

## ICON vs COSMO4

Comparisons of Summer cases with  
COSMO4km and ICON2.5km

# ICON at HNMS

## 1. The model setup

HNMS started daily runs of the ICON model on end of May 2019. These runs are performed at ECMWF, using billing units provided by DWD.

(Detailed description at [www.cosmo-model.org/content/tasks/operational/hnms/icon/default.htm](http://www.cosmo-model.org/content/tasks/operational/hnms/icon/default.htm))

### a. The domain

The Greek domain is (roughly) the minimum normal domain covering the COSMO rotated one that is currently in use. Its main characteristics are:



It is a subdomain of the global R2B10 domain  
(thus  $\delta x = 2466$  m with a facet average area of 6,08 km<sup>2</sup>)

It contains

2.471.992 facets

1.238.341 vertices

3.710.332 edges

### b. The run parameters

It is run once a day (00h) for 48hrs. Analysis and boundary conditions are provided by IFS (0.1 deg, per 3 hours), with  $dt = 22$  sec, 50 vertical layers.

Output is produced per hour (3 files, model/pressure/z-lev files) in netCDF-v4 format.

Each run takes about 1.4 hrs, using 30 nodes at ECMWF's cca (2160 logical (hyperthreaded) CPUs)

## **2. Plans for next year**

### **Immediate**

As weather becomes less uniform after summer, the the 12h cycle will be switched on and forecast range will expand from 48 to 72 hours. Possibly reduce the input step from 3hrs to one (the DWD-provided FTEs suffice for the rest of 2019).

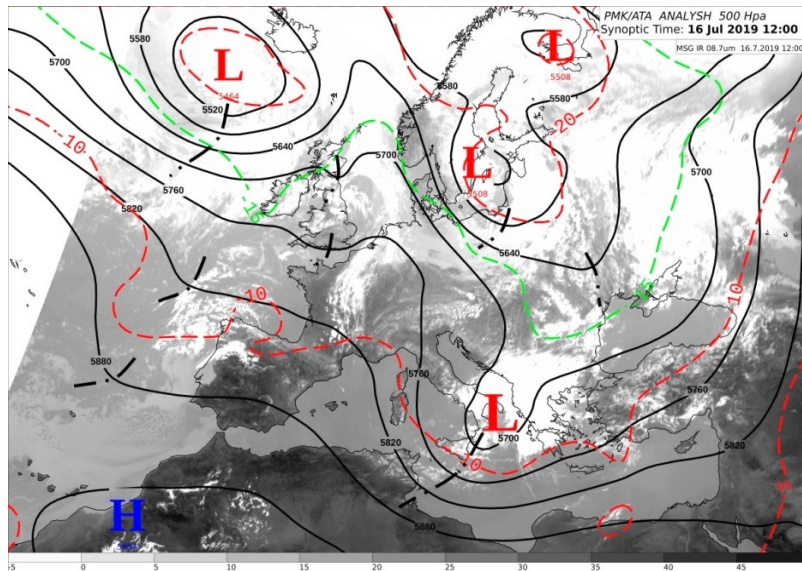
### **Mid-term**

Some technical issues have to be resolved: switch BC retrieval from MARS retrieval to ECMWF dissemination, add the ICON runs to a priority queue, familiarize COSMO-involved people with the new output format and adapt all current applications to ICON data (wave-model input wind, verification, automatic bulletins, graphics).

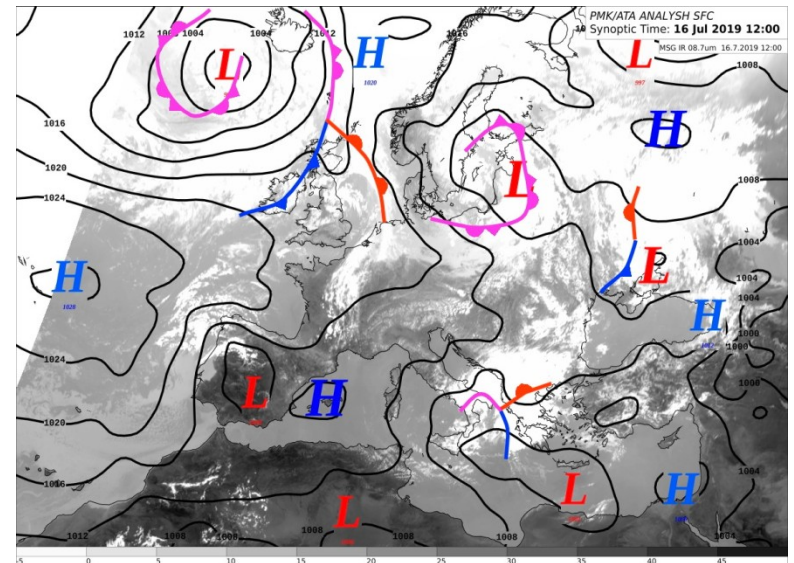
### **Before the end of the 2019-2020 “COSMO-year”**

Perform 1<sup>st</sup> tests with nested domains, evaluate results and start daily runs for less than 0.5km resolutions.

