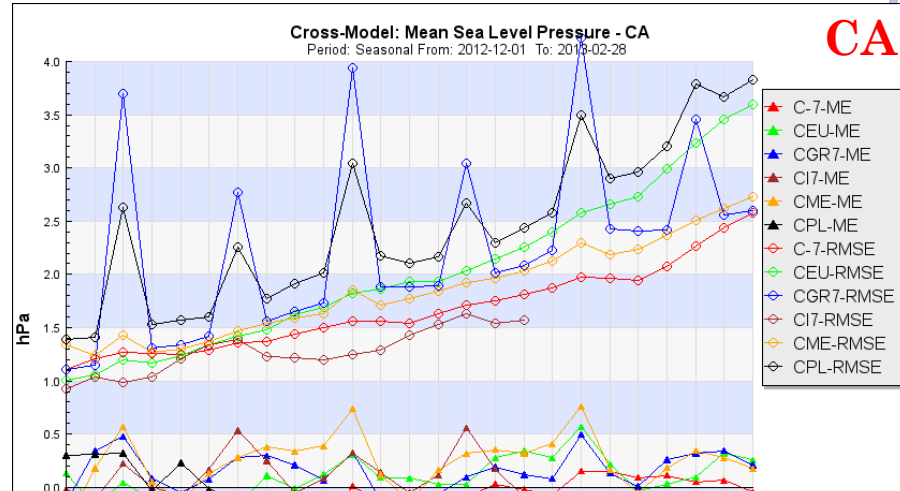
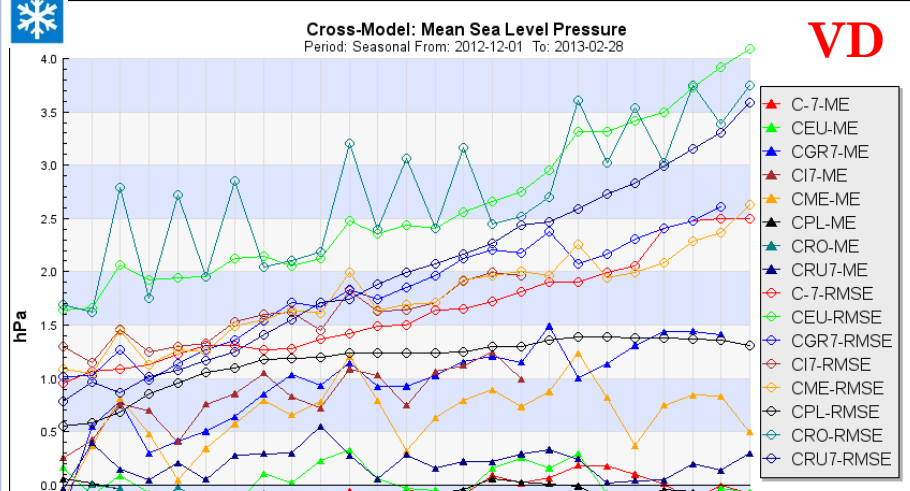
# 2M TEMPERATURE - DJF 2013 - MAM 2013



DJF and MAM: CPL, CGR increase underestimation in the CA while CEU, CME and CI7 decrease this tendency. RMSE in CA worse for CPL and CGR, while CI7, CEU, CME slightly improve.

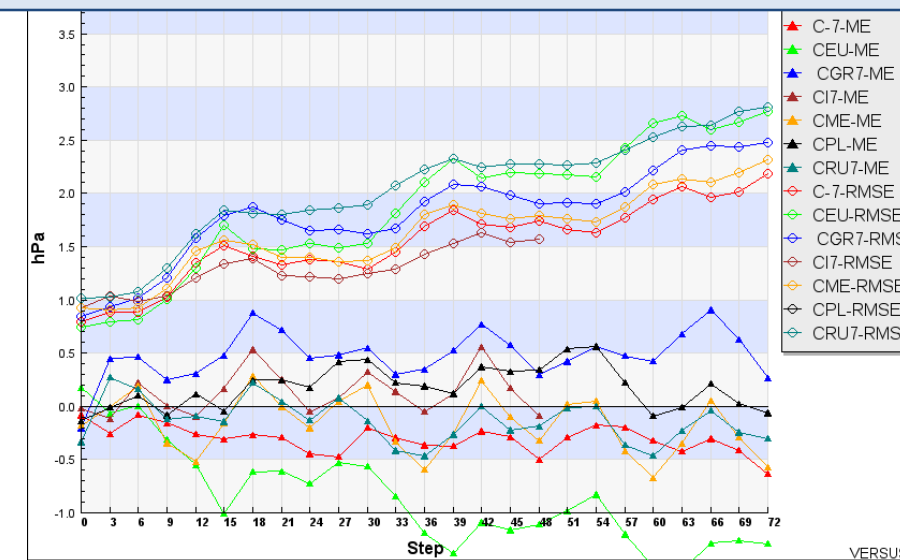
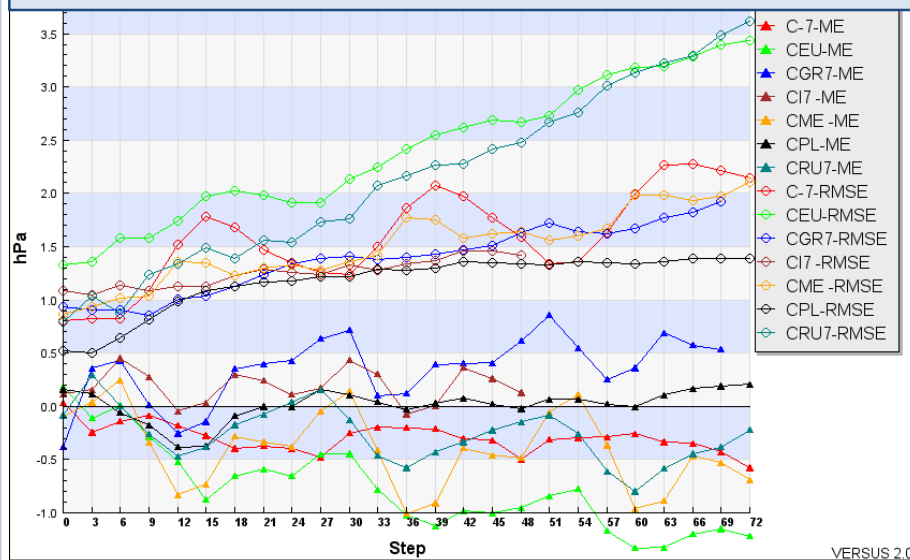


# MEAN SEA LEVEL PRESSURE - DJF 2013 – MAM 2013



DJF: CEU shows in both domains no bias value. CI7, CME and CGR show in VD overestimation that disappears in the CA (maybe due to the variability of weather in these areas). It is worth to note the evident peculiar underestimation of CRO in VD. RMSE shows improvement for CI7 and CEU, a steady value for CME and CGR, a clear worsening for CPL in the CA

MAM: CME CEU shows in both domains underestimation. almost no bias value for CPL for its own domain, but is overestimated in CA. Other models can be considered steady. RMSE shows an improvement for CRU and CEU, CGR shows higher values.

