

Operational Verification at HNMS

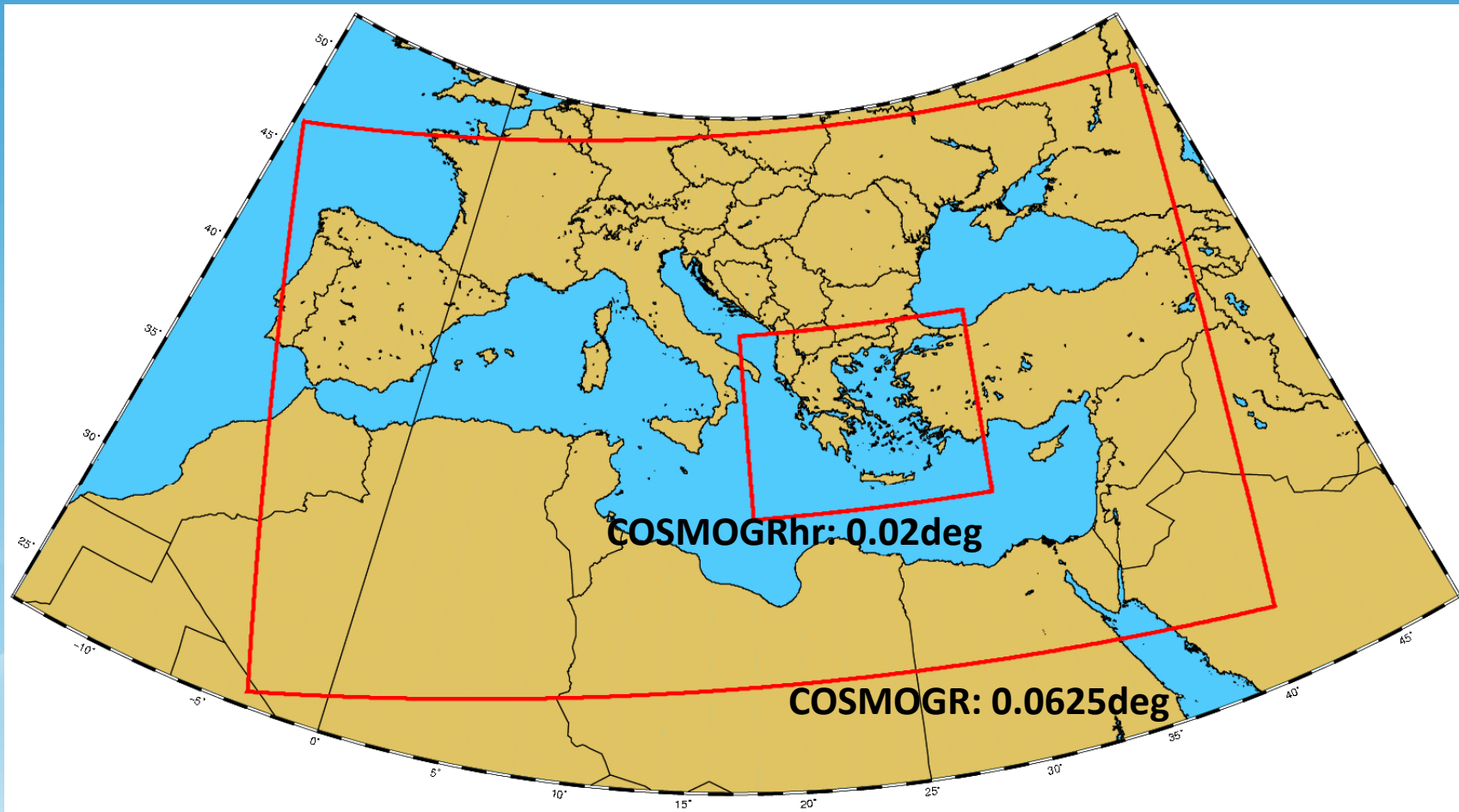
Flora Gofa



**ΕΘΝΙΚΗ
ΜΕΤΕΩΡΟΛΟΓΙΚΗ
ΥΠΗΡΕΣΙΑ**

HELLENIC NATIONAL METEOROLOGICAL SERVICE

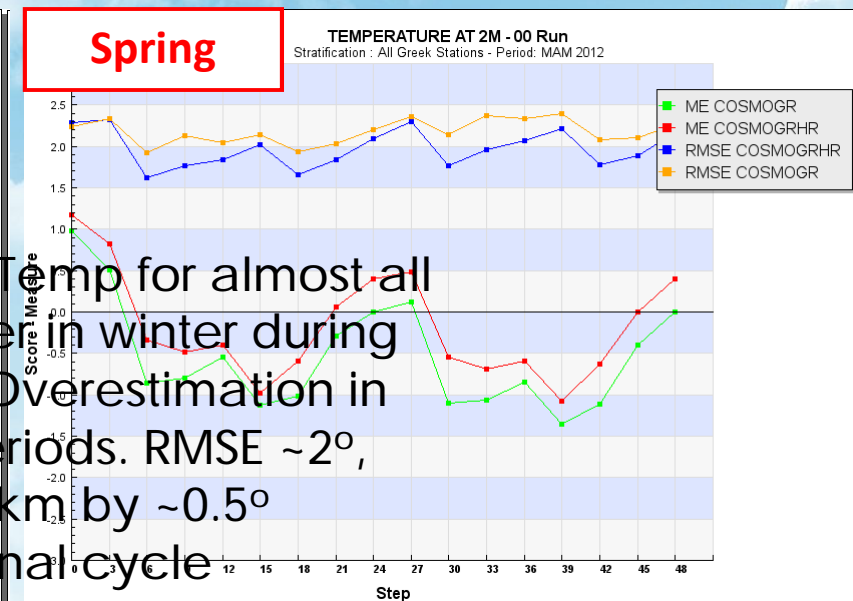
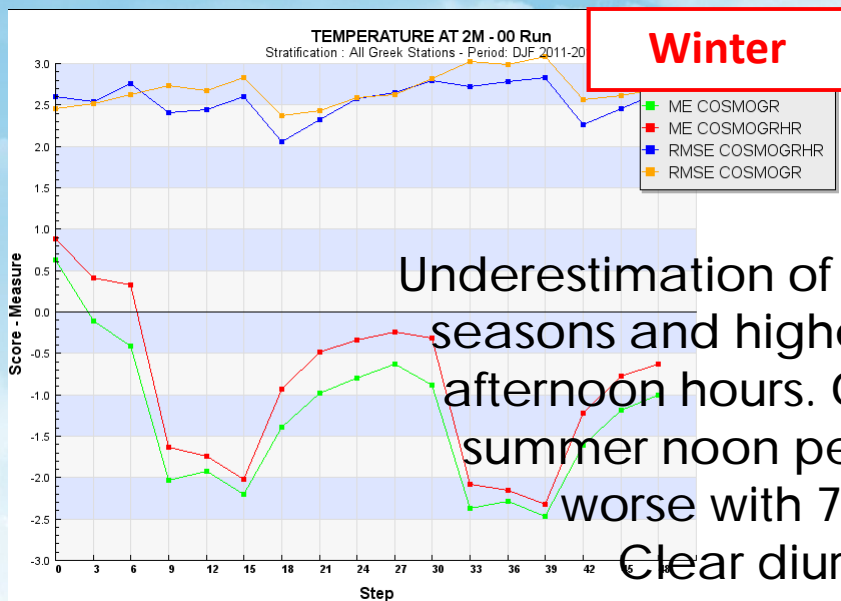
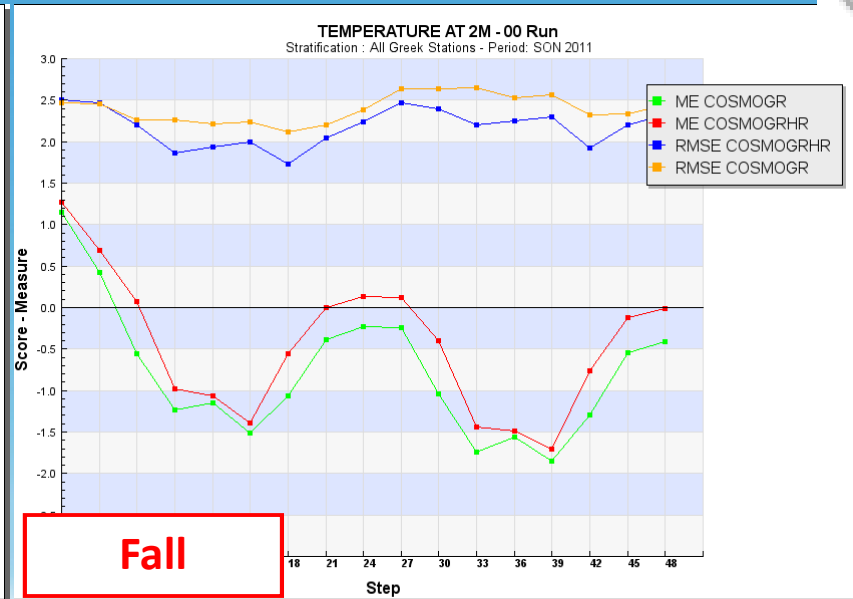
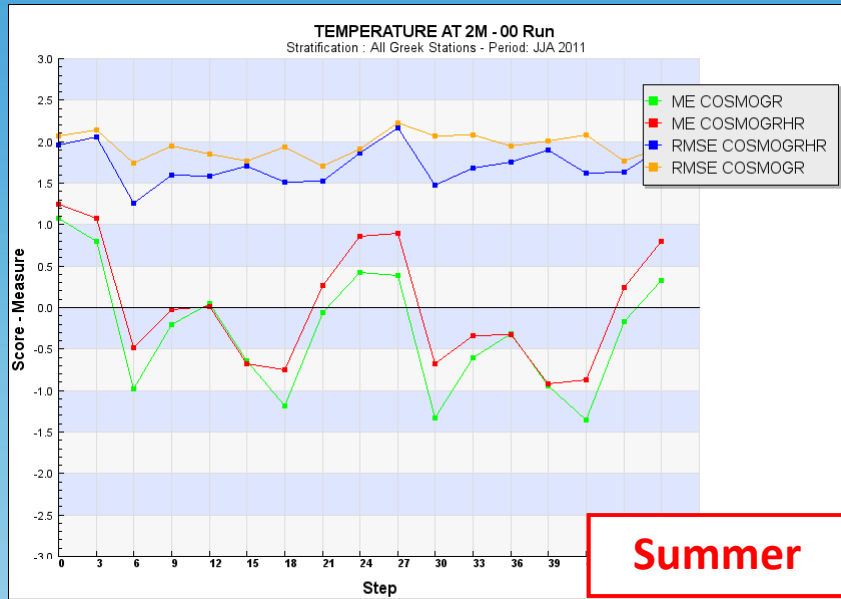
WG5 COSMO General Meeting, Lugano 2012



COSMOGR Grid Area

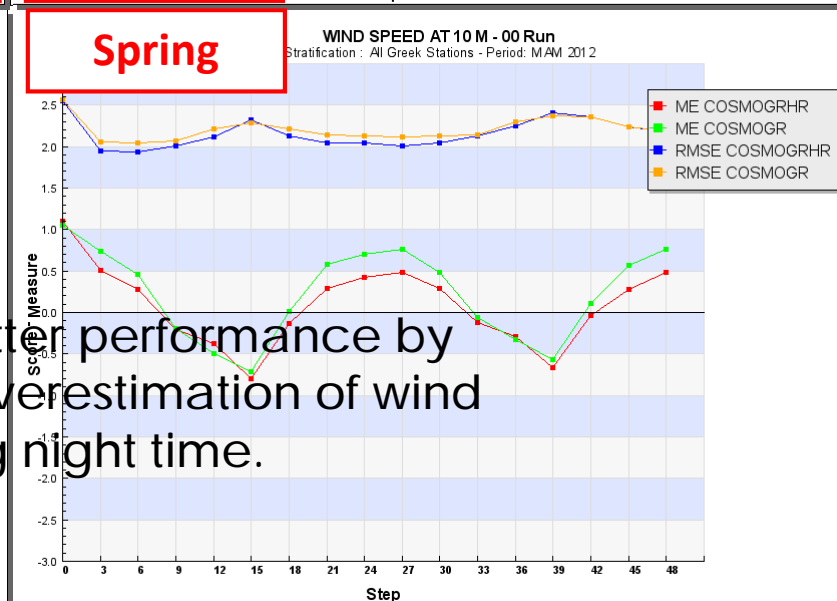
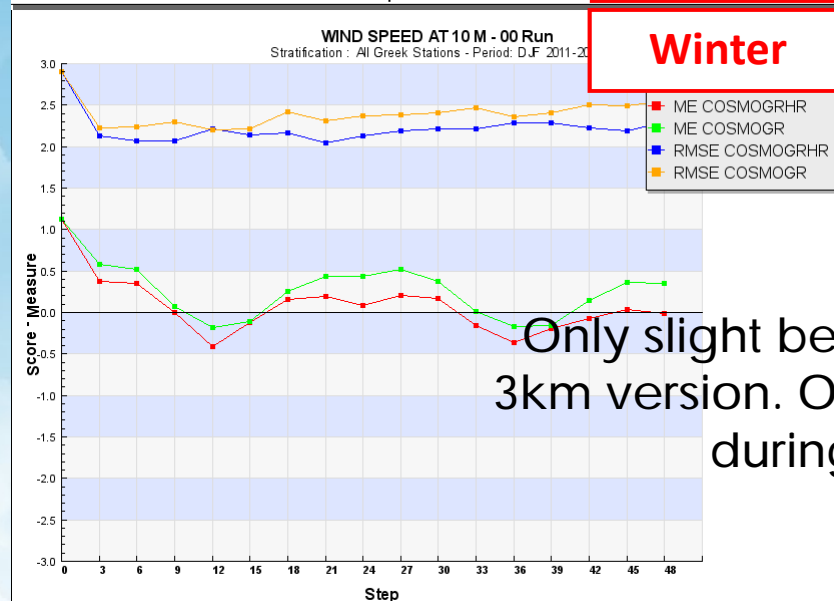
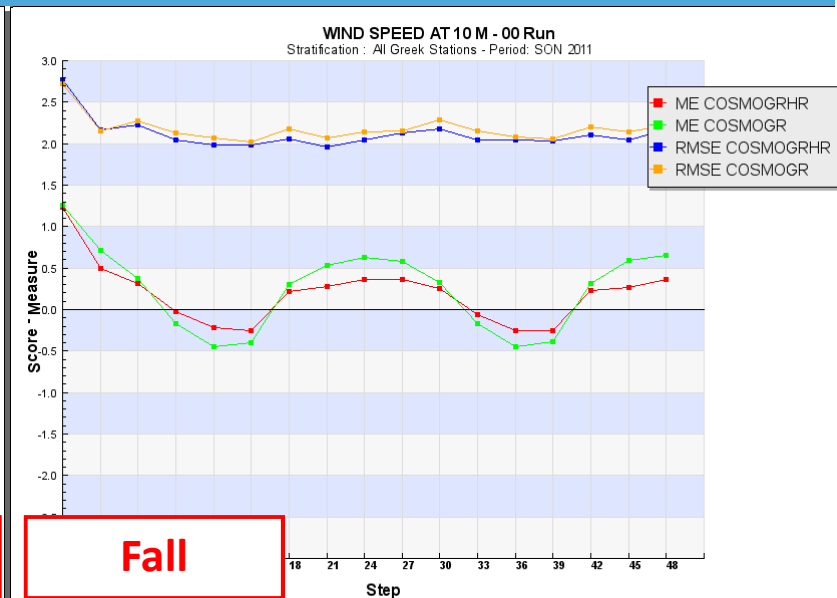
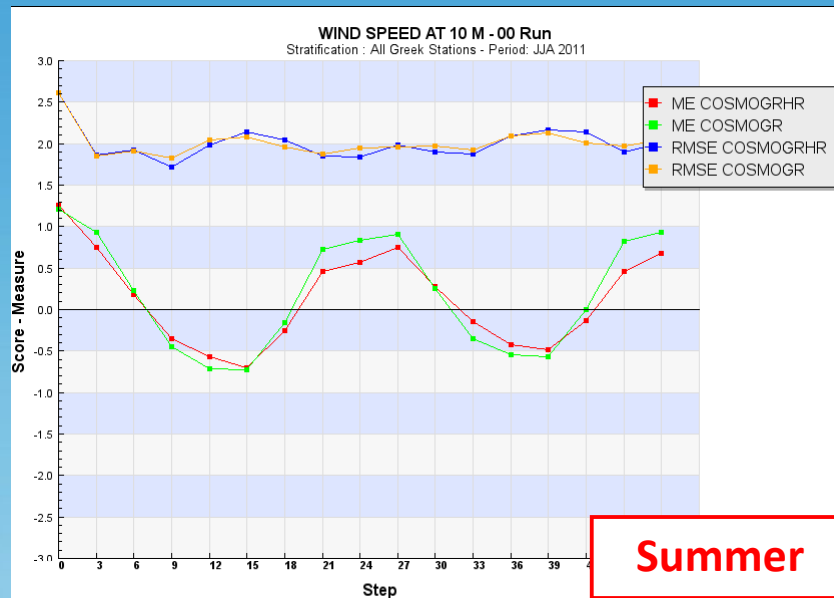
WG5 COSMO General Meeting, Lugano 2012

Temp 2m - 7km vs 3km



Underestimation of Temp for almost all seasons and higher in winter during afternoon hours. Overestimation in summer noon periods. RMSE ~2°, worse with 7km by ~0.5°
Clear diurnal cycle

Wind Speed - 7km vs 3km



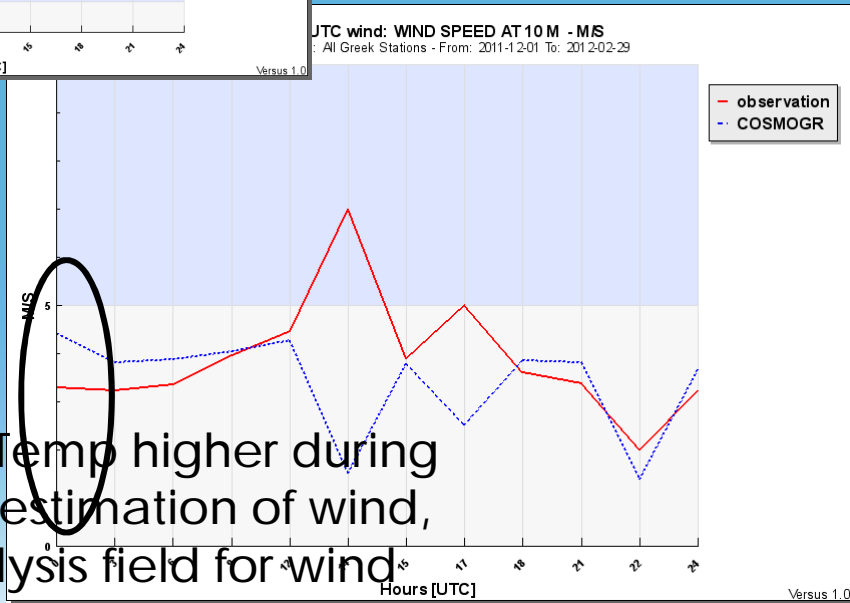
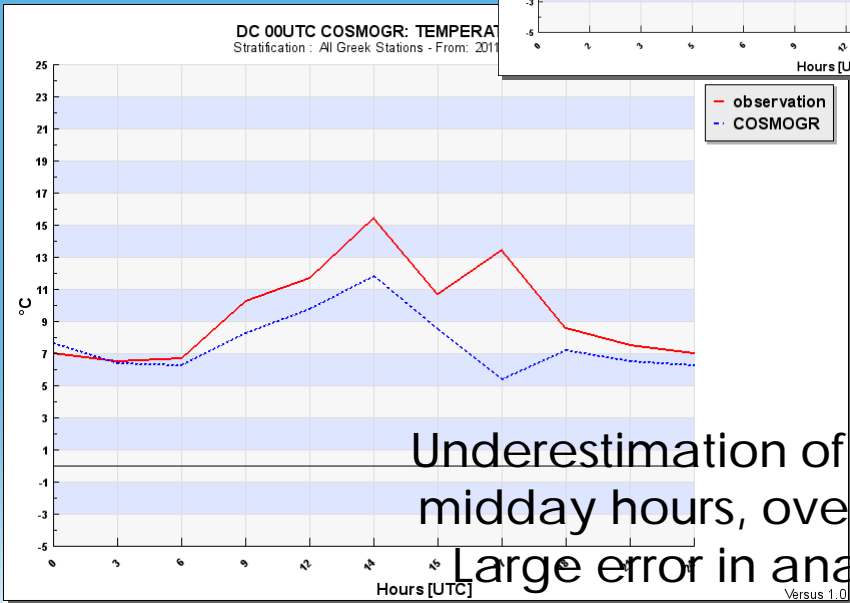
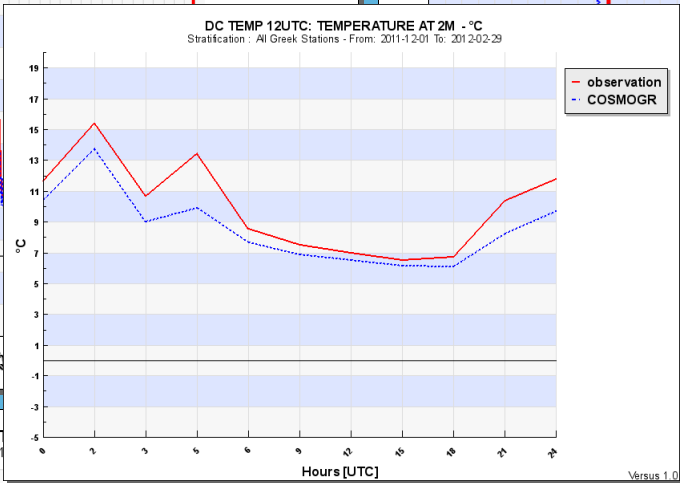
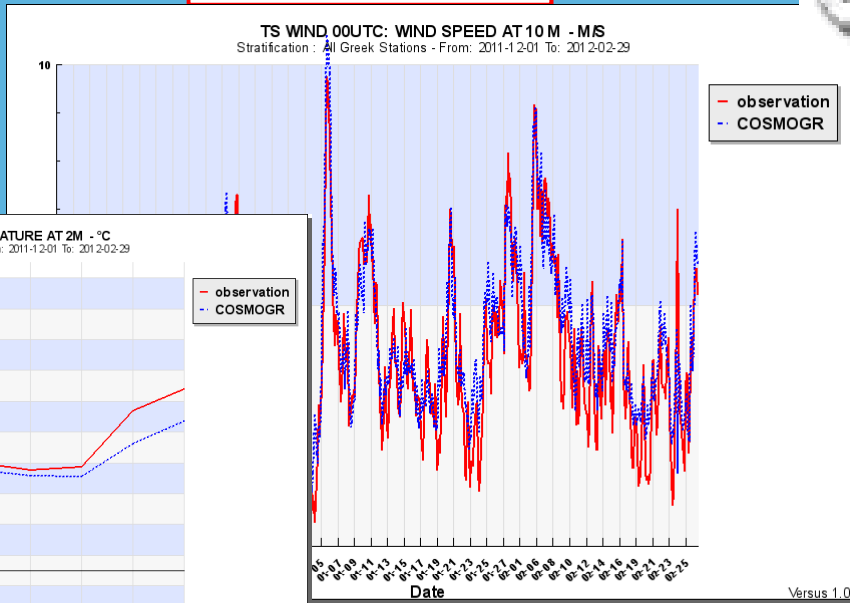
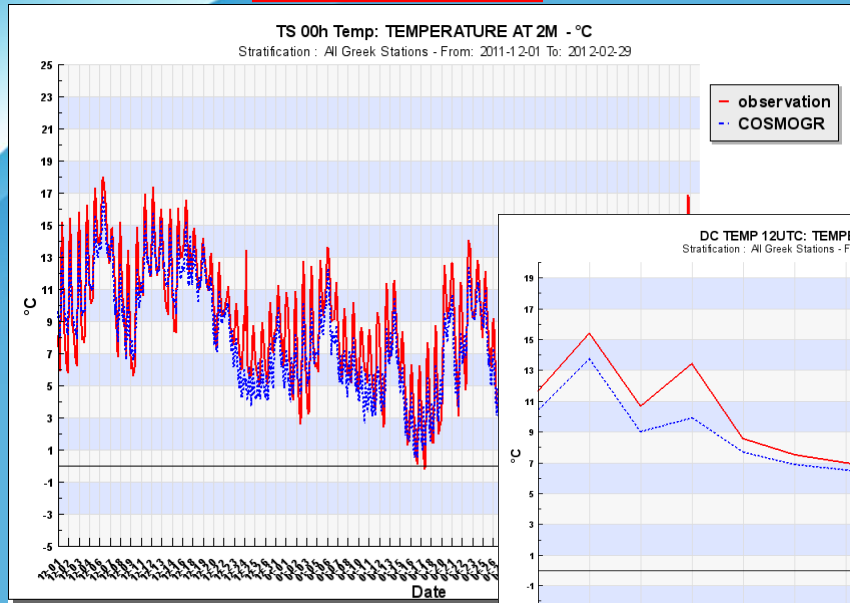
Only slight better performance by 3km version. Overestimation of wind during night time.

