

CROATIA CASE STUDY – 10.10.2015.

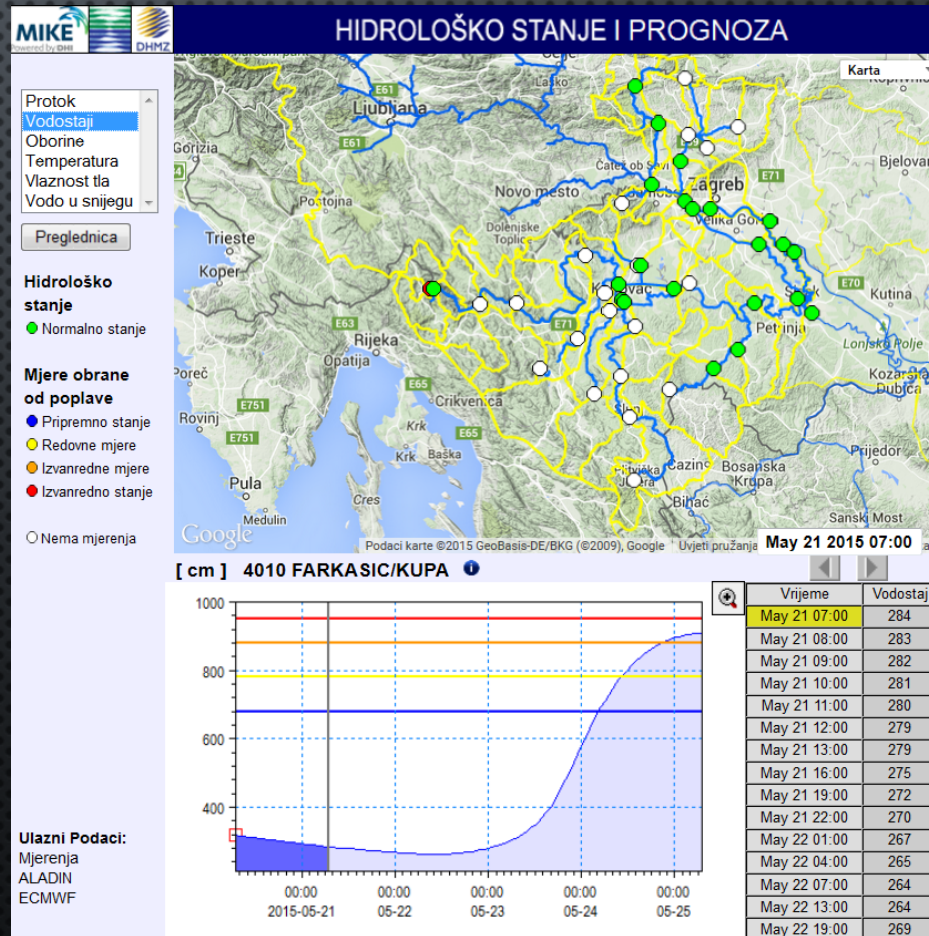
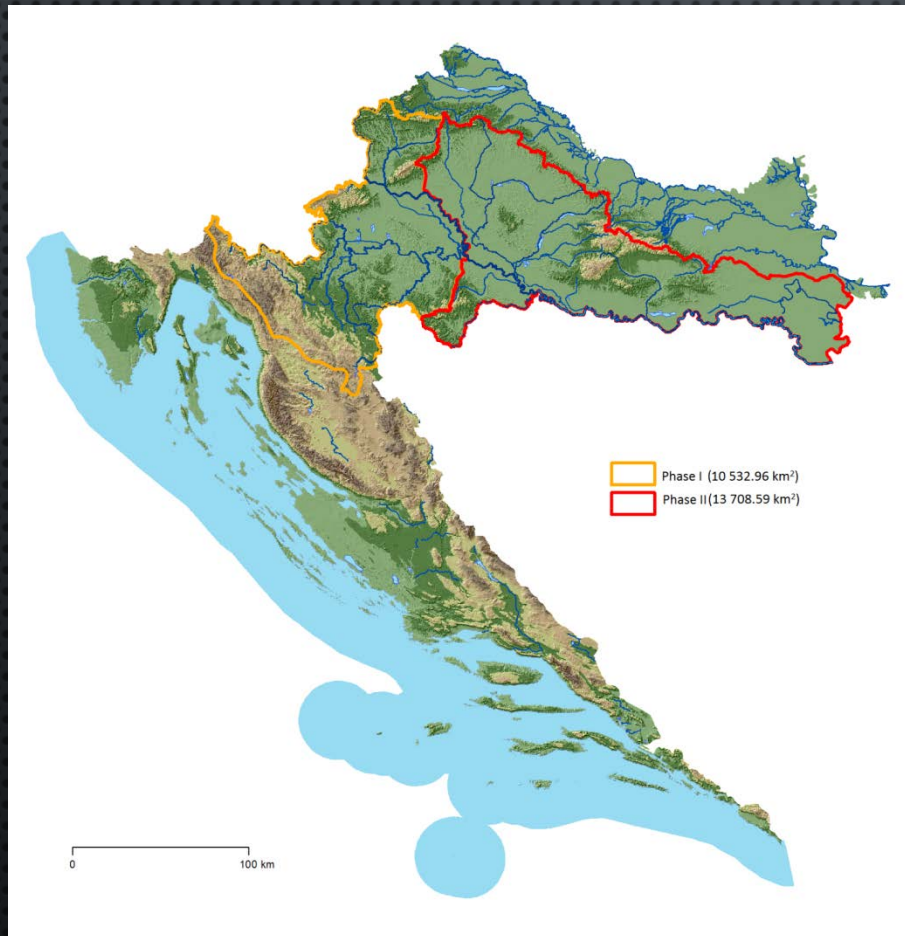
TONI JURLINA
PETRA MUTIĆ