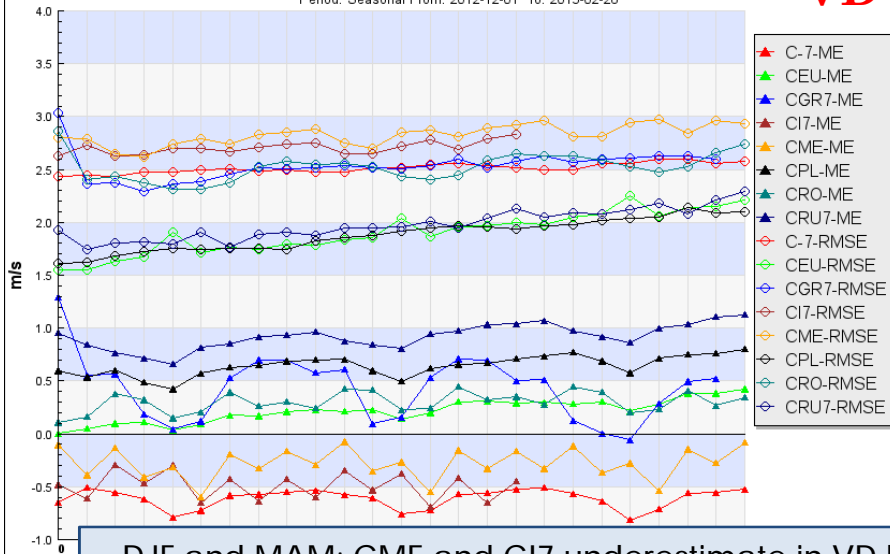


# WIND SPEED AT 10M - DJF 2013 – MAM 2013



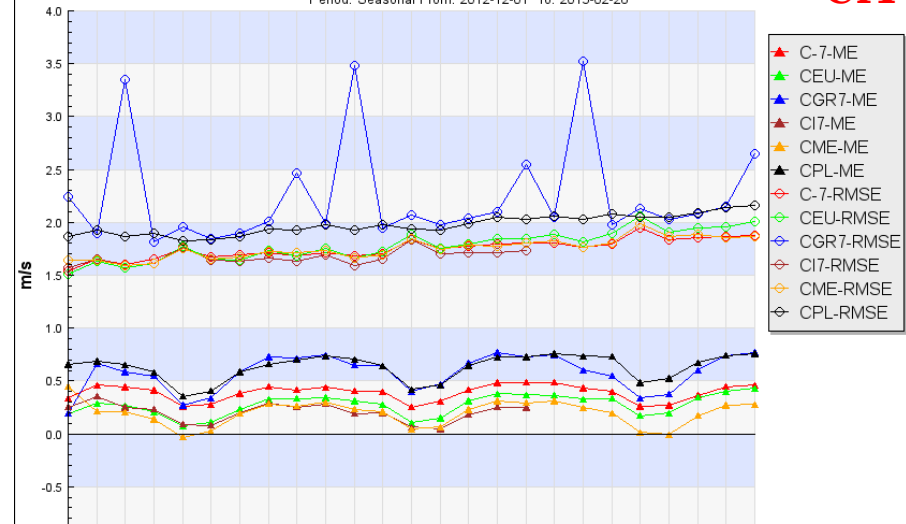
**Cross-Model: 10m wind speed**  
Period: Seasonal From: 2012-12-01 To: 2013-02-28

**VD**



**Cross-Model: 10m wind speed - CA**  
Period: Seasonal From: 2012-12-01 To: 2013-02-28

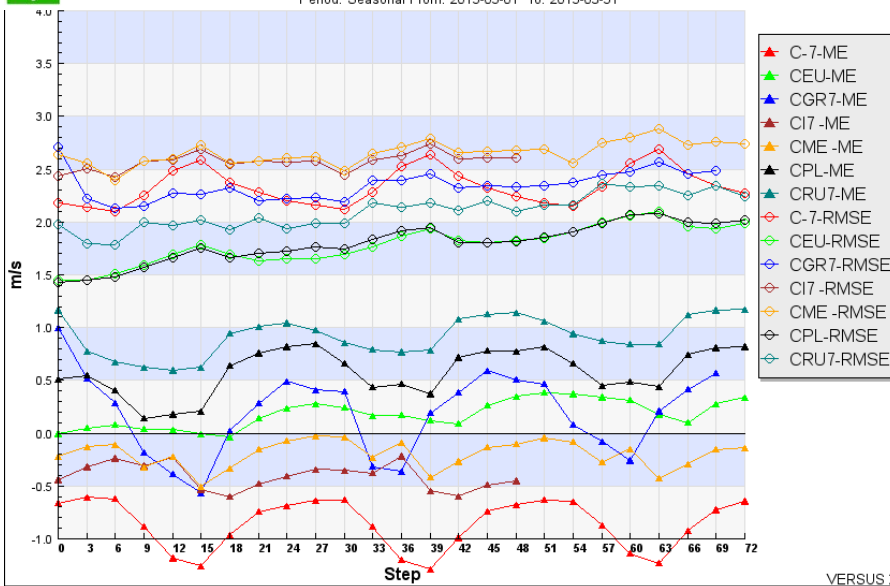
**CA**



DJF and MAM: CME and CI7 underestimate in VD but overestimate in the CA. CPL and CGR show similar ME, while CEU is slightly worse. CME, CI7, C7 and CGR improve dramatically RMSE, while CPL is worse.

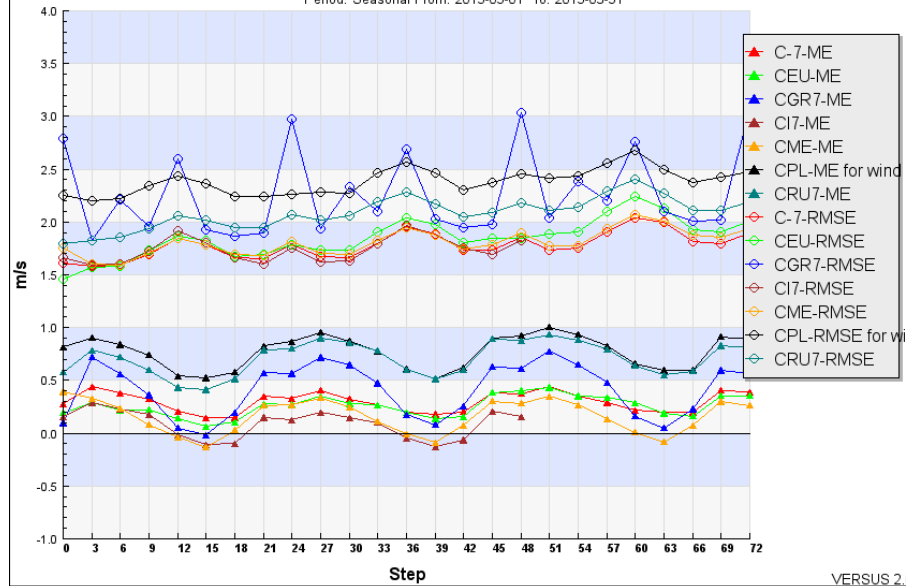


**Cross-Model: 10m wind speed**  
Period: Seasonal From: 2013-03-01 To: 2013-05-31



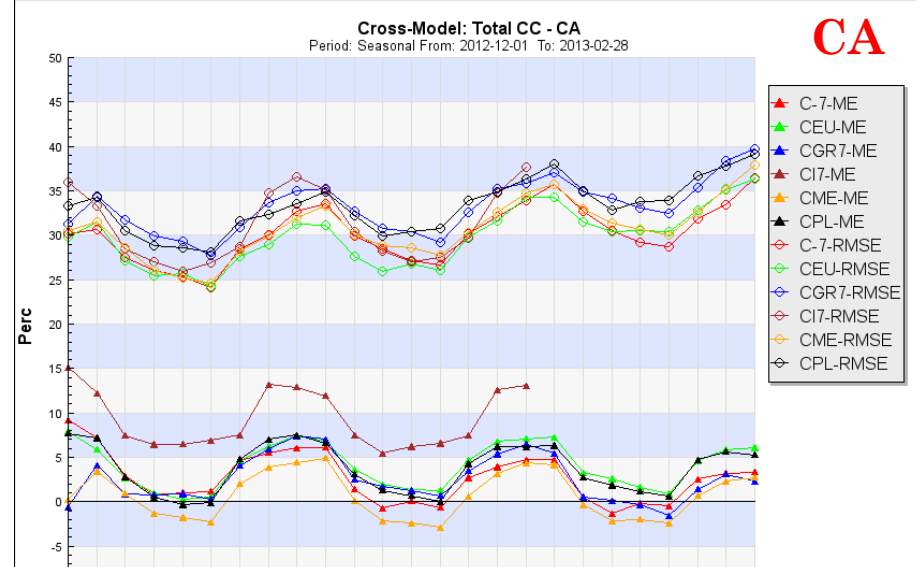
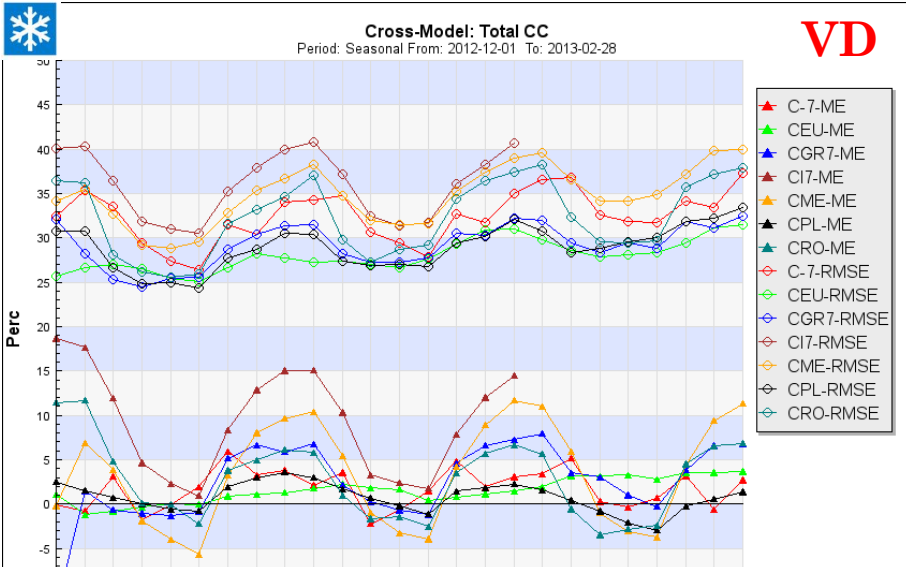
VERSUS 2.0

