

# ALADIN forecast experience in Croatia



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Service

# ALADIN at DHMZ

- main source for the operational forecast at National Service of Croatia (along with ECMWF global model)
  - particularly for short-range
- ALADIN8 four runs (00,06,12,18) up to 72 hours - operational
- ALADIN2 one run (06) up to 24 hours - operational
- ALADIN4 one run (00) up to 72 hours - operational soon
- AL38T1 for 8km run, AL36T1 for 2km NH run, AL38t1 for ALADIN 4km run
- initialization: 3DVAR+CANARI for 8km run, 6hr forecast from ALADIN8 for ALADIN 2km run, CANARI for 4km run
- ECMWF boundary conditions (lagged mode)
- dynamical adaptation (downscaling) at 2 km

# General forecasting experience

- very good wind forecast - **No. 1 model for wind**
  - particularly good for Bora wind (from NE)
  - not so skillfull for southerly winds
  - gusts over land sometimes to high
- temperature forecast **bad for extremes** (rarely better than ECMWF); cold advection is sometimes better forecast than warm advection
- tends to overestimate the precipitation (“**too wet**”), but seems to be improved this year (better than ECMWF for heavy precipitation)
- **underestimating low clouds** (sometimes more than ECMWF)

# Wind forecast

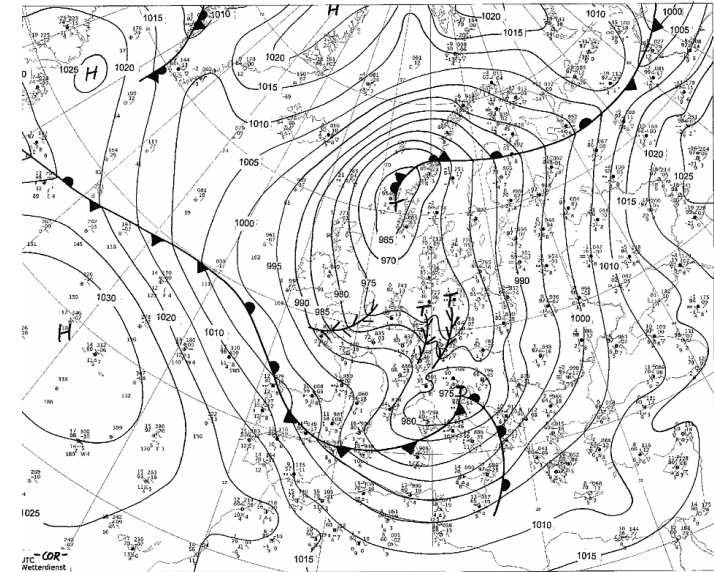
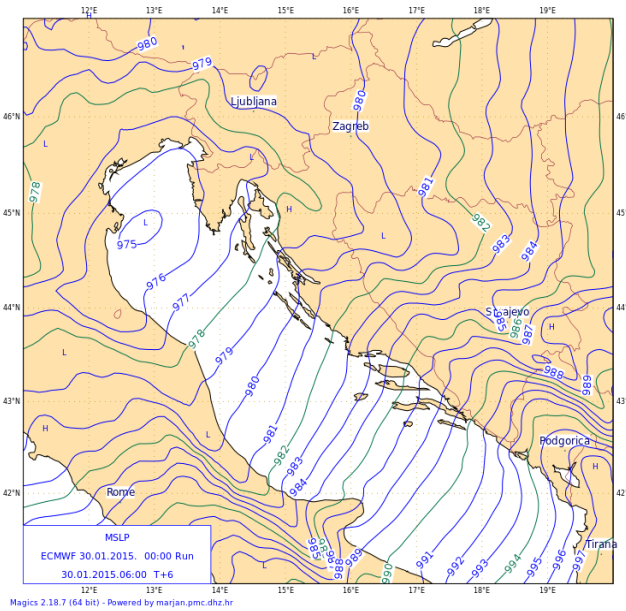
- much better than the ECMWF model - specially for Bora
- usually **good timing** for beginning of gale and storm wind situations...but not always for dying down
- gusts always better than mean wind speed forecast, specially from the downscaled 2km model
- Bora wind forecast **significantly better** for North Adriatic area; often underestimated for Southern part
- Forecast of S and SE winds **not so skillful**
  - specially for scirocco and for Adriatic open sea area
  - **too dependent** on the position and movement of surface

Low

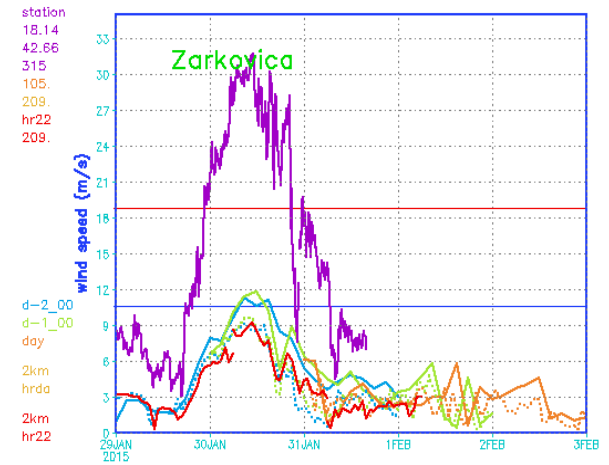
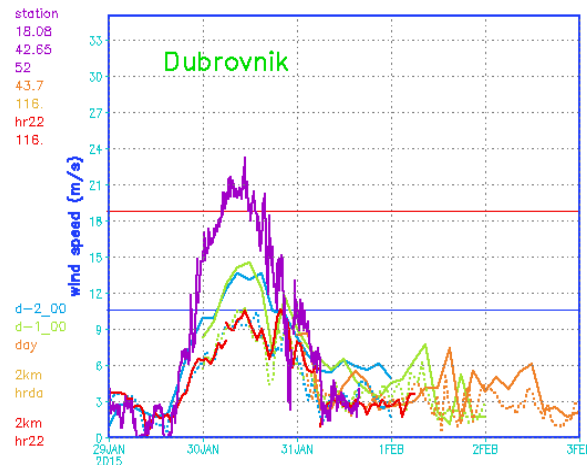
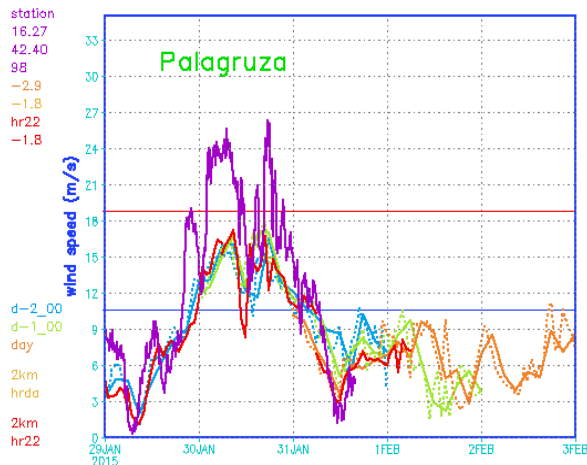
# S an SW wind episode

**30-31 January 2015**

- deep trough
- cyclogenesis in Ligurian sea
- secondary Low** over North Adriatic moving inland to NE
- extreme pressure falling** causing violent storm



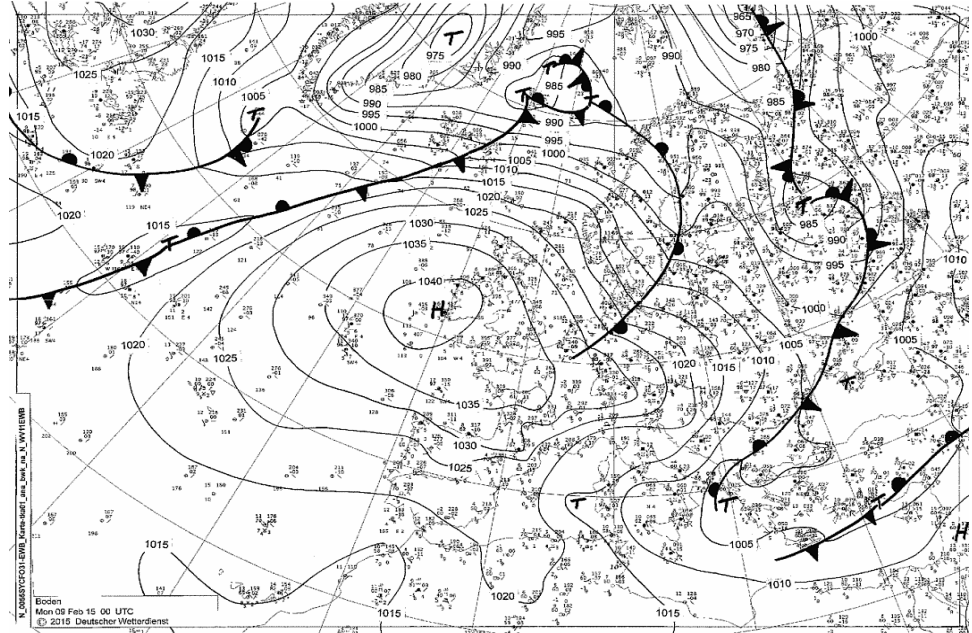
Verification of ALADIN near surface *average wind speed* with automatical station data