WINTER



2m Temp

Wind Speed



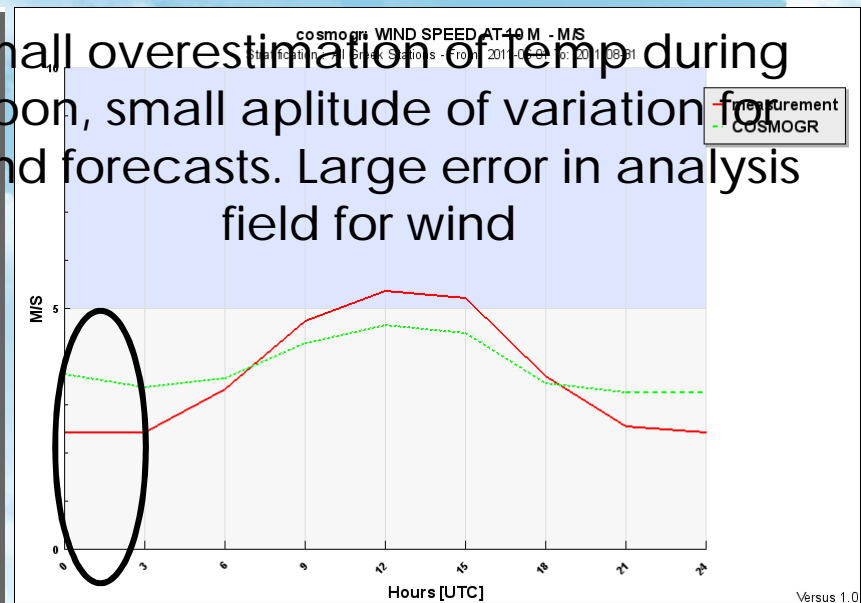
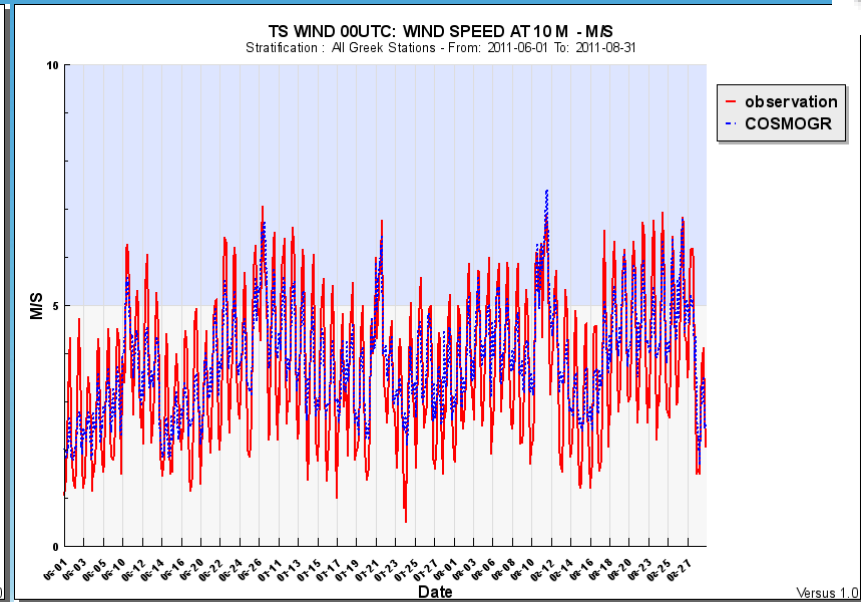
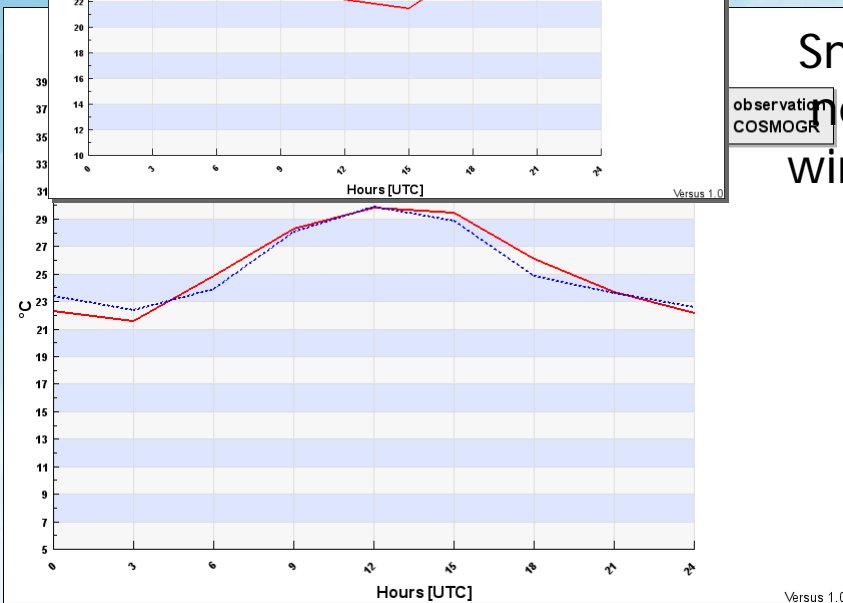
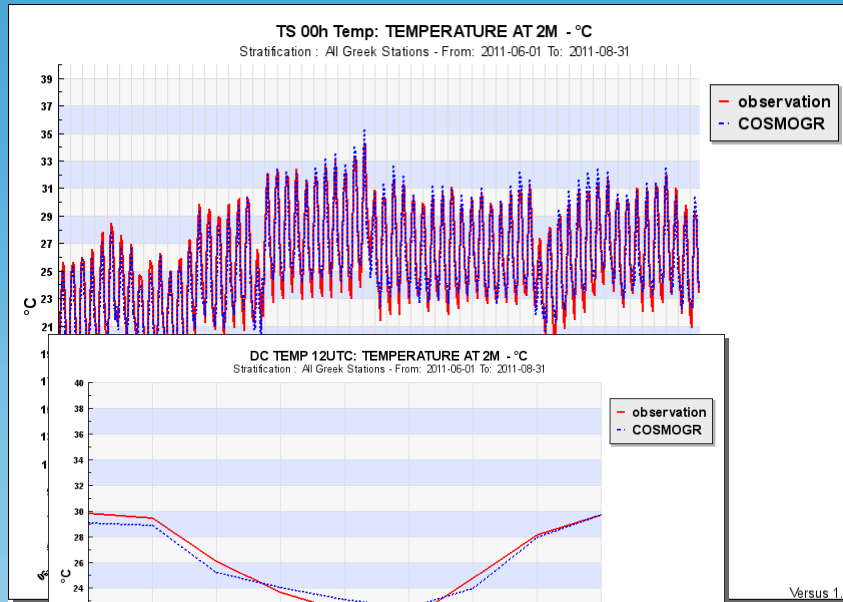
Underestimation of Temp higher during midday hours, overestimation of wind,

Large error in analysis field for wind

2m Temp

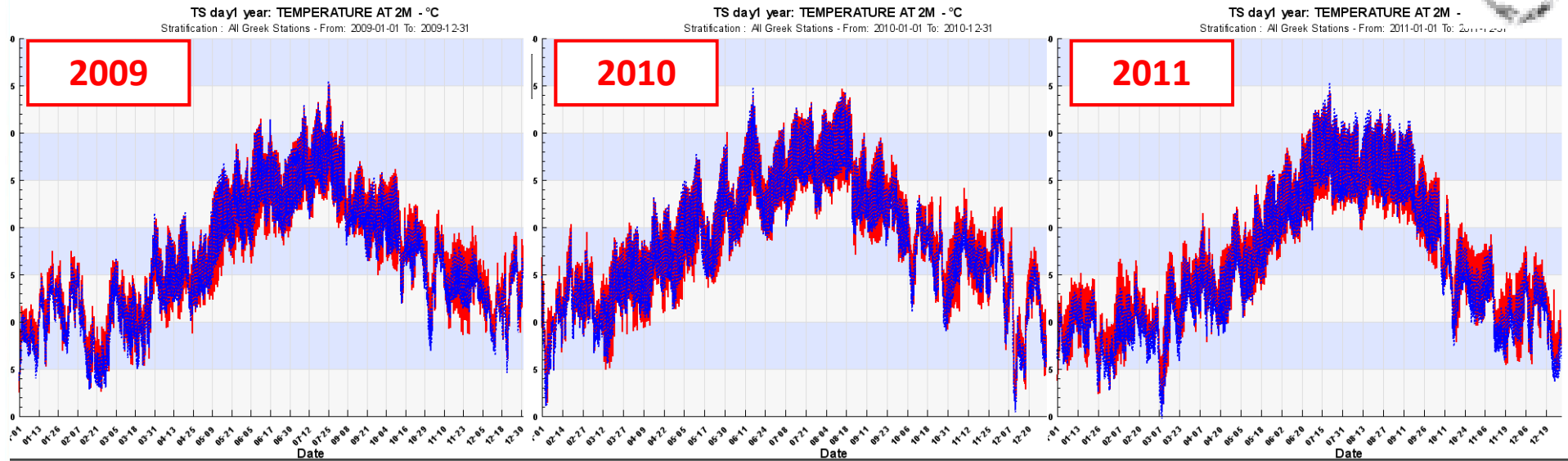
SUMMER

Wind Speed

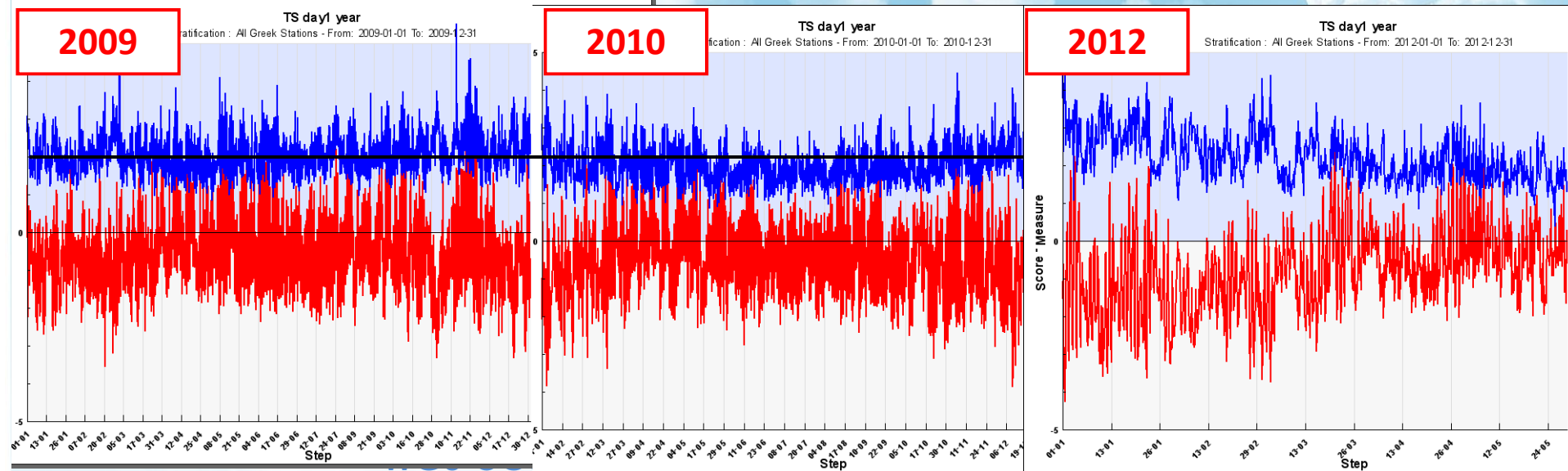


Small overestimation of temp during noon, small amplitude of variation for wind forecasts. Large error in analysis field for wind

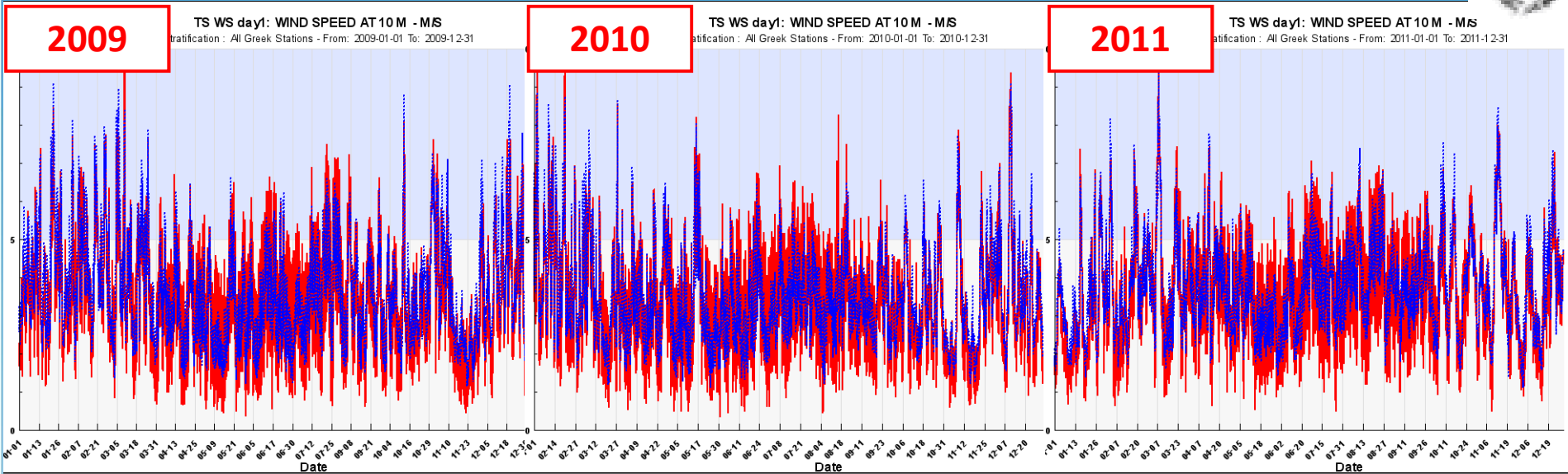
2M TEMP day1: fcs-obs TS



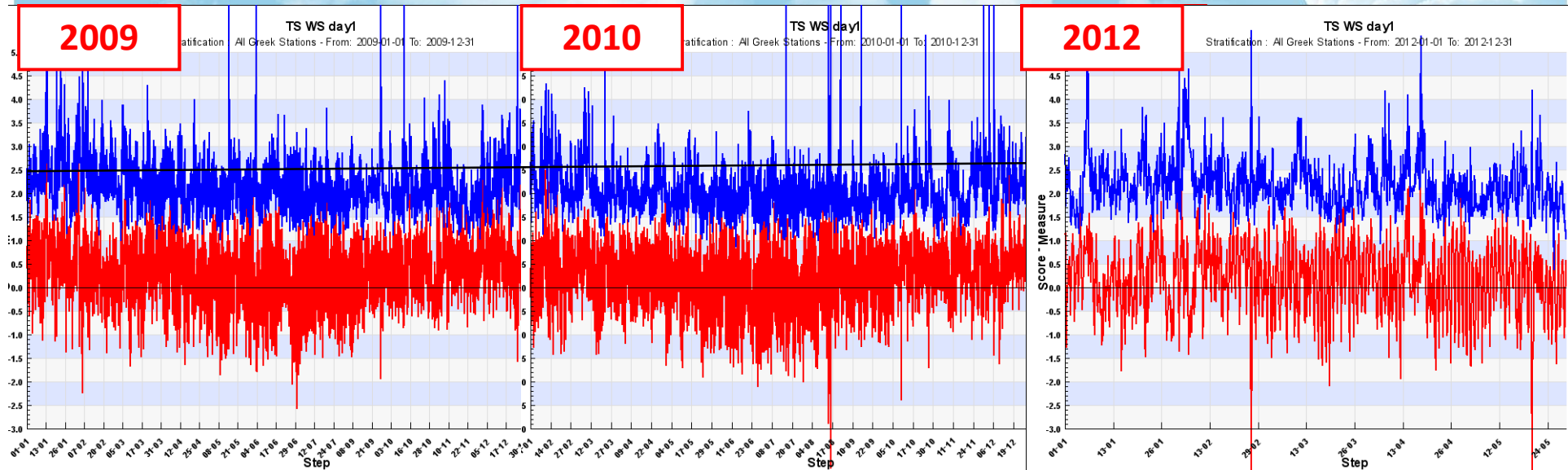
2M TEMP day1: RMSE-ME TS



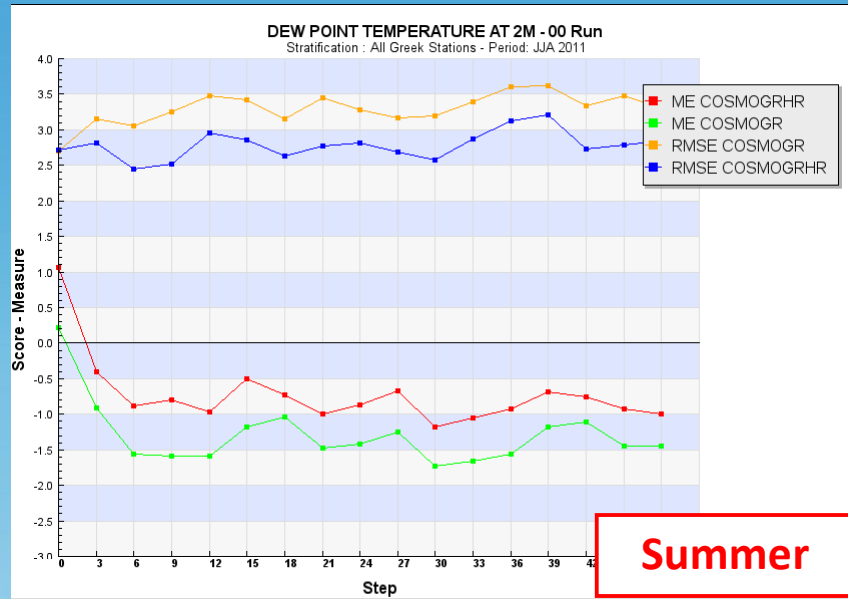
Wind speed day1: **fct-obs** TS



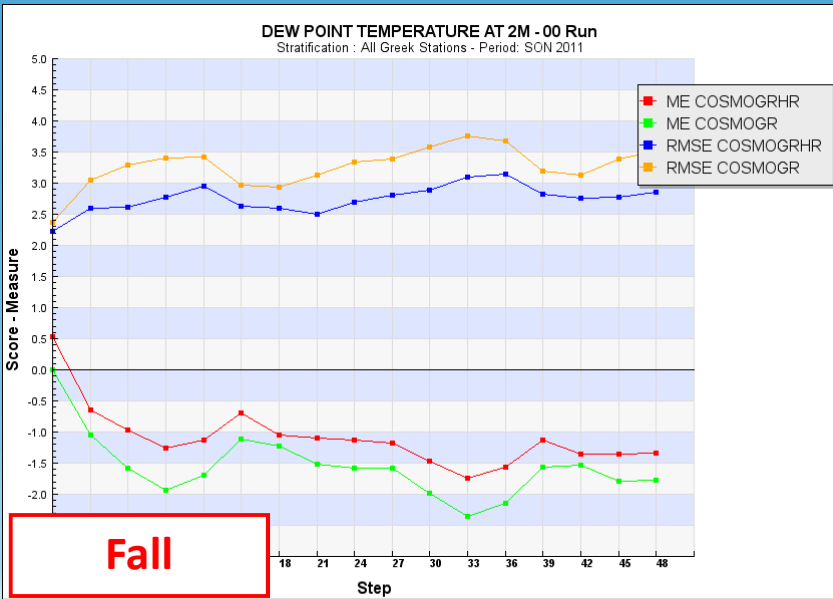
Wind speed day1: **RMSE-ME** TS



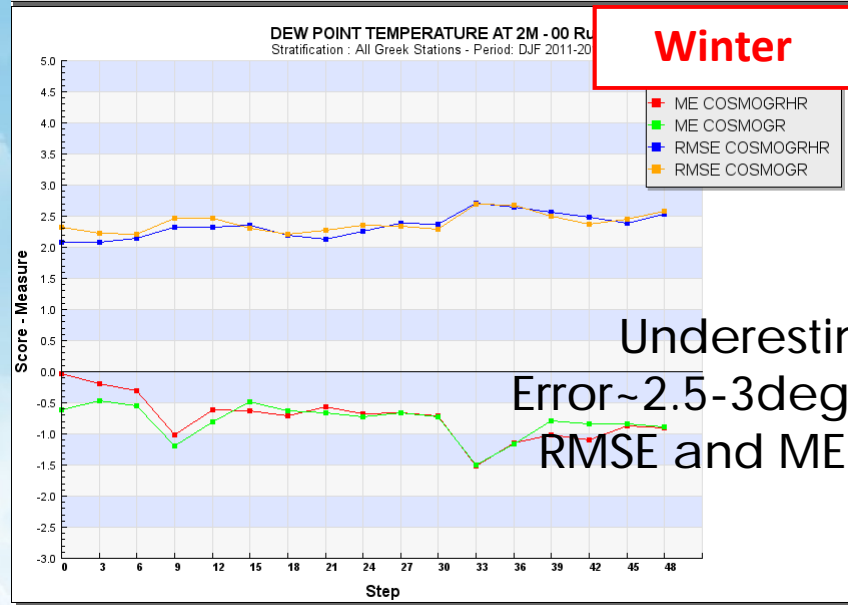
DewP Temp - 7km vs 3km



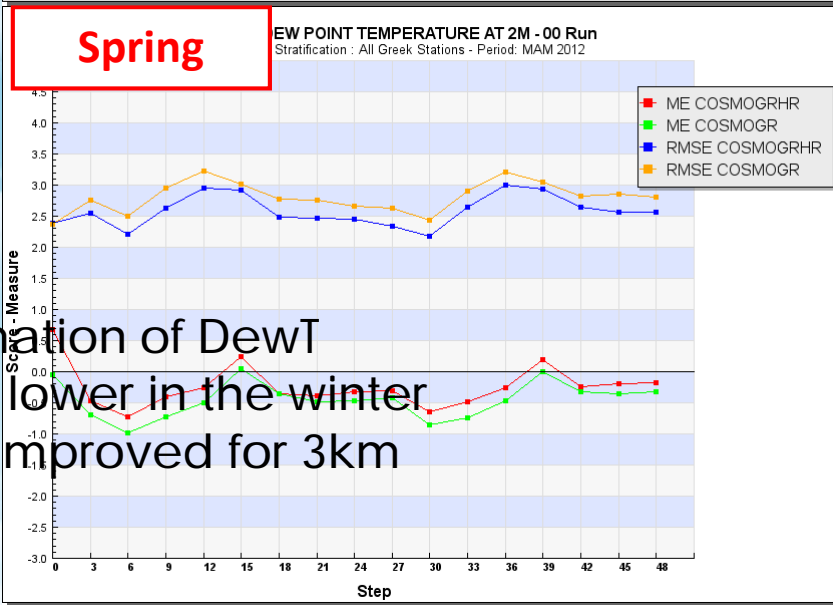
Summer



Fall



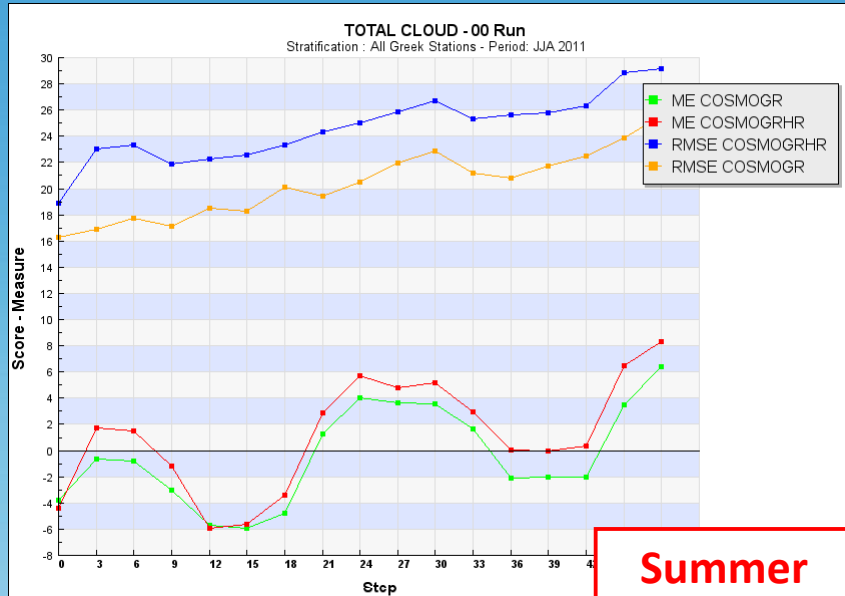
Winter



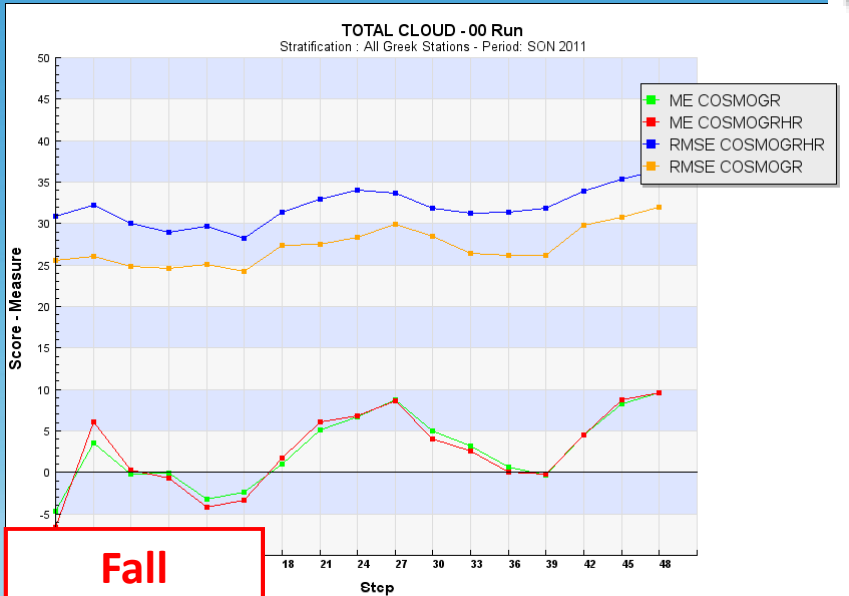
Spring

Underestimation of DewT
 Error ~2.5-3deg, lower in the winter
 RMSE and ME improved for 3km

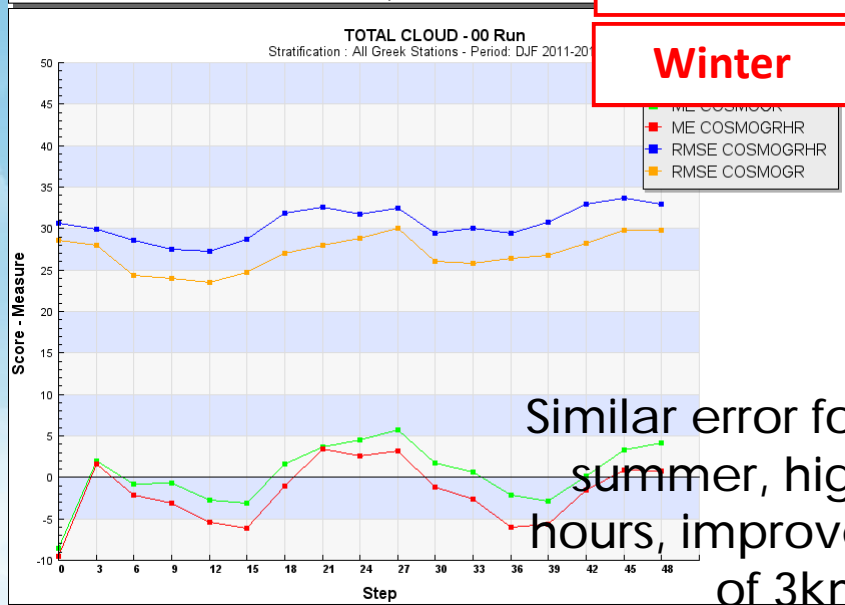
Cloud Cover - 7km vs 3km



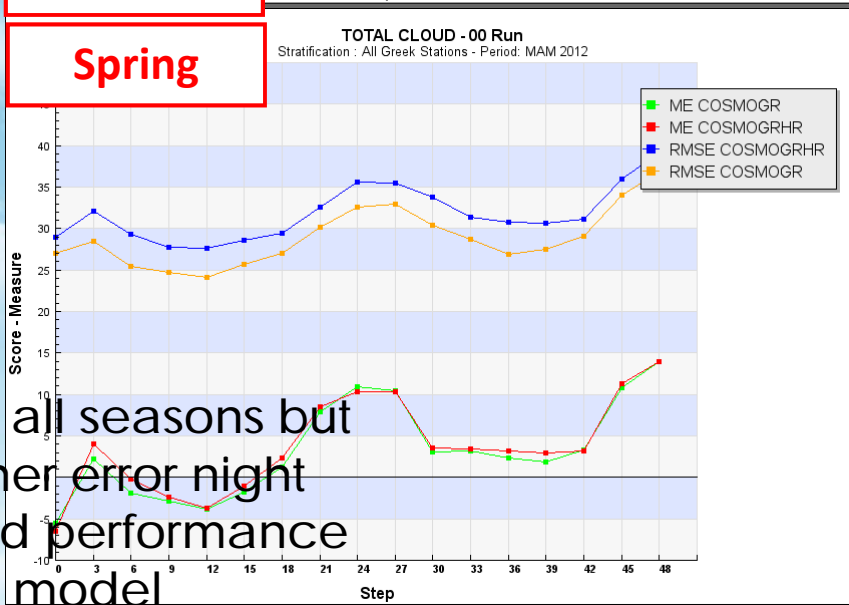
Summer



Fall



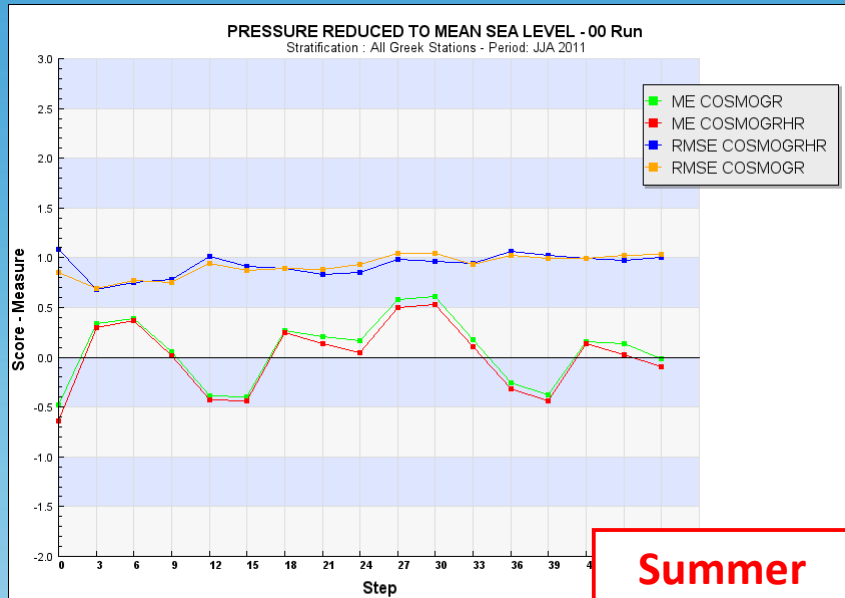
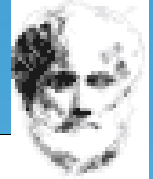
Winter