**Cross-Model: 10m wind speed - CA**  
Period: Seasonal From: 2013-03-01 To: 2013-05-31

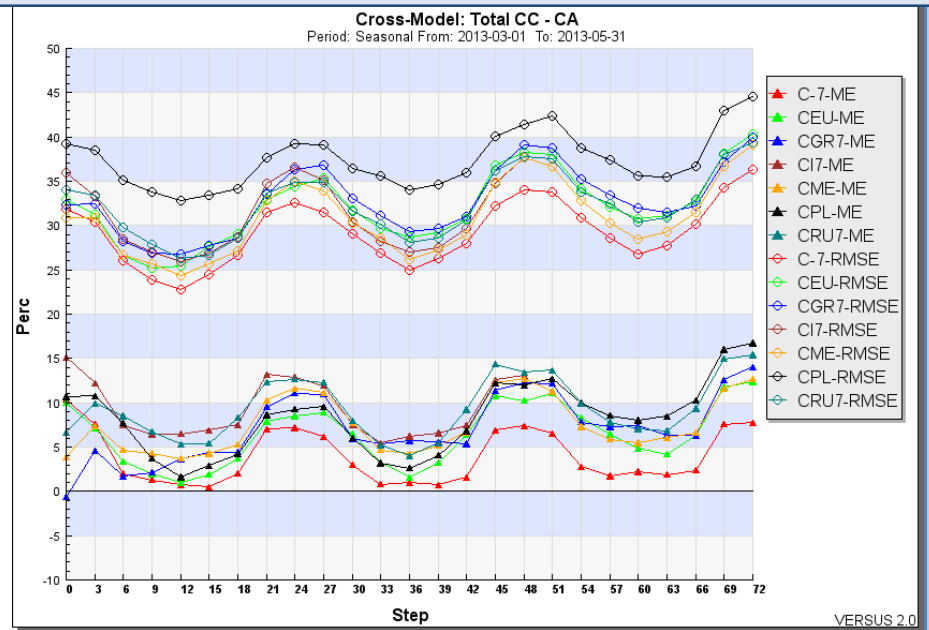
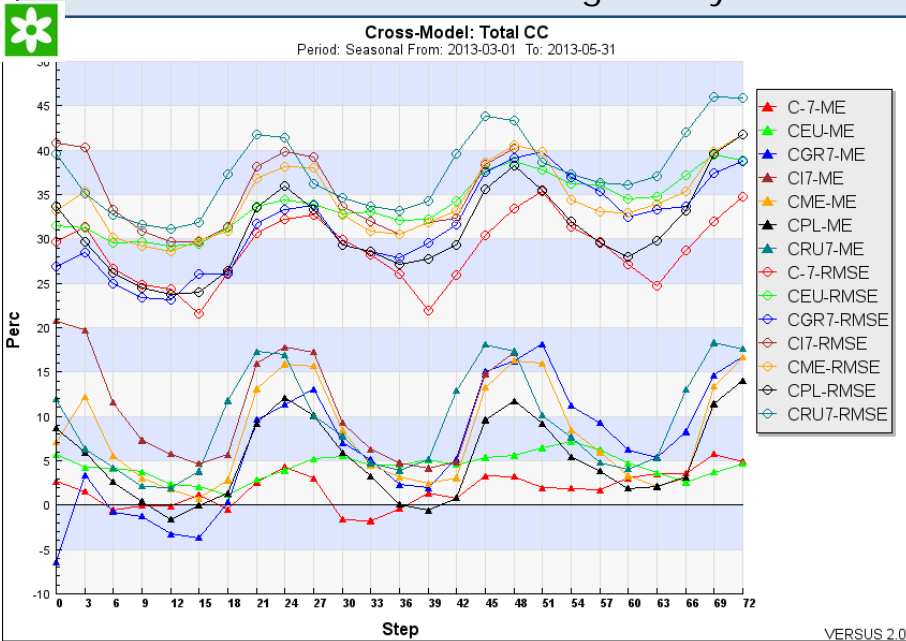


VERSUS 2.0

# TOTAL CLOUD COVER DJF 2013 – MAM 2013



DJF : Models looks similar, but with some peculiarities. The spread among the models of ME and RMSE is smaller for CA.  
 MAM: Models looks similar, but with some peculiarities. The spread among the models of ME and RMSE is smaller for CA. All the models are generally overestimating and behave better in the CA in terms of RMSE.



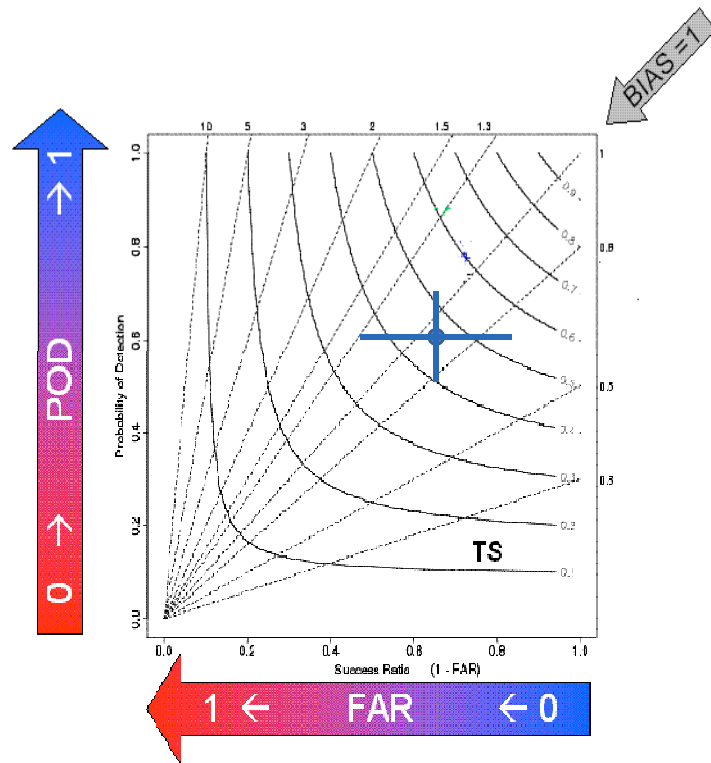
## SOME POINTS TO REMEMBER ABOUT PRECIPITATION VERIFICATION:

- The purpose of these plots is to see the overall performance of COSMO model
- Relative comparison is not “fair” because models are different (ic/bc, assimilation cycle, model version, region characteristics, number of stations used)
- Only some thresholds and cumulation time have been considered
  - they identify different rainfall regime depending on seasons and geographical characteristics





# PERFORMANCE DIAGRAM



- In the graph is exploited the geometric relationship between four measures of dichotomous forecast performance:
  - probability of detection (POD)
  - success ratio (SR, defined as 1-FAR)
  - bias score (BS)
  - threat score (TS, also known as the Critical Success Index).
- For good forecasts, POD, SR, bias and TS approach unity, such that a perfect forecast lies in the upper right of the diagram.
- The cross-hairs about the verification point represent the influence of the sampling variability.
  - They are estimated using a form of resampling with replacement bootstrapping from the verification data (from the contingency table).
  - The bars represents the 95<sup>th</sup> percentile range for SR and POD.