FOLLOW UP OPERATIONS WORKSHOP
SOUTH EAST EUROPE FLASH FLOOD GUIDANCE
(SEEFFG) SYSTEM
ZAGREB, CROATIA, 9-13 MAY 2016

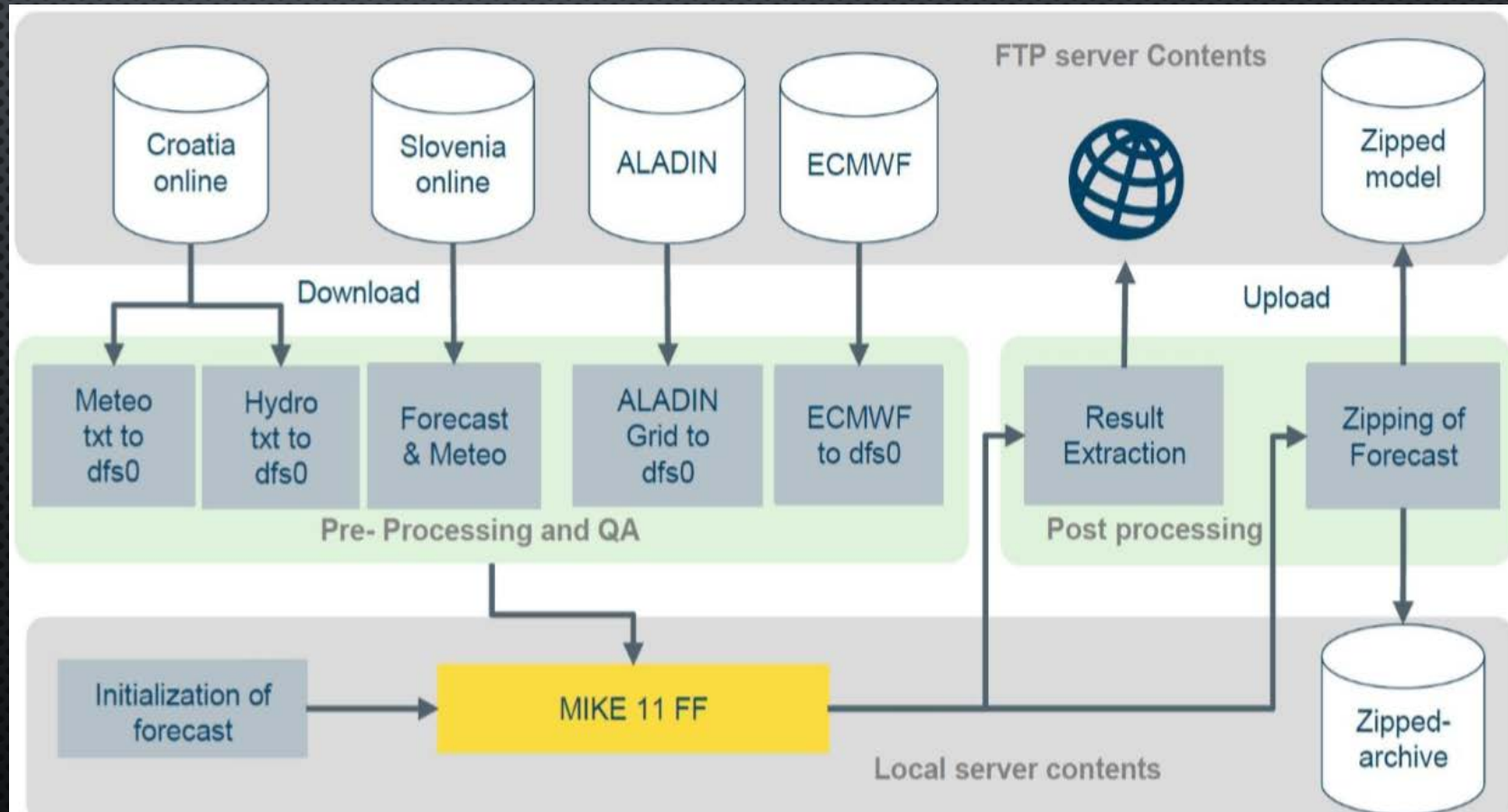
CONTENT

1. INTRODUCTION