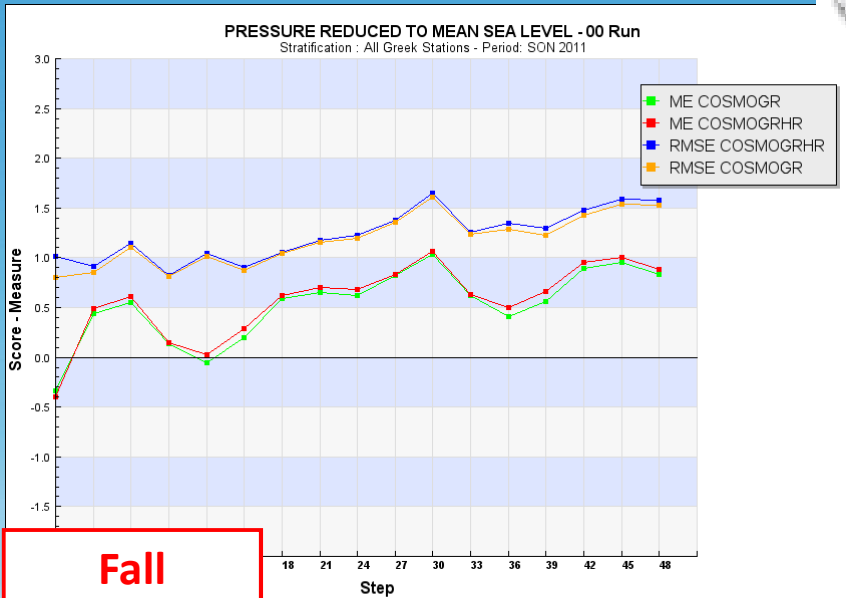
Spring

Similar error for all seasons but summer, higher error night hours, improved performance of 3km model

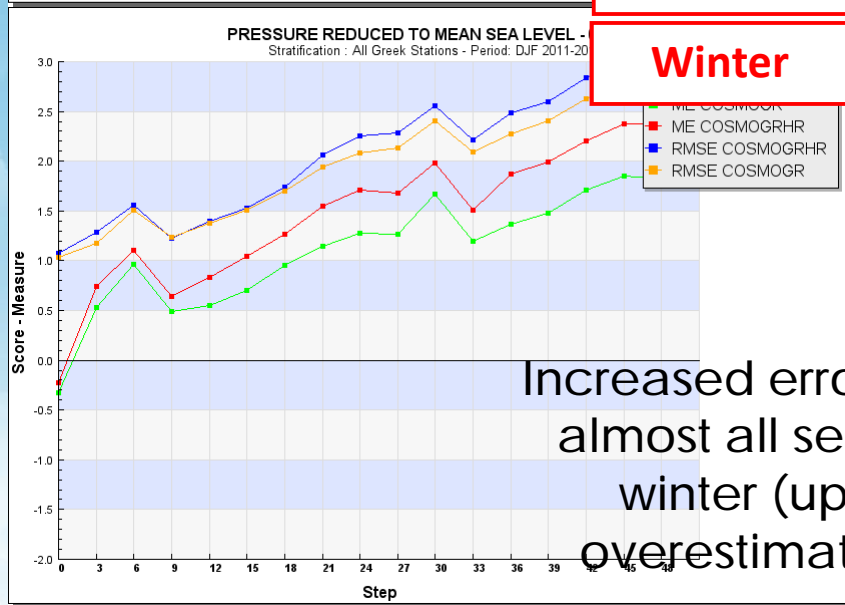
MSLP - 7km vs 3km



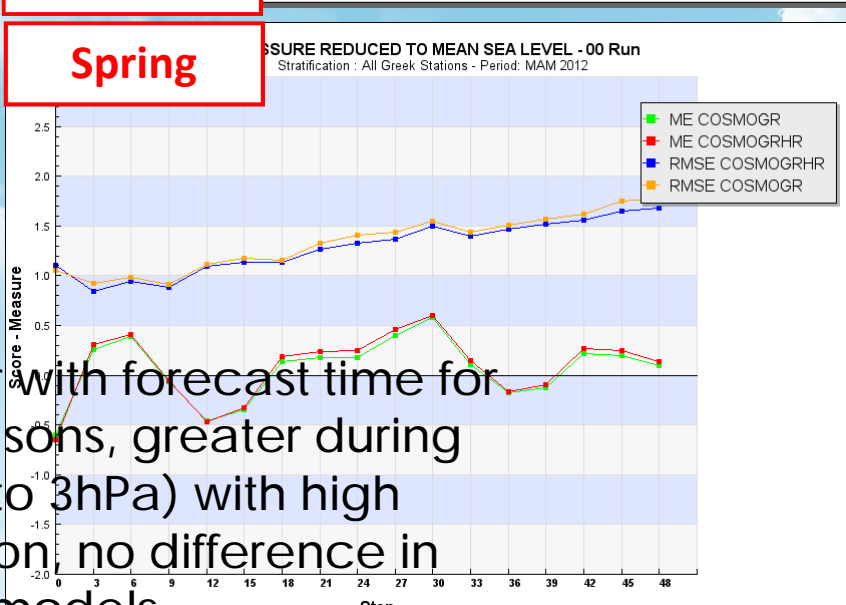
Summer



Fall



Winter



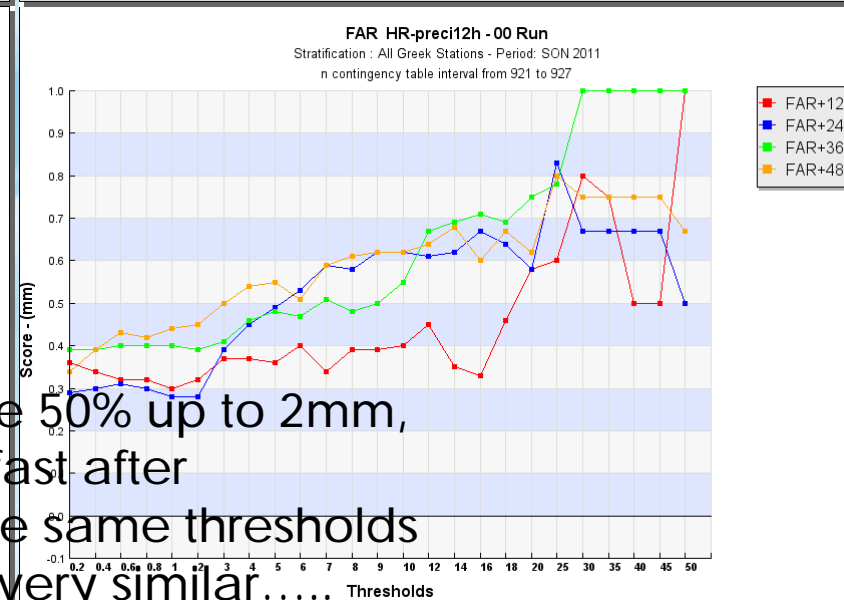
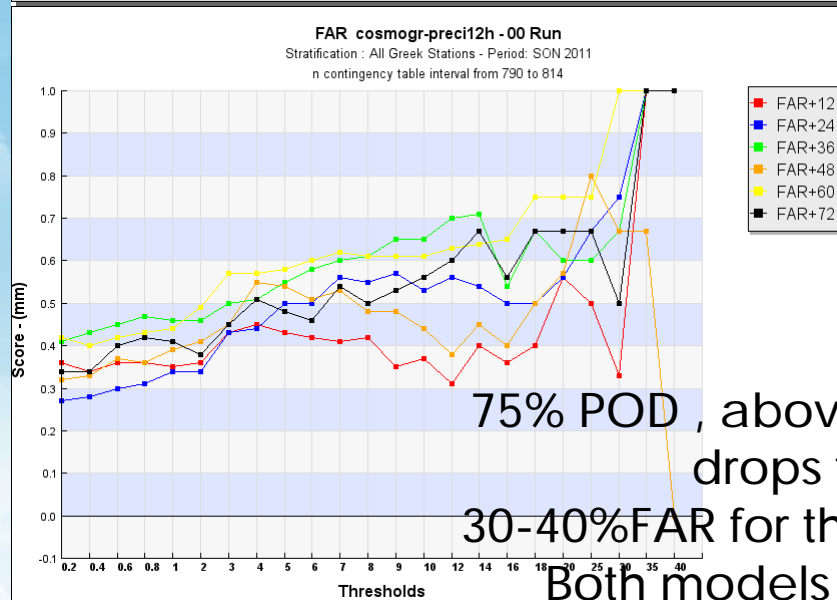
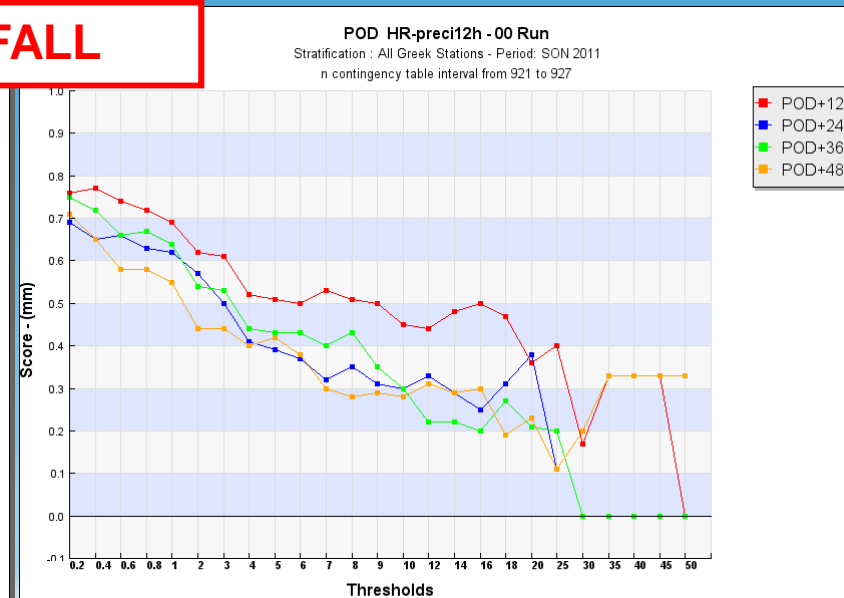
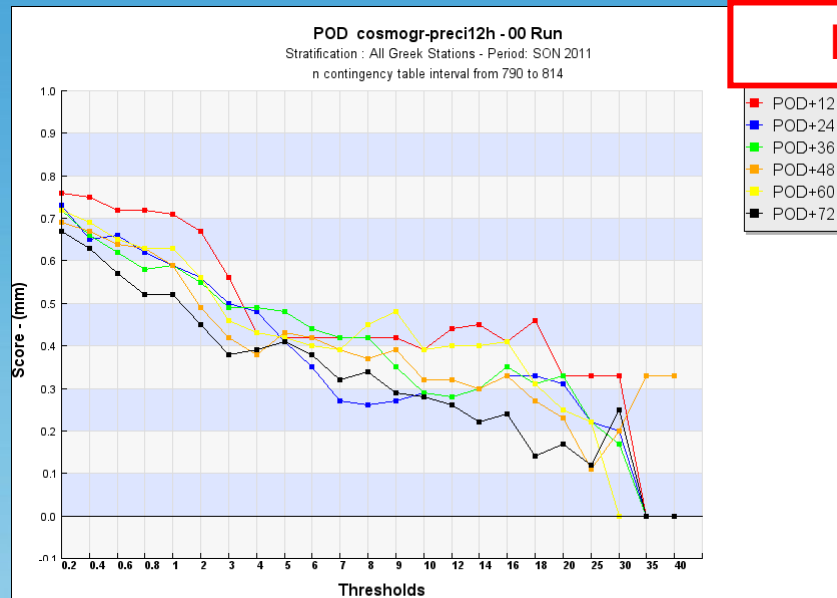
Spring

Increased error with forecast time for almost all seasons, greater during winter (up to 3hPa) with high overestimation no difference in models



12h Precipitation - 7km vs 3km

FALL



75% POD , above 50% up to 2mm,
 drops fast after
 30-40%FAR for the same thresholds
 Both models very similar.....

FG6

ETS - range: $-1/3$ to 1 , $ps=1$

fraction of observed and/or forecast events correctly predicted, adjusted for hits associated with random chance

FBI - range: 0 to ∞ , unbiased score= 1

Indicates tendency to underforecast ($BIAS < 1$) or overforecast ($BIAS > 1$) events.

70-80% POD , above 50% up to 2mm, drops fast after

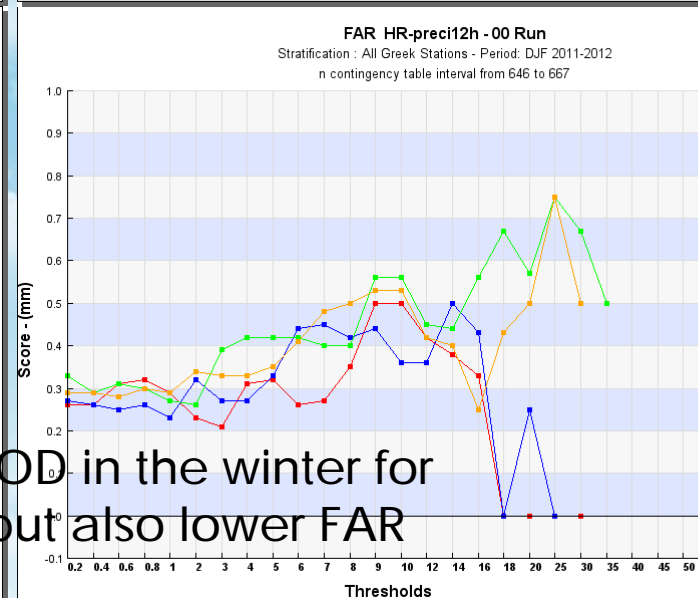
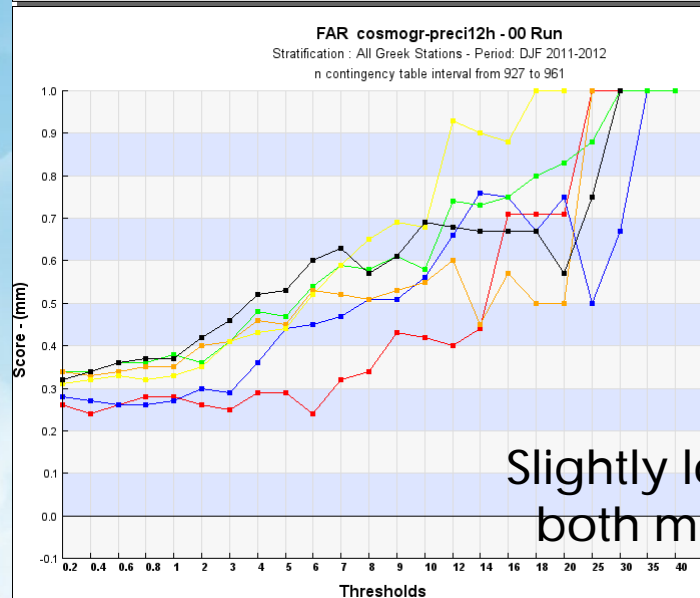
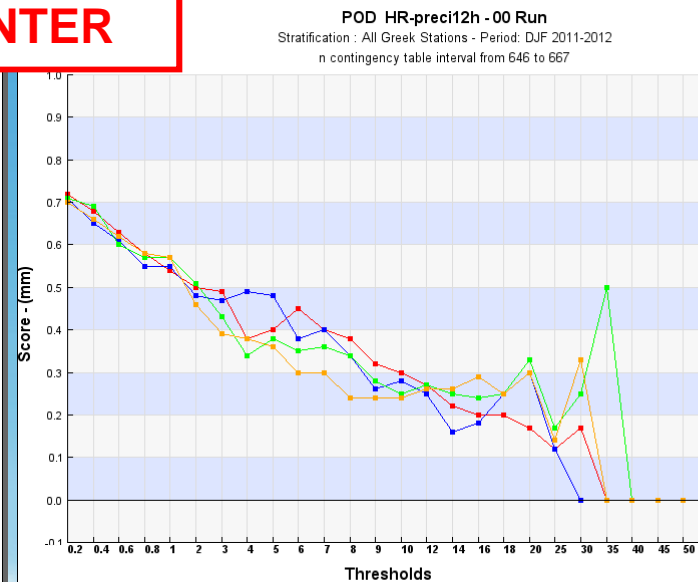
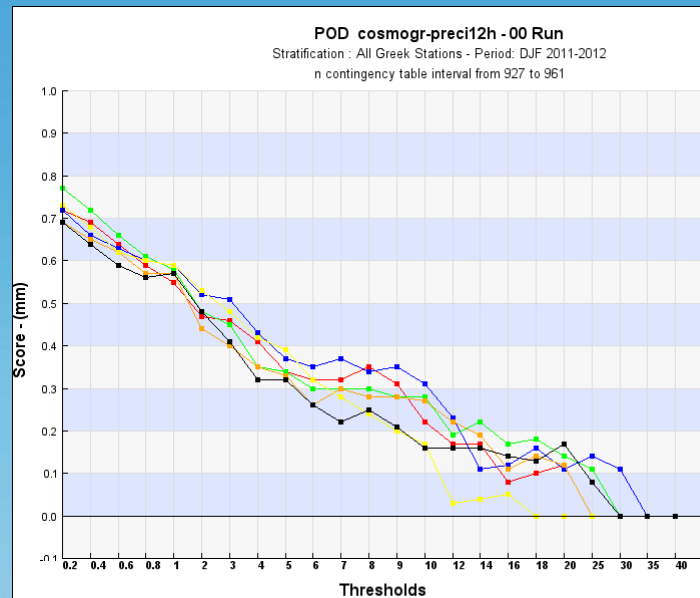
Higher FAR for HR model

Flora Gofa, 02/09/2010

12h Precipitation - 7km vs 3km



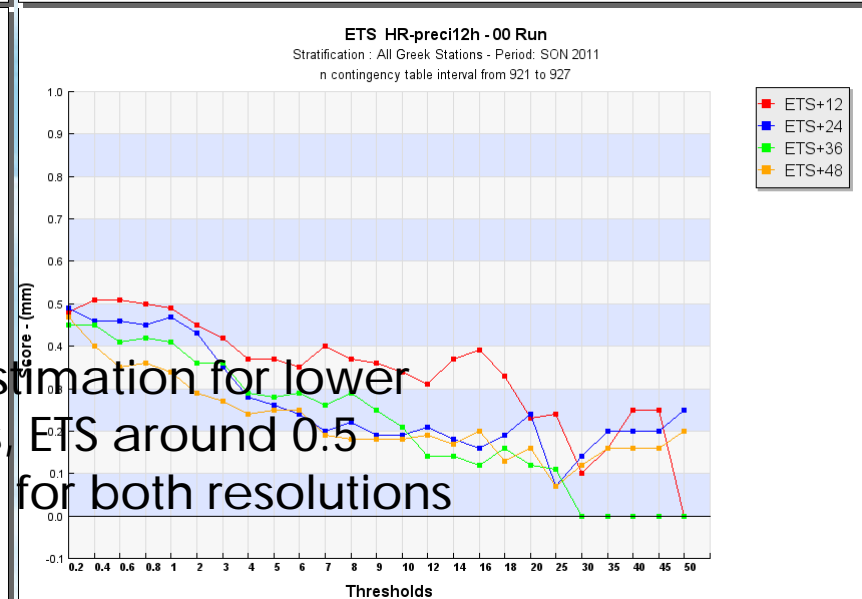
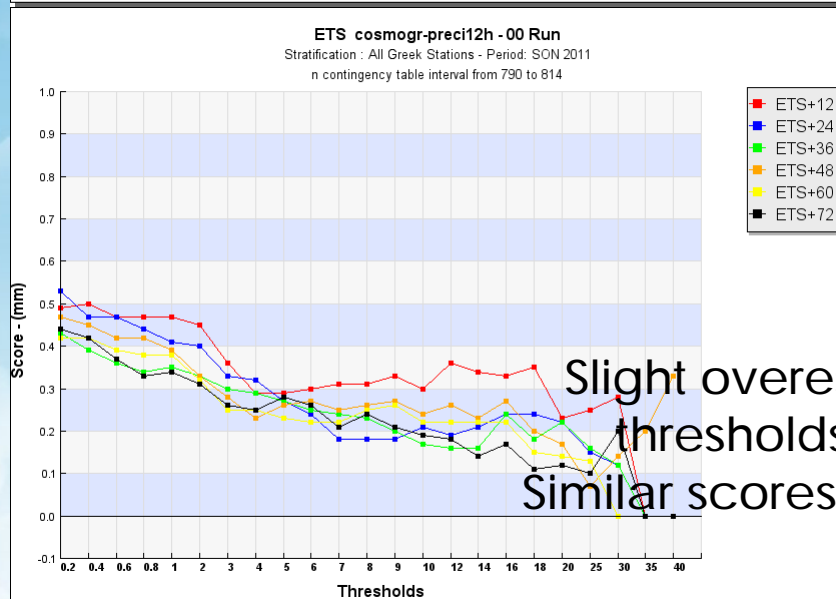
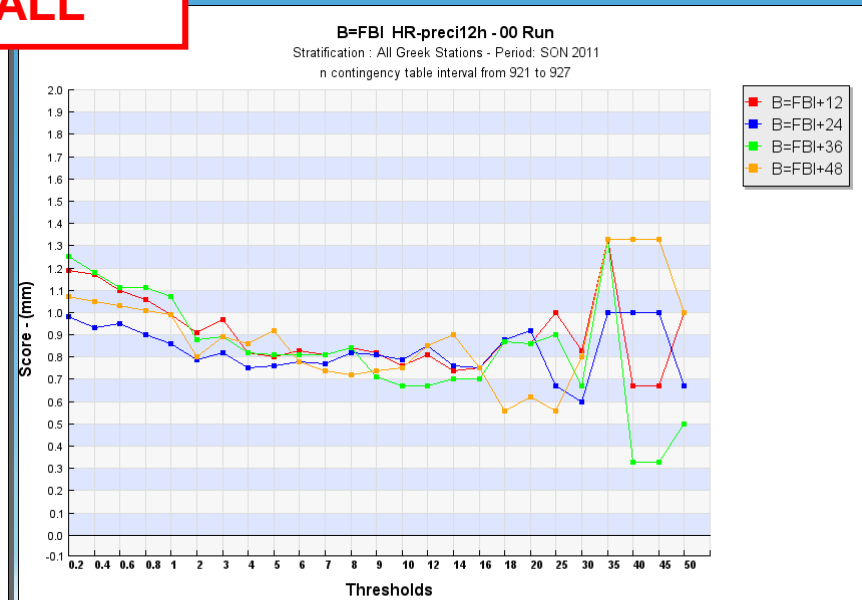
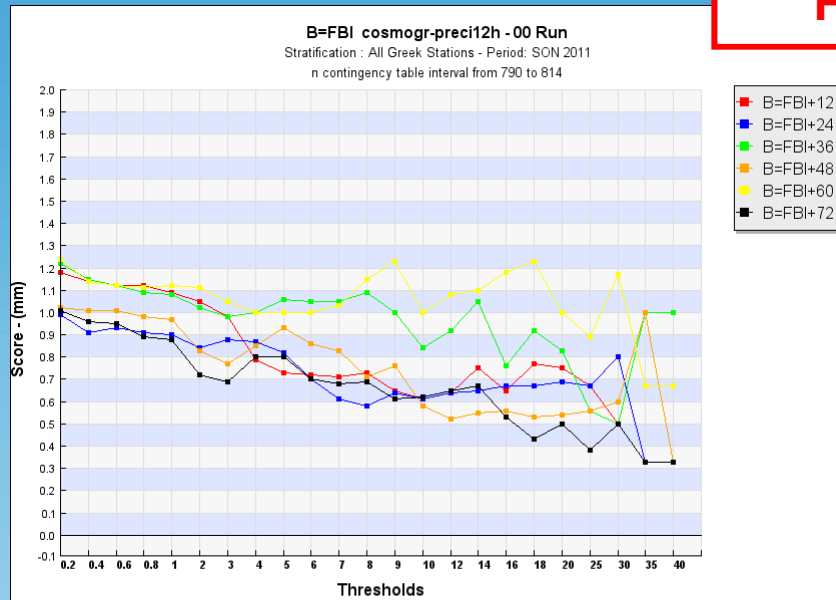
WINTER



Slightly lower POD in the winter for both models but also lower FAR

12h Precipitation - 7km vs 3km

FALL

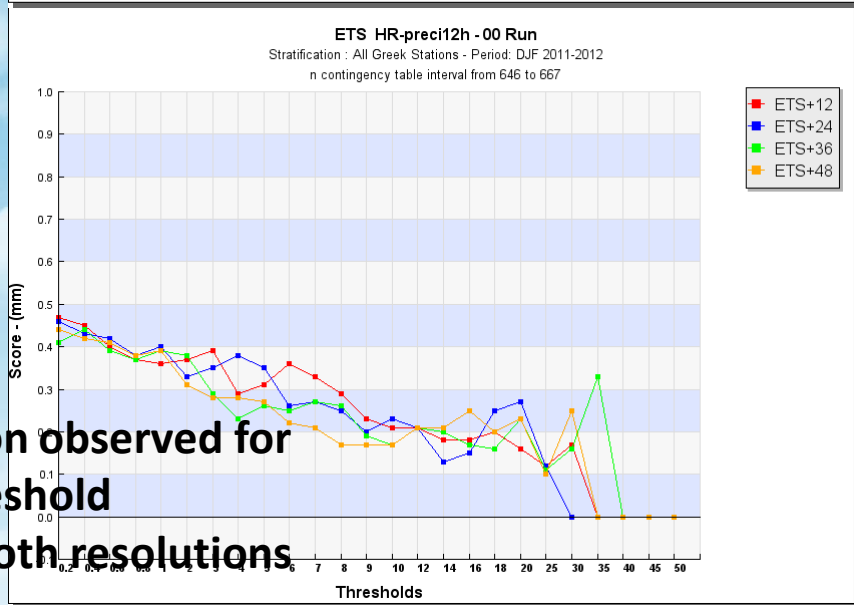
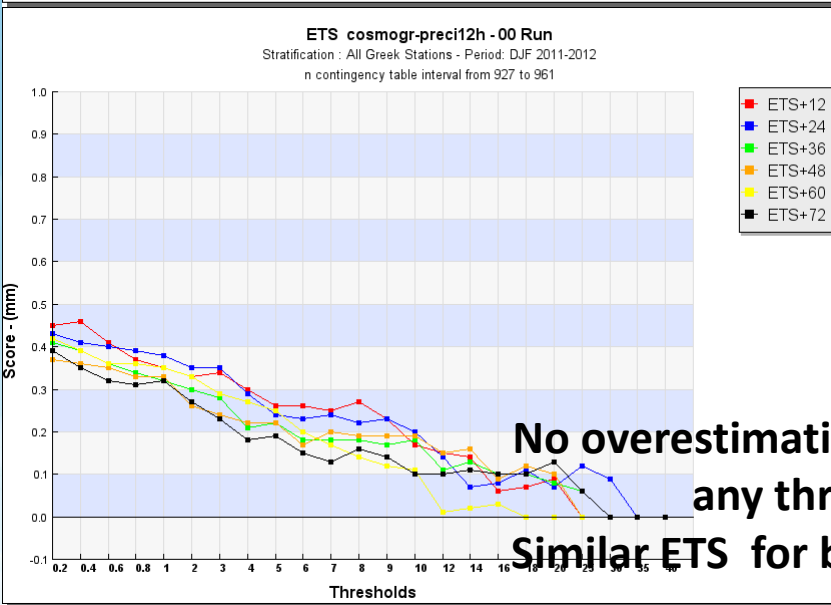
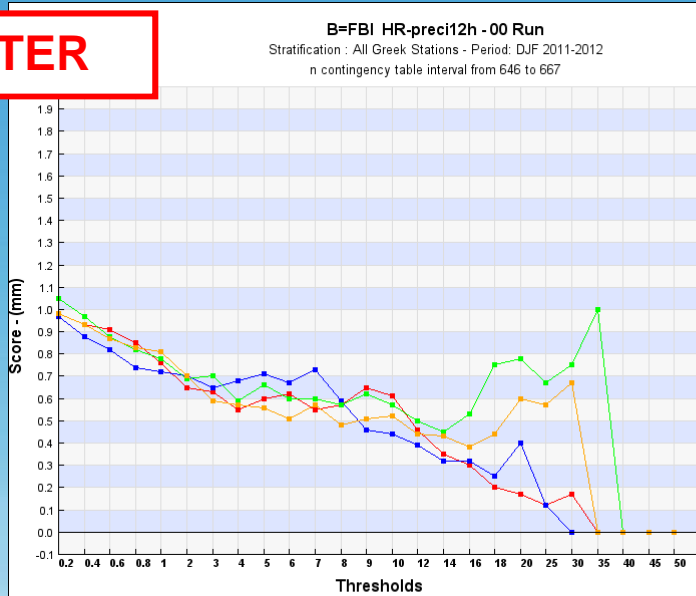
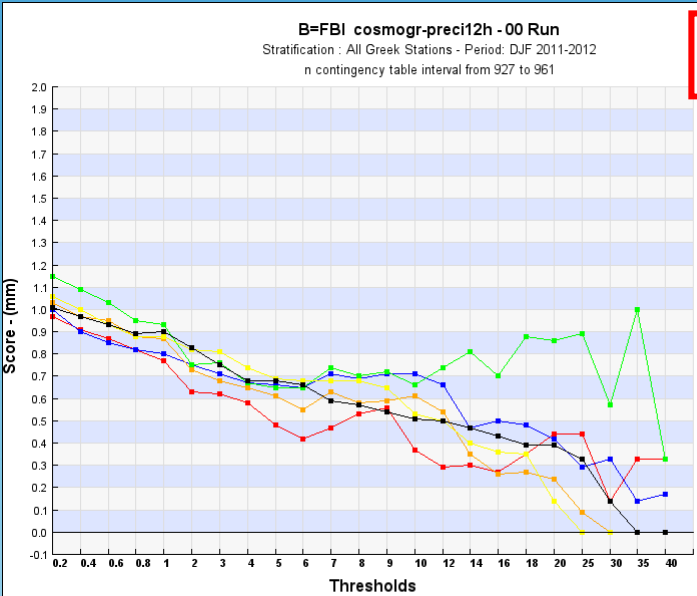