1

- Common area → Italy
- Dataset → high res raingauges
- Method → 24h/6h averaged cumulated precipitation or maximum values (both observed and forecasted) over 90 meteo-hydrological basins



3 methods

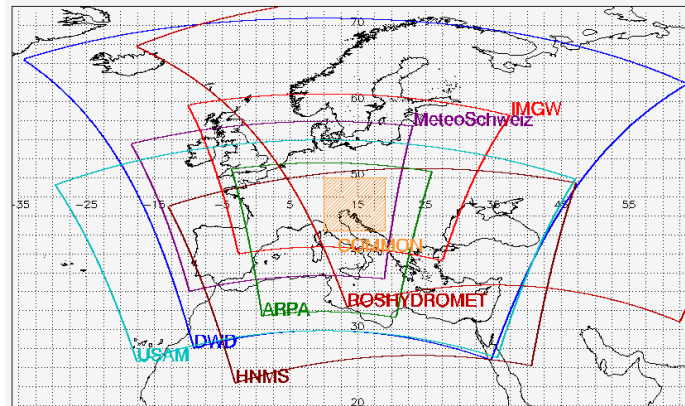
3

- Various domains → each countries dataset → synop stations
- Method → 24h/6h averaged cumulated forecasted precipitation values over 15 km radius, 24h/6h cumulated observed precipitation values over station point



2

- Common area → decided in Lugano
- Dataset → synop stations
- Method → 24h/6h averaged cumulated forecasted precipitation values over 15 km radius, 24h/6h cumulated observed precipitation values over station point

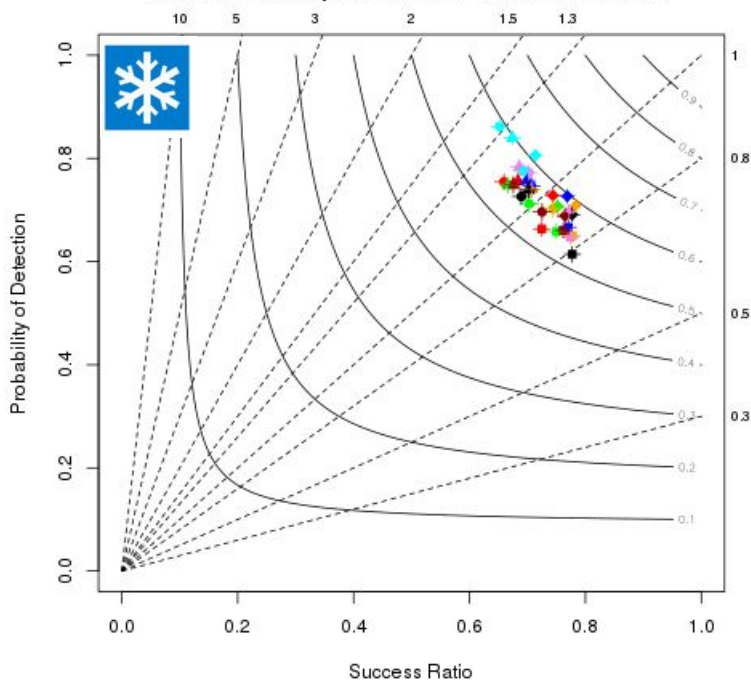


# Cumulation period: 6 h

- We considered for the 6h cumulation period only the first day of forecast:
  - + 0h to +6h
  - + 6h to +12h
  - + 12h to +18h
  - + 18h to +24h
- Reference threshold:
  - 0.2 mm
  - 2 mm
  - 10 mm

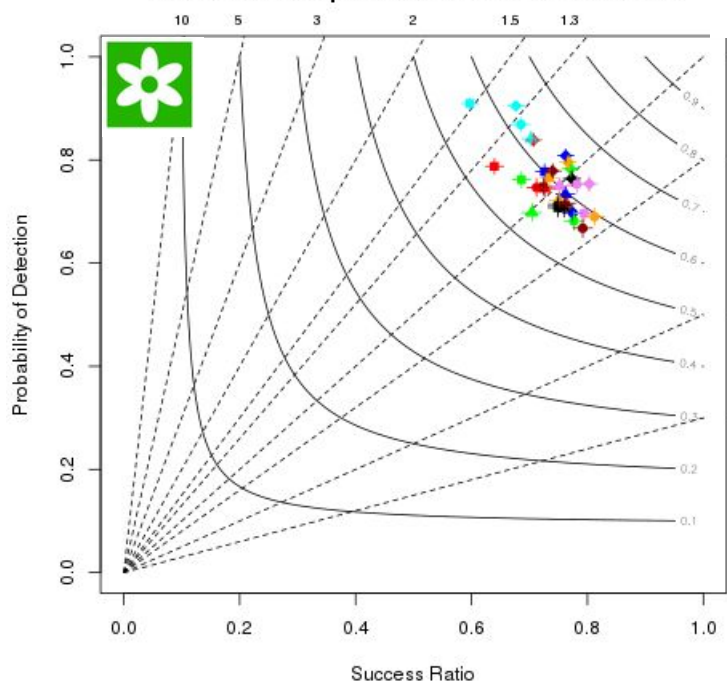
1

DJF2013: Precipitation in 6h - 0.2 mm threshold



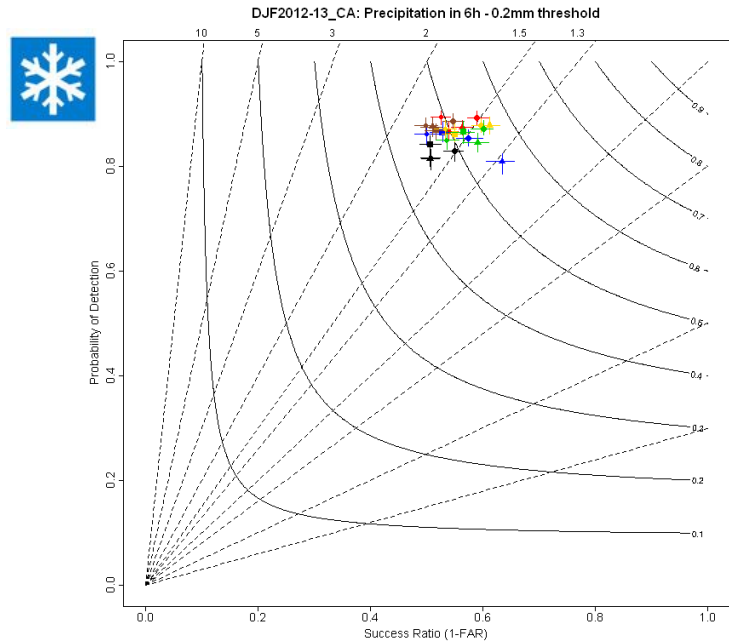
Average over area > 0.2 mm/6h

MAM2013: Precipitation in 6h - 0.2 mm threshold



Models are grouped together with good ETS and around FBI= 0, except IFS show overestimation