## CASE 1: 16/7/2019 1200 UTC: A summer convective precipitation event



500hPa

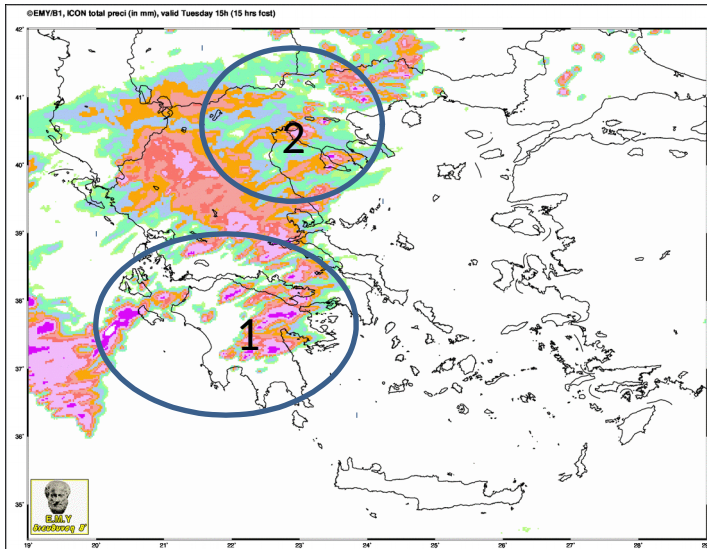


SFC

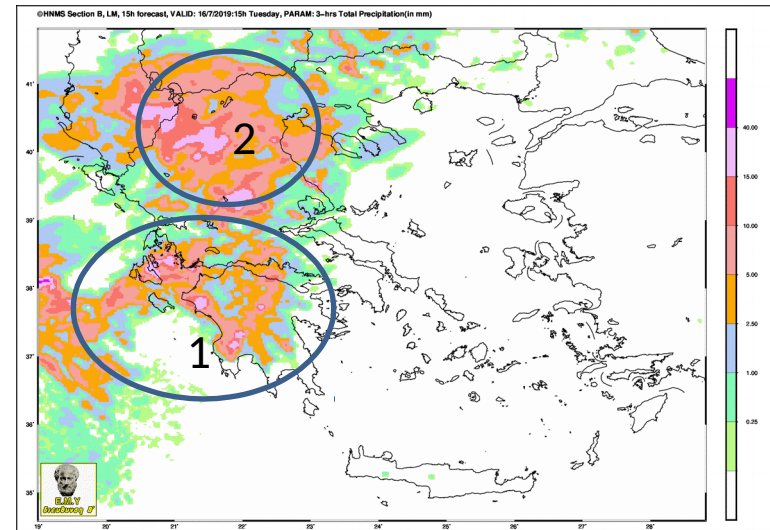
In mid-summer, a cold intrusion from the North accompanied by a trough reached the country and remained for 3 days. At the surface, a low system formed with frontal activity. The conditions were unusual for the month of July. Precipitation amounts over the country were very high at places even over Crete and South Dodecanese (Southern islands). Precipitation forecasts of COSMO and ICON of 15/7 00 UTC are presented

## 3h Precipitation

ICON



COSMO4



Metars 15 UTC

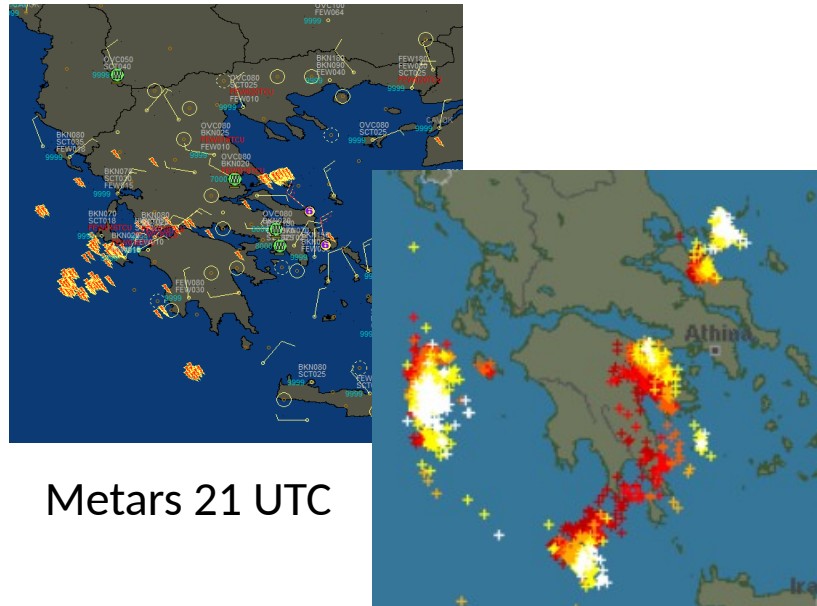
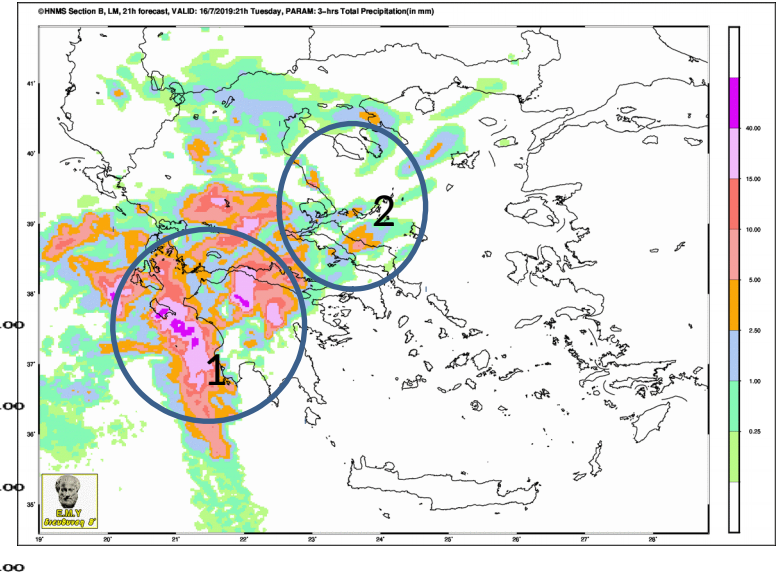
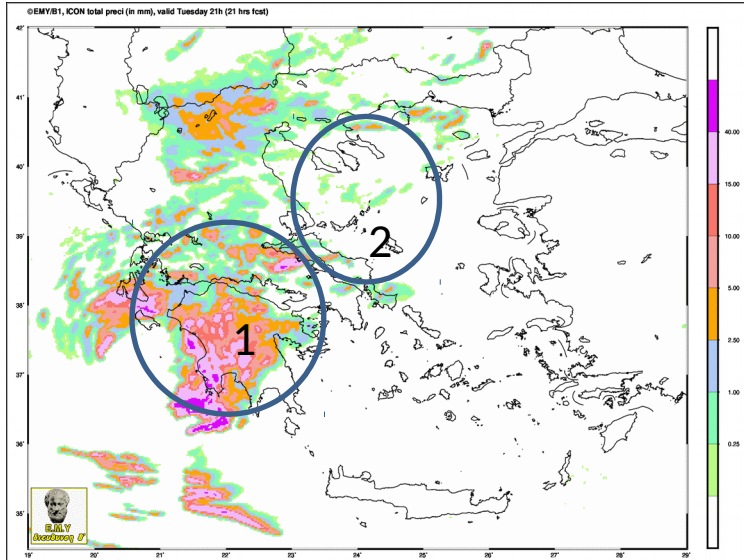
**16/7 15 UTC.** The general precipitation distribution was captured and was similar for the two models. The difference lies on the locally higher ICON amounts at places over the South mainland, and Ionian sea (1) while COSMO predicted overall more extended area of precipitation. The rain amounts over Northern mainland (2) were slightly overestimated by both models.