Slight overestimation for lower thresholds, ETS around 0.5
Similar scores for both resolutions



12h Precipitation - 7km vs 3km

WINTER



No overestimation observed for any threshold
 Similar ETS for both resolutions



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Conditional

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Delete

Weather Type

COSI

Time Series

Daily Cycle



Configuration



Report

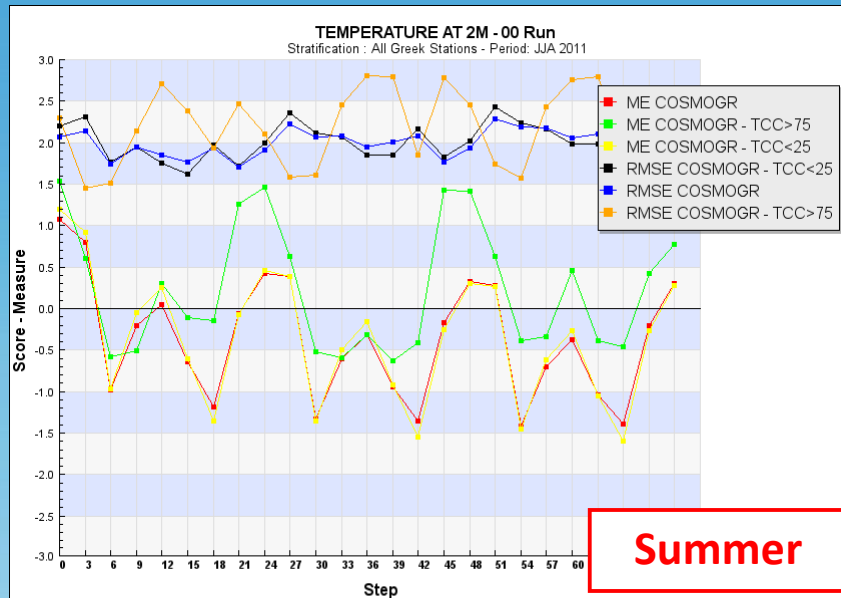
Conditional Verification

Extracting information for relevant performance of weather parameters

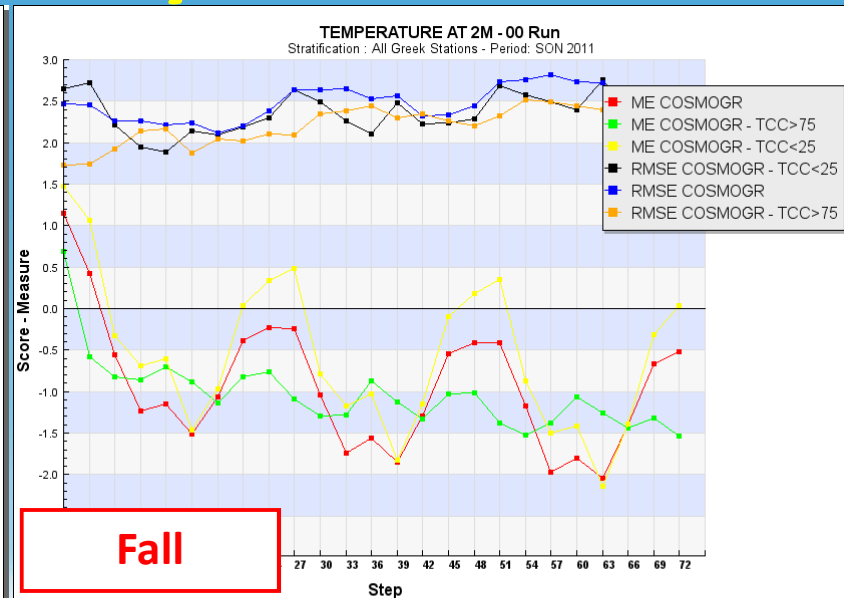
The input from modelers and forecasters is necessary for identifying and testing hypotheses.

The tests applied were based on the recommendations from Users Meeting in April (document in VERSUS forum)

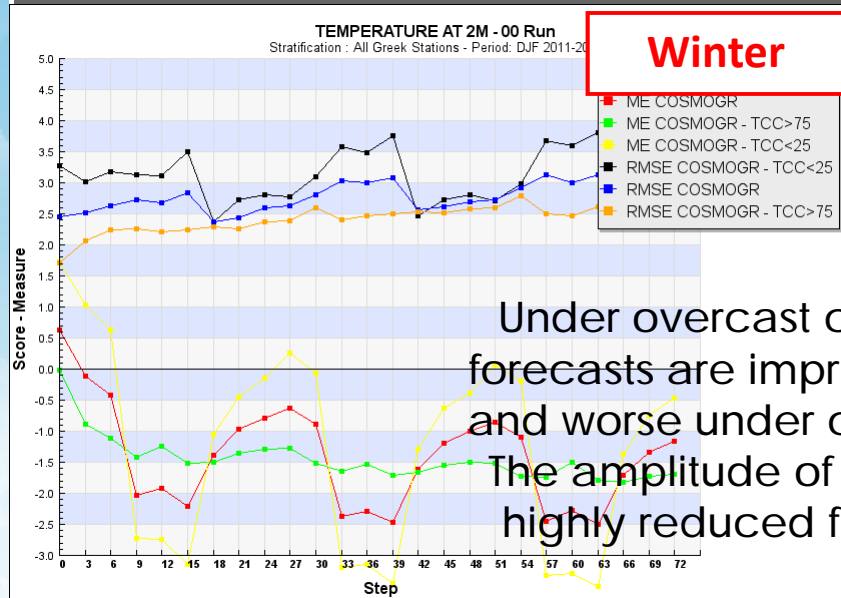
2mT vs 2mT in overcast conditions 2mT in clear sky conditions



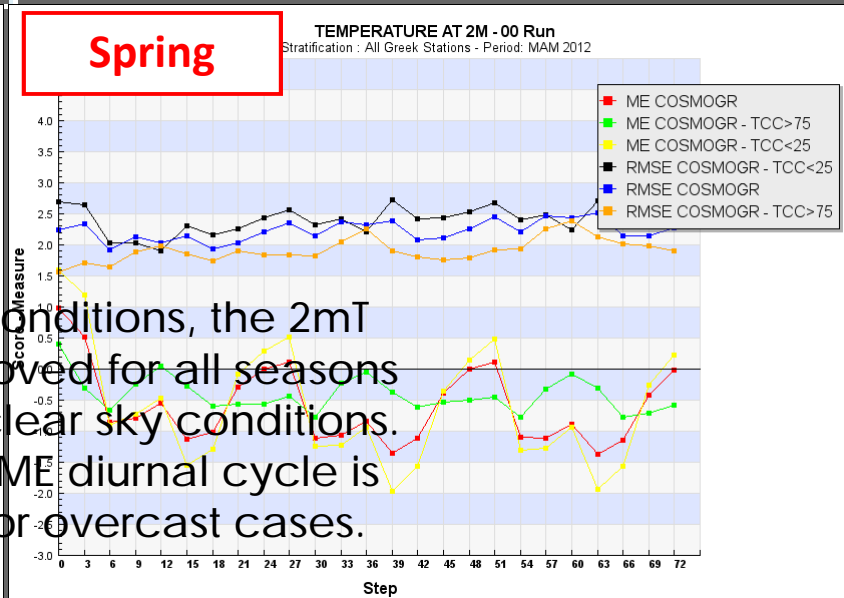
Summer



Fall



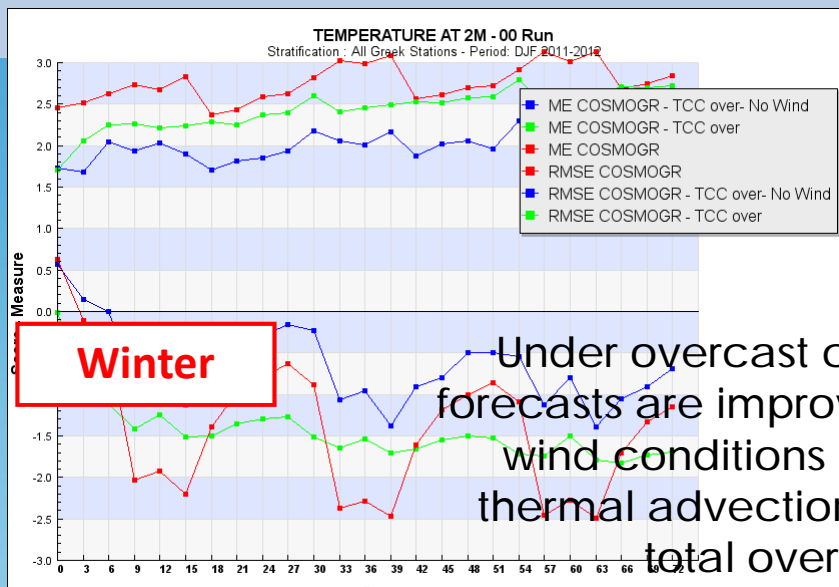
Winter



Spring

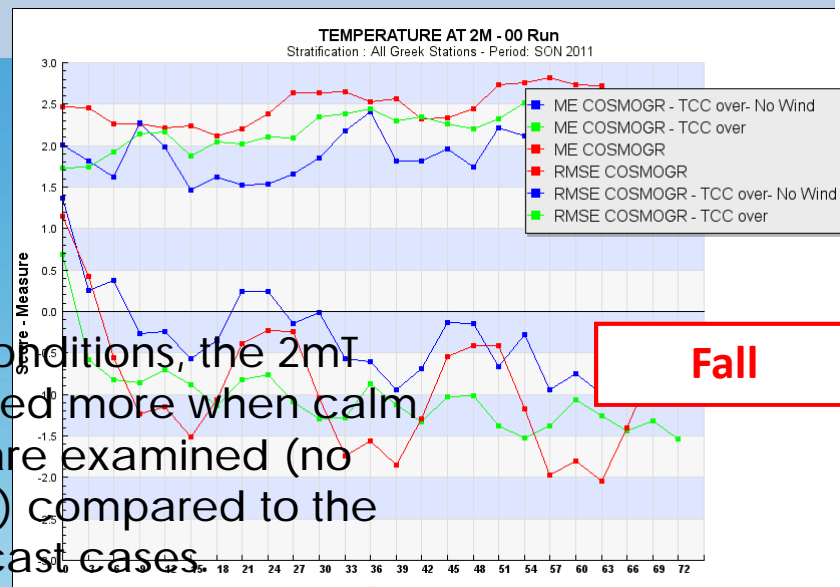
Under overcast conditions, the 2mT forecasts are improved for all seasons and worse under clear sky conditions. The amplitude of ME diurnal cycle is highly reduced for overcast cases.

2mT vs 2mT in overcast/no wind conditions



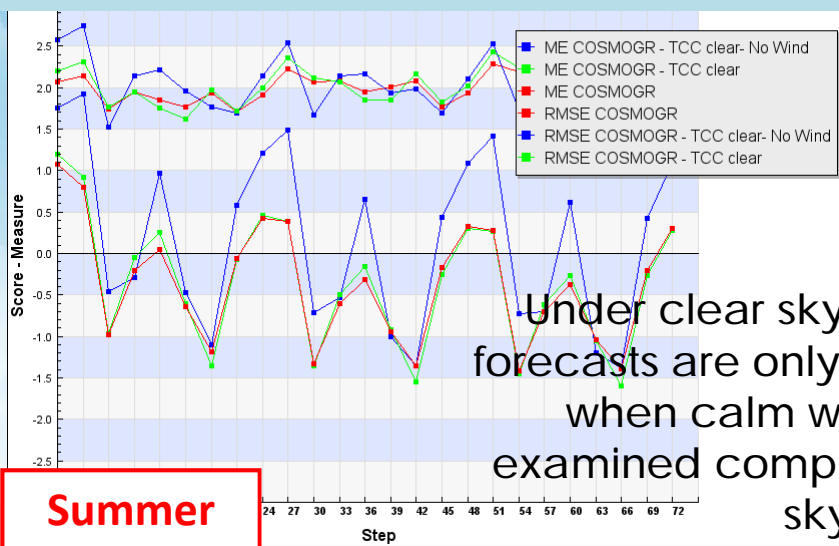
Winter

Under overcast conditions, the 2mT forecasts are improved more when calm wind conditions are examined (no thermal advection) compared to the total overcast cases.



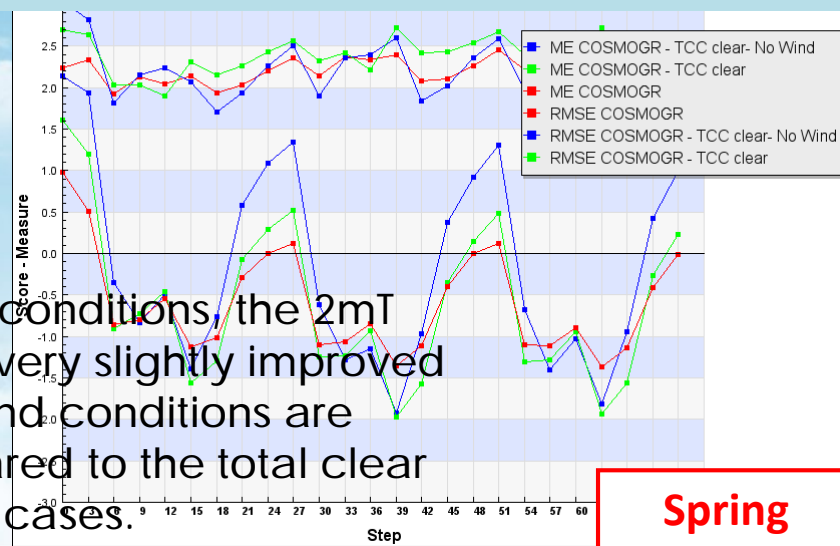
Fall

2mT vs 2mT in skyclear/no wind conditions



Summer

Under clear sky conditions, the 2mT forecasts are only very slightly improved when calm wind conditions are examined compared to the total clear sky cases.



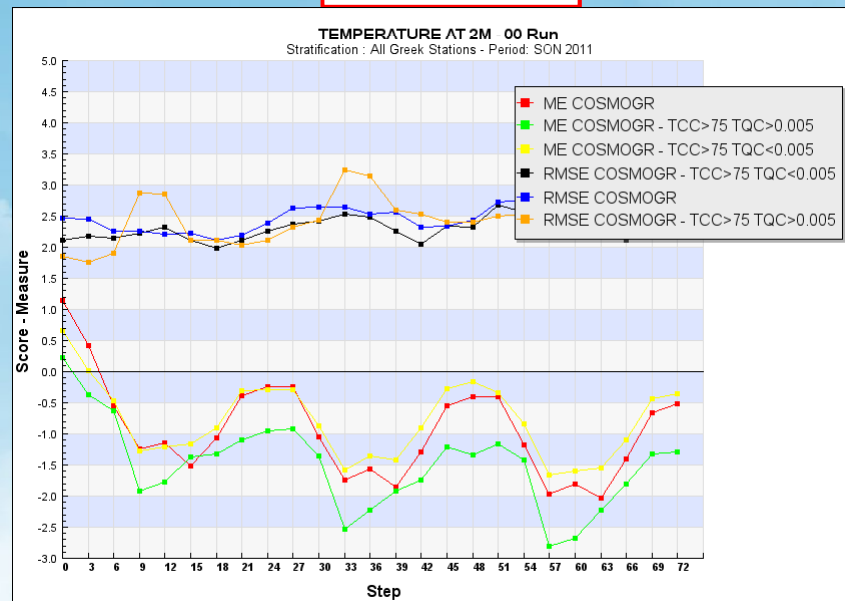
Spring



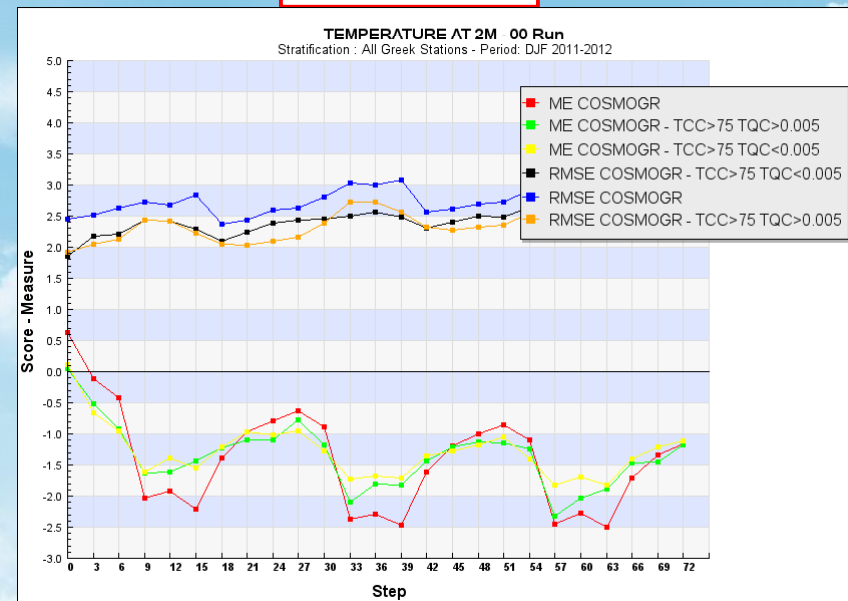
2mT vs 2mT, overcast, TQC >0.005 (cond on fct space)

No effect on 2mT forecasts has the TQC threshold compared to the **big** effect that Cloud Coverage has

Fall



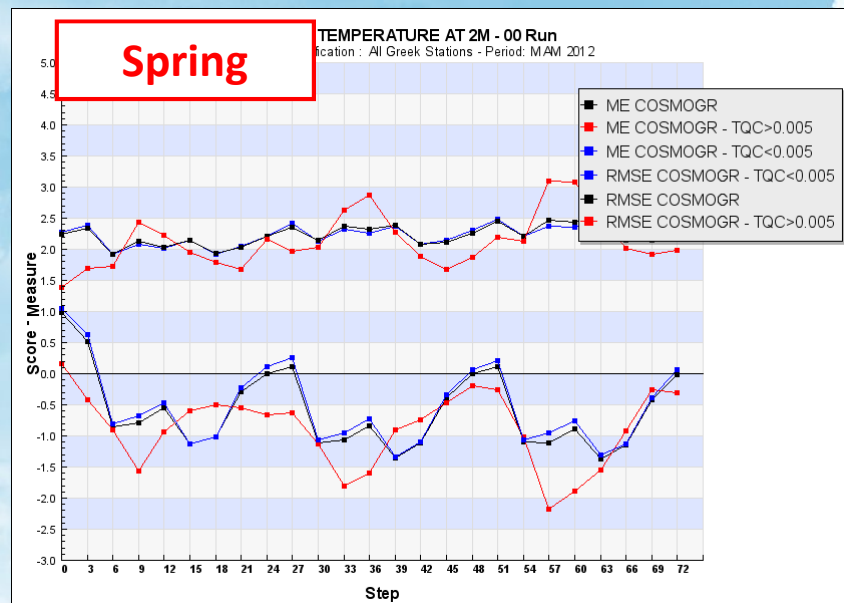
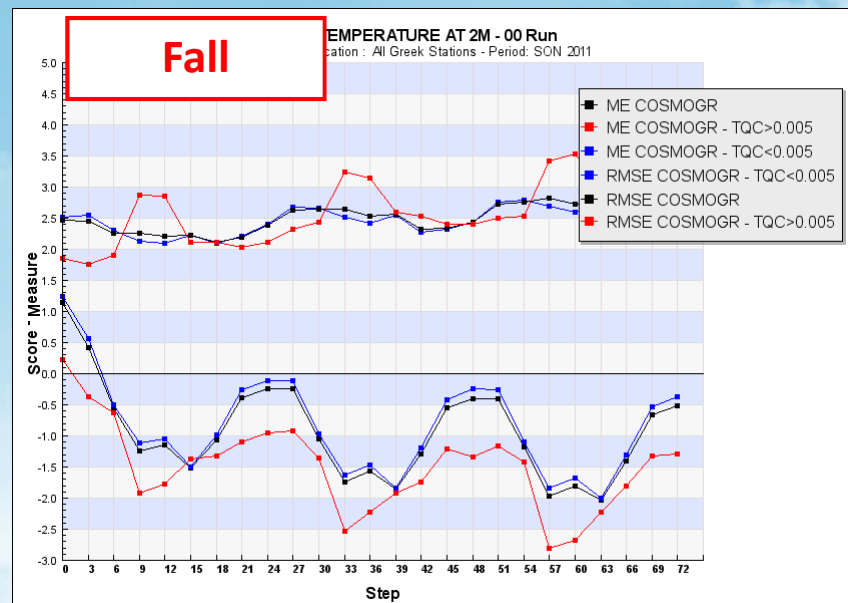
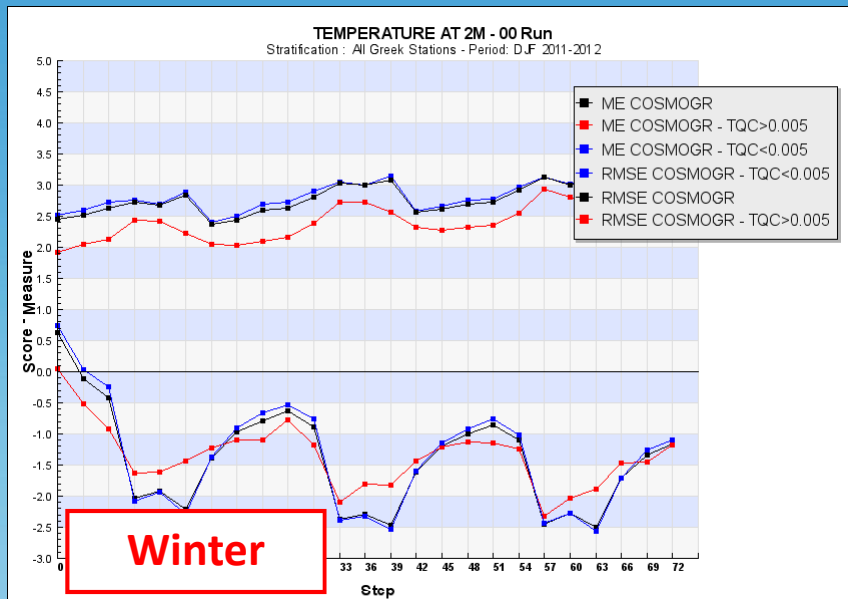
Winter

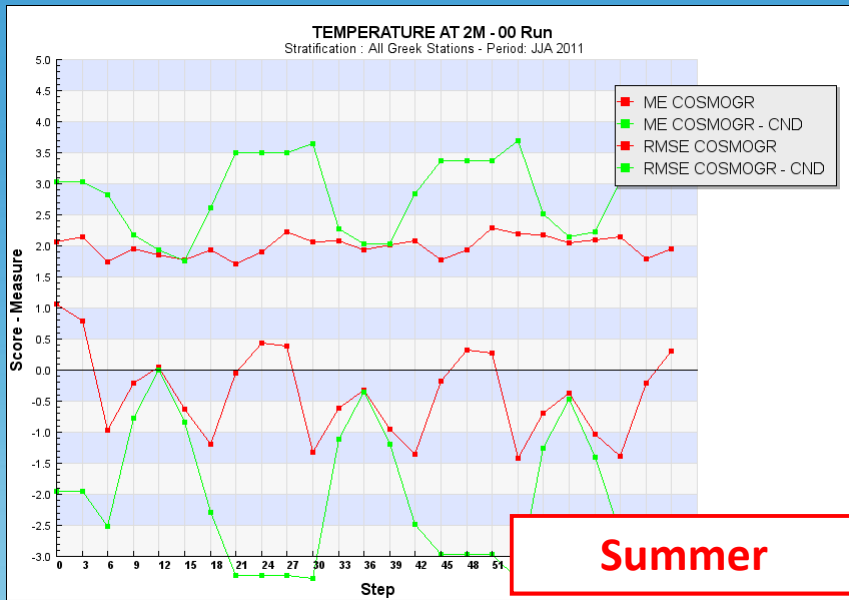




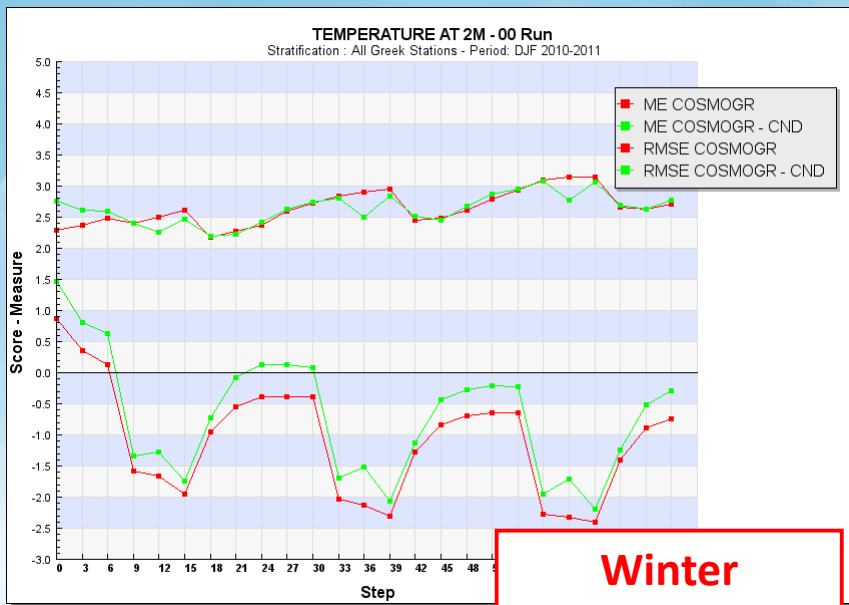
2mT vs 2mT under variable TQC (cond on fct space)

Similar effect with cloudiness, higher TQC values match with better performance in 2mT predictions