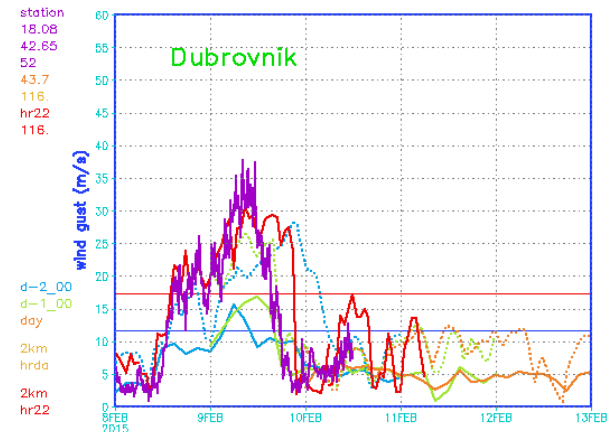
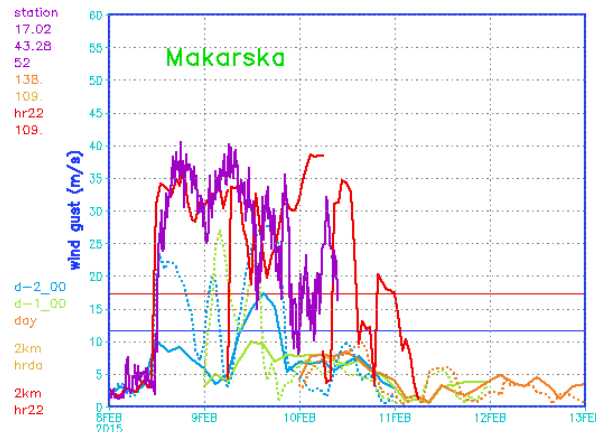
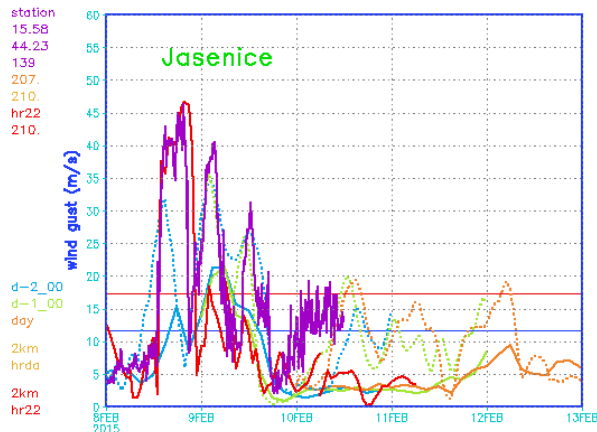
# BORA wind episode

**8-9 February 2015**

- surface Low over Ionian sea and **ridge** of high pressure building up from NW
- **gale force gusts up to 170 km/h**
- **Very good timing**
- 2km model gusts very accurate; Underestimated for Southern part in 8 km model two and one day before



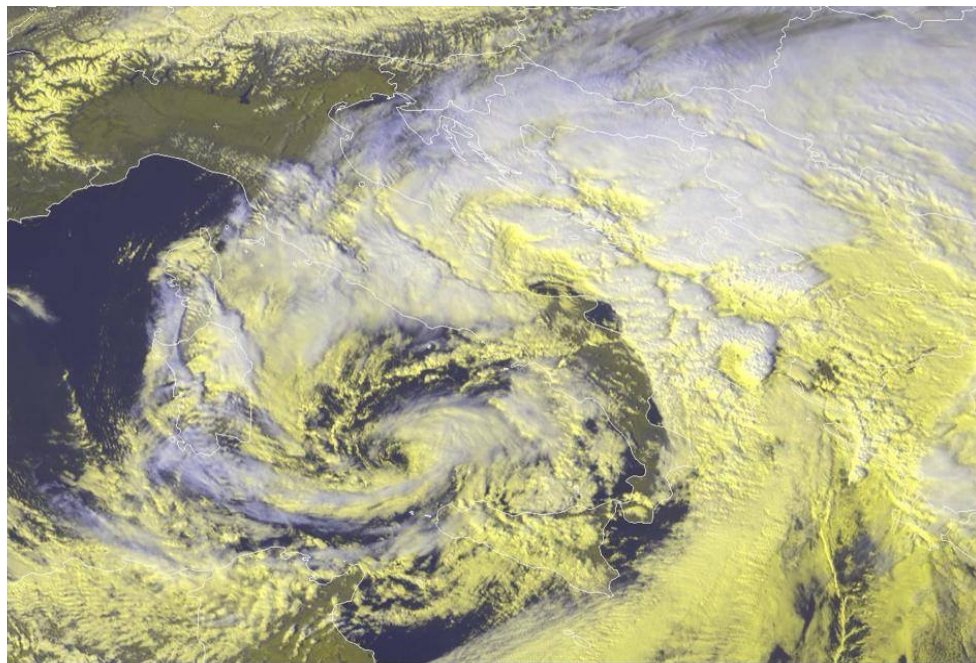
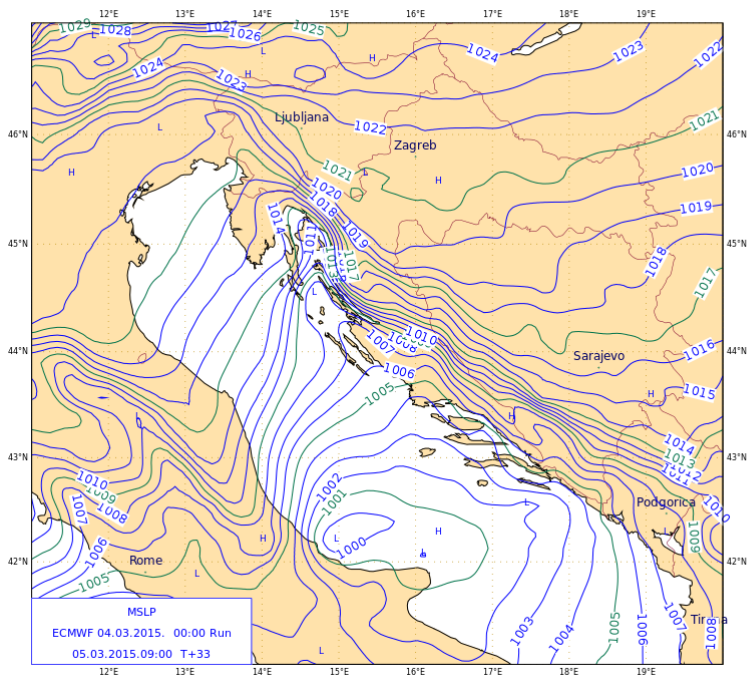
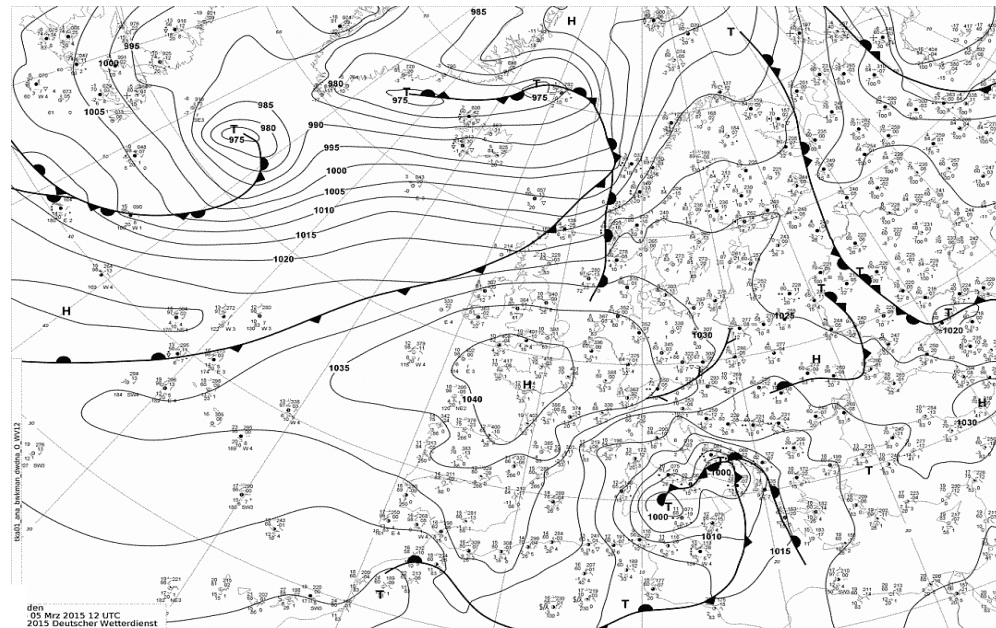
Verification of ALADIN near surface *maximum gust wind speed* with automatical station data