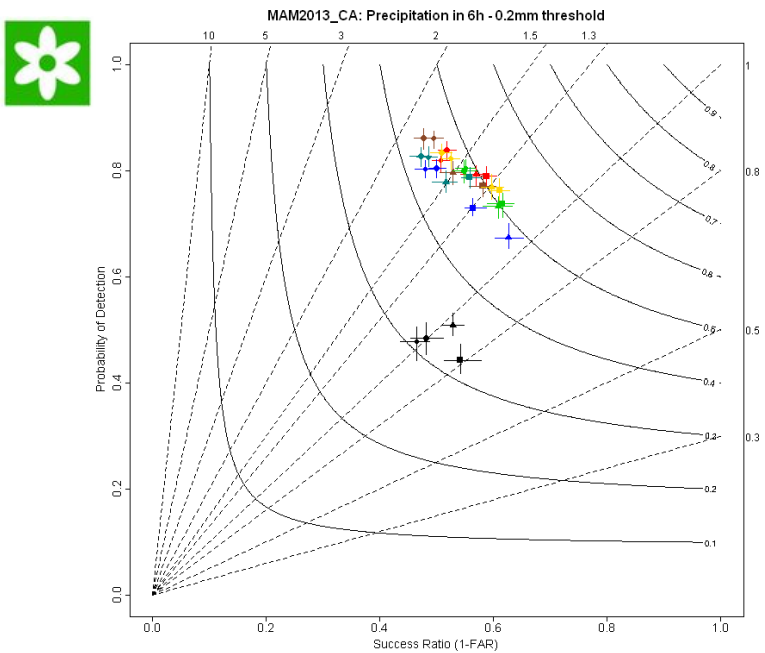
- I7 0006
- I7 0612
- ◇ I7 1218
- △ I7 1824
- 7 0006
- 7 0612
- ◇ 7 1218
- △ 7 1824
- EU 0006
- EU 0612
- ◇ EU 1218
- △ EU 1824
- ME 0006
- ME 0612
- ◇ ME 1218
- △ ME 1824
- I2 0006
- I2 0612
- ◇ I2 1218
- △ I2 1824
- IT 0006
- IT 0612
- ◇ IT 1218
- △ IT 1824
- GR 0006
- GR 0612
- ◇ GR 1218
- △ GR 1824
- ECMWF 0006
- ECMWF 0612
- ◇ ECMWF 1218
- △ ECMWF 1824



- FORECAST DAY 1
- ▲ COSMO-7 + 06
  - COSMO-7 + 12
  - ◆ COSMO-7 + 18
  - COSMO-7 + 24
  - ▲ COSMO-GR + 06
  - COSMO-GR + 12
  - ◆ COSMO-GR + 18
  - COSMO-GR + 24
  - ▲ COSMO-I7 + 06
  - COSMO-I7 + 12
  - ◆ COSMO-I7 + 18
  - COSMO-I7 + 24
  - ▲ COSMO-ME + 06
  - COSMO-ME + 12
  - ◆ COSMO-ME + 18
  - COSMO-ME + 24
  - ▲ COSMO-PL + 06
  - COSMO-PL + 12
  - ◆ COSMO-PL + 18
  - COSMO-PL + 24
  - ▲ COSMO-EU + 06
  - COSMO-EU + 12
  - ◆ COSMO-EU + 18
  - COSMO-EU + 24

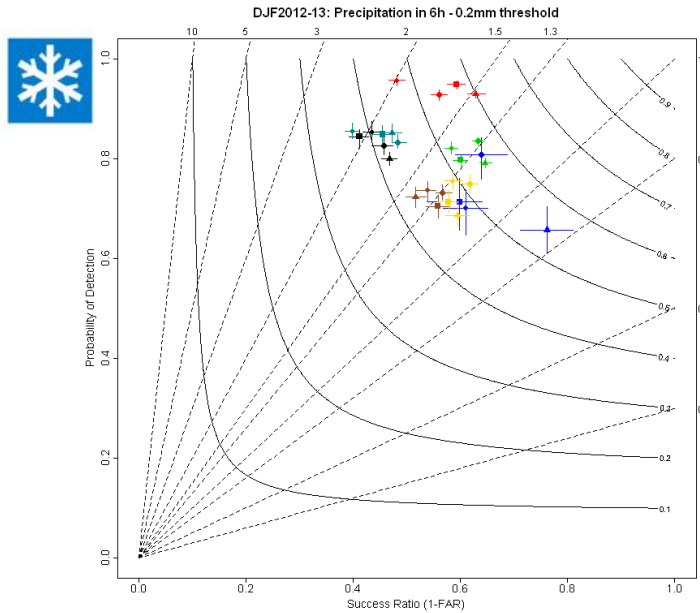
Average over area > 0.2 mm/6h

2



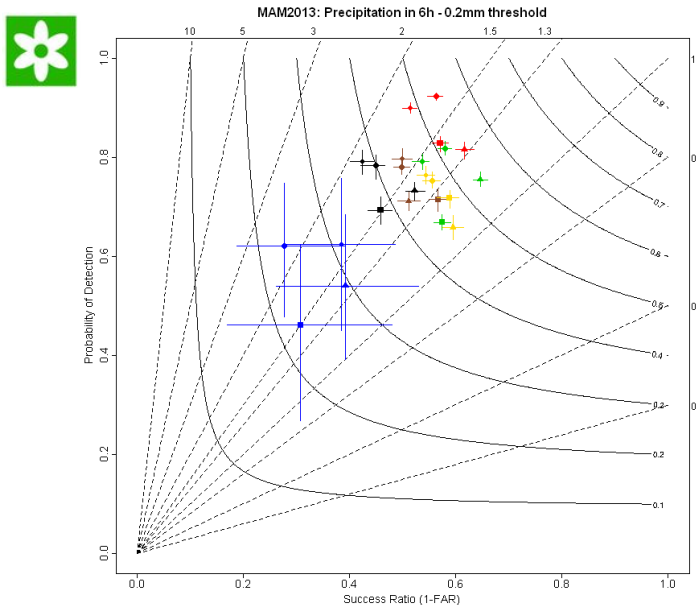
- FORECAST DAY 1
- ▲ COSMO-7 + 06
  - COSMO-7 + 12
  - ◆ COSMO-7 + 18
  - COSMO-7 + 24
  - ▲ COSMO-GR + 06
  - COSMO-GR + 12
  - ◆ COSMO-GR + 18
  - COSMO-GR + 24
  - ▲ COSMO-I7 + 06
  - COSMO-I7 + 12
  - ◆ COSMO-I7 + 18
  - COSMO-I7 + 24
  - ▲ COSMO-ME + 06
  - COSMO-ME + 12
  - ◆ COSMO-ME + 18
  - COSMO-ME + 24
  - ▲ COSMO-PL + 06
  - COSMO-PL + 12
  - ◆ COSMO-PL + 18
  - COSMO-PL + 24
  - ▲ COSMO-EU + 06
  - COSMO-EU + 12
  - ◆ COSMO-EU + 18
  - COSMO-EU + 24
  - ▲ COSMO-RU + 06
  - COSMO-RU + 12
  - ◆ COSMO-RU + 18
  - COSMO-RU + 24

Again models are grouped together in CA 2, with tendency to overestimation



Average over area > 0.2 mm/6h

3

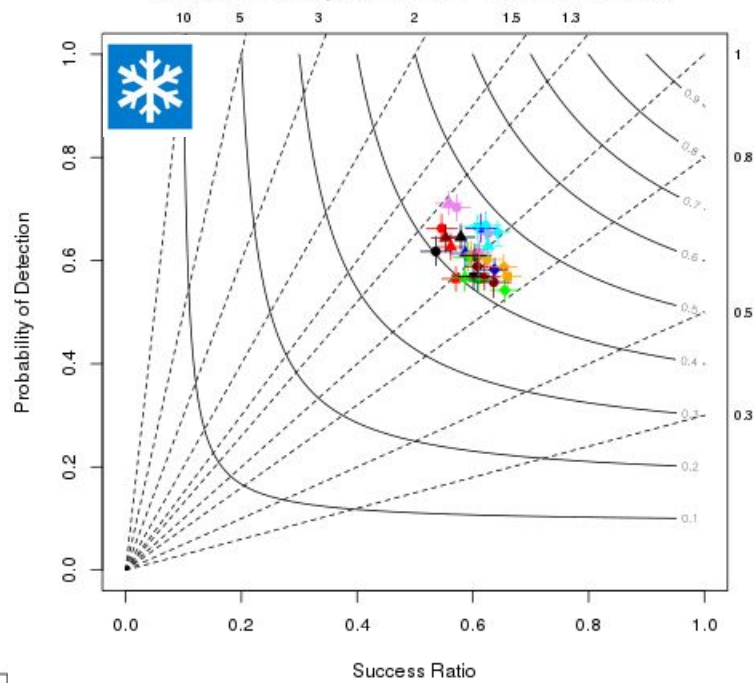


Models are not grouped together anymore in their domains, tendency to overestimation remains