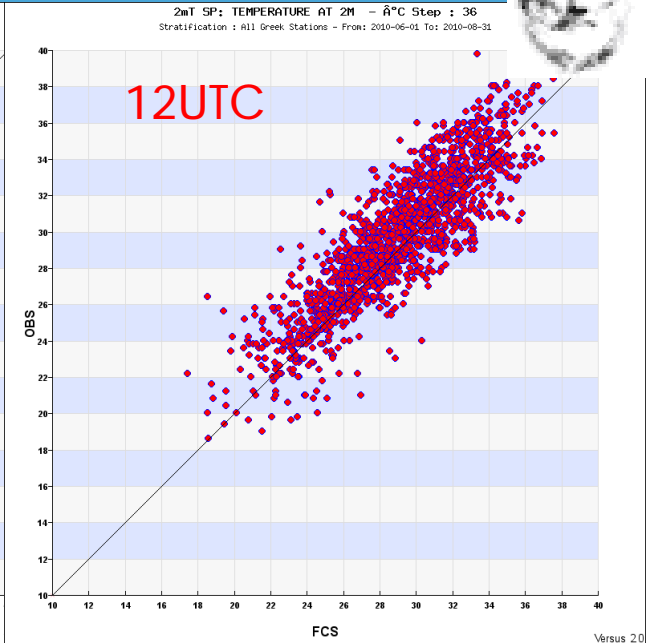
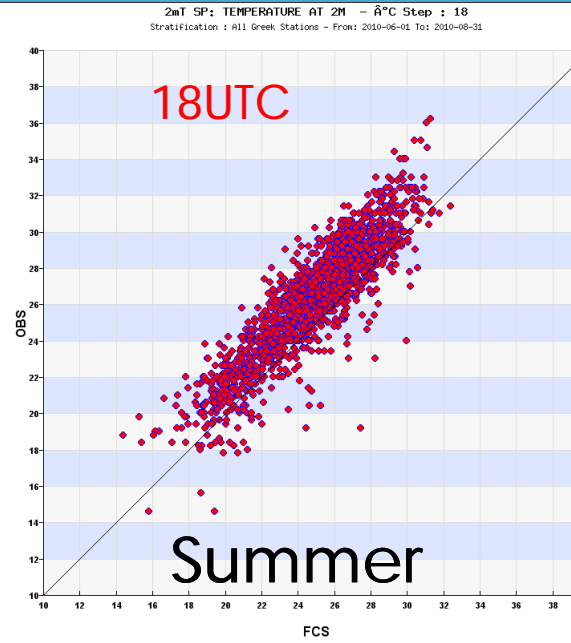
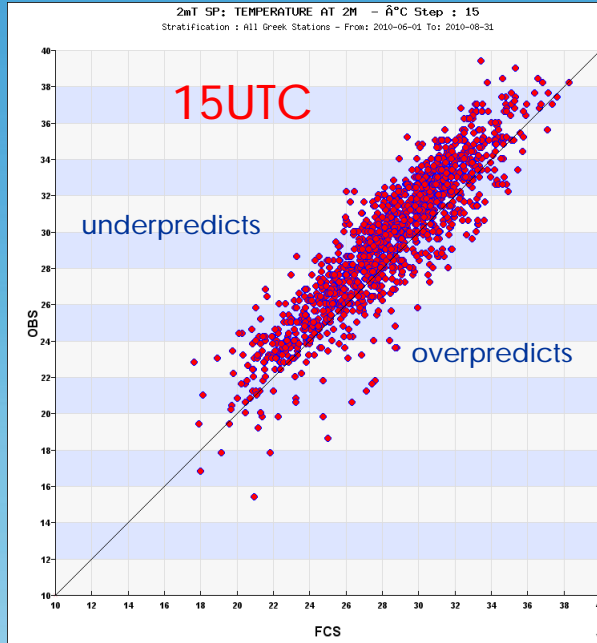


2mT vs 2mT for $T > 30^{\circ}\text{C}$

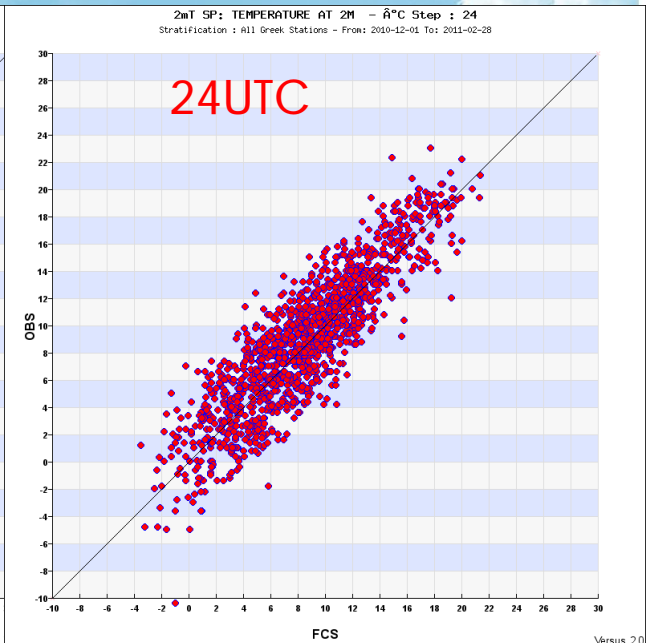
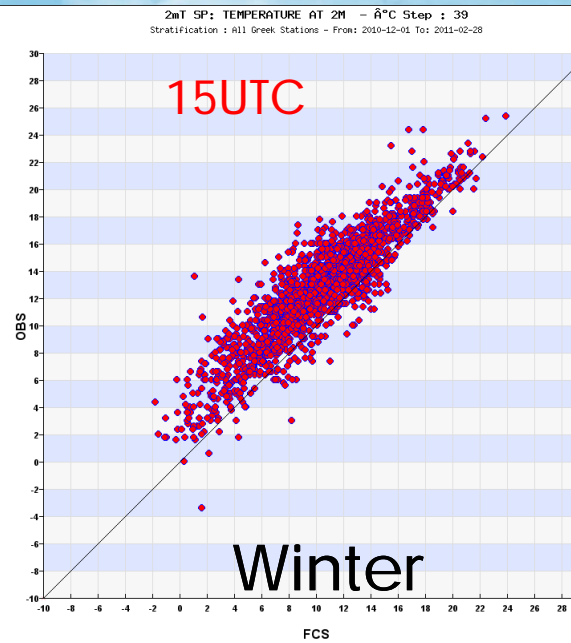
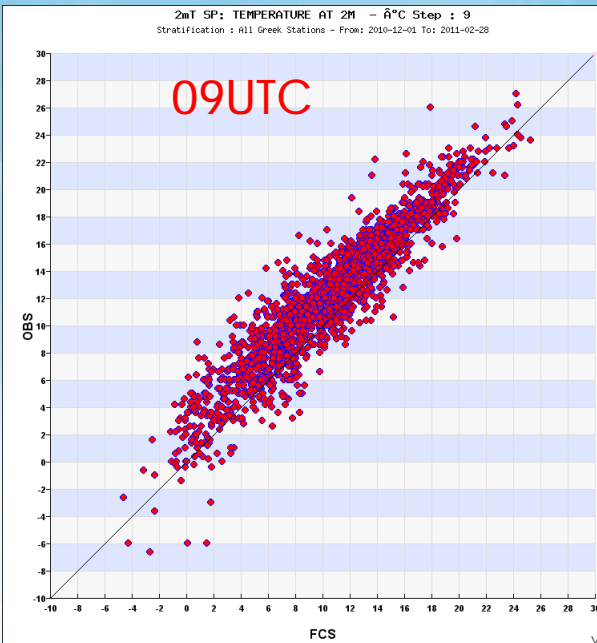


2mT vs 2mT for $T < 10^{\circ}\text{C}$

Scatter Plots for 2mT



Summer



Winter

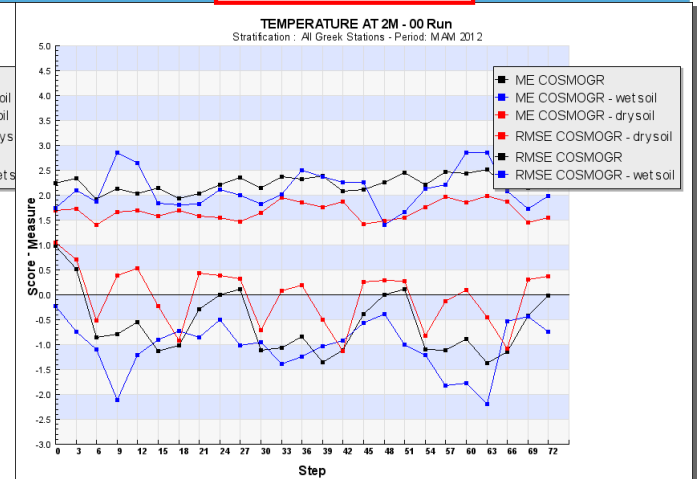
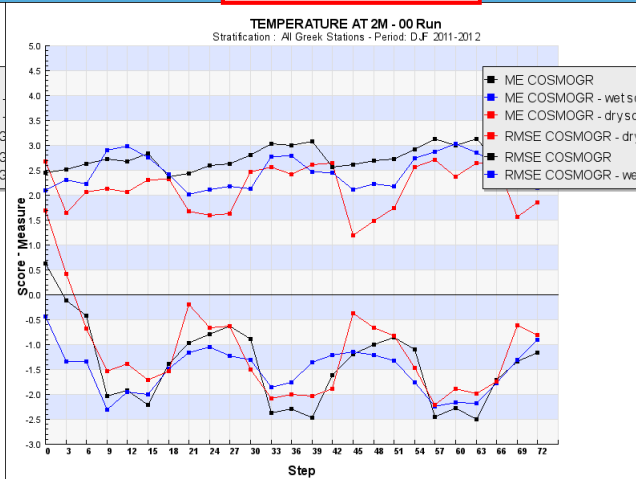
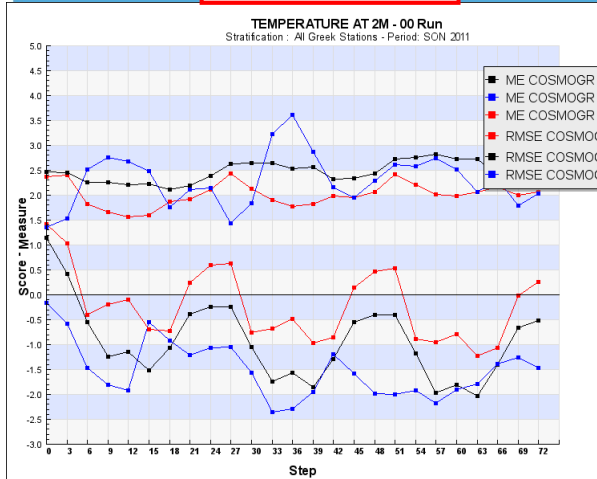
DewP T, 2mT with dry or wet soil conditions



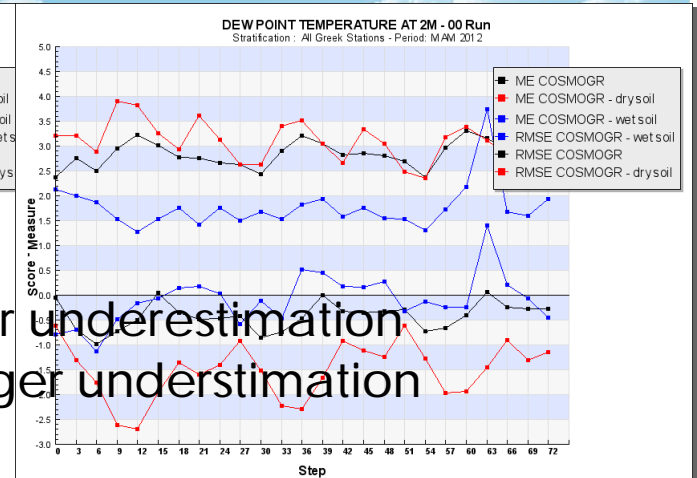
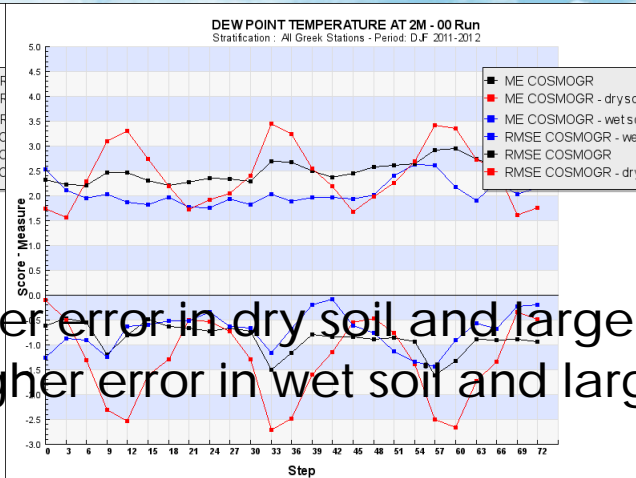
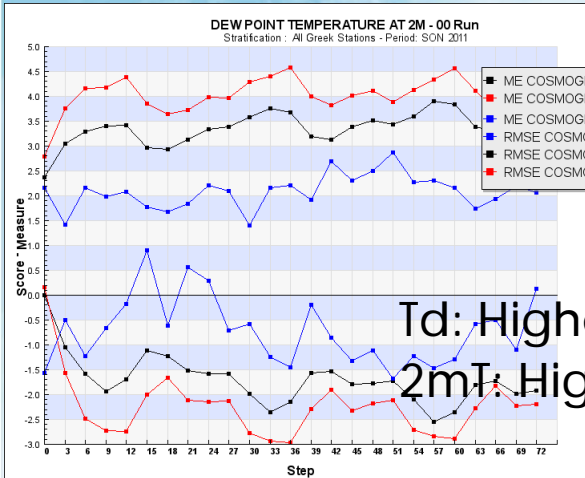
Fall

Winter

Spring



W_SO Water content of first soil layer(kg/m2) 1cm.



Td: Higher error in dry soil and larger underestimation
 2mT: Higher error in wet soil and larger underestimation

Fall

Winter

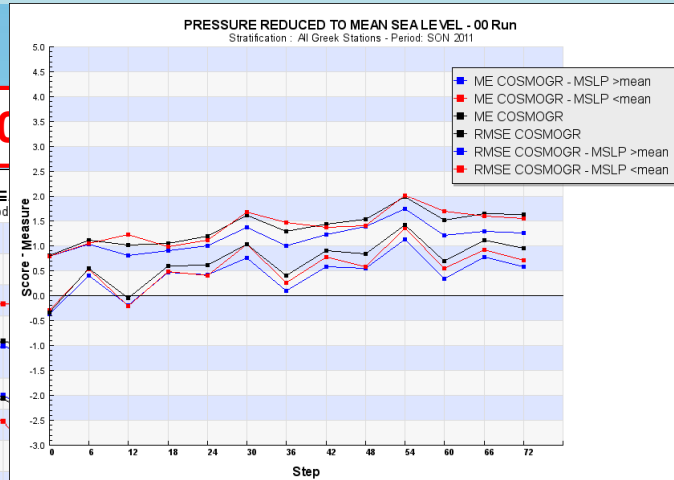
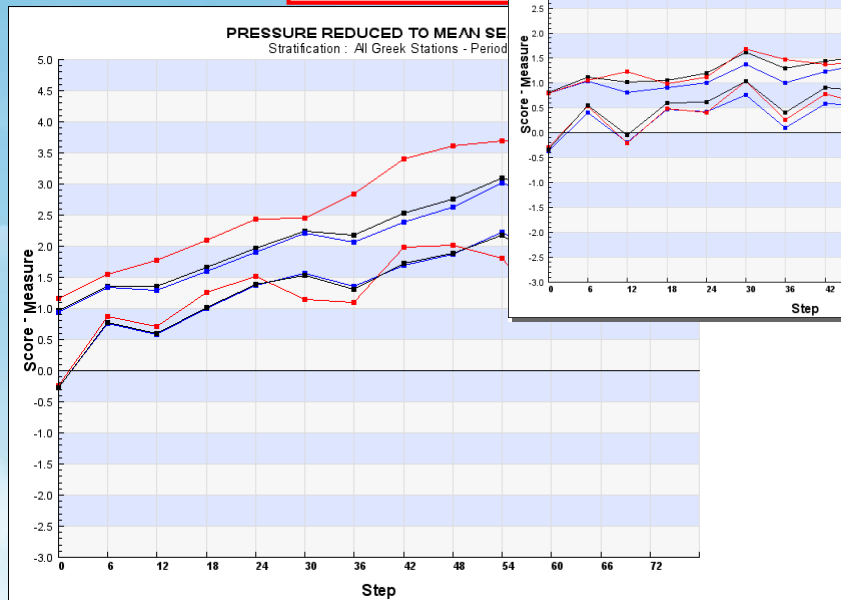
Spring

MSLP for winter with comparison to cases when higher – lower Mean

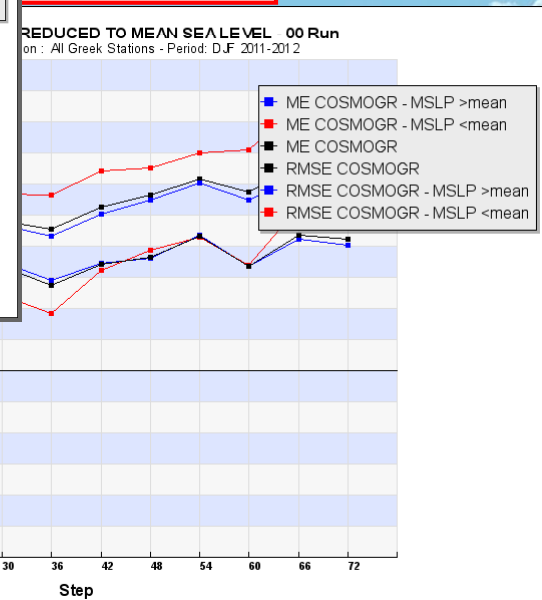


For the cases that MSLP is lower than mean in the winter (possible passage of low pressure system), the model underpredicts more MSLP values and the error is higher.

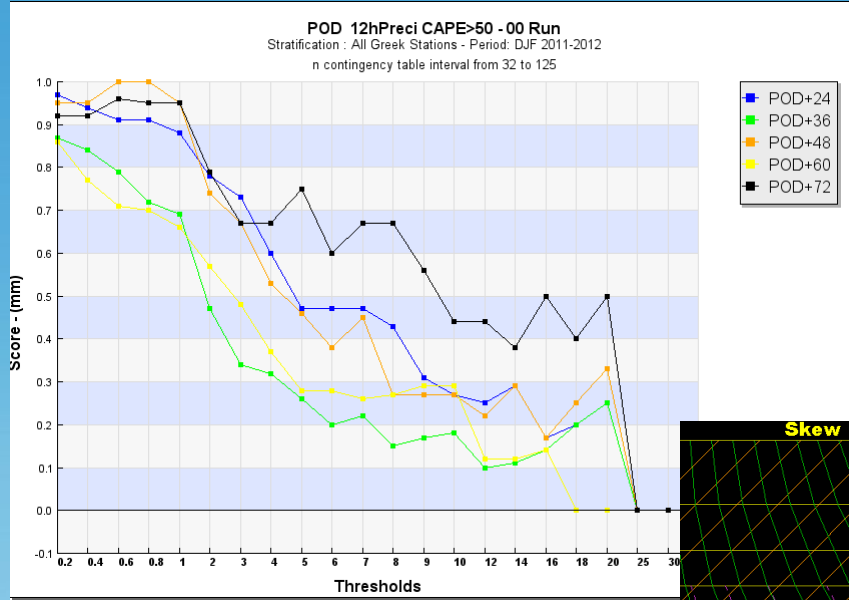
Winter 2011



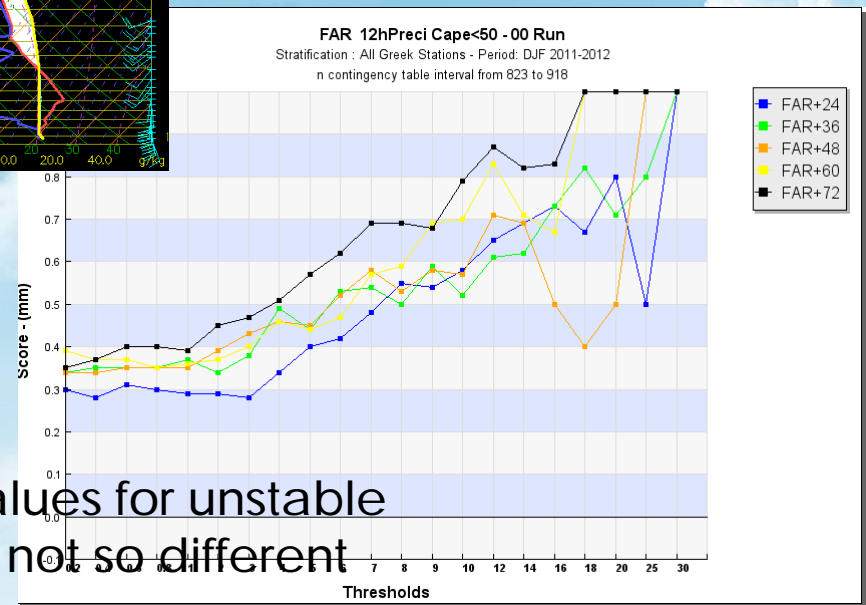
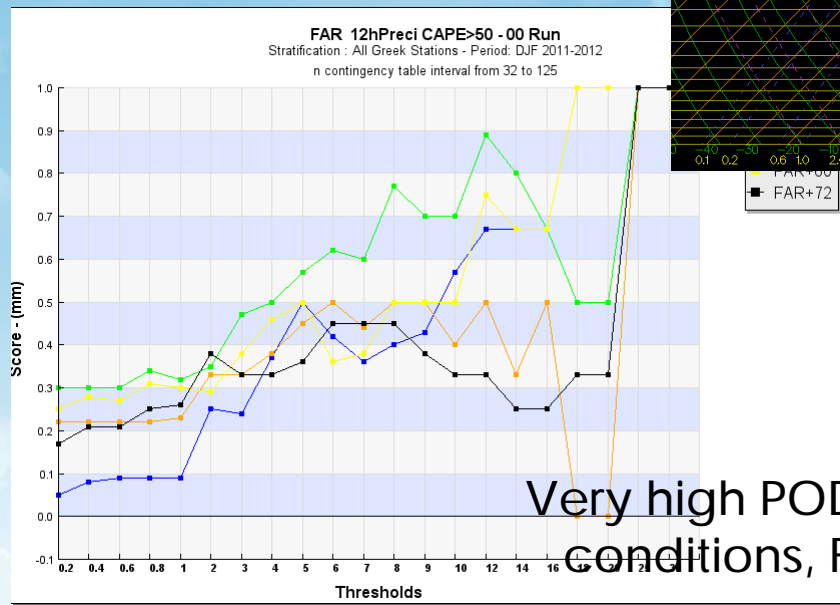
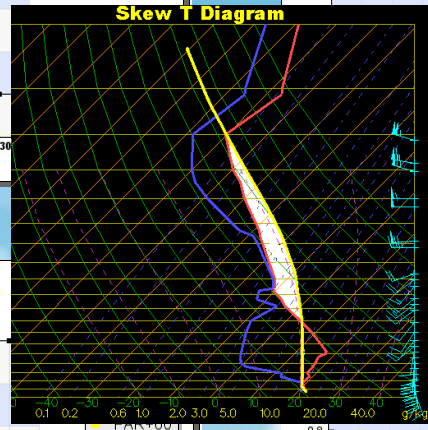
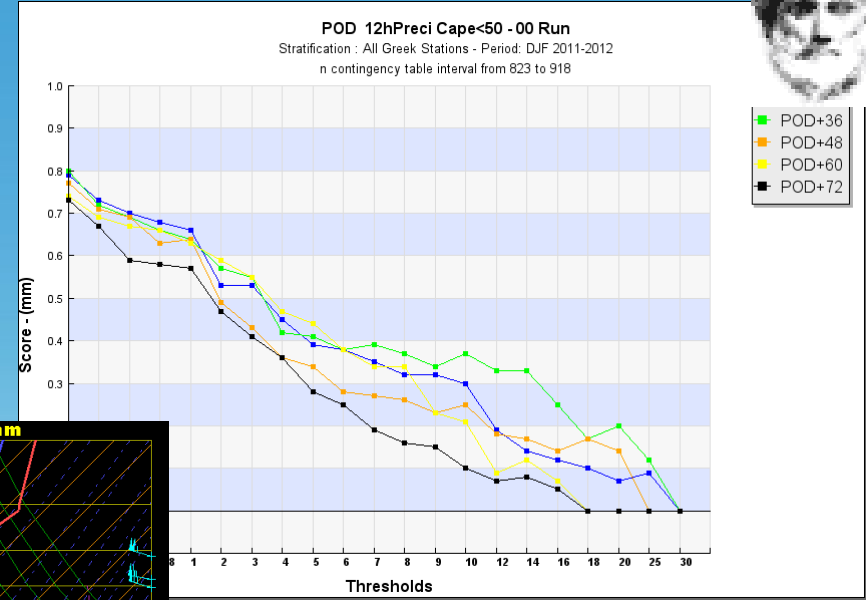
Winter 2012



CAPE>50



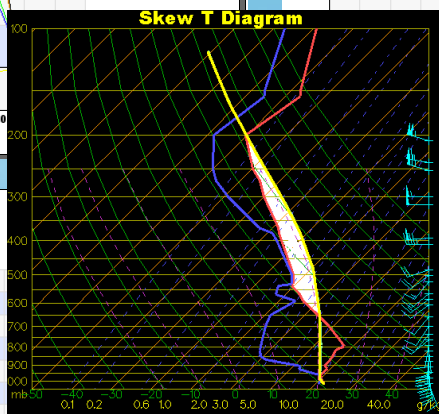
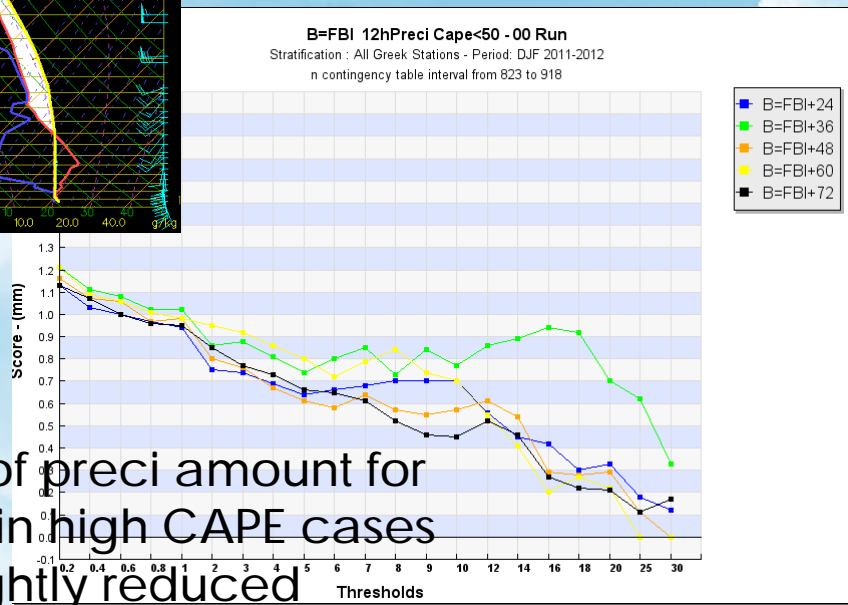
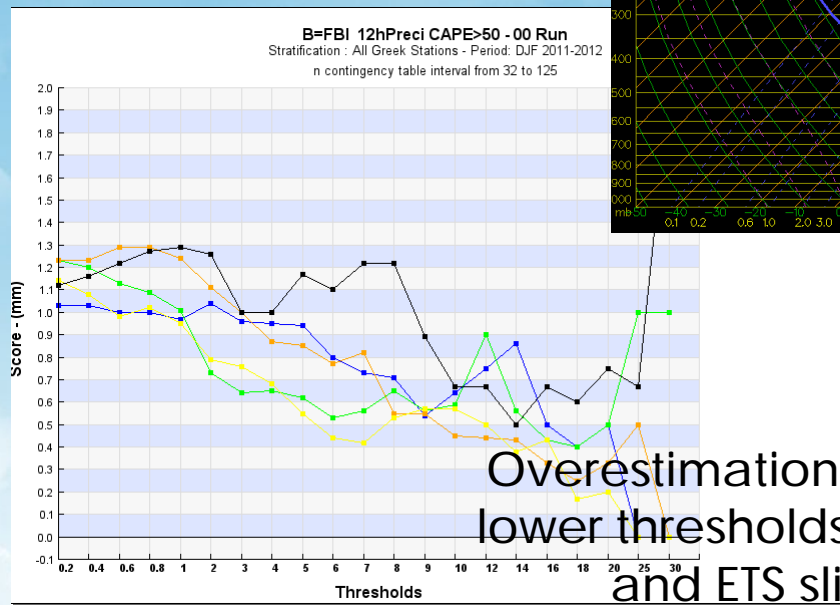
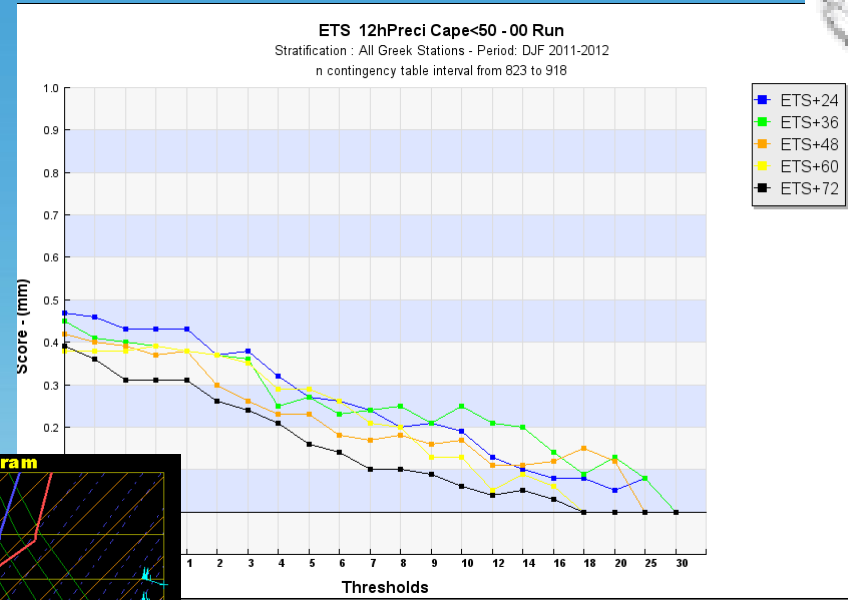
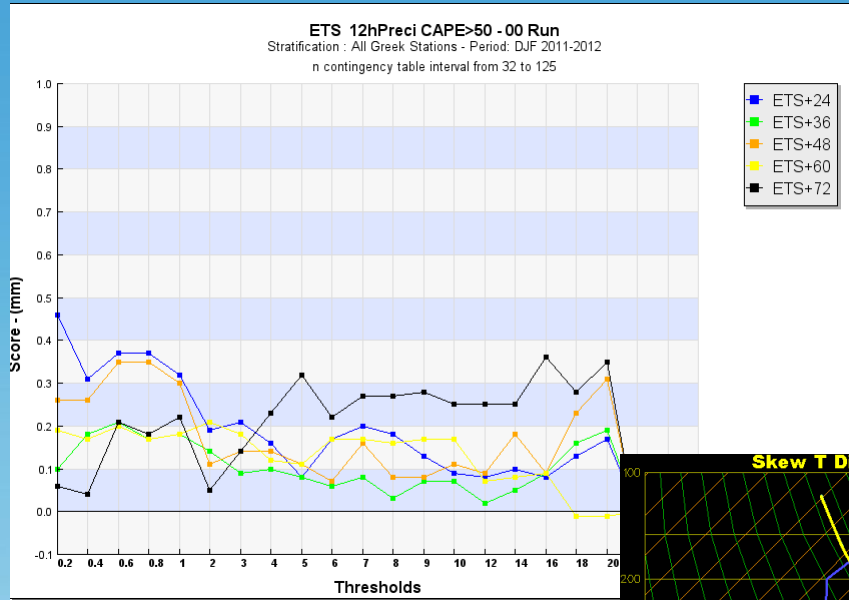
CAPE<50