# ICON

## 3h Precipitation

# COSMO4

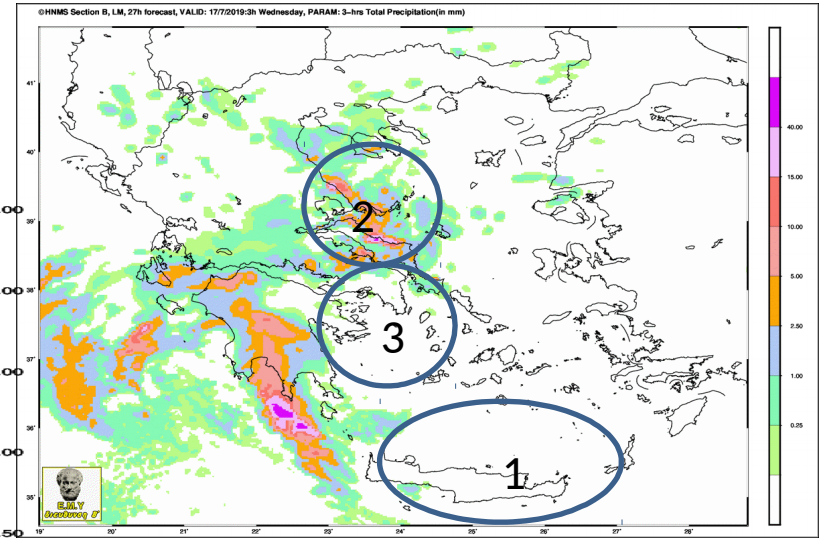
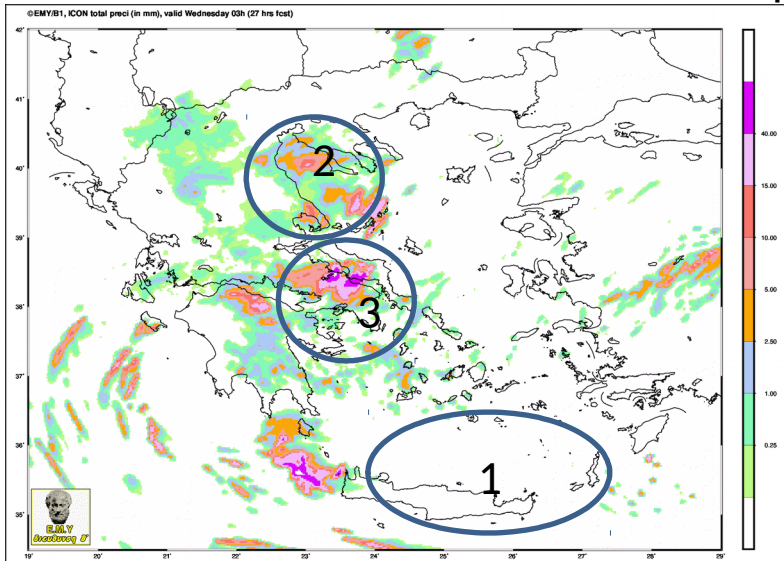


Metars 21 UTC

**16/7 21 UTC** COSMO predicted more extended area of precipitation over SW (1) which was slightly overestimated. COSMO predicted better in Eastern parts (2) where significant convective precipitation amounts were observed.