Next slides for higher thresholds show similar behaviour

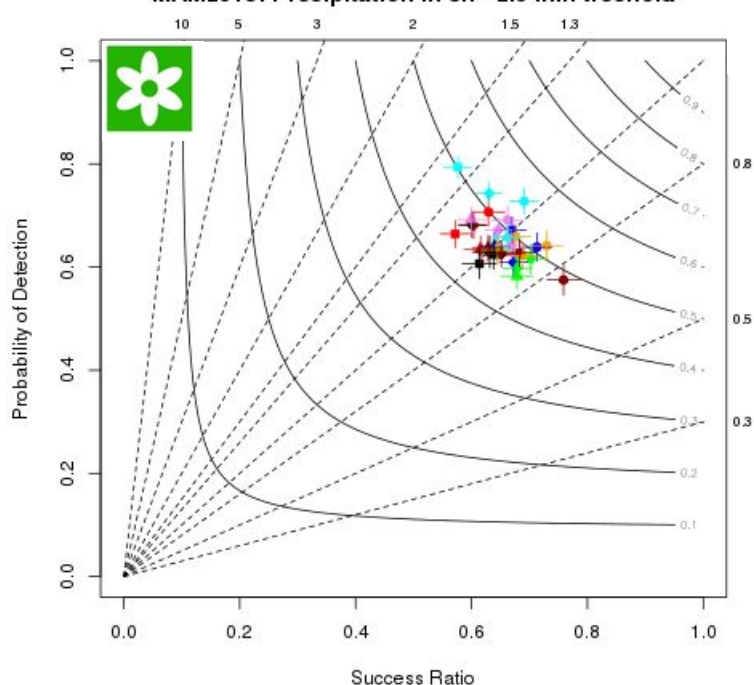
1

DJF2013: Precipitation in 6h - 2.0 mm threshold



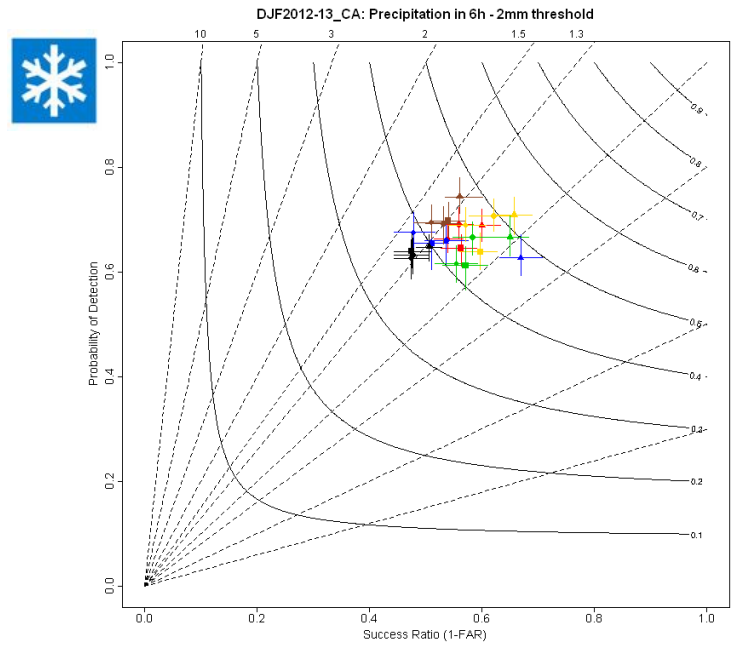
Average over area > 2 mm/6h

MAM2013: Precipitation in 6h - 2.0 mm threshold



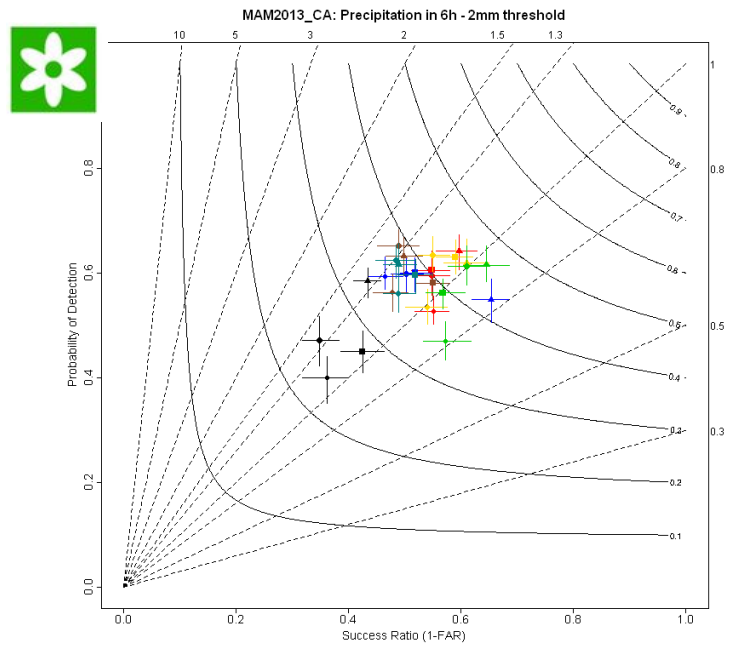
IFS exhibits less overestimation

- I7 0006
- I7 0612
- ◇ I7 1218
- △ I7 1824
- 7 0006
- 7 0612
- ◇ 7 1218
- △ 7 1824
- EU 0006
- EU 0612
- ◇ EU 1218
- △ EU 1824
- ME 0006
- ME 0612
- ◇ ME 1218
- △ ME 1824
- I2 0006
- I2 0612
- ◇ I2 1218
- △ I2 1824
- IT 0006
- IT 0612
- ◇ IT 1218
- △ IT 1824
- GR 0006
- GR 0612
- ◇ GR 1218
- △ GR 1824
- ECMWF 0006
- ECMWF 0612
- ◇ ECMWF 1218
- △ ECMWF 1824