# Violent storm and hurricane BORA episode

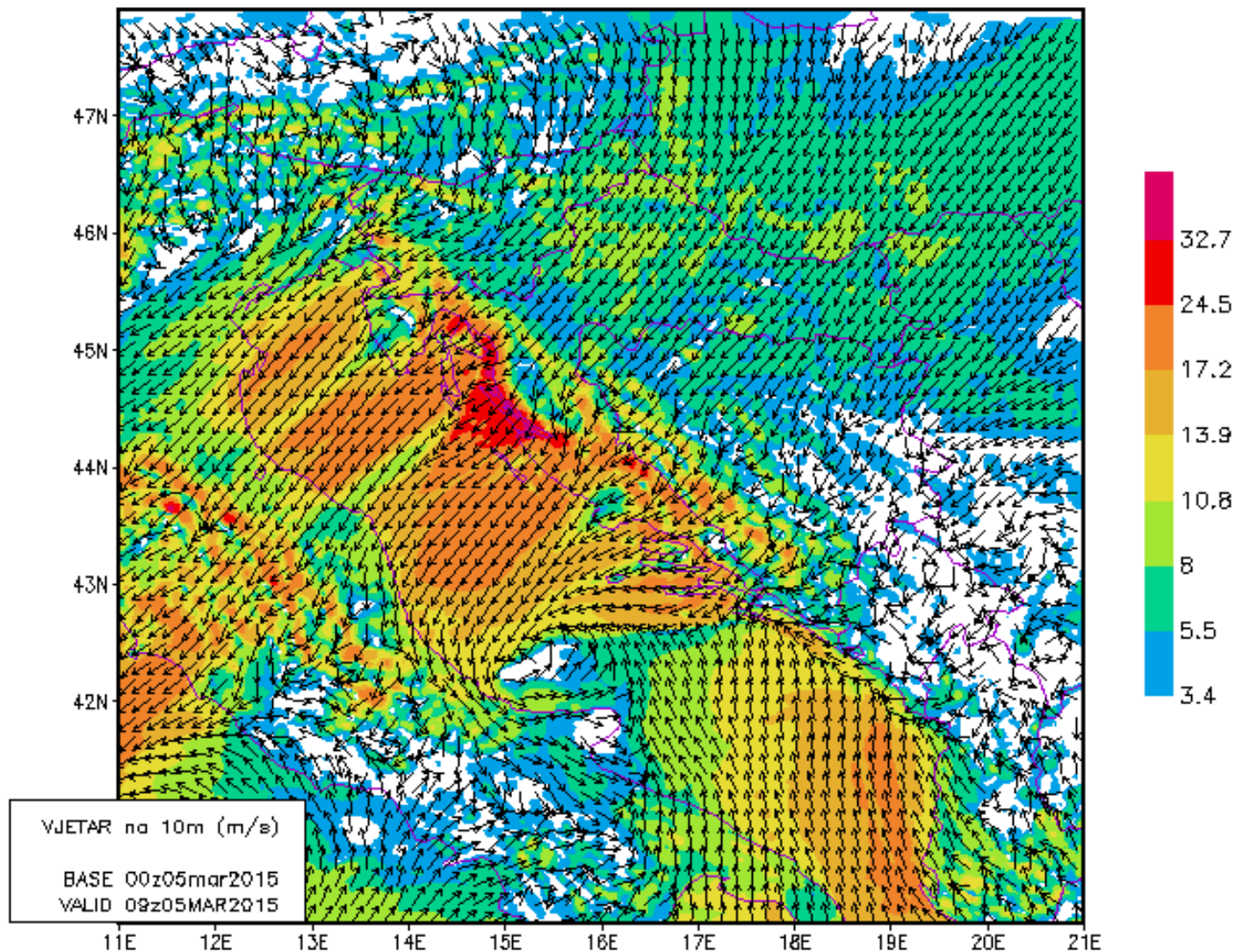
**5-7 March 2015**

- surface Low over Tirrenian sea and **ridge** of high pressure building up from WNW
- secondary Low in Middle Adriatic region
- **tight pressure gradient**
- **Perfect timing**
- 4 and 2 km model very



# Aladin 00 run 05 march 2015 - Bora

HR22 VJETAR u 05MAR2015 09UTC 03h forecast

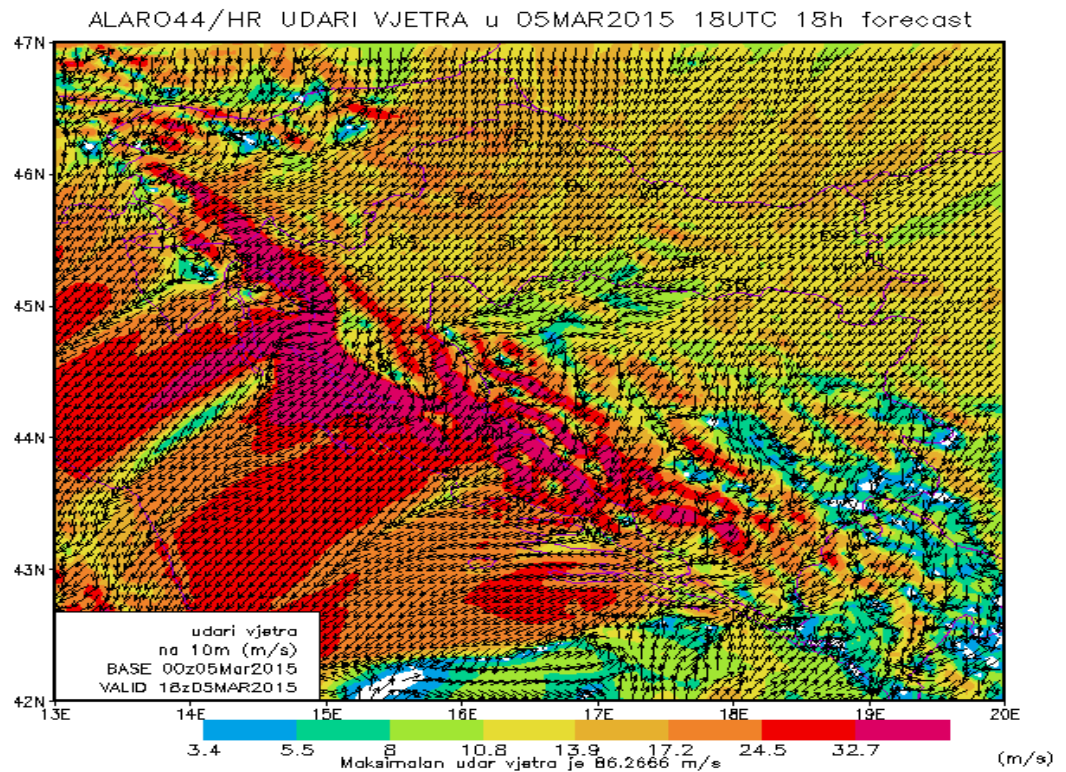


Maksimalna brzina vjetro je 35.2323 m/s

(m/s)



4km model  
forecast of wind  
gusts for March  
5th in the  
evening

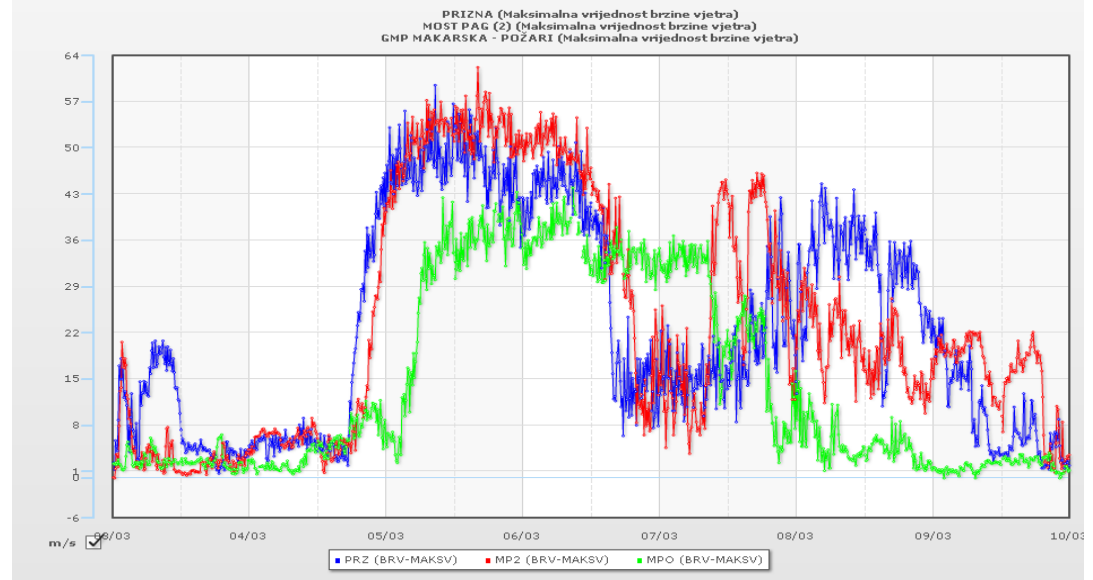


-wind gusts measured  
on 3 stations along  
the coast

-sudden violent wind

-sharp increase in  
wind speed

**-maximum gust 220  
km/h**



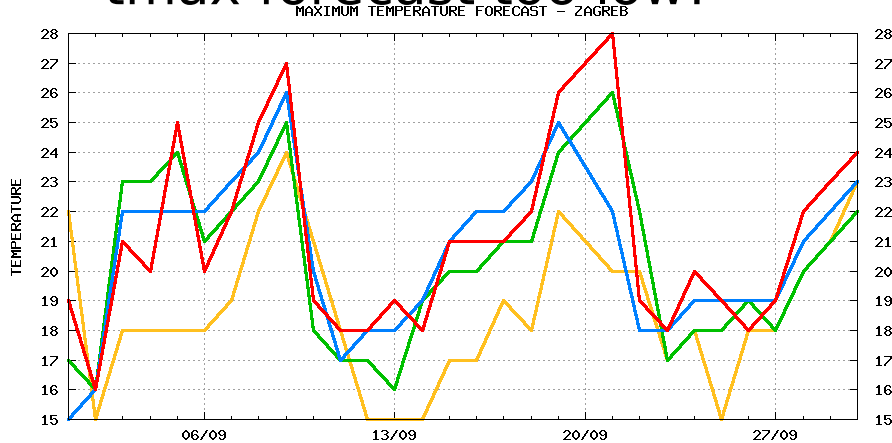
# Possible reasons for occasional model imperfection

- **Region with *Complex Topography* and Coastline**
- Model orography of Dinaric Alps much more realistic in the Northern part
- Numerical modelling of Adriatic sea basin:
  - **approximation** of coastline (**heavily indented** with 1244 islands)
  - **depth variability** (bathymetry) - only few metres in North up to South Adriatic pit with 1233 m
  - spatial **sea surface temperature variability** (+ constant value during the day?)
- low density measurements - bad data assimilation?