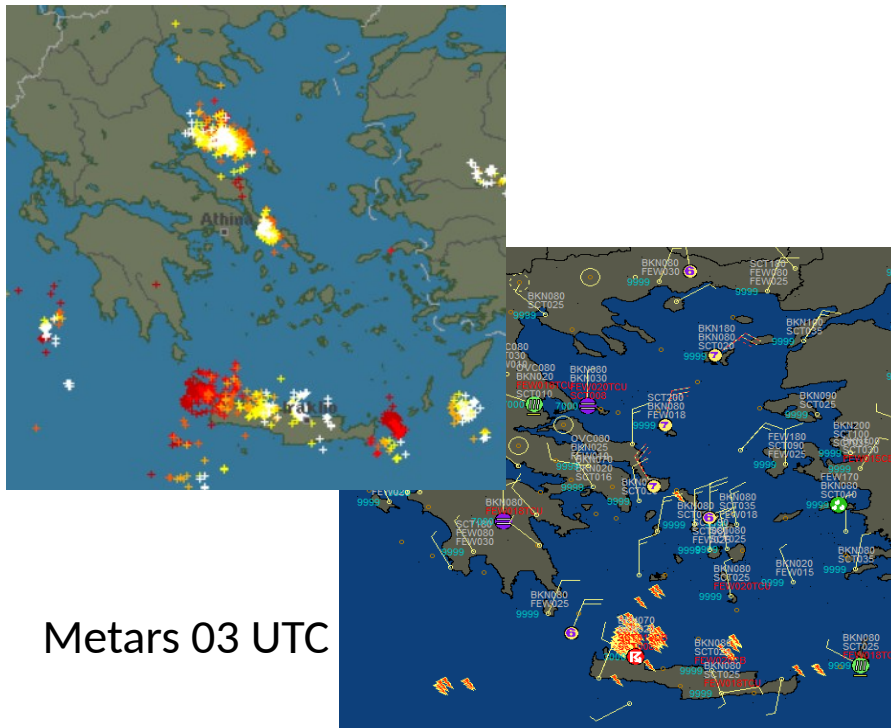
# ICON

# 3h Precipitation



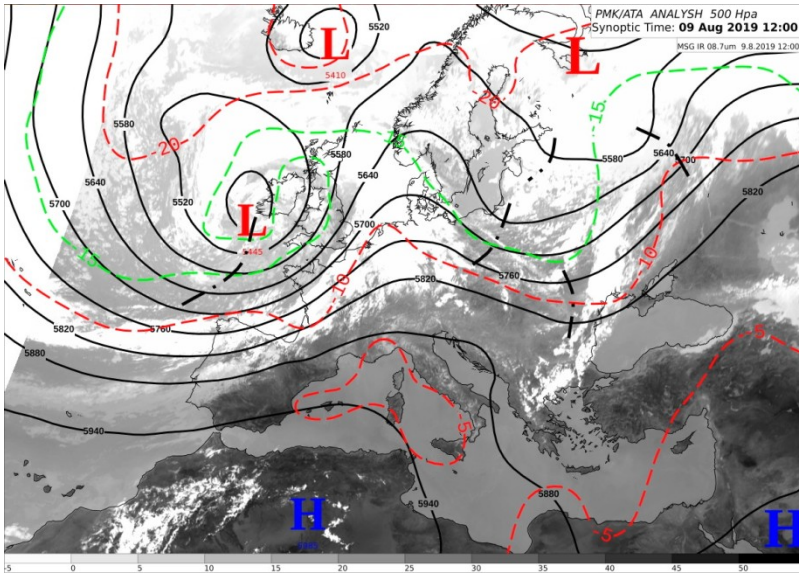
## COSMO4

**17/7 03 UTC:** The precipitation over Southern islands (1)(Crete and Dodecanese) was not predicted. Over North Eastern islands (2) the forecast was quite satisfactory while Attica Region amounts (3) were overestimated especially by ICON.