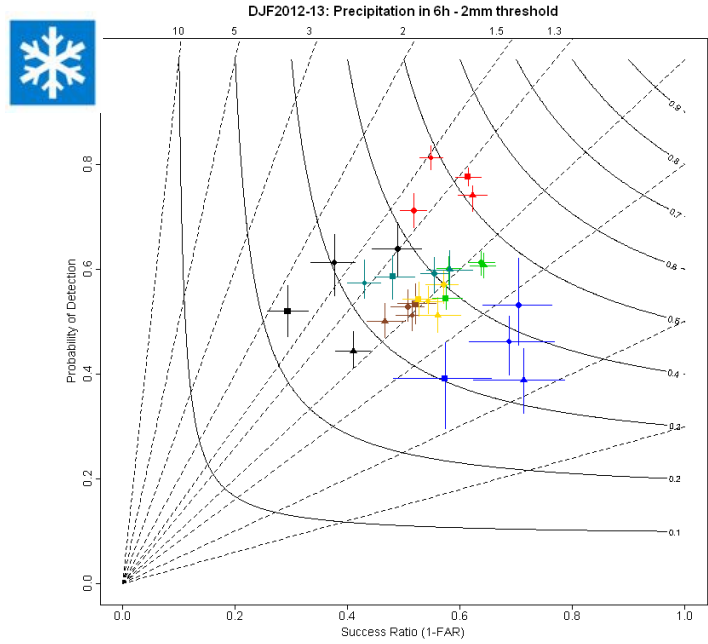
Average over area > 2 mm/6h

2



Similar situation of CA

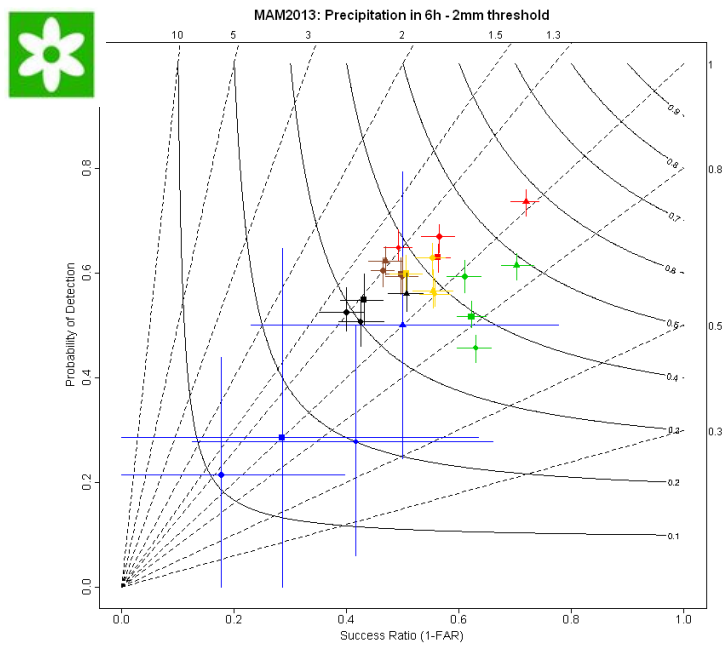




- FORECAST DAY 1
- ▲ COSMO-7 + 06
  - COSMO-7 + 12
  - ◆ COSMO-7 + 18
  - COSMO-7 + 24
  - ▲ COSMO-GR + 06
  - COSMO-GR + 12
  - ◆ COSMO-GR + 18
  - COSMO-GR + 24
  - ▲ COSMO-I7 + 06
  - COSMO-I7 + 12
  - ◆ COSMO-I7 + 18
  - COSMO-I7 + 24
  - ▲ COSMO-ME + 06
  - COSMO-ME + 12
  - ◆ COSMO-ME + 18
  - COSMO-ME + 24
  - ▲ COSMO-PL + 06
  - COSMO-PL + 12
  - ◆ COSMO-PL + 18
  - COSMO-PL + 24
  - ▲ COSMO-EU + 06
  - COSMO-EU + 12
  - ◆ COSMO-EU + 18
  - COSMO-EU + 24
  - ▲ COSMO-RO + 06
  - COSMO-RO + 12
  - ◆ COSMO-RO + 18
  - COSMO-RO + 24

Average  
over area >  
2 mm/6h

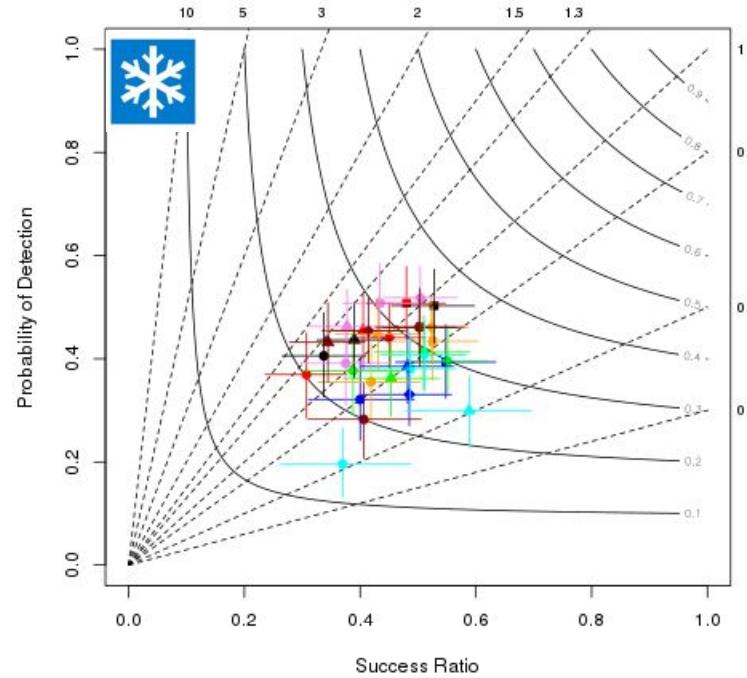
3



- FORECAST DAY 1
- ▲ COSMO-7 + 06
  - COSMO-7 + 12
  - ◆ COSMO-7 + 18
  - COSMO-7 + 24
  - ▲ COSMO-GR + 06
  - COSMO-GR + 12
  - ◆ COSMO-GR + 18
  - COSMO-GR + 24
  - ▲ COSMO-I7 + 06
  - COSMO-I7 + 12
  - ◆ COSMO-I7 + 18
  - COSMO-I7 + 24
  - ▲ COSMO-ME + 06
  - COSMO-ME + 12
  - ◆ COSMO-ME + 18
  - COSMO-ME + 24
  - ▲ COSMO-PL + 06
  - COSMO-PL + 12
  - ◆ COSMO-PL + 18
  - COSMO-PL + 24
  - ▲ COSMO-EU + 06
  - COSMO-EU + 12
  - ◆ COSMO-EU + 18
  - COSMO-EU + 24

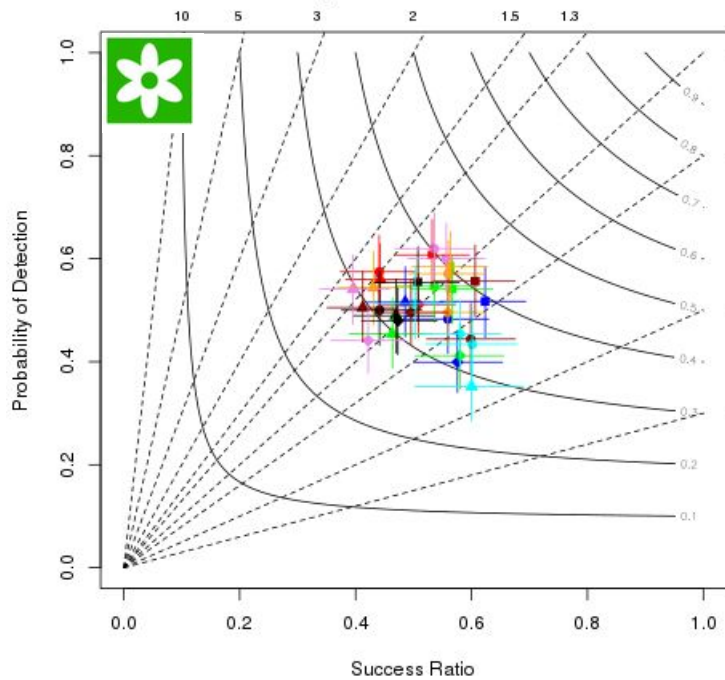
1

DJF2013: Precipitation in 6h - 10.0 mm treshold



Average over area > 10 mm/6h

MAM2013: Precipitation in 6h - 10.0 mm treshold

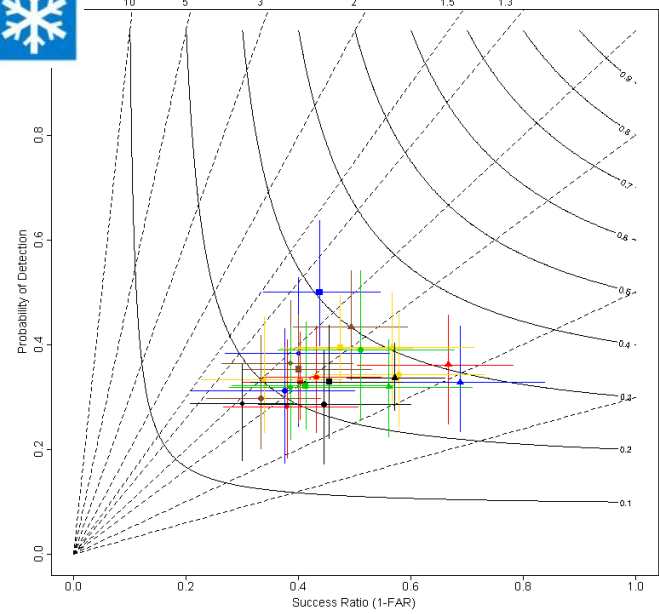


Uncertainty grows. Low scores for IFS

- I7 0006
- I7 0612
- ◇ I7 1218
- △ I7 1824
- 7 0006
- 7 0612
- ◇ 7 1218
- △ 7 1824
- EU 0006
- EU 0612
- ◇ EU 1218
- △ EU 1824
- ME 0006
- ME 0612
- ◇ ME 1218
- △ ME 1824
- I2 0006
- I2 0612
- ◇ I2 1218
- △ I2 1824
- IT 0006
- IT 0612
- ◇ IT 1218
- △ IT 1824
- GR 0006
- GR 0612
- ◇ GR 1218
- △ GR 1824
- ECMWF 0006
- ECMWF 0612
- ◇ ECMWF 1218
- △ ECMWF 1824