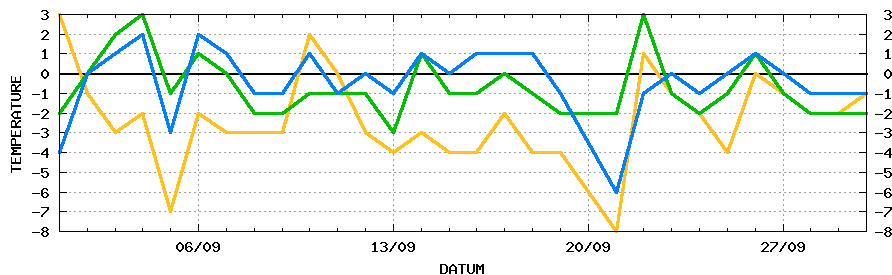
# Temperature forecast

**September 2014** - example of **very poor** Aladin **tmax** forecast  
- tmax forecast too low!

Aladin ———  
ECMWF ———  
DHMZ ———  
Tmax ———



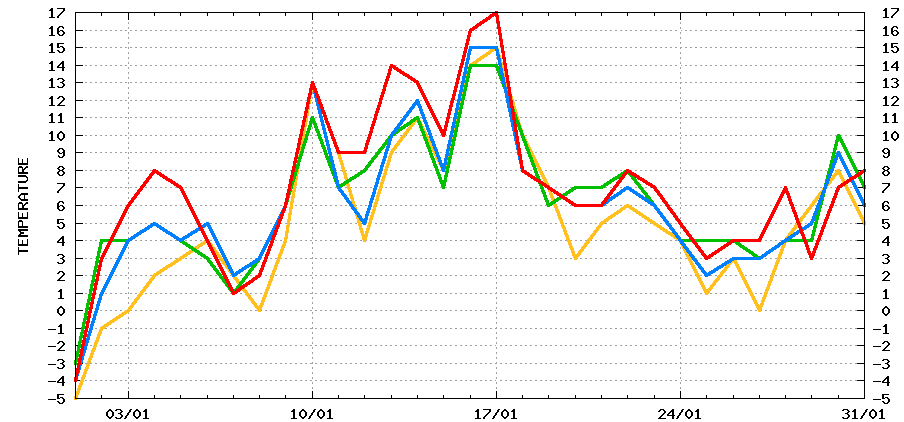
ANOMALY (FORECAST - OBSERVED)



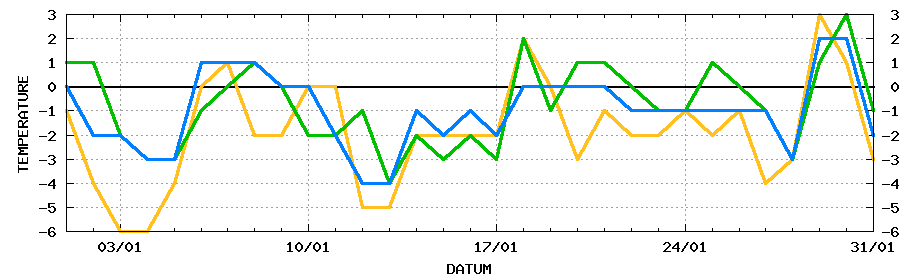
ME= NaN MAE= 1.2 RMSE= 1.7 ACCURACY= 89%  
ME=-0.7 MAE= 1.4 RMSE= 1.7 ACCURACY= 89%  
ME=-2.3 MAE= 2.7 RMSE= 3.2 ACCURACY= 48%

**January 2015** - not so good **tmax** forecast, still worse than ECMWF and particularly our forecasters

MAXIMUM TEMPERATURE FORECAST - ZAGREB



ANOMALY (FORECAST - OBSERVED)



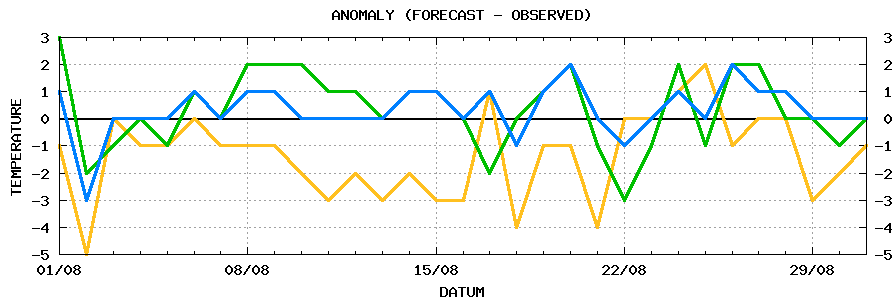
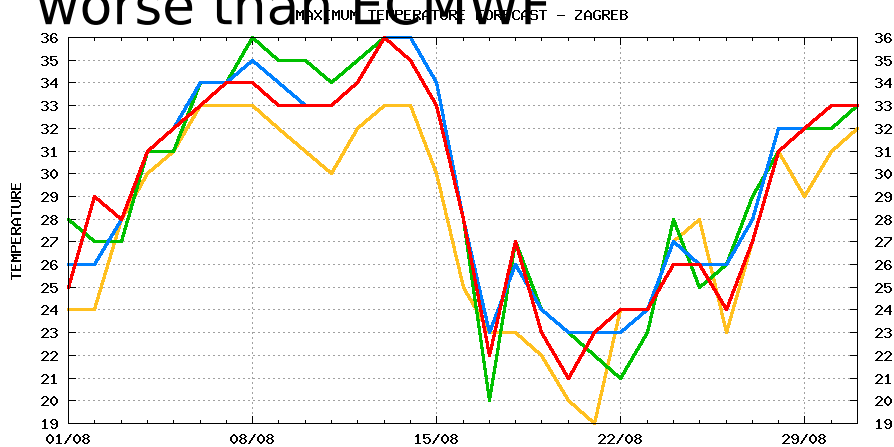
ME= NaN MAE= 1.4 RMSE= 1.8 ACCURACY= 83%  
ME=-0.8 MAE= 1.5 RMSE= 1.9 ACCURACY= 77%  
ME=-1.9 MAE= 2.3 RMSE= 2.9 ACCURACY= 64%

# Temperature forecast

cont...

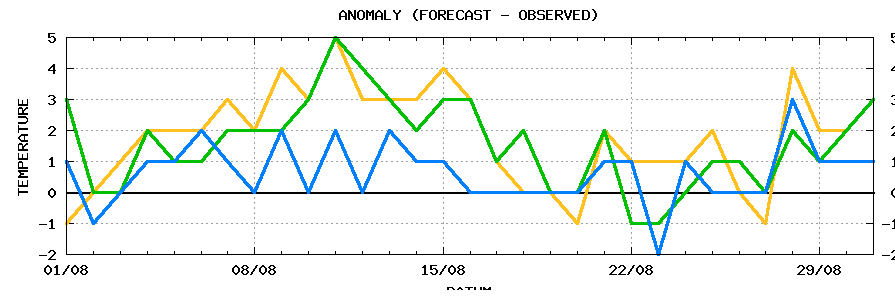
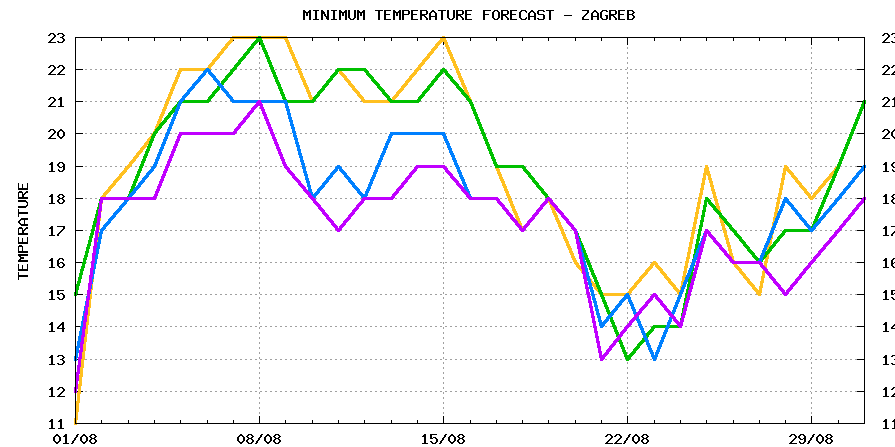
**August 2015** - example of **good** Aladin **tmax** forecast, still

worse than ECMWF



ME= NaN MAE= 0.6 RMSE= 1.0 ACCURACY= 96%  
 ME= 0.3 MAE= 1.2 RMSE= 1.5 ACCURACY= 93%  
 ME= -1.4 MAE= 1.6 RMSE= 2.1 ACCURACY= 74%

**August 2015** - example of **poor** Aladin **tmin** forecast - tmin forecast too high!



ME= 0.6 MAE= NaN RMSE= 1.2 ACCURACY= 96%  
 ME= 1.6 MAE= 1.7 RMSE= 2.1 ACCURACY= 74%  
 ME= 1.8 MAE= 2.0 RMSE= 2.4 ACCURACY= 64%

# Precipitation forecast

- generally **better forecast of stratiform precipitation** than convective
- during **heavy precipitation episodes** connected with cyclone or frontal passages **usually good precipitation amounts** are forecast but sometimes **location is wrong or timing not good enough**
  - also precipitation tend to fall in shorter period than is expected
- **convective precipitation cases** not related to fronts or cyclones (e.g. airmass or pre-frontal) - **generally not so good forecast of amounts, location and timing**
- latest ALADIN8 runs almost always better than previous
- **ALADIN 8 is generally better than ALADIN2, particularly for convection**

**18-19 January  
2015**

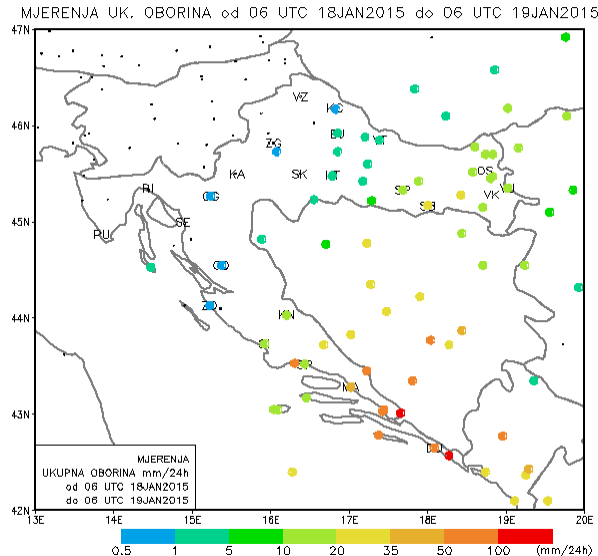
**VERY GOOD  
precip  
forecast**

-both location  
and amounts  
OK

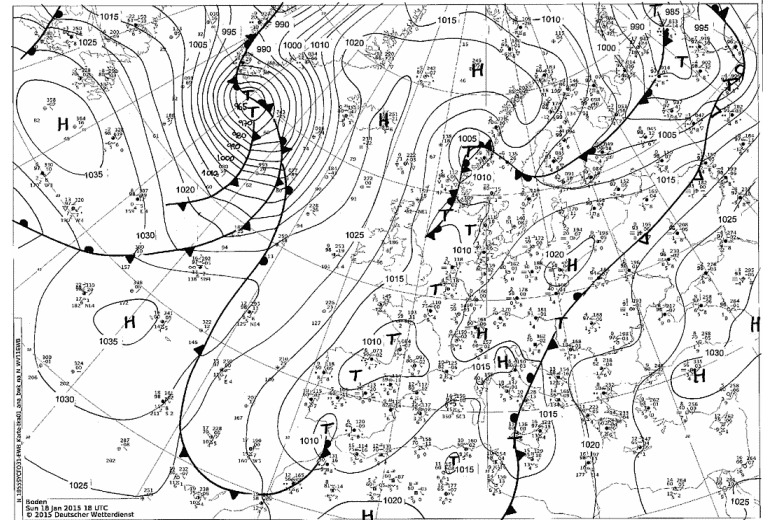
-cyclone in the  
Thyrrennian sea

-frontal system  
over  
Croatia

Measurement (06-06 UTC)