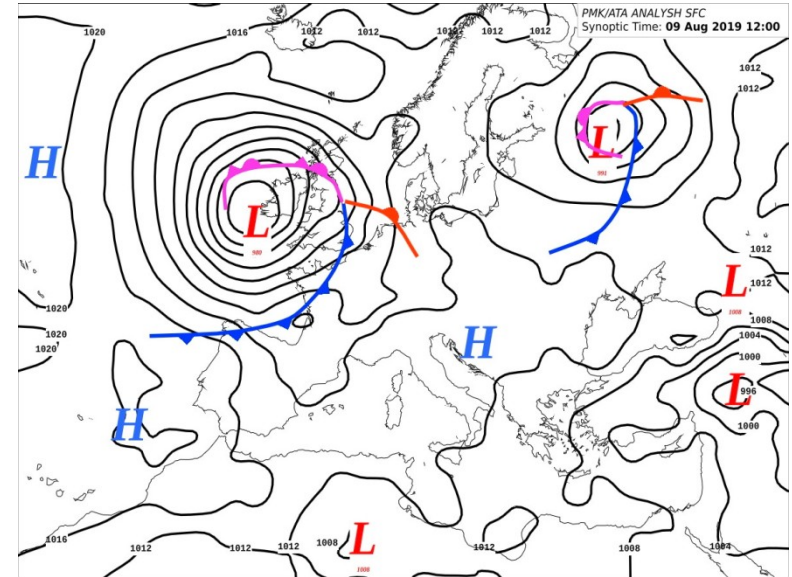


## Metars 03 UTC

## CASE 2 : A typical summer warm weather case 09/08/2019



500hPa



SFC

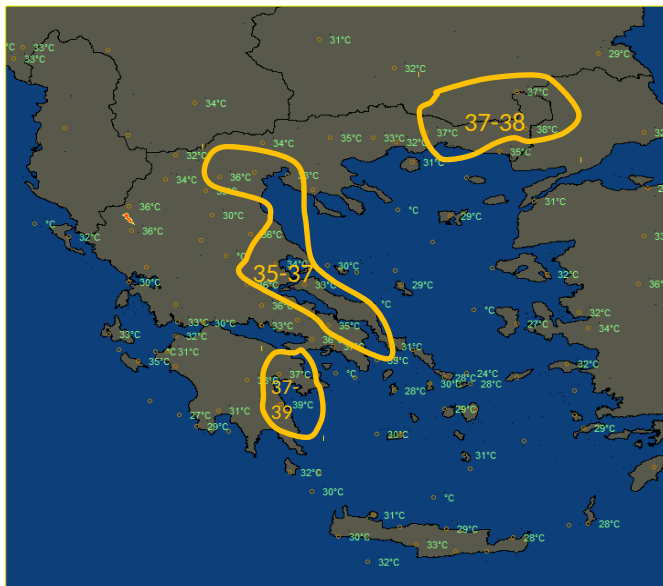
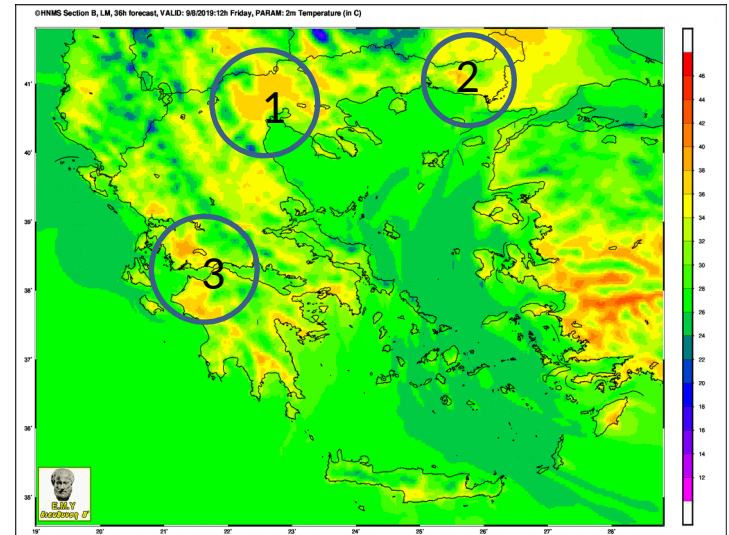
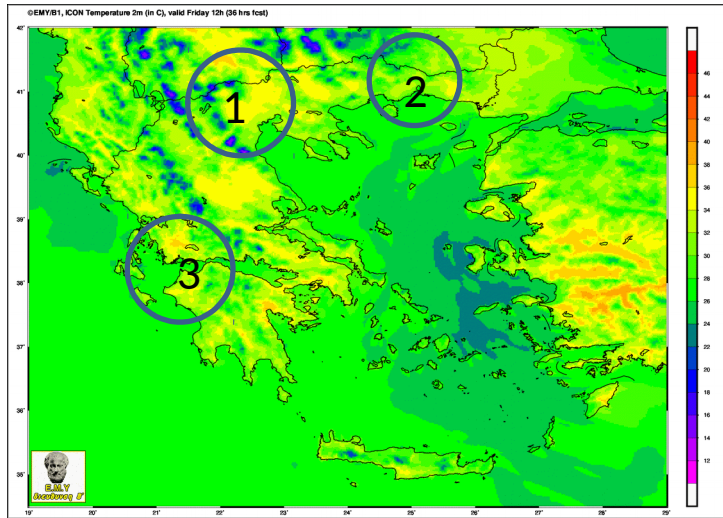
Anticyclonic Conditions with High Pressures in the Country resulted in temperatures above 35° C over Eastern parts.



## ICON

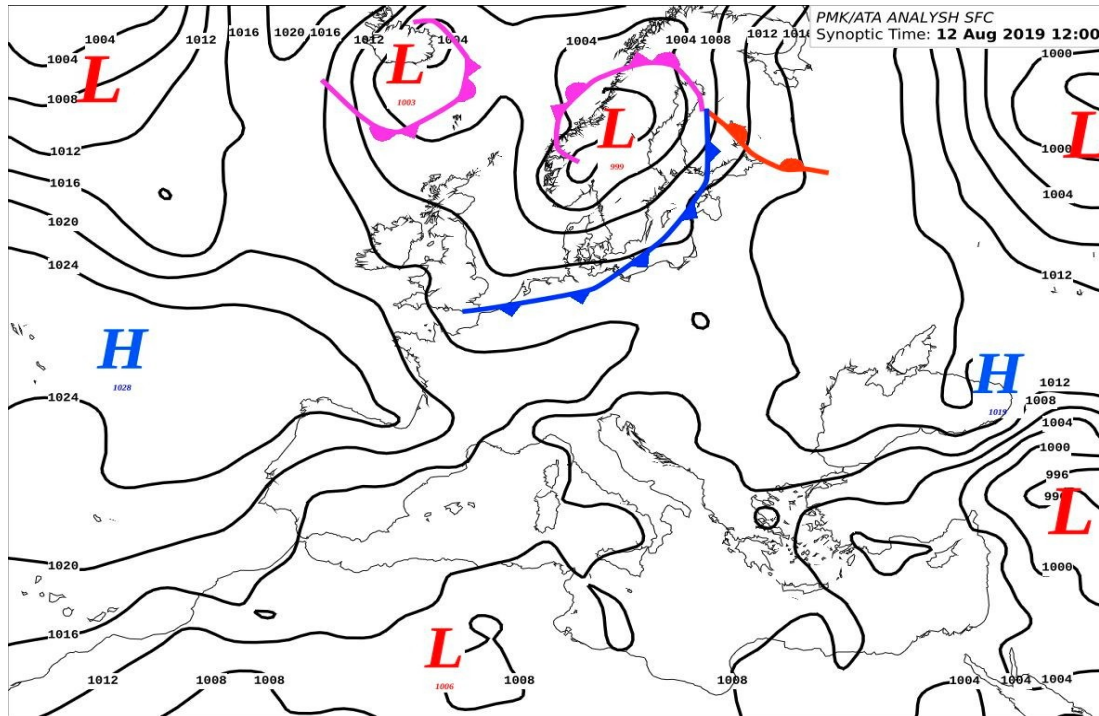
## 2m Temperature

## COSMO4



**09/08 12 UTC:** (Run of 08/08 00 UTC)  
 COSMO generally warmer (daily forecast) than ICON. ICON cooler mountain tops and Eastern Aegean. (finer resolution) . The observed warm areas (2-3 deg.) over North better captured by COSMO, BUT COSMO overpredicted the Southern Peloponnese (3). More detailed verification is needed.