DJF2012-13\_CA: Precipitation in 6h - 10mm threshold



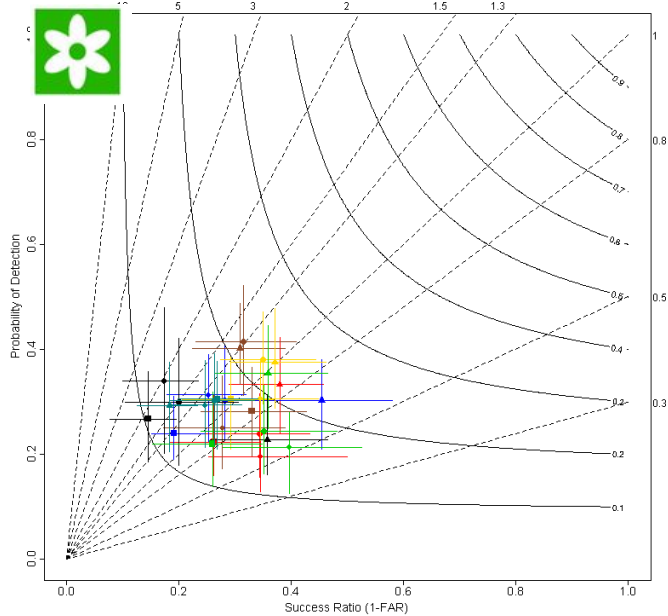
- FORECAST DAY 1
- ▲ COSMO-7 + 06
  - COSMO-7 + 12
  - COSMO-7 + 18
  - COSMO-7 + 24
  - ▲ COSMO-GR + 06
  - COSMO-GR + 12
  - COSMO-GR + 18
  - COSMO-GR + 24
  - ▲ COSMO-I7 + 06
  - COSMO-I7 + 12
  - COSMO-I7 + 18
  - COSMO-I7 + 24
  - ▲ COSMO-ME + 06
  - COSMO-ME + 12
  - COSMO-ME + 18
  - COSMO-ME + 24
  - ▲ COSMO-PL + 06
  - COSMO-PL + 12
  - COSMO-PL + 18
  - COSMO-PL + 24
  - ▲ COSMO-EU + 06
  - COSMO-EU + 12
  - COSMO-EU + 18
  - COSMO-EU + 24

Average over area > 10 mm/6h

2

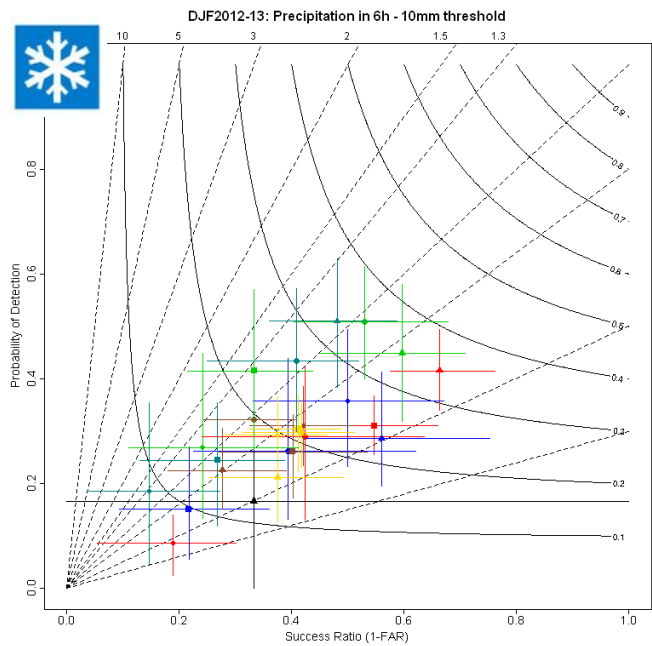


MAM2013\_CA: Precipitation in 6h - 10mm threshold



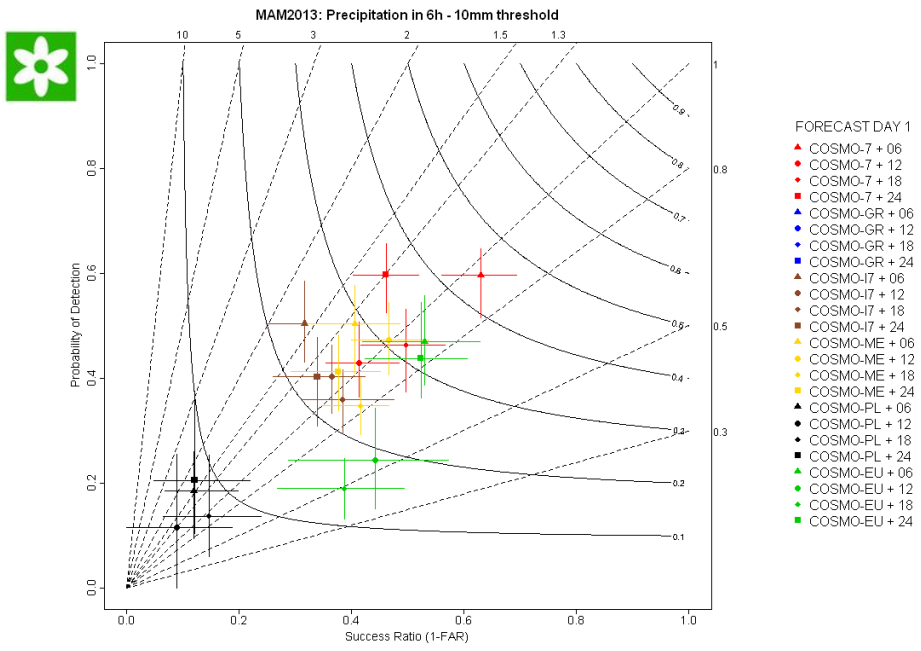
- FORECAST DAY 1
- ▲ COSMO-7 + 06
  - COSMO-7 + 12
  - COSMO-7 + 18
  - COSMO-7 + 24
  - ▲ COSMO-GR + 06
  - COSMO-GR + 12
  - COSMO-GR + 18
  - COSMO-GR + 24
  - ▲ COSMO-I7 + 06
  - COSMO-I7 + 12
  - COSMO-I7 + 18
  - COSMO-I7 + 24
  - ▲ COSMO-ME + 06
  - COSMO-ME + 12
  - COSMO-ME + 18
  - COSMO-ME + 24
  - ▲ COSMO-PL + 06
  - COSMO-PL + 12
  - COSMO-PL + 18
  - COSMO-PL + 24
  - ▲ COSMO-EU + 06
  - COSMO-EU + 12
  - COSMO-EU + 18
  - COSMO-EU + 24
  - ▲ COSMO-RU + 06
  - COSMO-RU + 12
  - COSMO-RU + 18
  - COSMO-RU + 24

Similar situation of CA-1. Lower scores due probably to the use of SYNOP in CA-2 and high resolution network in CA-1



Average  
over area >  
10 mm/6h

3



# Some considerations

1. Useful to investigate the characteristics, peculiarity, the errors and deficiencies of the own model version over the own territory, **BUT it is also necessary to have a wider vision**→ a common area (CA1 or/and CA2) with a **common dataset** (base rate) used by everyone in order to compare **objectively** the results
2. **How big is the impact of the methodology of verification on the final results?**
3. Over Italy we consider observed and forecasted mean values over areas, instead over CA and VD we average only the forecasted values (15 km radius) compare with the single synop station: is it too unfair for the model?
4. There are some similarities between CA1 and CA2 results, BUT with a general tendency of overestimation over CA2: probably it is connected with the use of single station observation.

# Thank you – Ευχαριστώ

WG5

WG5

COSMO GM Plenary session, 2-5 Sept 2013, Sibiu