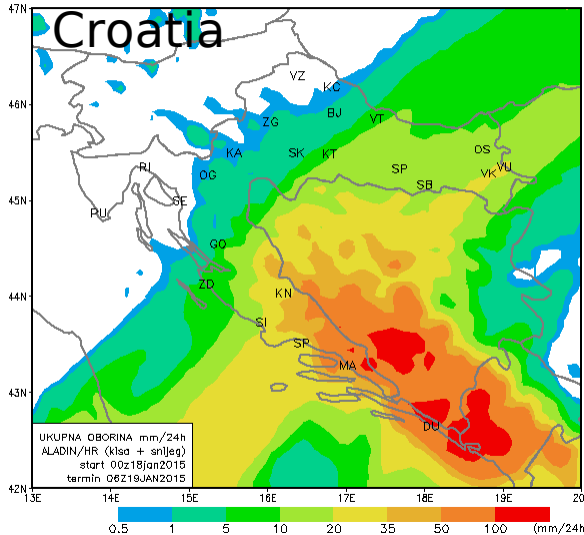
Surface analysis 18.01. 18 UTC



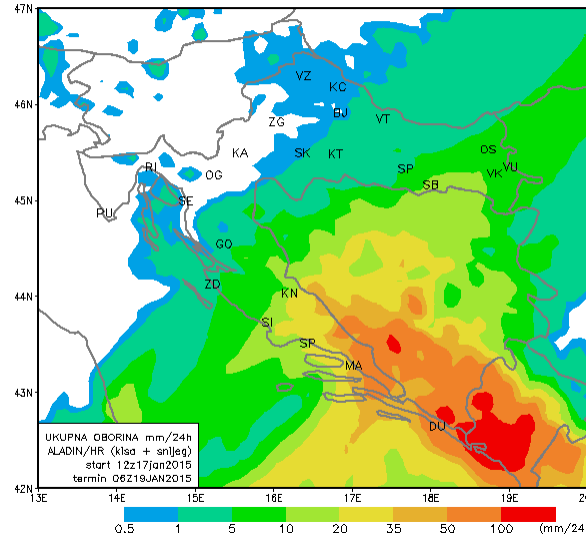
ALADIN8 00UTC run ALADIN8 12UTC run previous day

ALADIN2 06UTC run

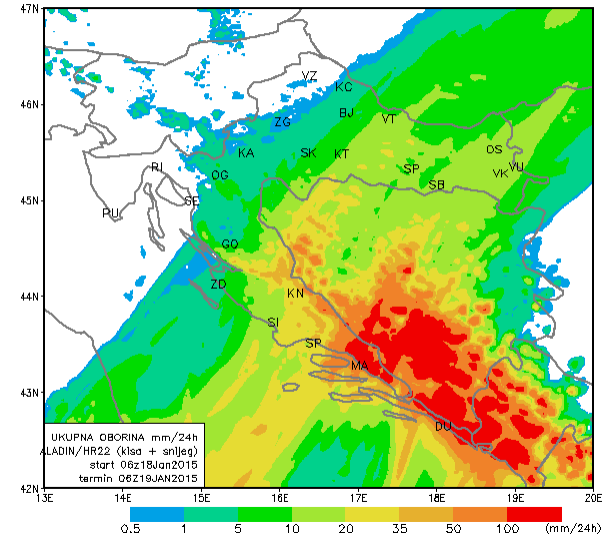
UKUPNA OBORINA od 06 UTC 18JAN2015 do 06 UTC 19JAN2015



UKUPNA OBORINA od 06 UTC 18JAN2015 do 06 UTC 19JAN2015



UKUPNA OBORINA od 06 UTC 18JAN2015 do 06 UTC 19JAN2015

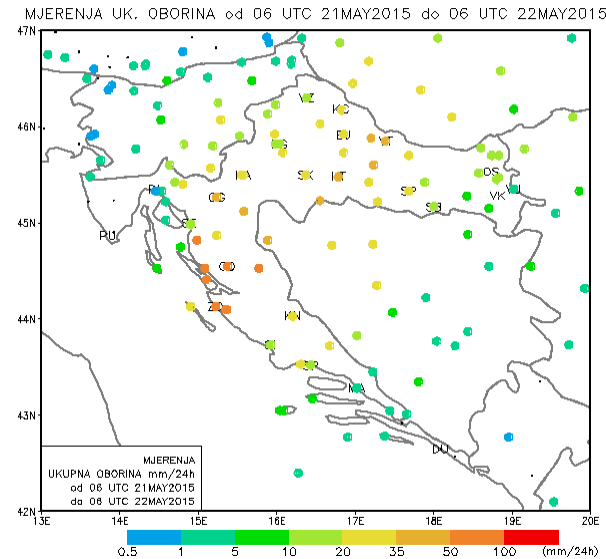


**21-25 May  
2015**

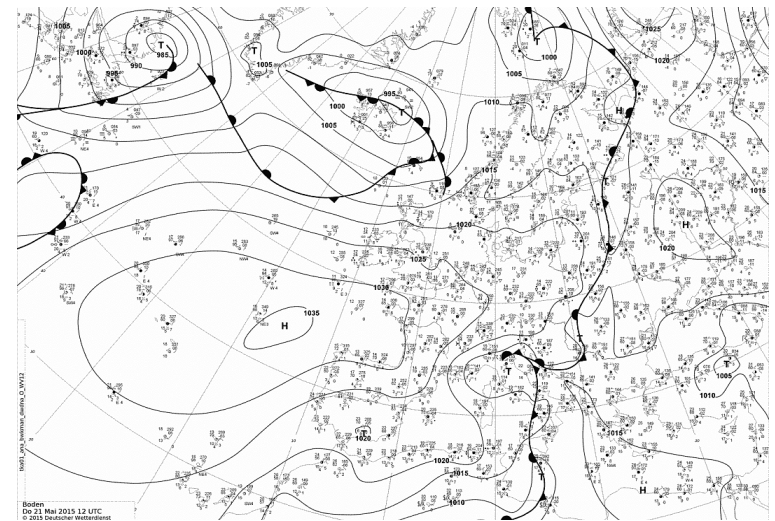
**NOT SO GOOD  
precip  
forecast**

-main  
maximum  
mislocated,  
amounts OK  
-cyclone was  
moving to the  
Adriatic sea

Measurement (06-06 UTC)



Surface analysis 21.05. 12 UTC

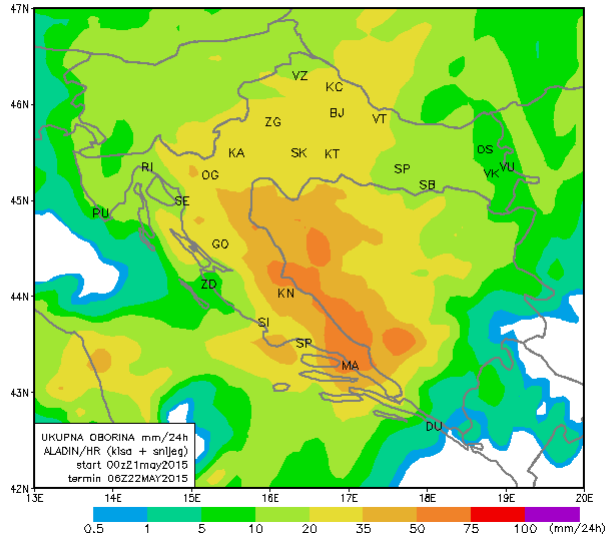


ALADIN8 00UTC run

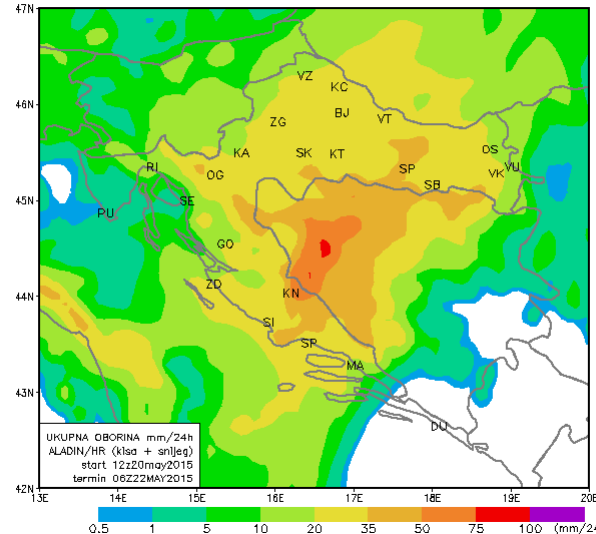
ALADIN8 12UTC run previous day

ALADIN2 06UTC run

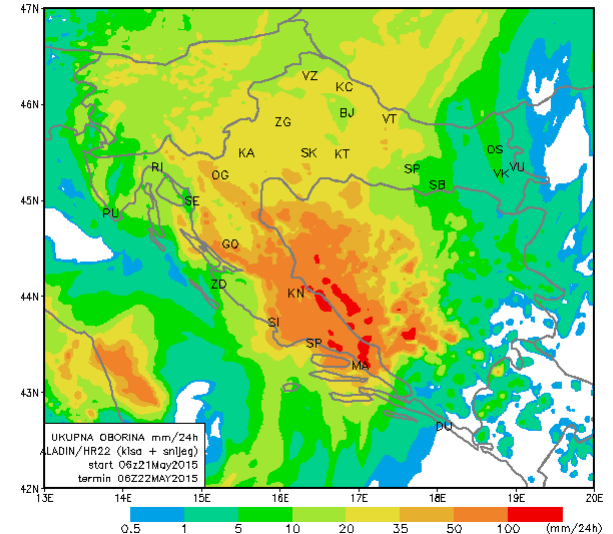
UKUPNA OBORINA od 06 UTC 21MAY2015 do 06 UTC 22MAY2015