Very high POD values for unstable conditions, FAR not so different

CAPE>50

CAPE<50



Overestimation of preci amount for lower thresholds in high CAPE cases and ETS slightly reduced



Upper Air Verification

WG5 COSMO General Meeting, Lugano 2012

GEOPOTENTIAL

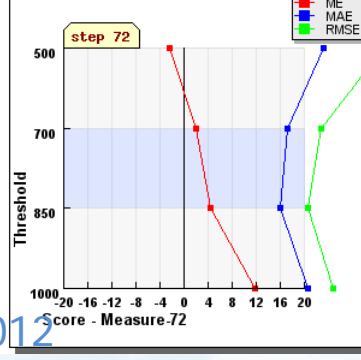
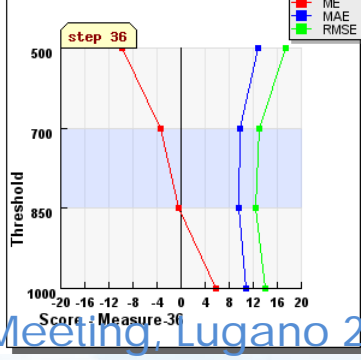
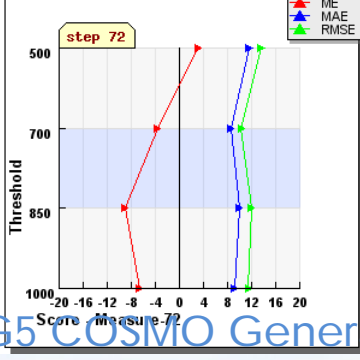
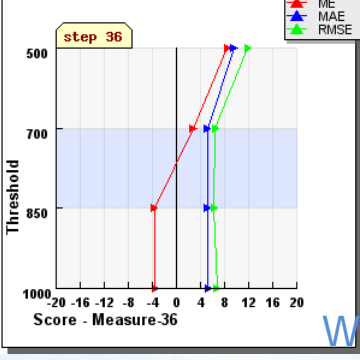
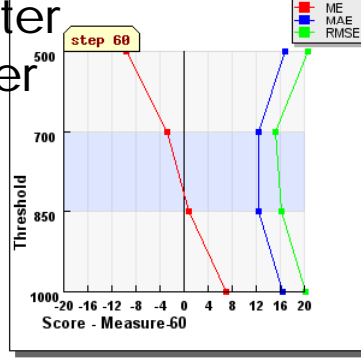
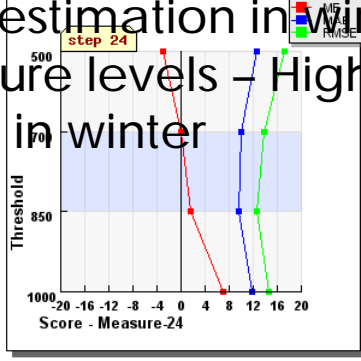
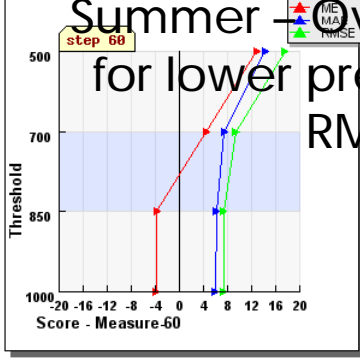
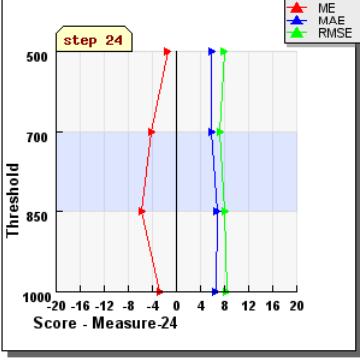
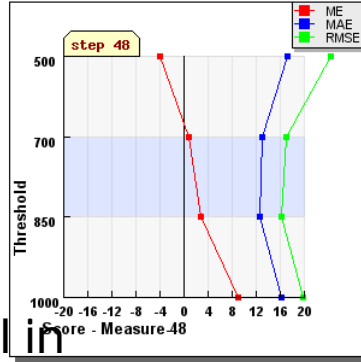
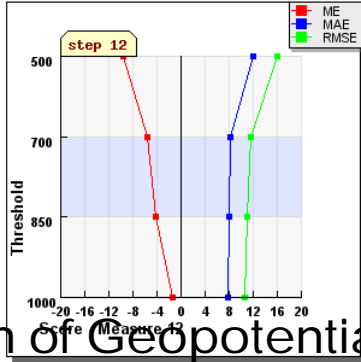
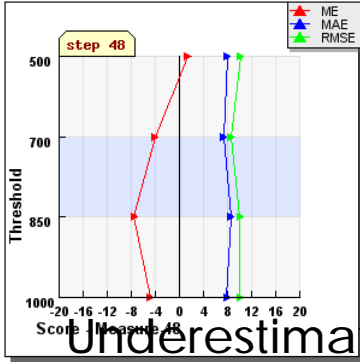
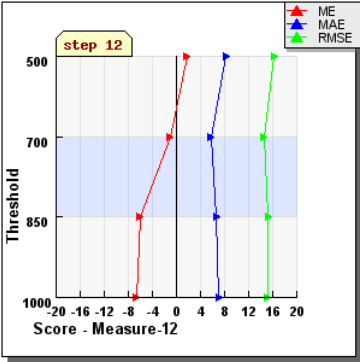


Summer

Winter

GEOPOTENTIAL - 00 Run
Stratification : All Greek Stations - Period: JJA 2011

GEOPOTENTIAL - 00 Run
Stratification : All Greek Stations - Period: DJF 2011-2012



Underestimation of Geopotential in Summer - Overestimation in winter for lower pressure levels - Higher RMSE in winter

Summer

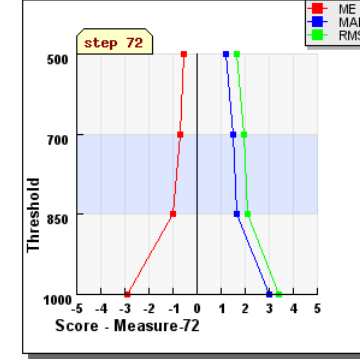
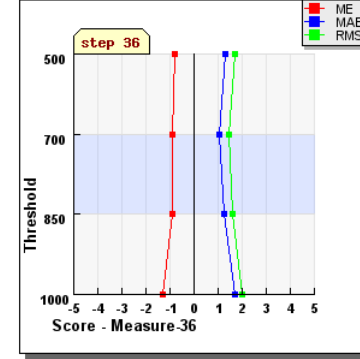
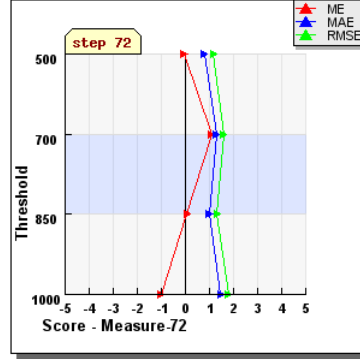
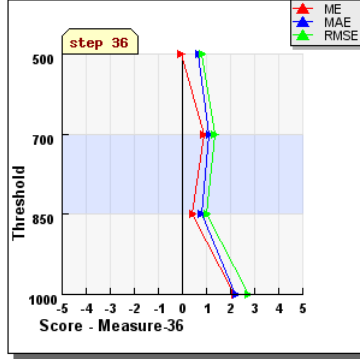
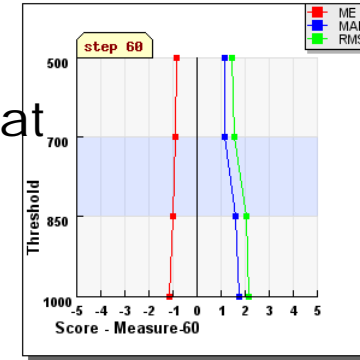
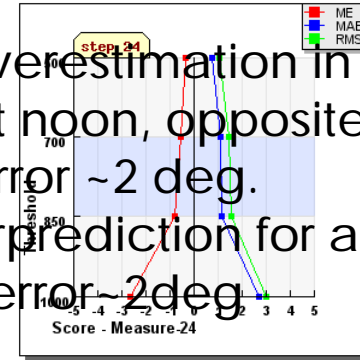
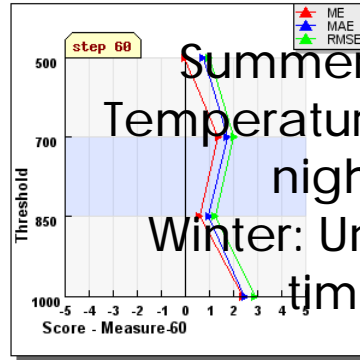
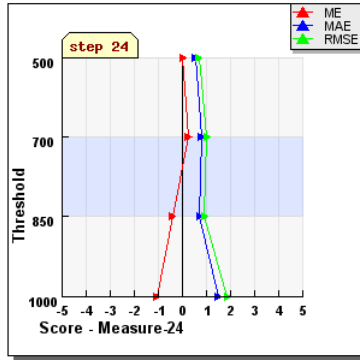
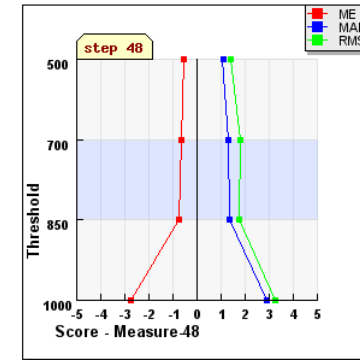
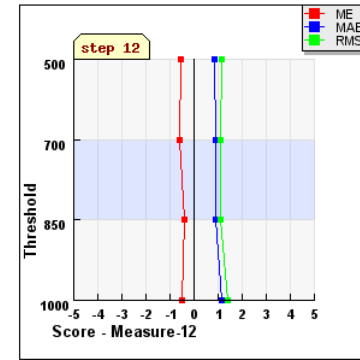
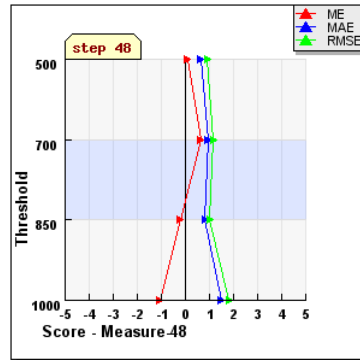
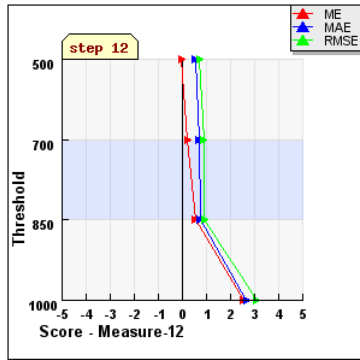
TEMPERATURE

Winter



TEMPERATURE - 00 Run
Stratification : All Greek Stations - Period: JJA 2011

TEMPERATURE - 00 Run
Stratification : All Greek Stations - Period: DJF 2011-2012



Summer: Overestimation in Temperature at noon, opposite at night, error ~2 deg.
 Winter: Underprediction for all times, error ~2deg

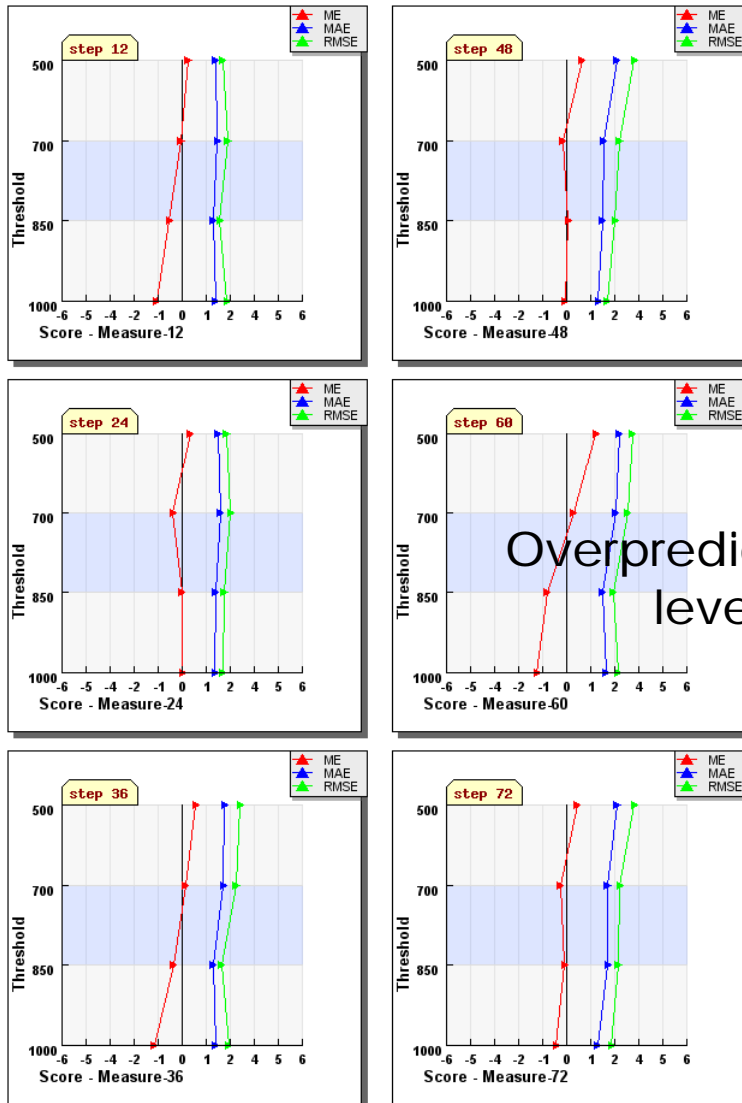
Wind Speed

Summer

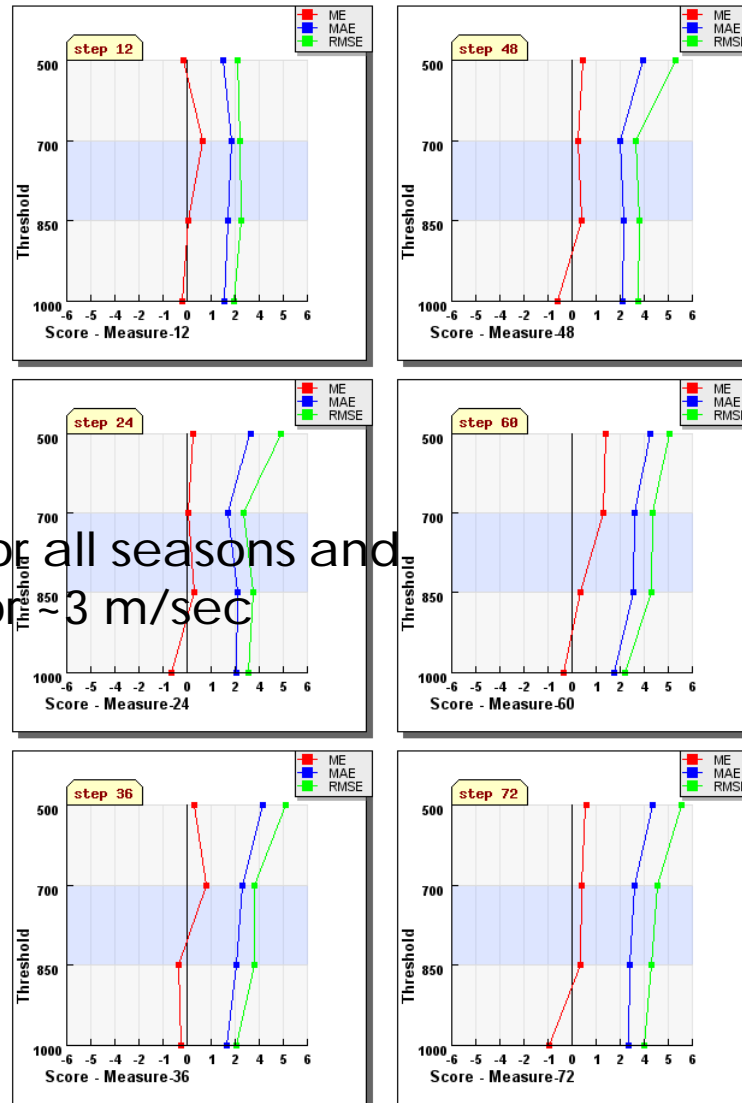
Winter



WIND SPEED - 00 Run
Stratification : All Greek Stations - Period: JJA 2011



WIND SPEED - 00 Run
Stratification : All Greek Stations - Period: DJF 2011-2012



Overprediction for all seasons and levels, error ~ 3 m/sec

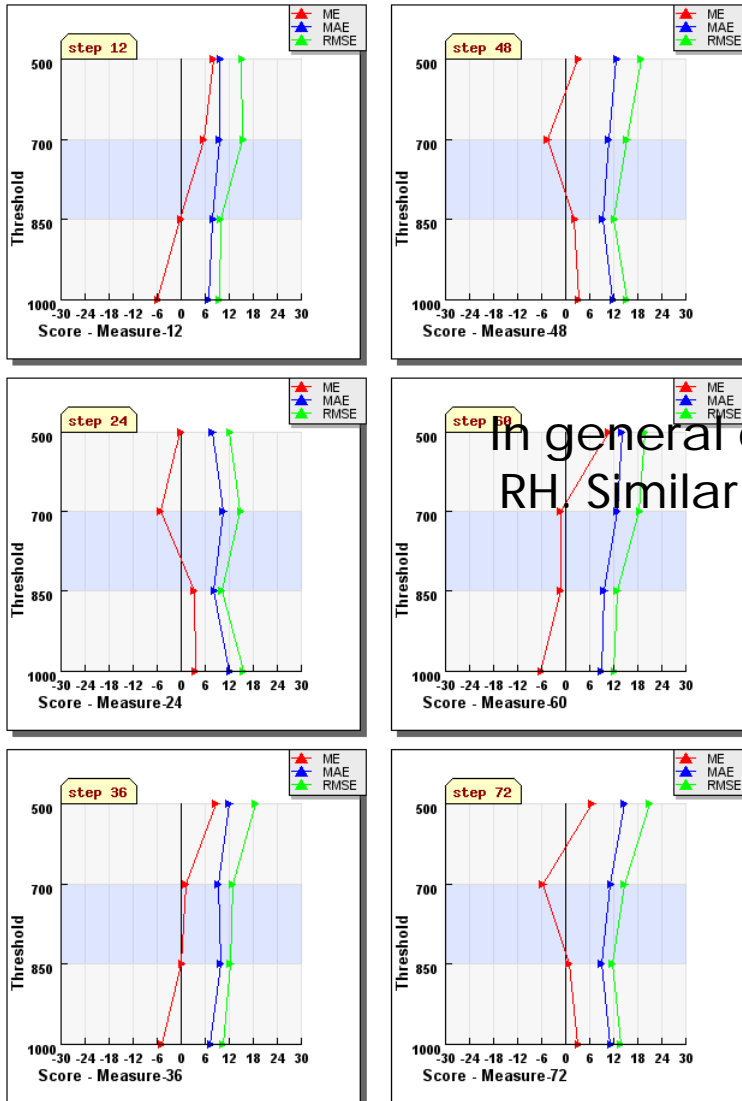
Relative Humidity

Summer

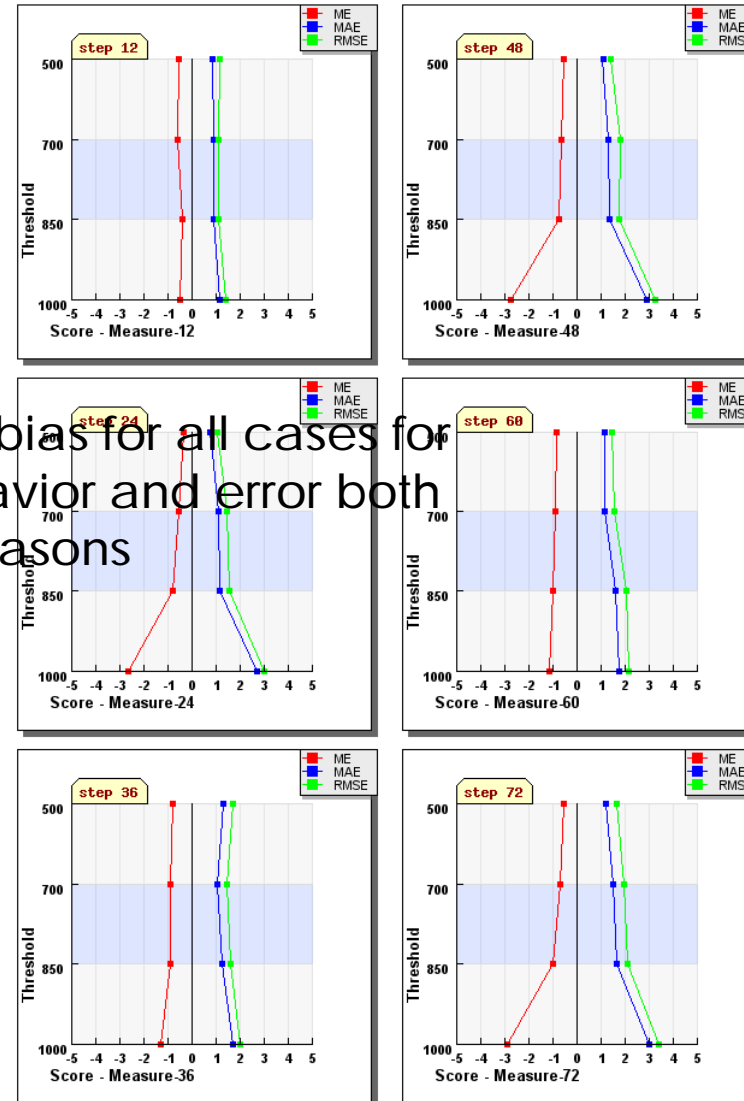
Winter



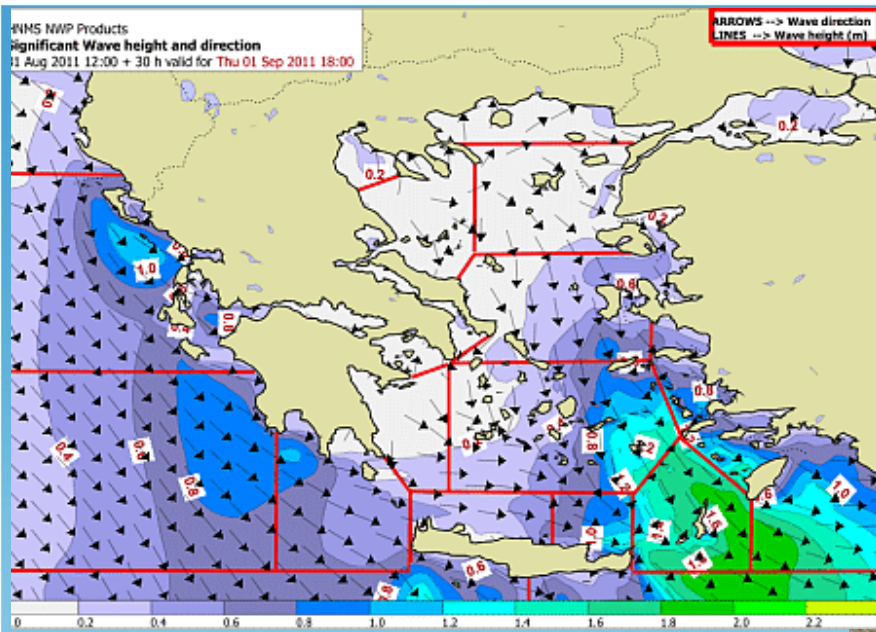
RH - 00 Run
Stratification : All Greek Stations - Period: JJA 2011



TEMPERATURE - 00 Run
Stratification : All Greek Stations - Period: DJF 2011-2012

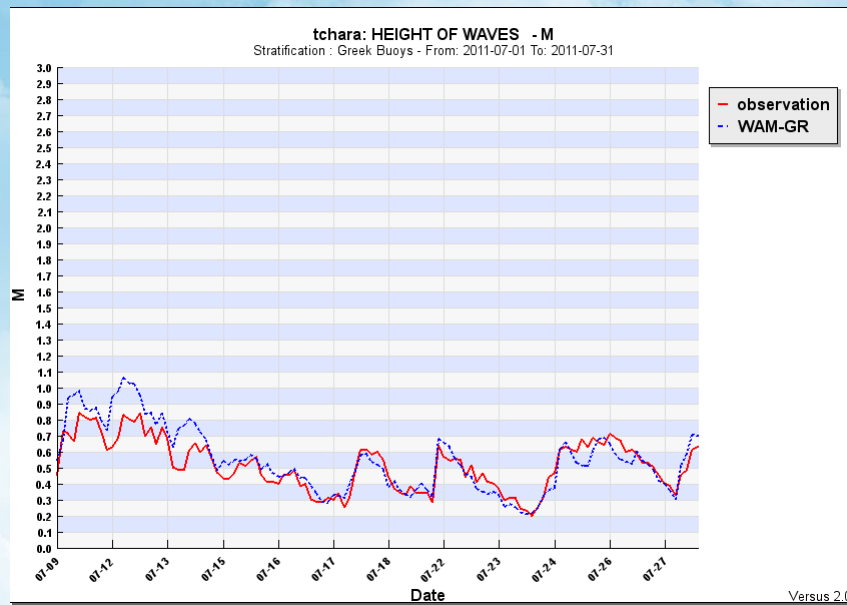


In general cold bias for all cases for RH. Similar behavior and error both seasons