### CASE 3: Etesian winds of 12/8

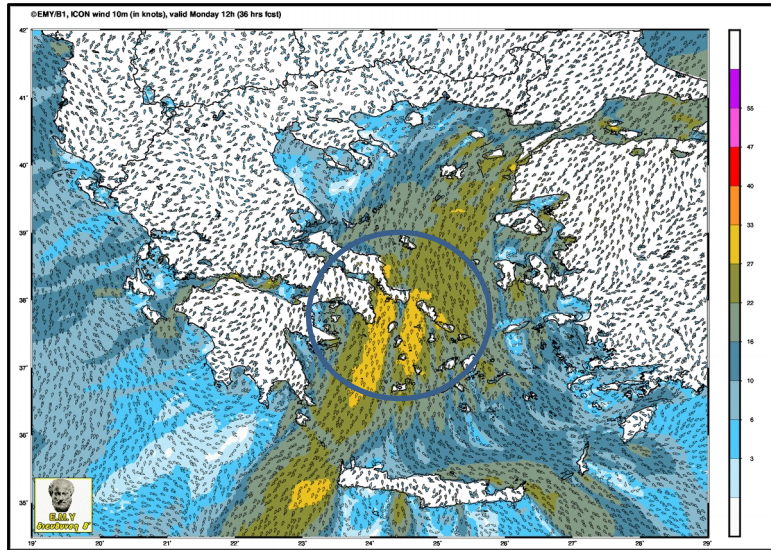


High Pressures over Eastern Balkans and and lower over Turkey resulted in a pressure gradient over Central and Eastern Aegean, which is typical for summertime in Greece.

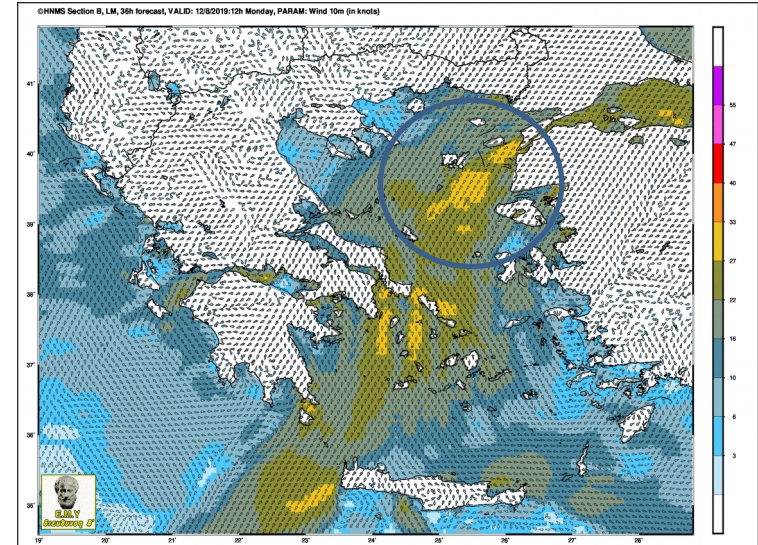
Runs of COSMO and ICON of 11/8 00 UTC are presented.

## 10m winds

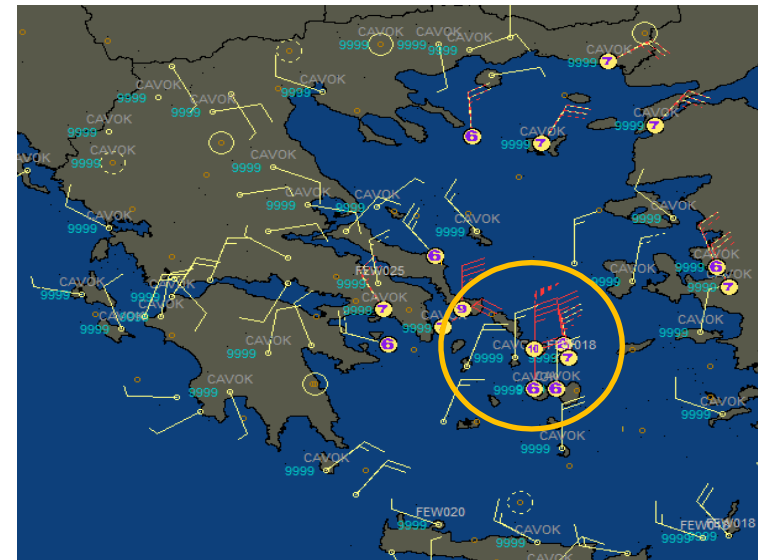
### ICON



### COSMO4



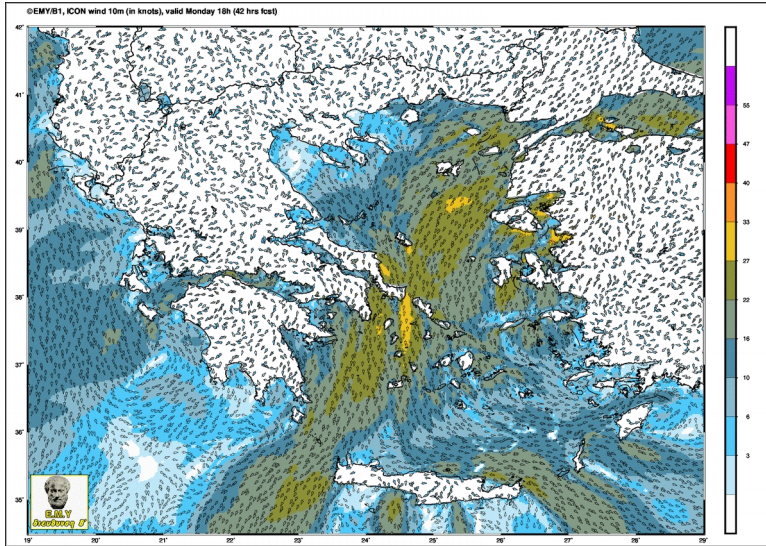
**12/8 12 UTC:** Northerly winds with gusts up to 8 B prevailed over Central and Eastern Aegean. Over Central Aegean, the winds are stronger compared to Eastern Aegean and this was better captured by ICON for this case.