UKUPNA OBORINA od 06 UTC 21MAY2015 do 06 UTC 22MAY2015



UKUPNA OBORINA od 06 UTC 21MAY2015 do 06 UTC 22MAY2015



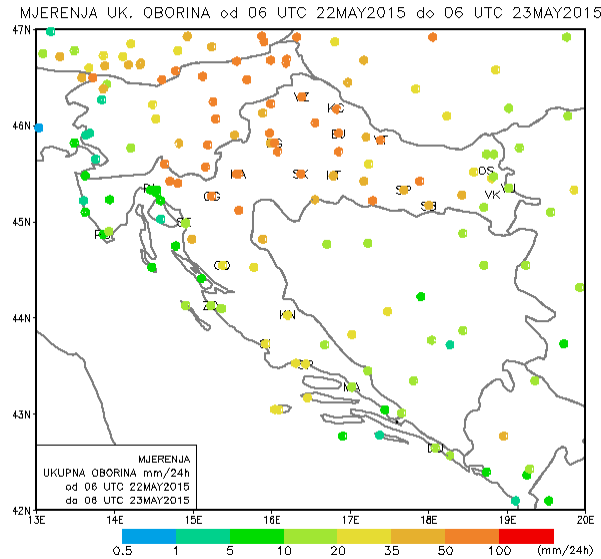
**22-23 May  
2015**

**GOOD  
precipitation  
forecast**

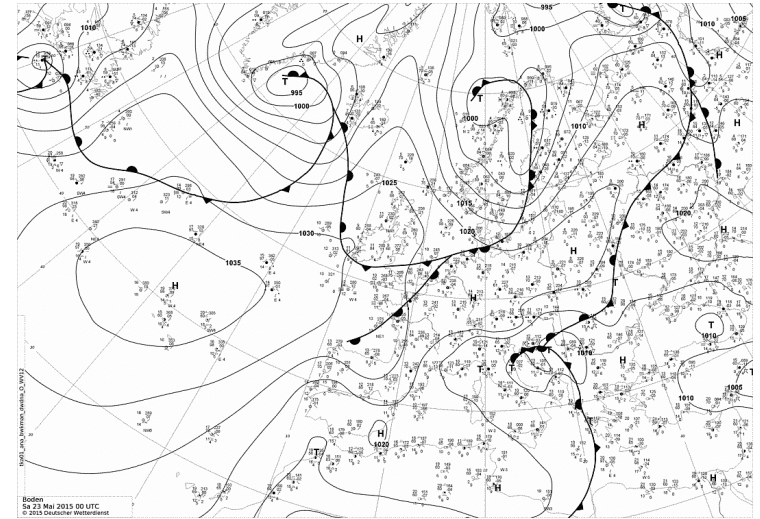
-location and  
amounts  
generally OK  
-cyclone over  
the

Adriatic sea  
moved inland

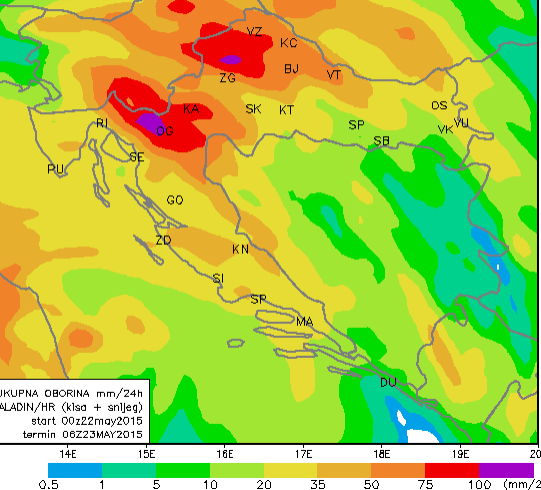
Measurement (06-06 UTC)



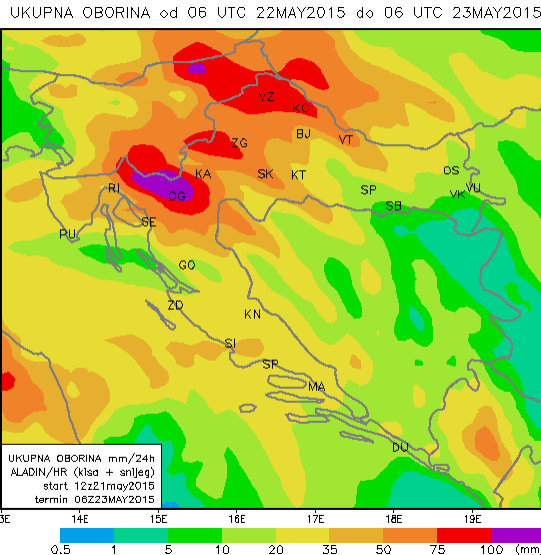
Surface analysis 23.05. 00 UTC



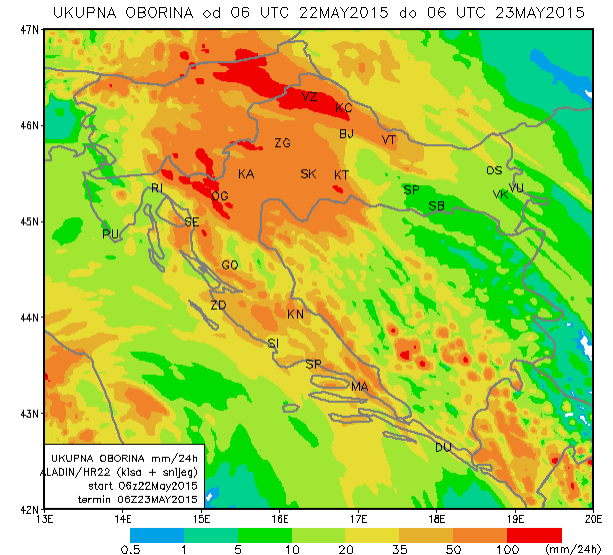
ALADIN8 00UTC run  
over Croatia



ALADIN8 12UTC run previous day



ALADIN2 06UTC run





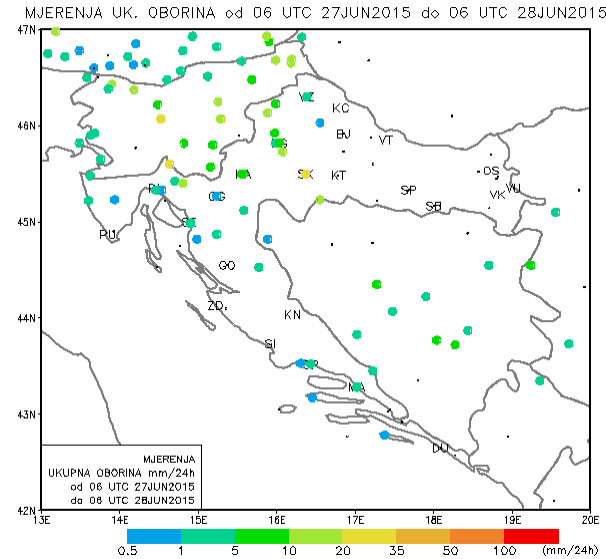
**27-28 June  
2015**

**VERY BAD  
precip forecast**

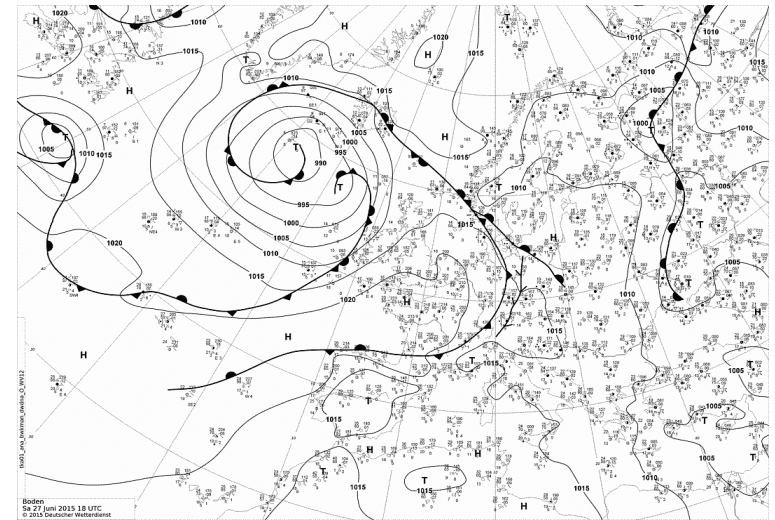
-precipitation  
strongly  
mislocated,  
amounts  
underestimated

-airmass T-  
showers in low-  
gradient  
pressure field

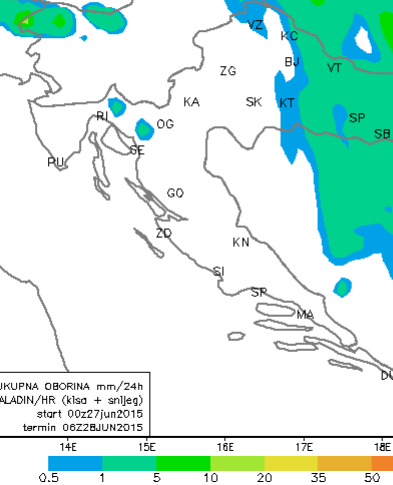
Measurement (06-06 UTC)