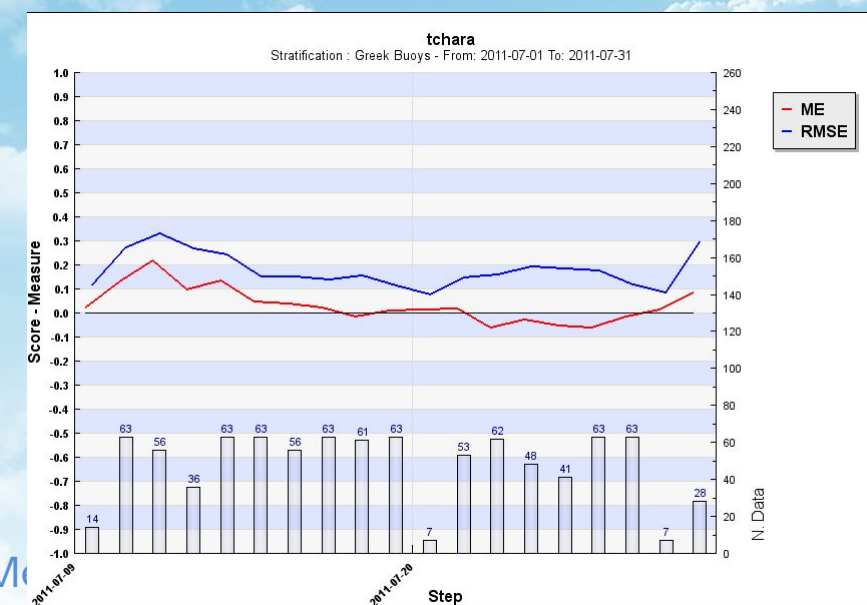


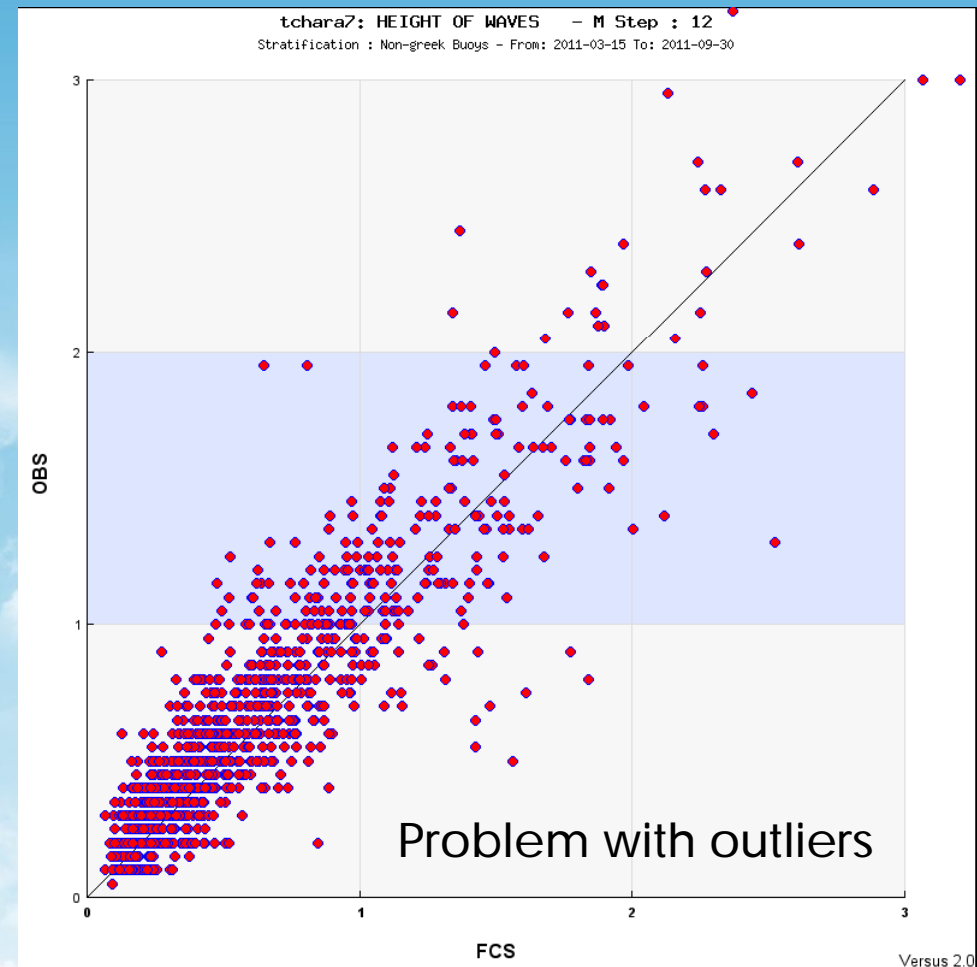
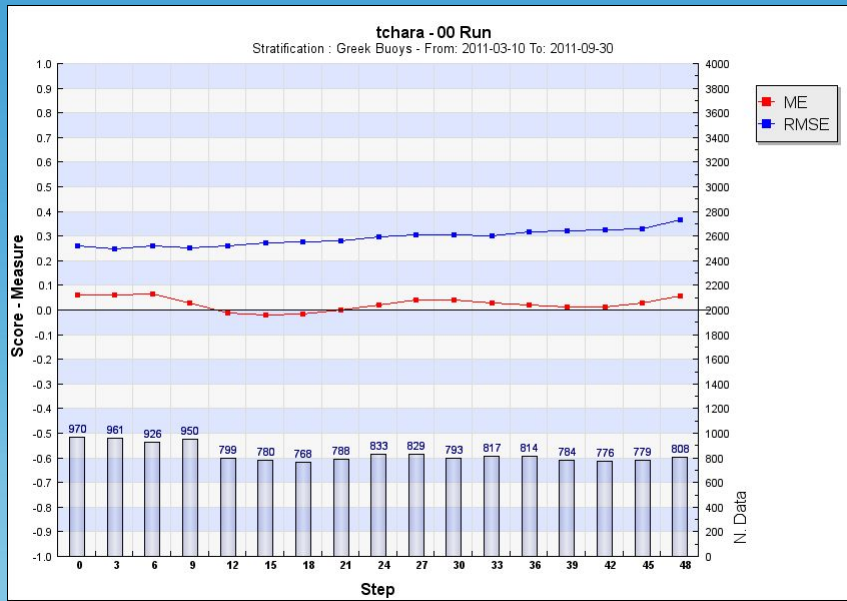
Wave Atmospheric Model

Driven by COSMOGR (7km) output - Verification of significant wave height/direction



Versus 2.0

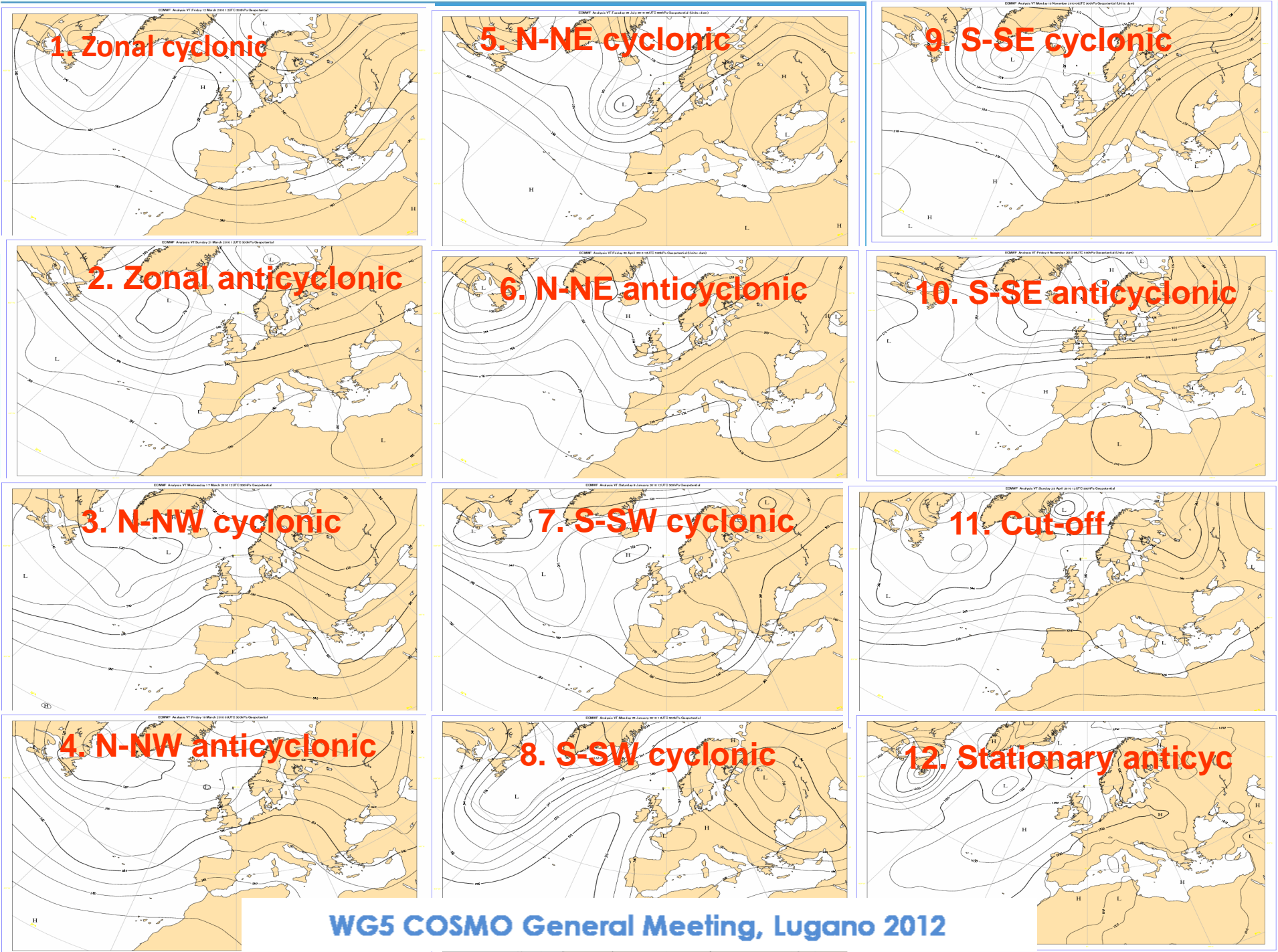






Weather Defined Verification

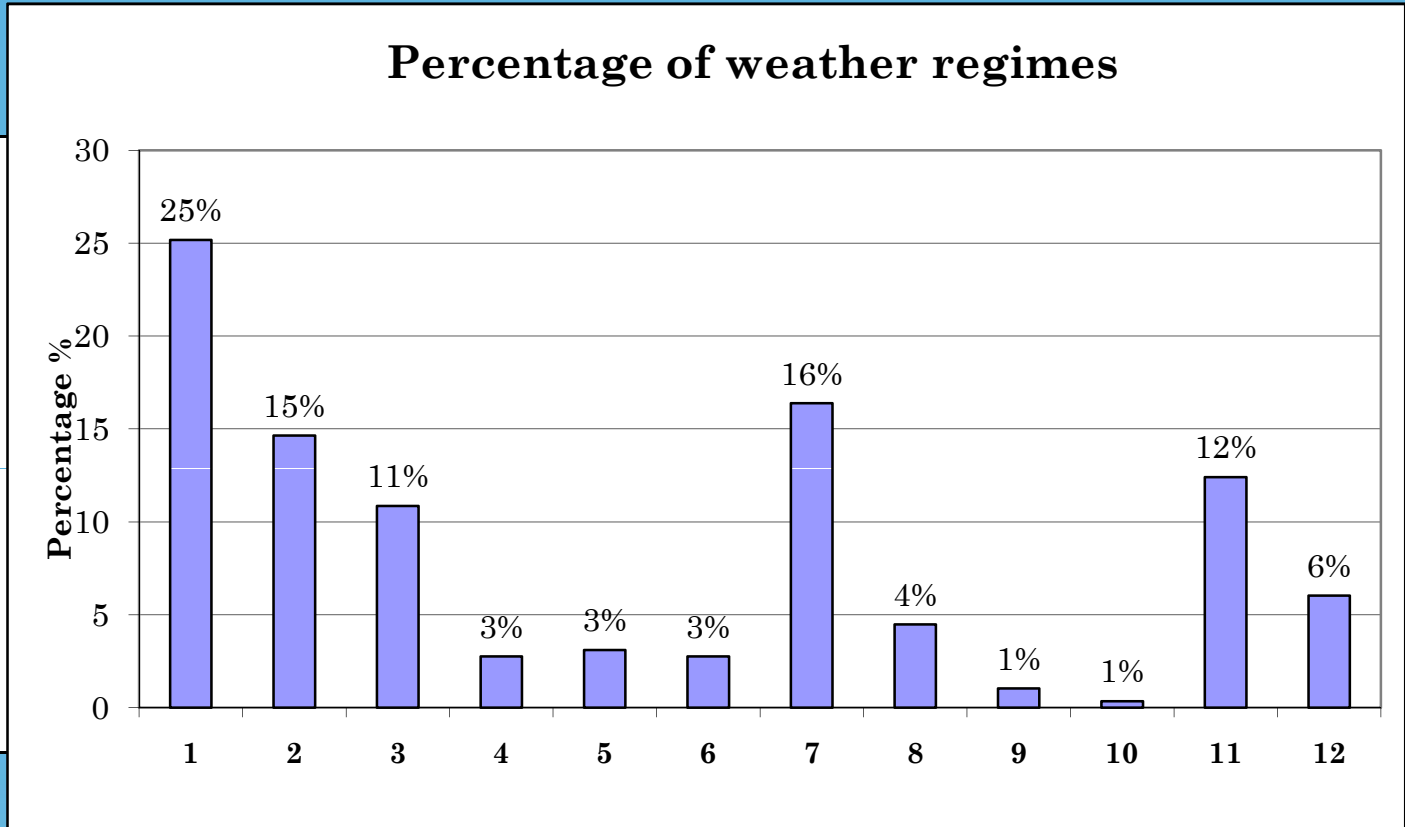
WG5 COSMO General Meeting, Lugano 2012

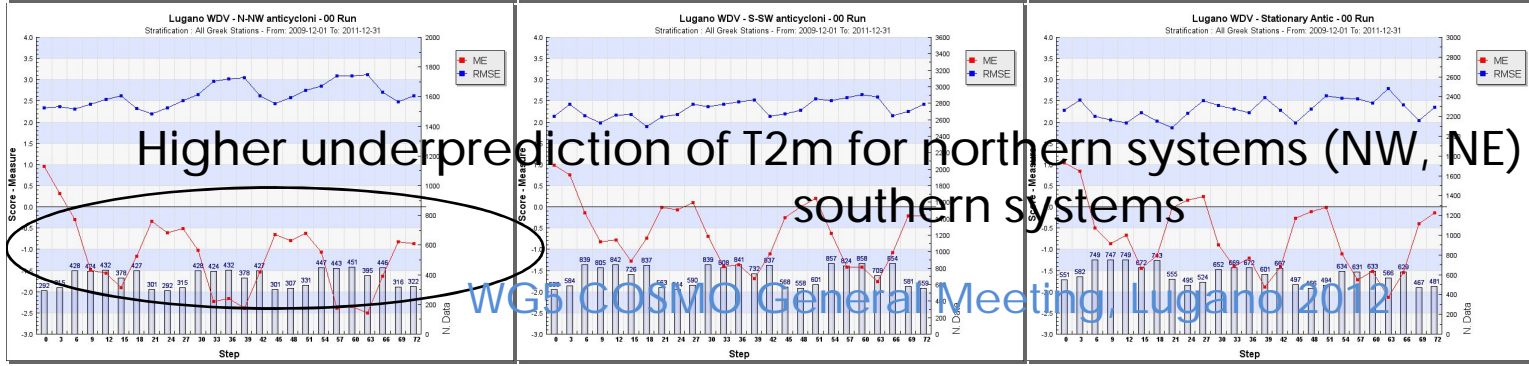
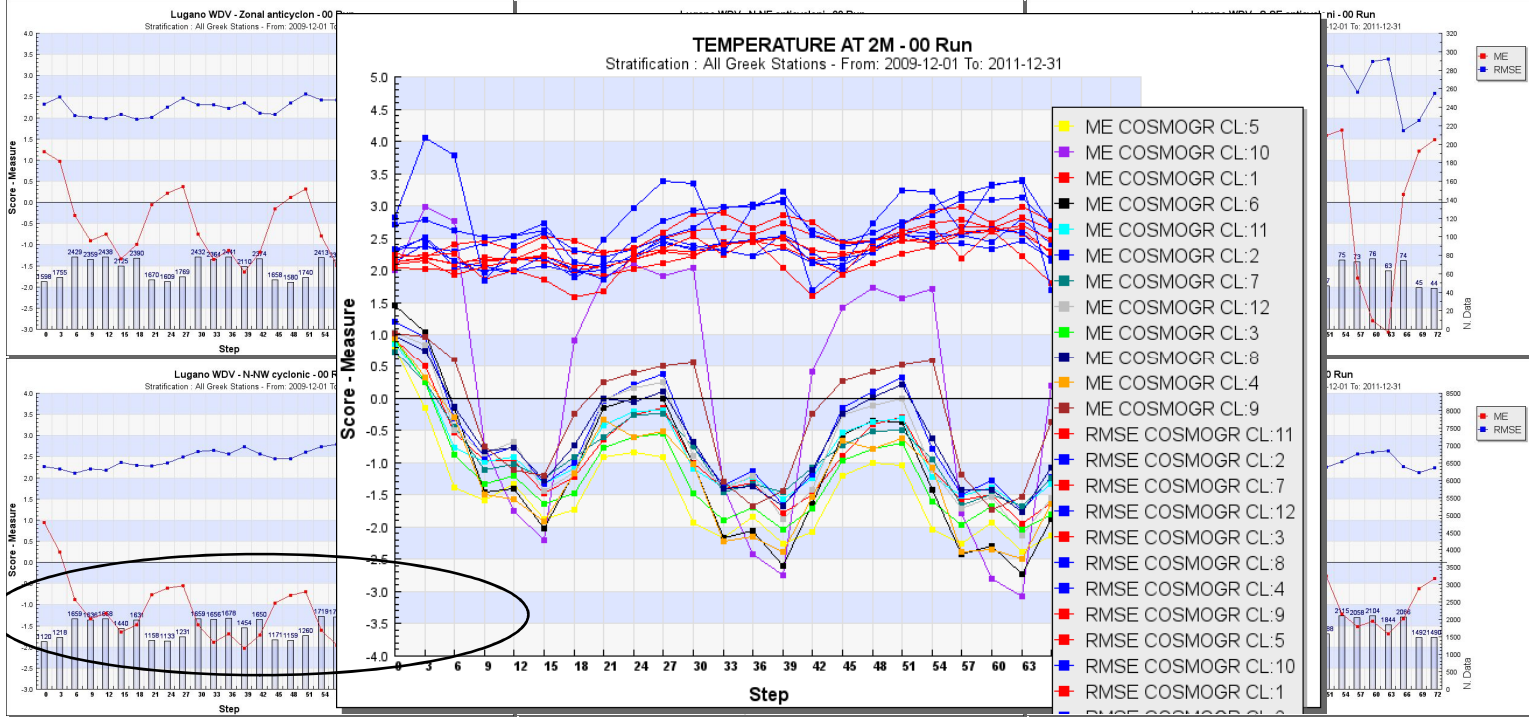
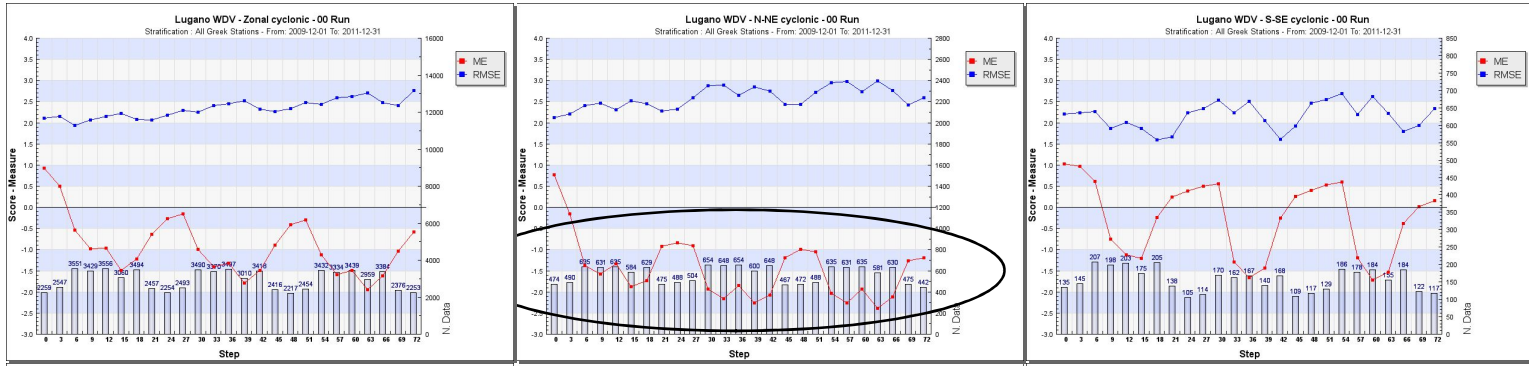


Weather Classification: 01/09/2009-31/12/2011=580day

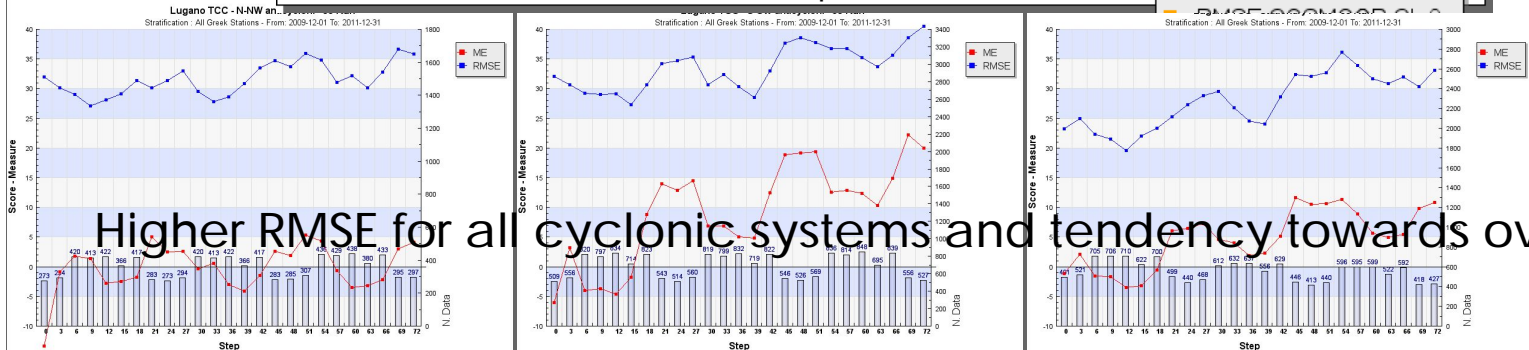
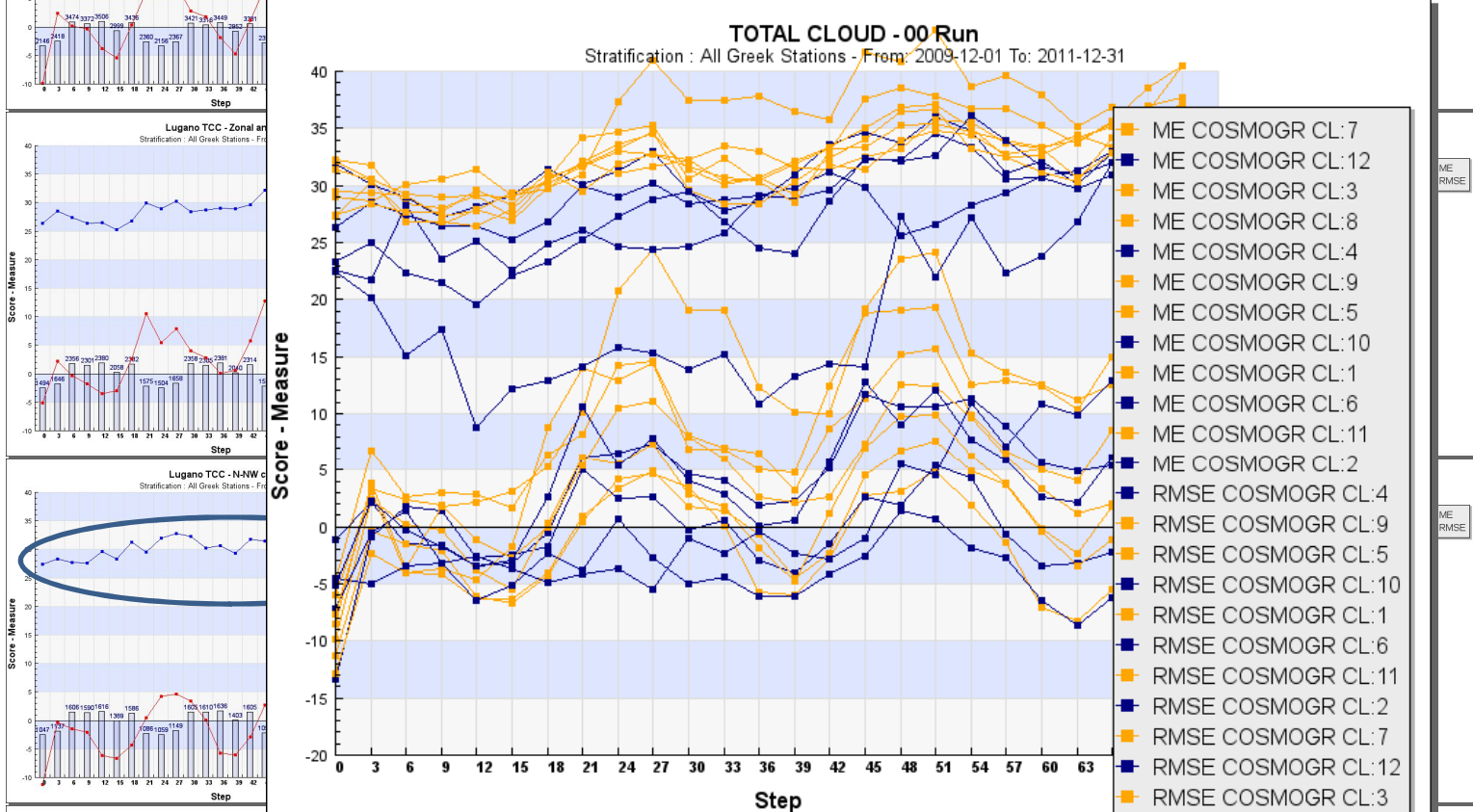
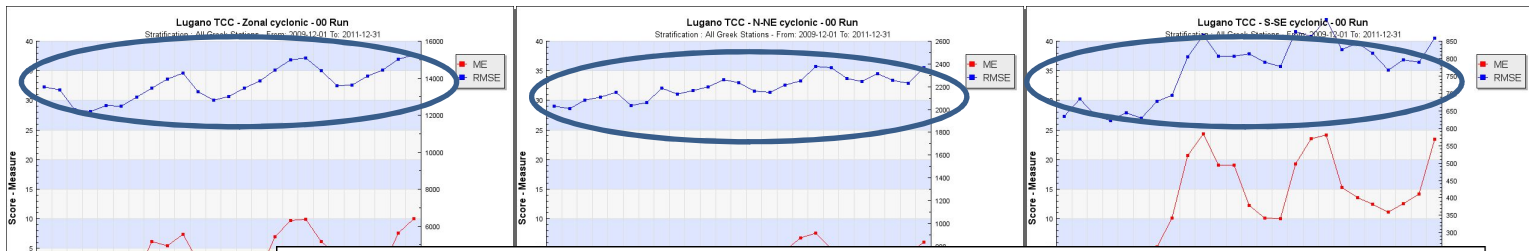


1	Zonal cyclonic
2	Zonal anticyclonic
3	N-NW cyclonic
4	N-NW anticyclonic
5	N-NE cyclonic
6	N-NE anticyclonic
7	S-SW cyclonic
8	S-SW anticyclonic
9	S-SE cyclonic
10	S-SE anticyclonic
11	Cut-off
12	Stationary Anticyclone