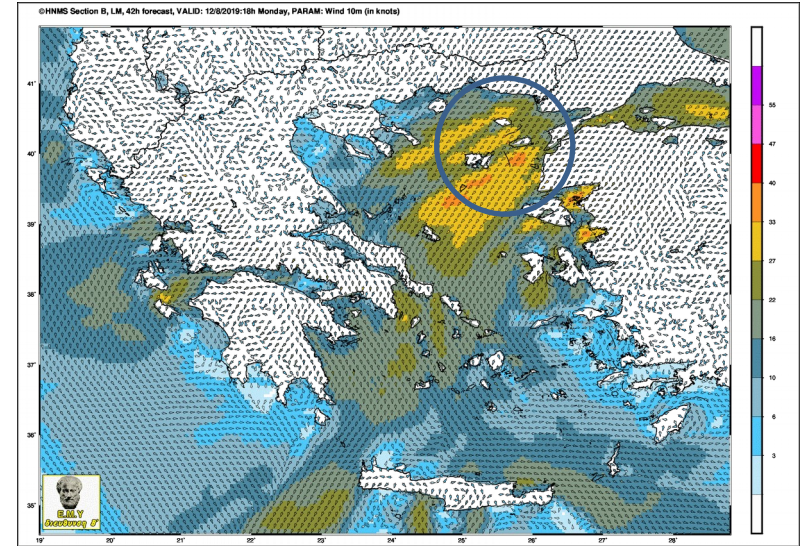


# ICON

## 10m winds



# COSMO4



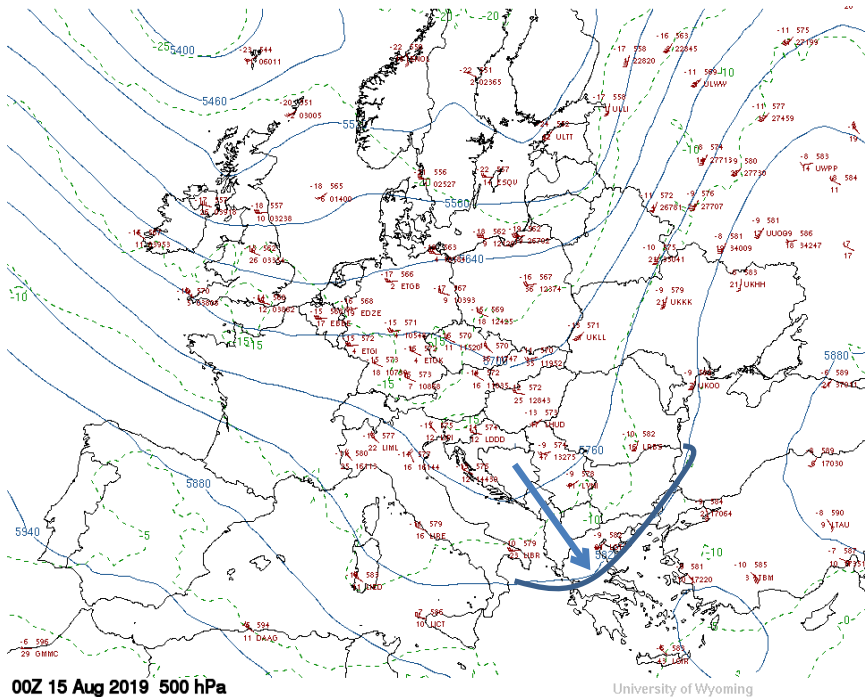
**12/8 18 UTC :** COSMO model predicted higher wind speeds over Eastern Aegean. Although there are not enough observations in the sea, the wind speeds do not support the COSMO values in the Eastern parts at this time.