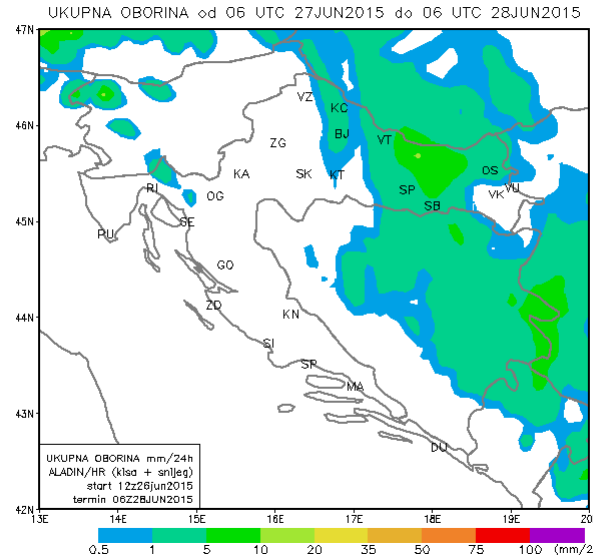
Surface analysis 27.06. 18 UTC



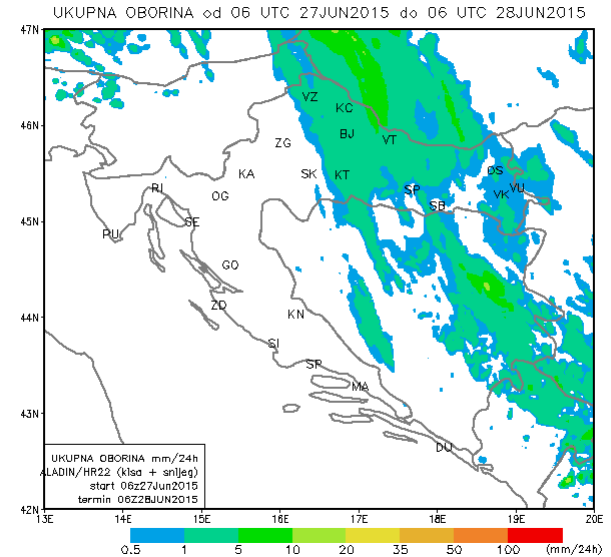
ALADIN8 00UTC run



ALADIN8 12UTC run previous day



ALADIN2 06UTC run



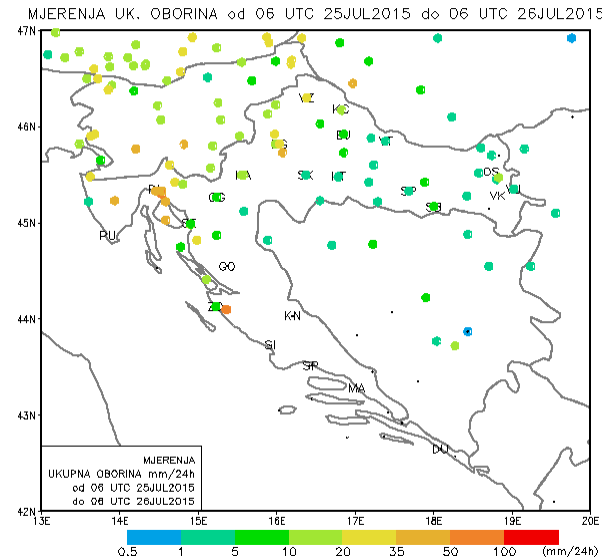
**25-26 July  
2015**

**NOT VERY  
BAD precip  
forecast**

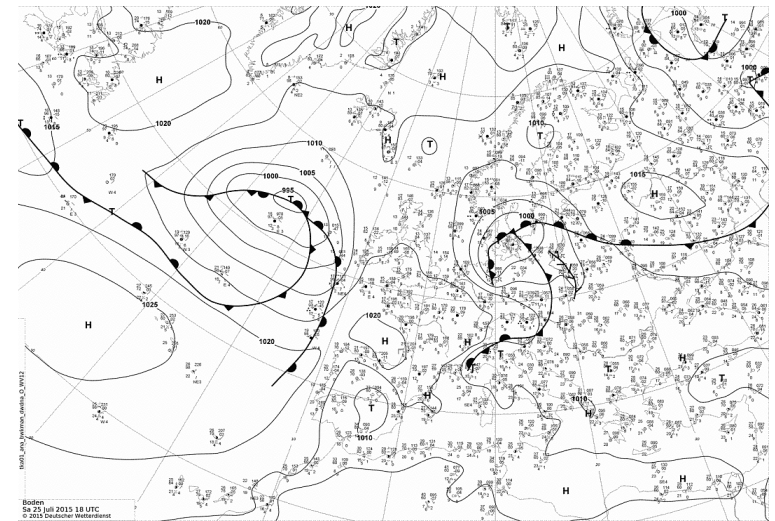
-maximum  
mislocated,  
amounts  
underestimated

-pre-frontal  
convection in  
low-gradient  
field

Measurement (06-06 UTC)



Surface analysis 25.07. 18 UTC

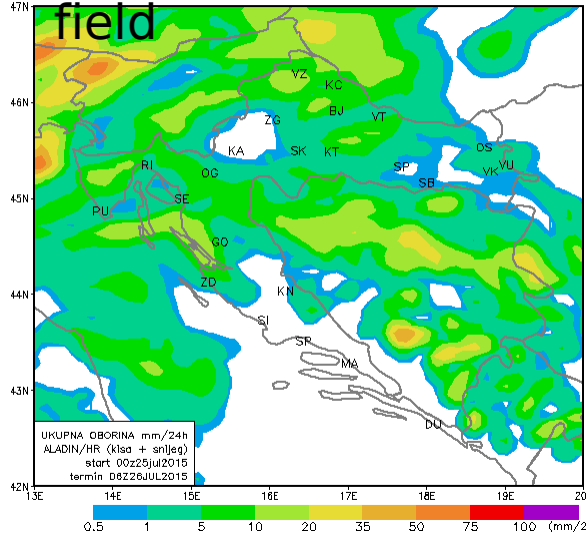


ALADIN8 00UTC run

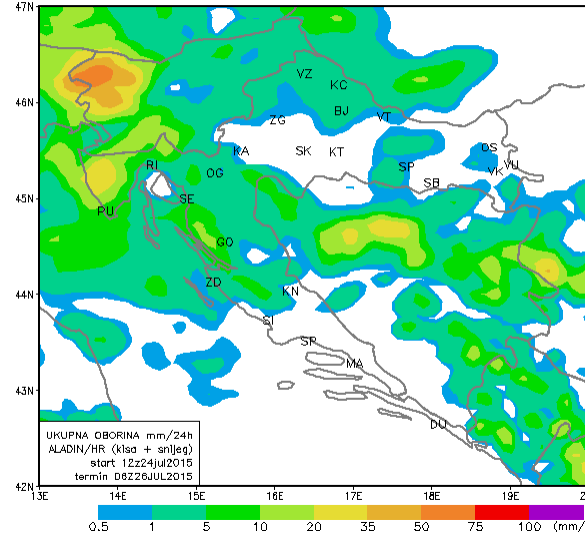
ALADIN8 12UTC run previous day

ALADIN2 06UTC run

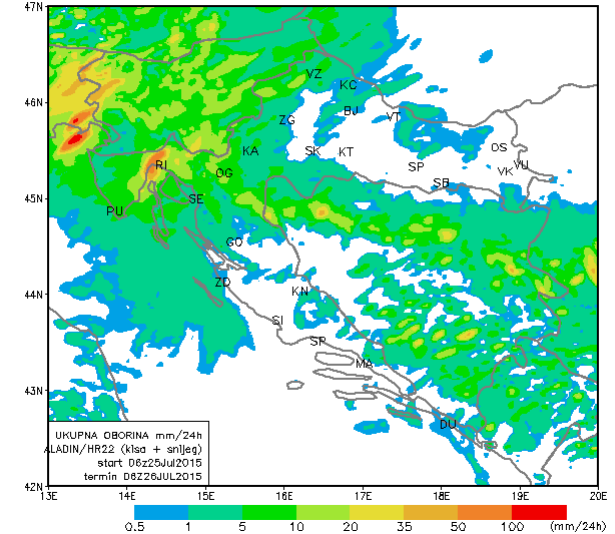
UKUPNA OBORINA od 06 UTC 25JUL2015 do 06 UTC 26JUL2015



UKUPNA OBORINA od 06 UTC 25JUL2015 do 06 UTC 26JUL2015



UKUPNA OBORINA od 06 UTC 25JUL2015 do 06 UTC 26JUL2015



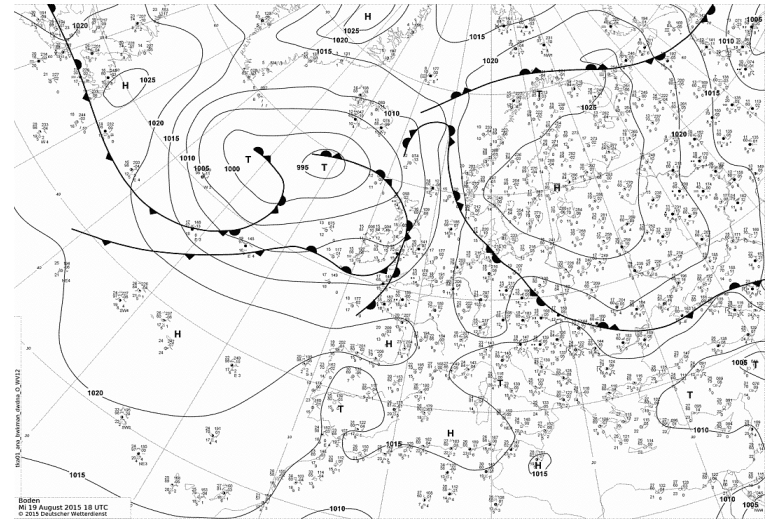
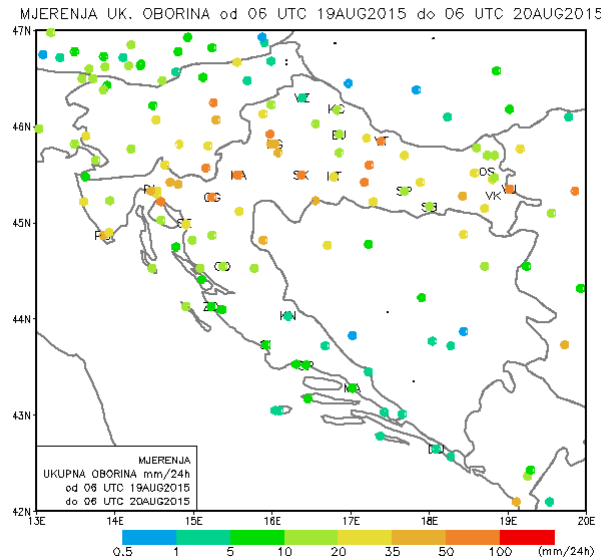
**19-20 August 2015**