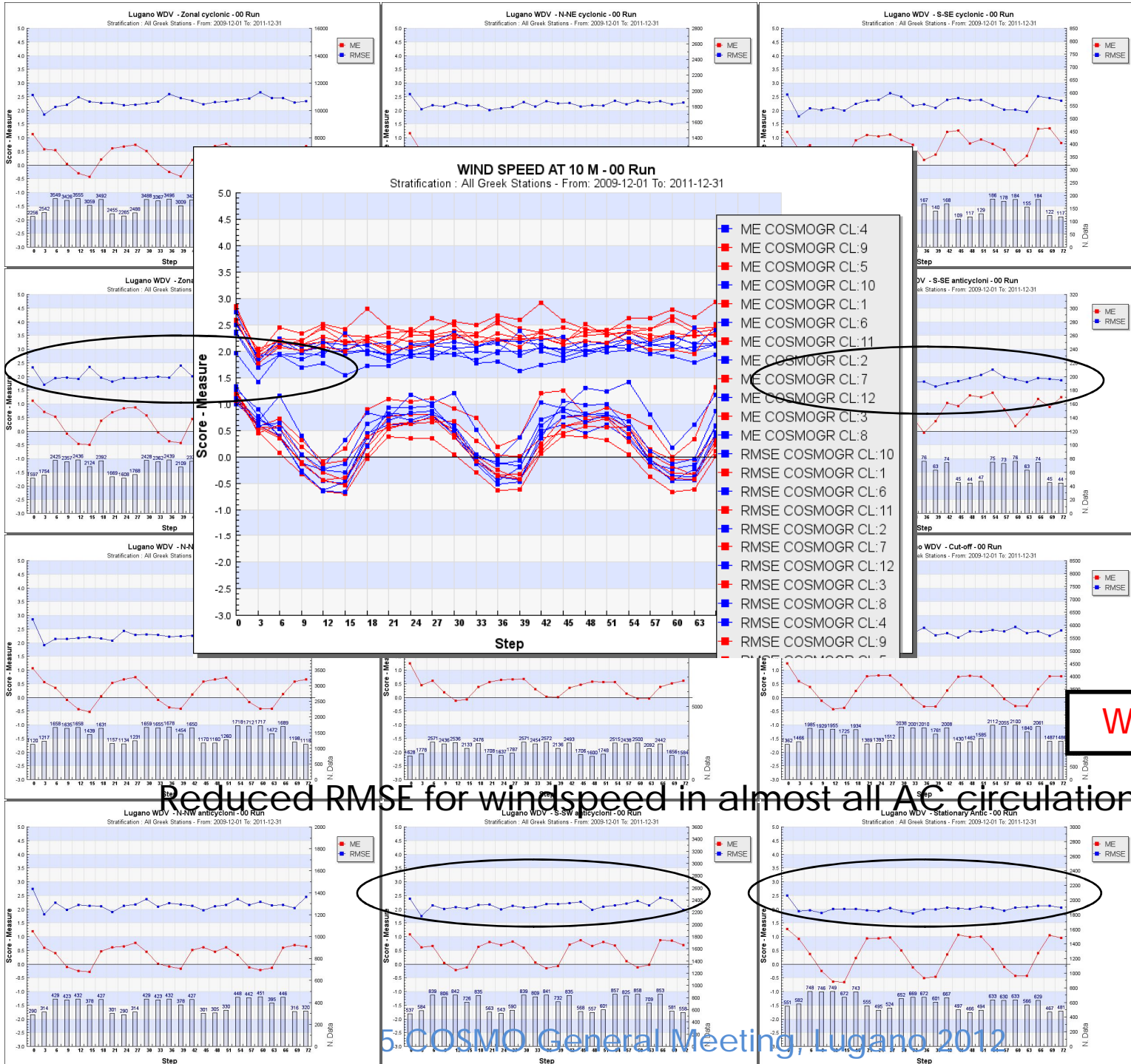


Temp 2m

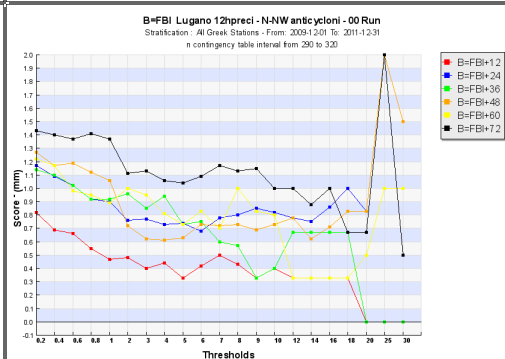
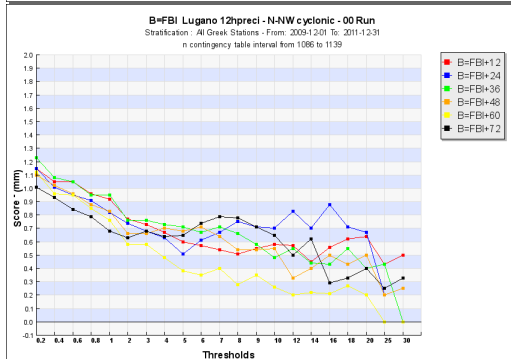
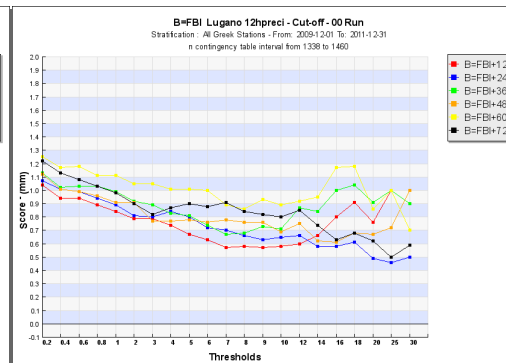
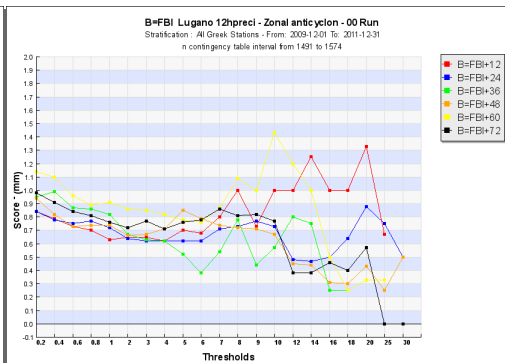
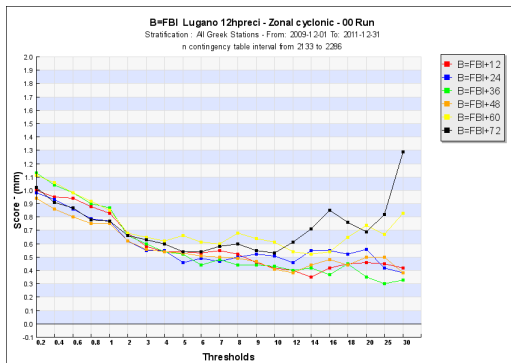


TCC

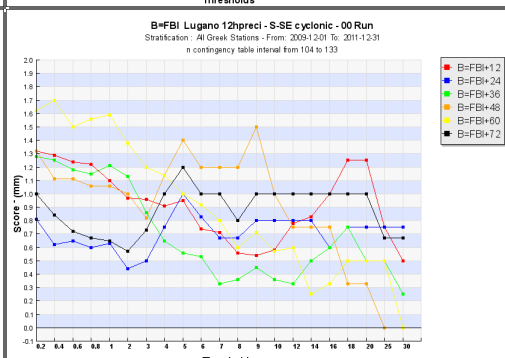
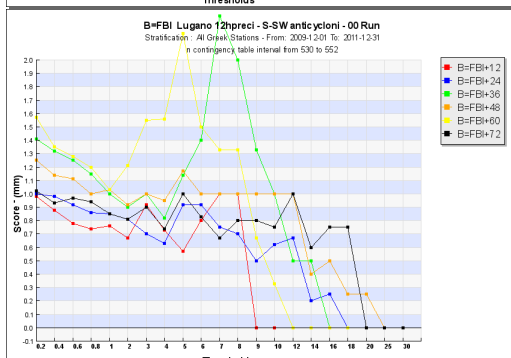
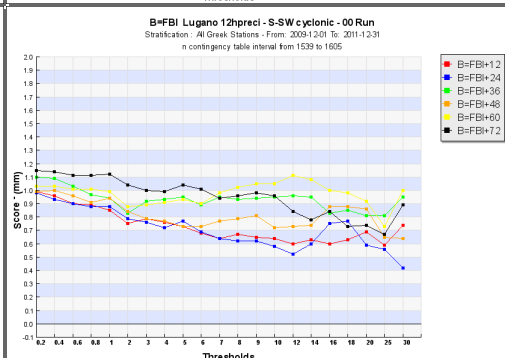
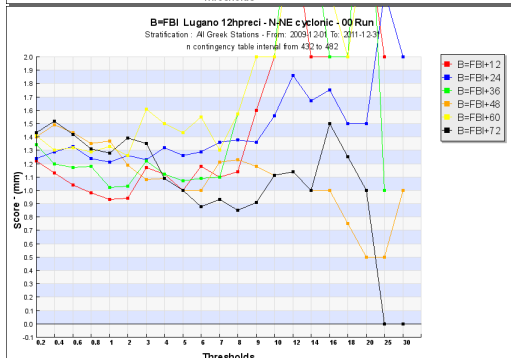
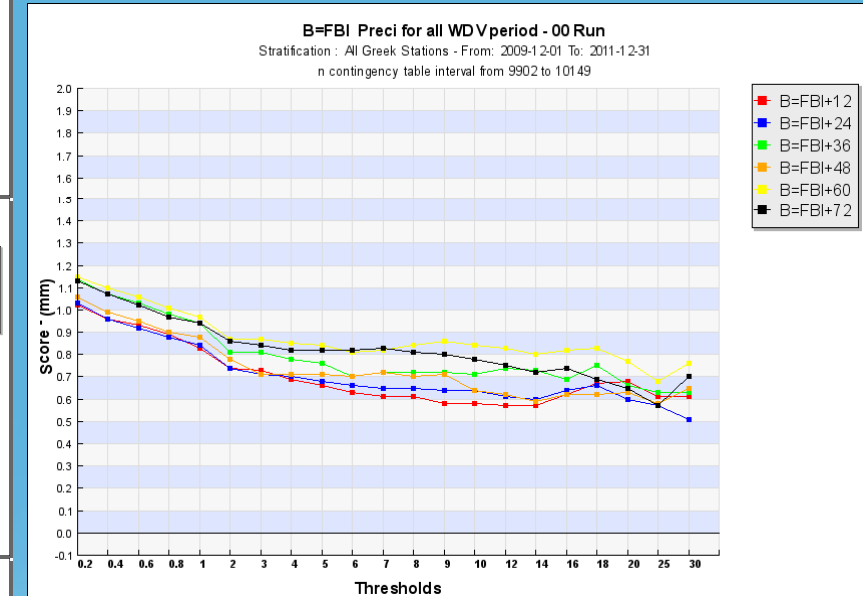
Higher RMSE for all cyclonic systems and tendency towards overprediction



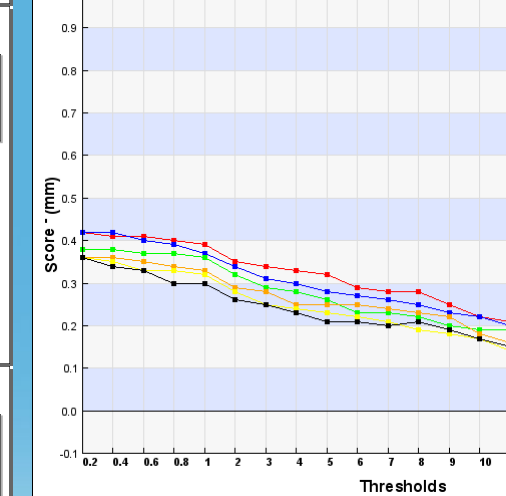
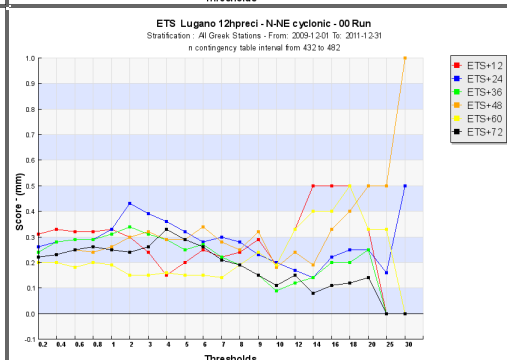
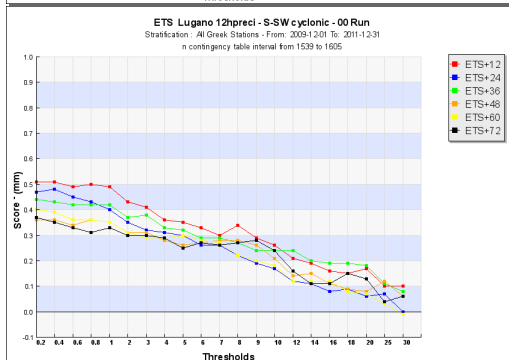
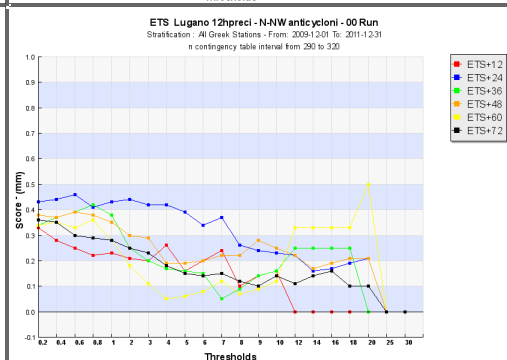
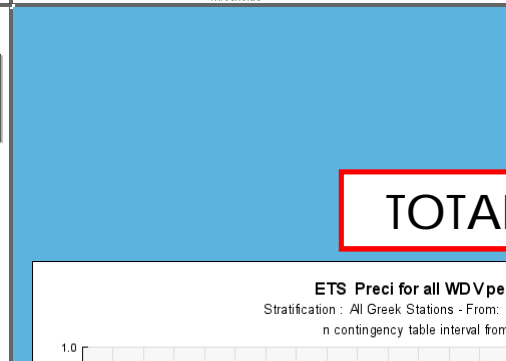
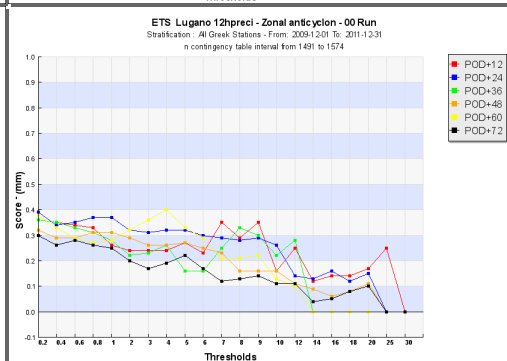
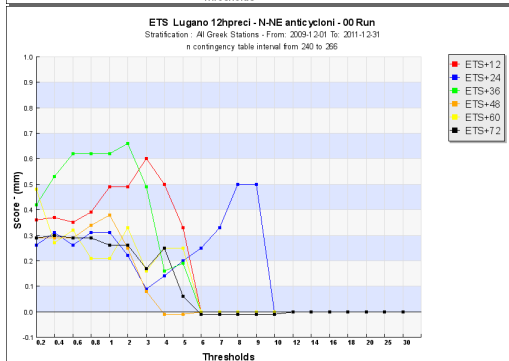
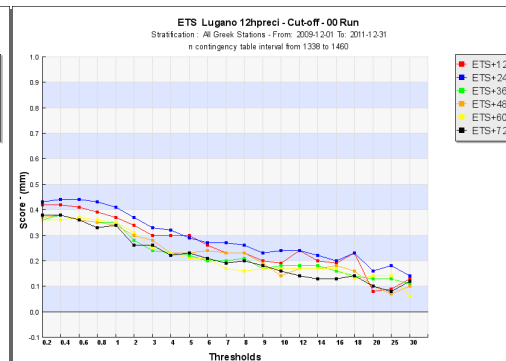
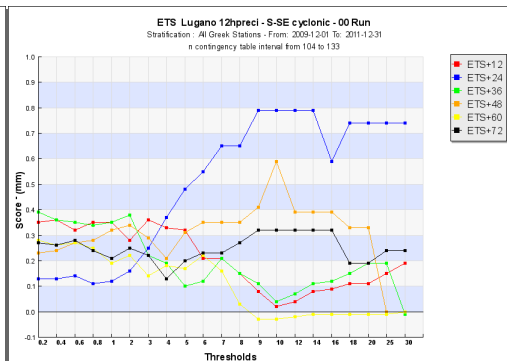
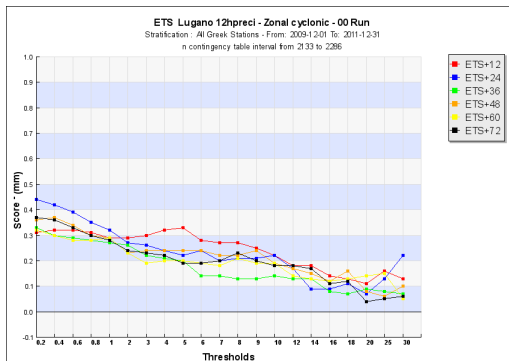
Reduced RMSE for windspeed in almost all AC circulations



TOTAL



FBI exhibits underprotection in the lower precipitation thresholds when present is an anticyclonic circulation



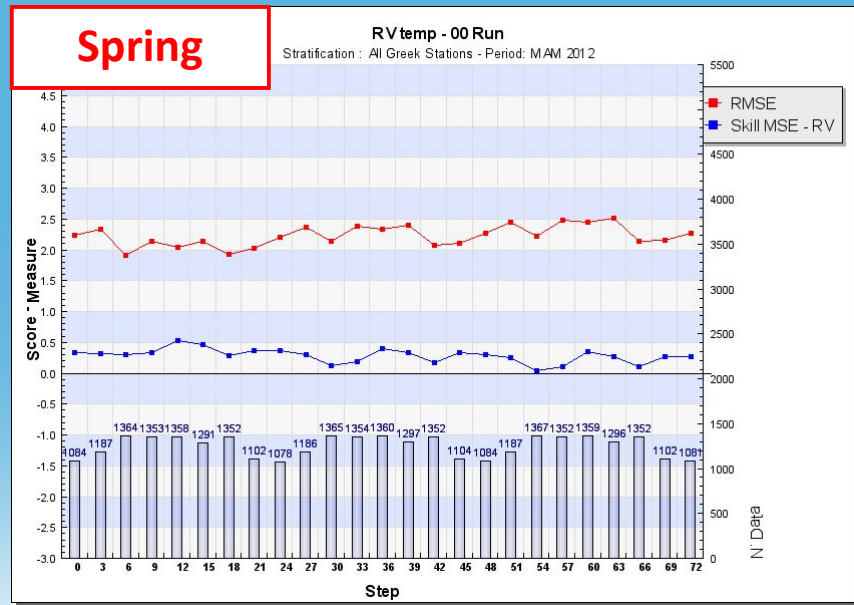
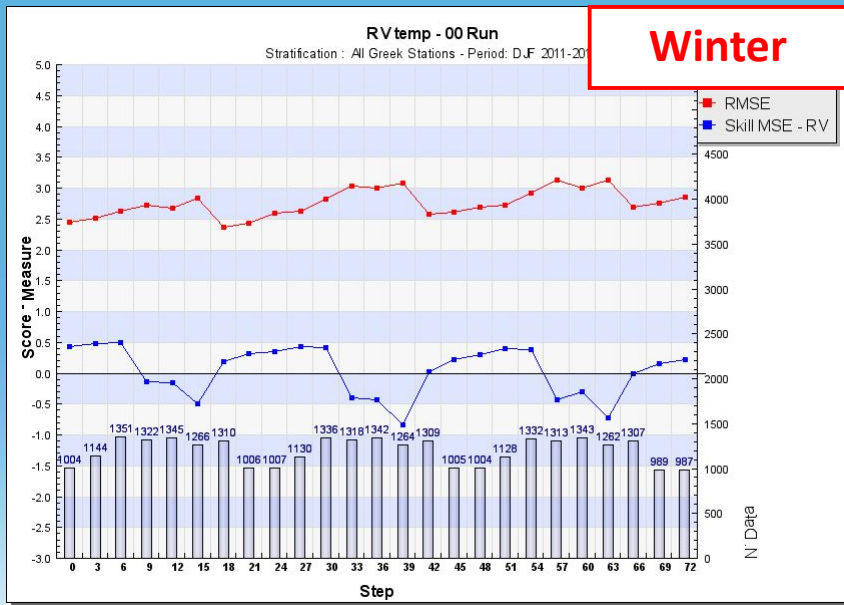
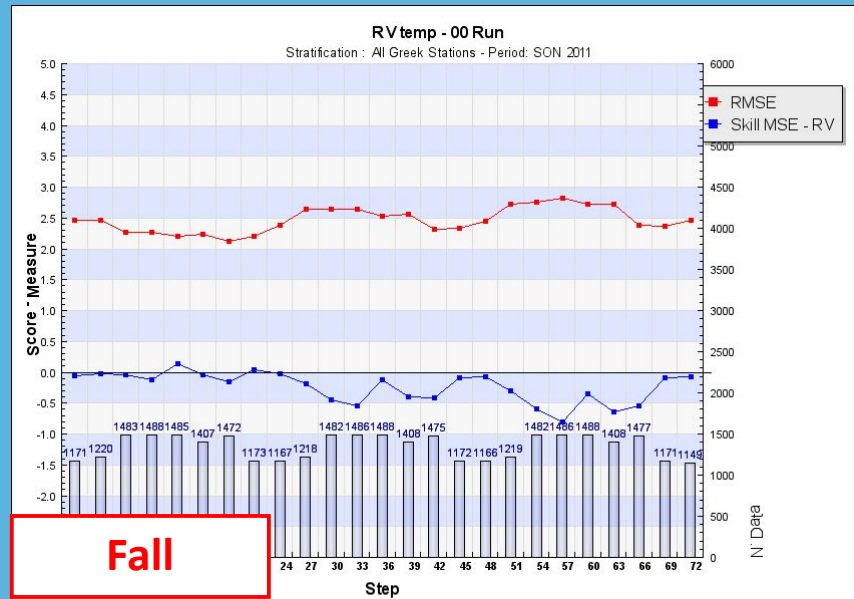
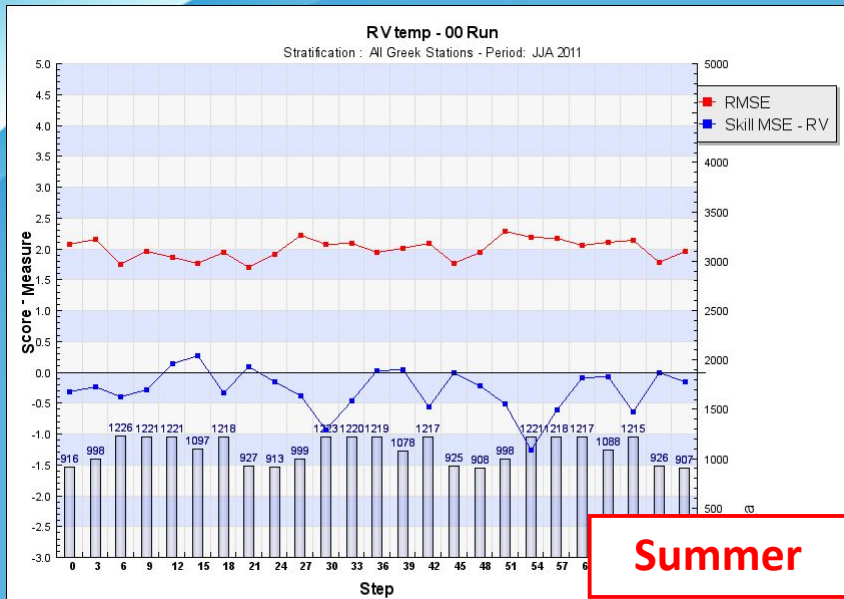
TOTAL

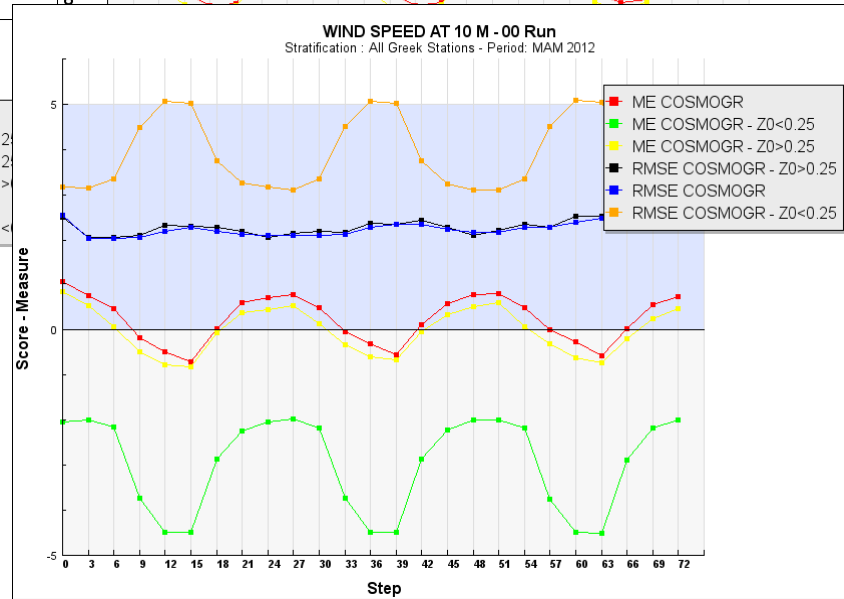
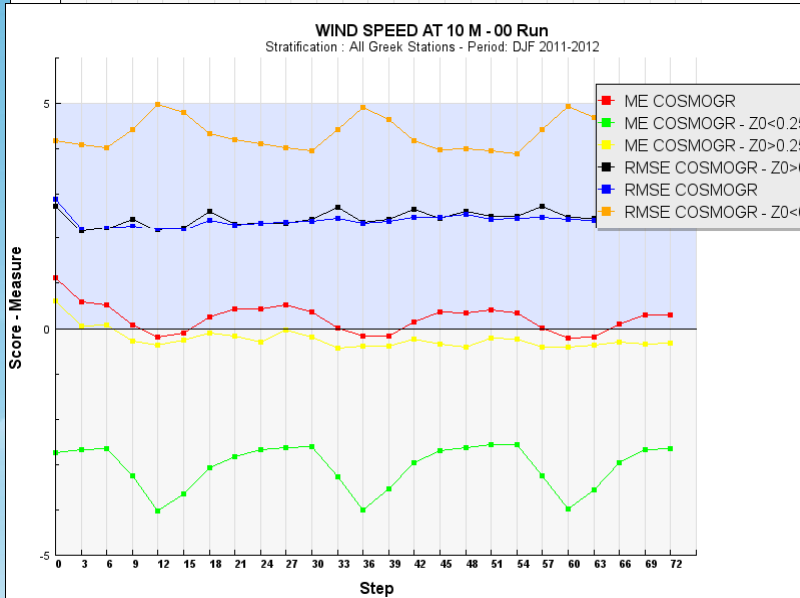
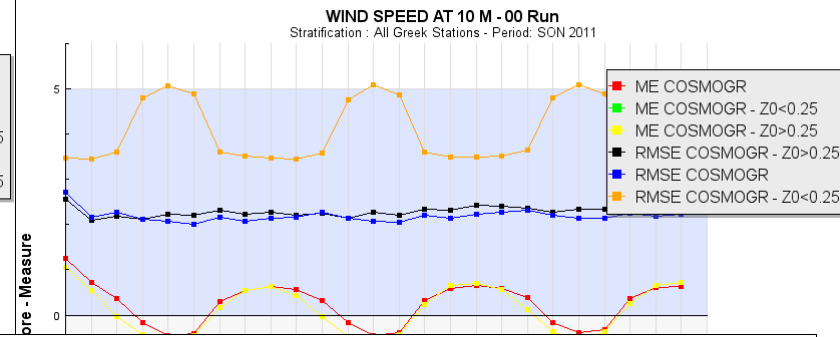
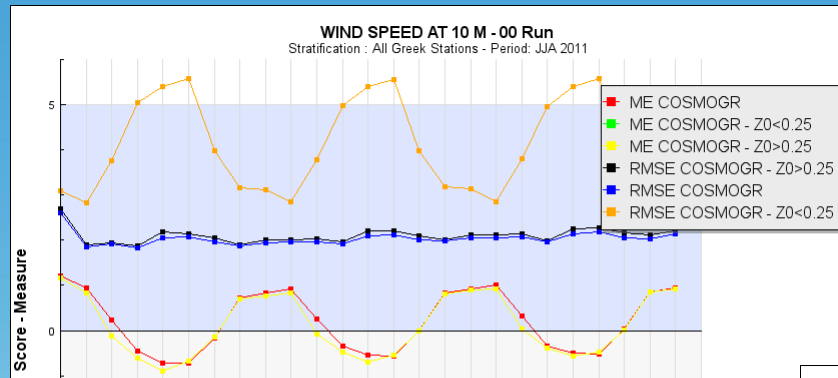
ETS scores slightly better for SW systems



Thank you!

T2m : RMSE – RV





Obstacles	0.03
Low crops, occasional large obstacles; $x'/h > 20^*$	0.10
High crops, scattered obstacles, $15 < x'/h < 20^*$	0.25
Parkland, bushes, numerous obstacles, $x'/h 10^*$	0.50
Regular large obstacle coverage (suburb, forest)	0.50 - 1.0

Wind Speed with respect to Roughness Length

Strong underestimation of wind in positions with small roughness length and increased error

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