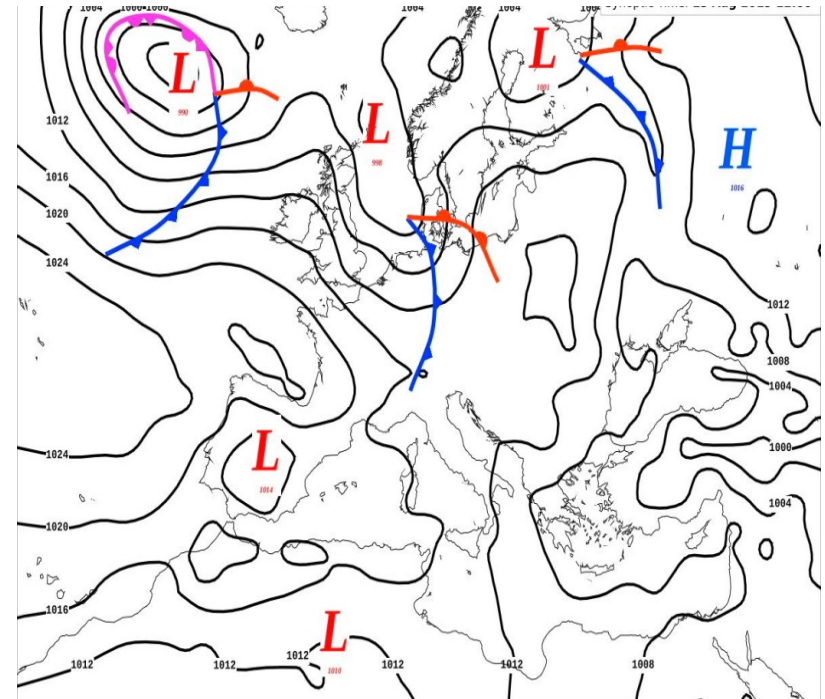


## Case 4: 14-15 August 2019- A miss

500hPa



SFC

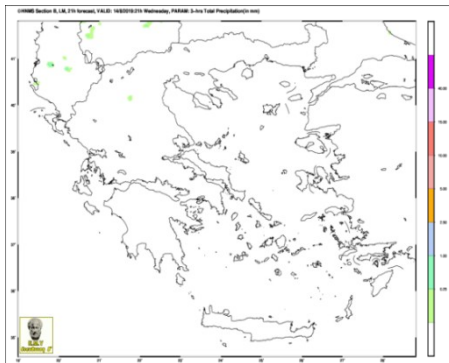
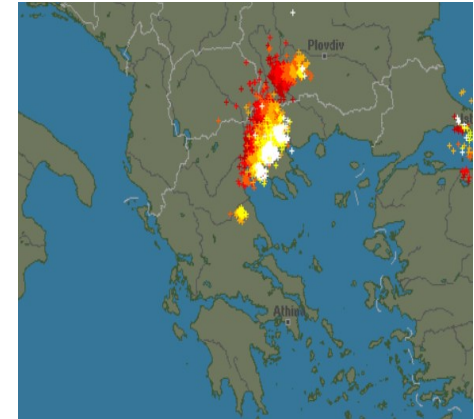
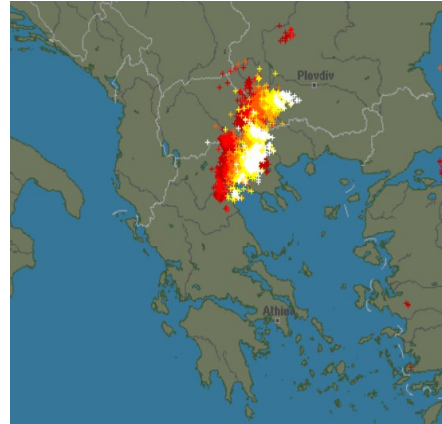
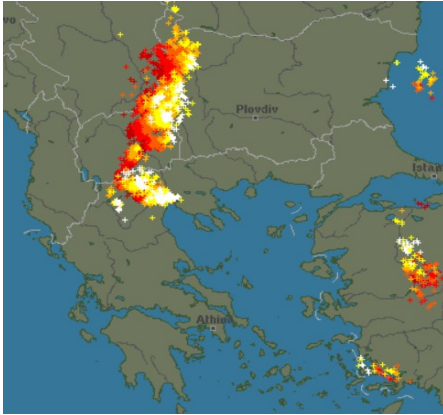


After a series of warm days, an intrusion of cold air from the North over Greece combined with thermal forcing produced convective precipitation around noon. However, Around 2000 UTC, unexpectedly, when only dynamical forcing prevailed, a block of thunderstorms locally over Western and Central Macedonia appeared in the late evening of 14/8 and remained till the first morning hours of 15/8. This limited area event was not captured neither by COSMO or ICON models.

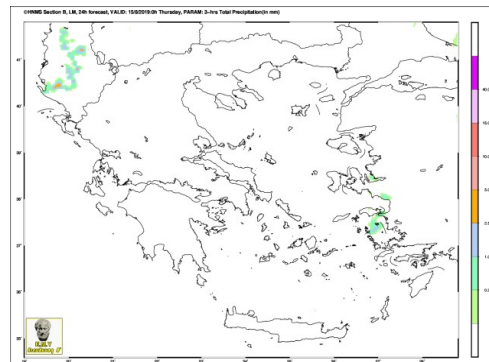
14/8 2100

15/8 0000

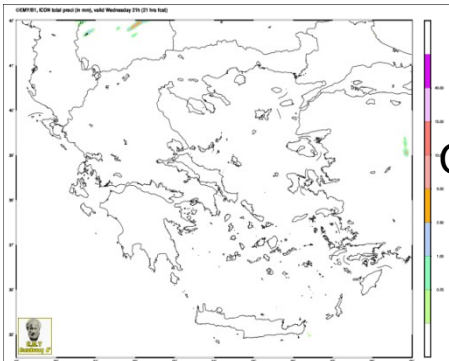
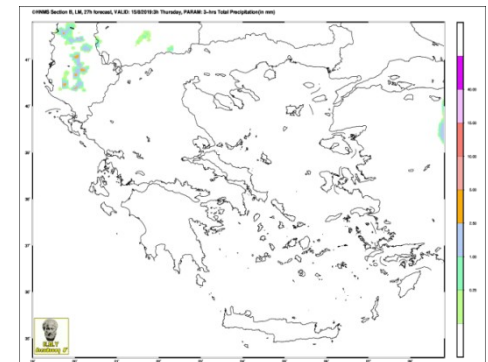
15/8 0300



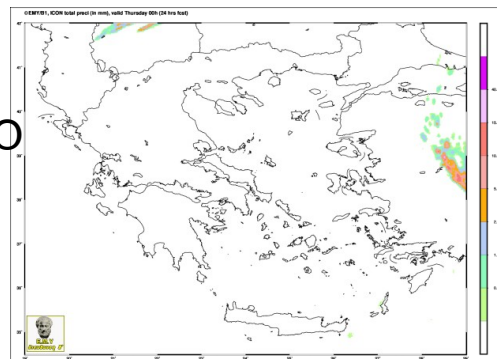
ICON



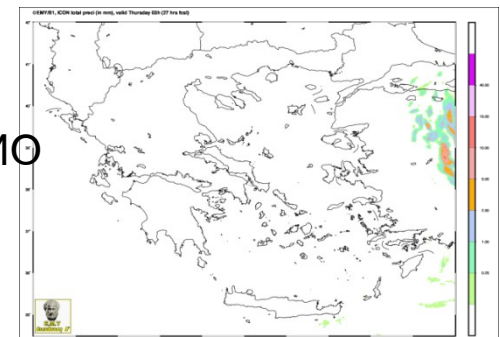
ICON



COSMO



COSMO



ICON and COSMO Model Runs of 14/5 00 UTC. No precipitation



## Conclusions

Test cases from the daily forecast (visual verification) show that there are local differences between the two models in all parameters. There is need for more detailed verification results which we are in process to implement in order to produce time series and verification scores and come to conclusions about the relative performance of the models.

Thank you !!