**NOT SO GOOD precip forecast**

-maxima mislocated, amounts a bit underestimated  
-shallow low pressure field center over

Measurement (06-06 UTC)

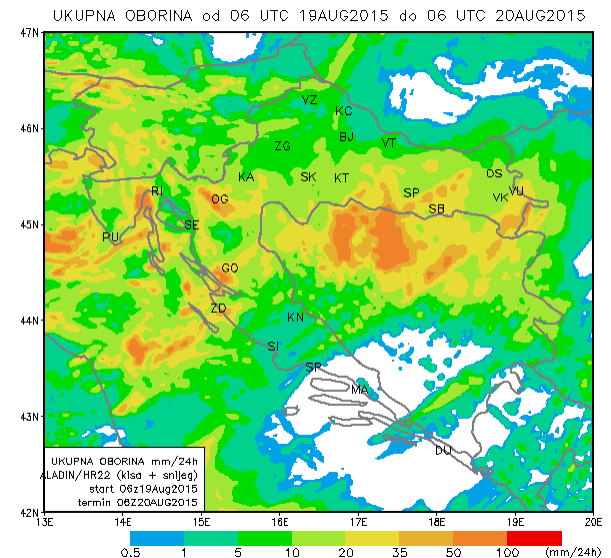
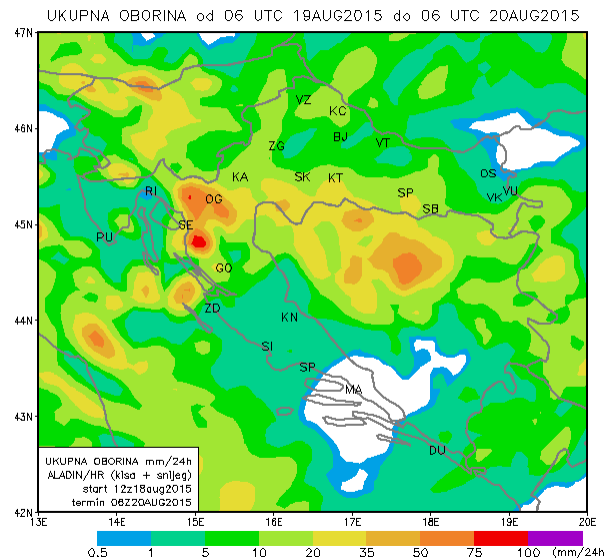
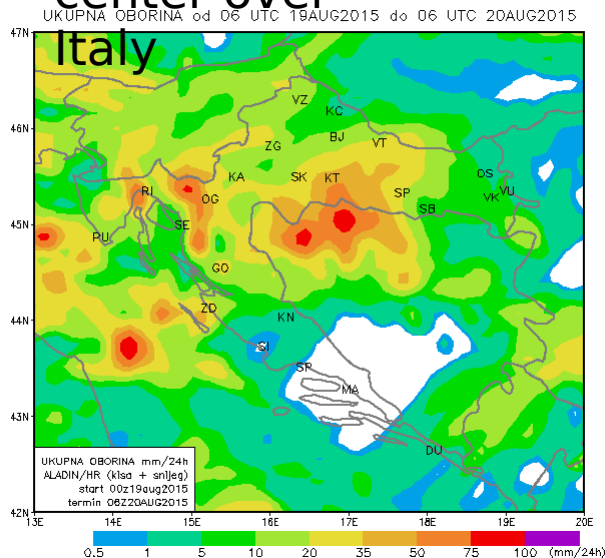
Surface analysis 19.08. 18 UTC



ALADIN8 00UTC run

ALADIN8 12UTC run previous day

ALADIN2 06UTC run



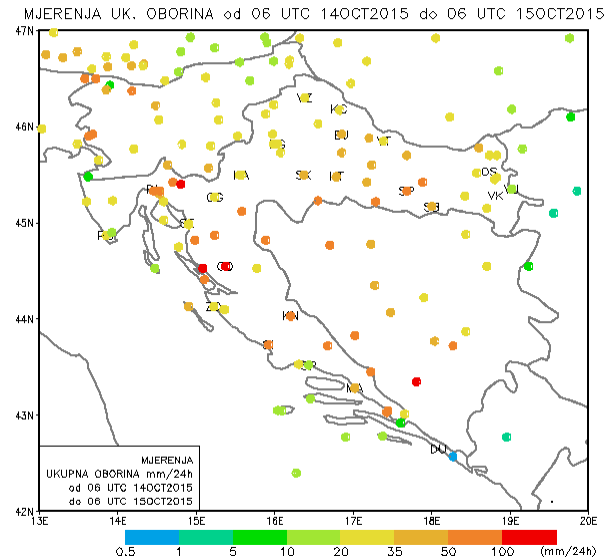
**14-15 October 2015**

**GOOD precip forecast**

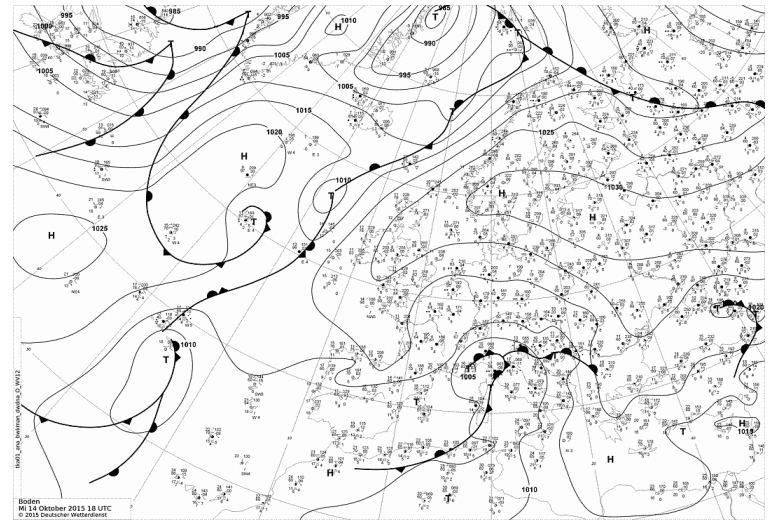
-maxima location OK on shore but not inland, amounts OK

-Genoa cyclone, convective and stratiform precip

Measurement (06-06 UTC)



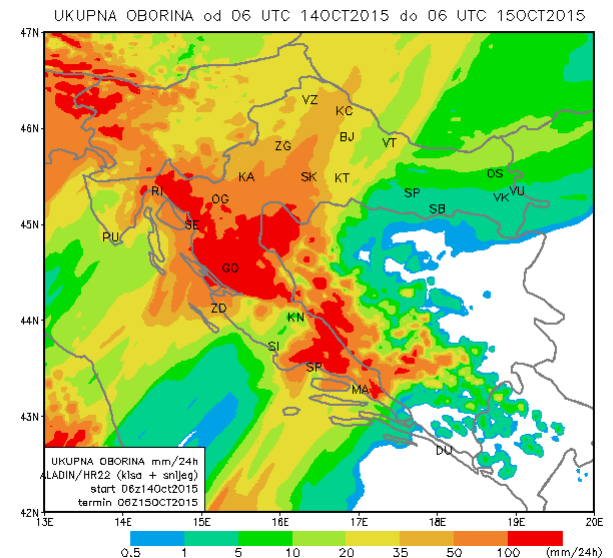
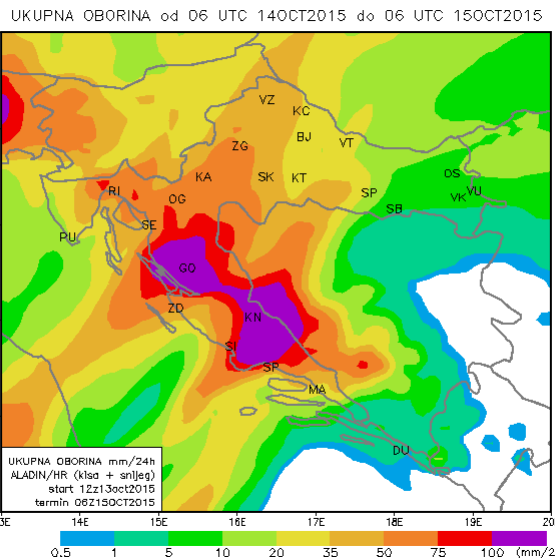
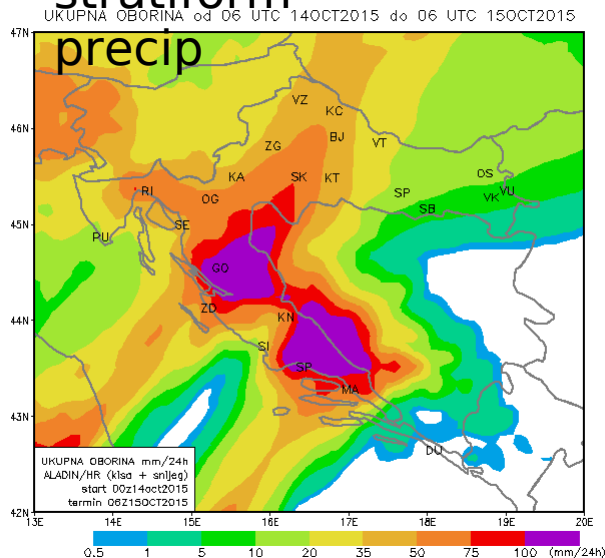
Surface analysis 14.10. 18 UTC



ALADIN8 00UTC run

ALADIN8 12UTC run previous day

ALADIN2 06UTC run



Thank you for the attention!