2. OPERATIONAL HYDROLOGICAL FORECASTING IN CROATIA
3. CASE STUDY
4. CONCLUSION

OPERATIONAL HYDROLOGICAL FORECASTING IN CROATIA



OPERATIONAL HYDROLOGICAL FORECASTING IN CROATIA



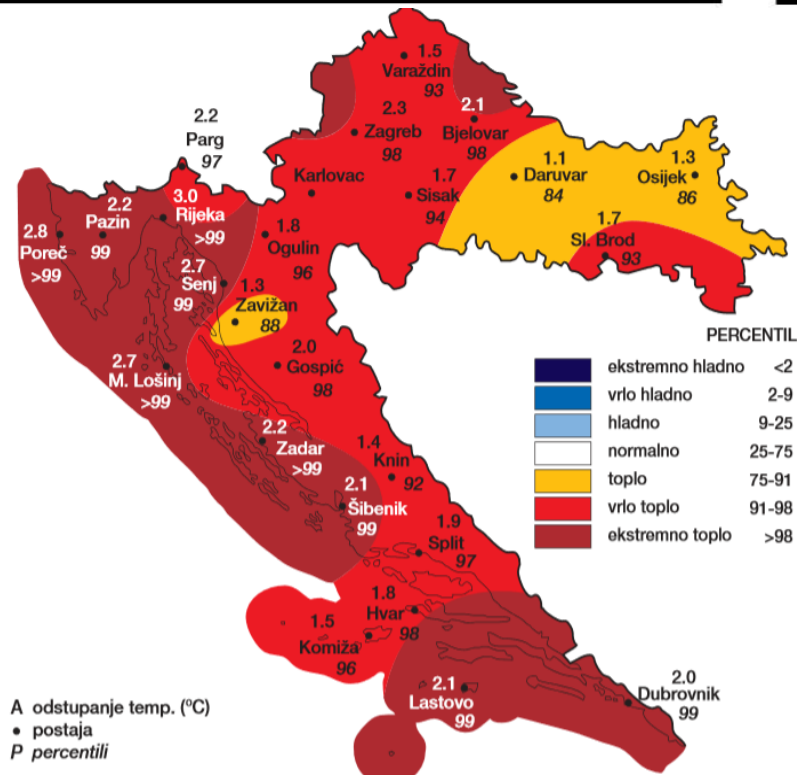
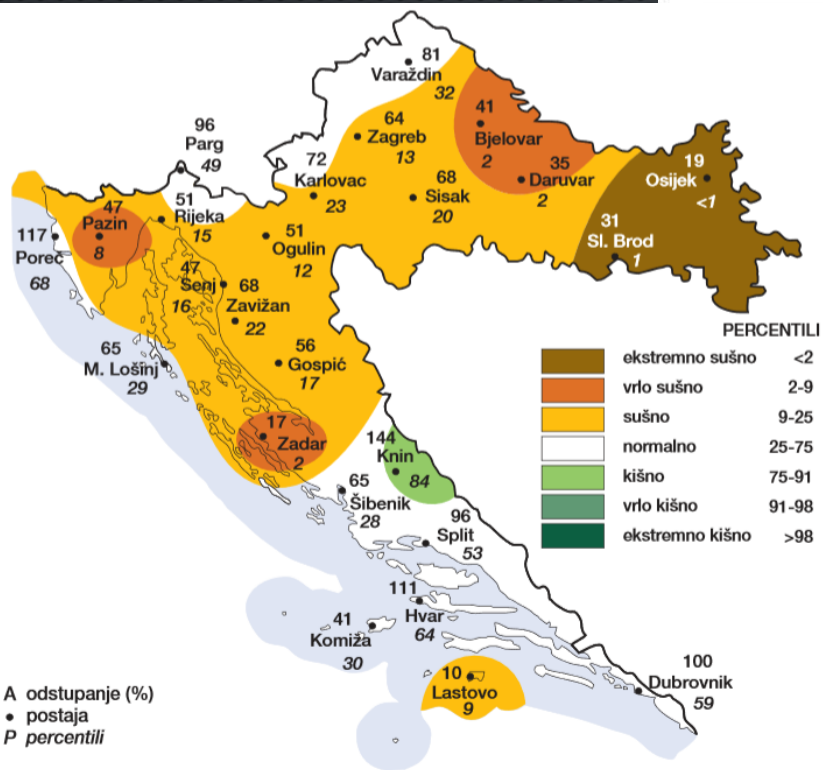
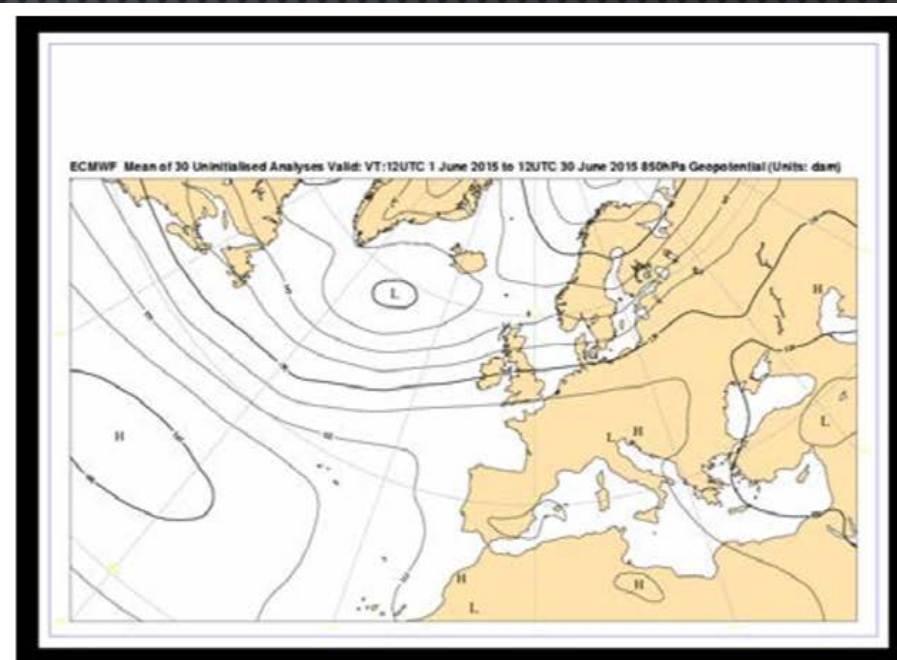
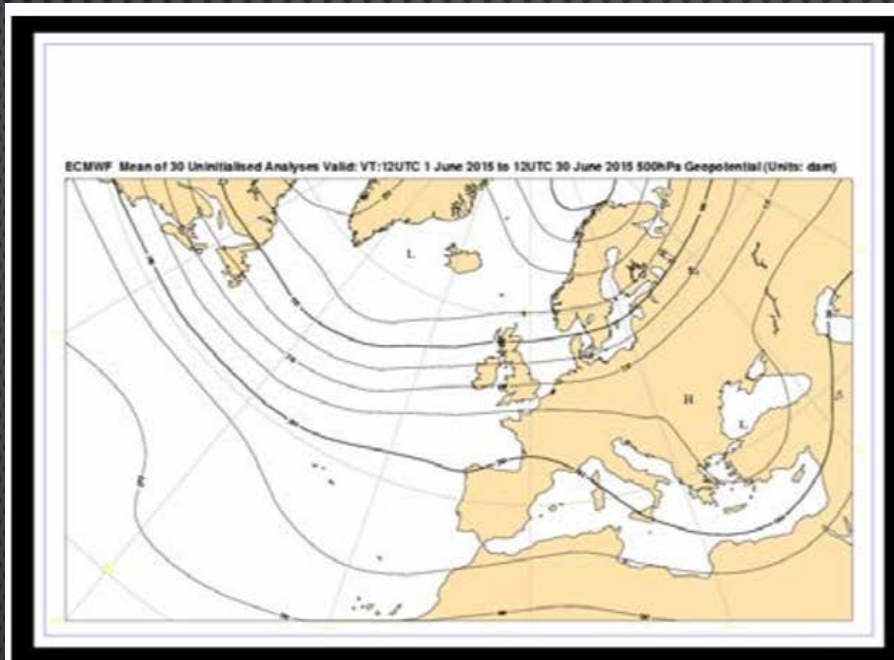


CASE STUDY

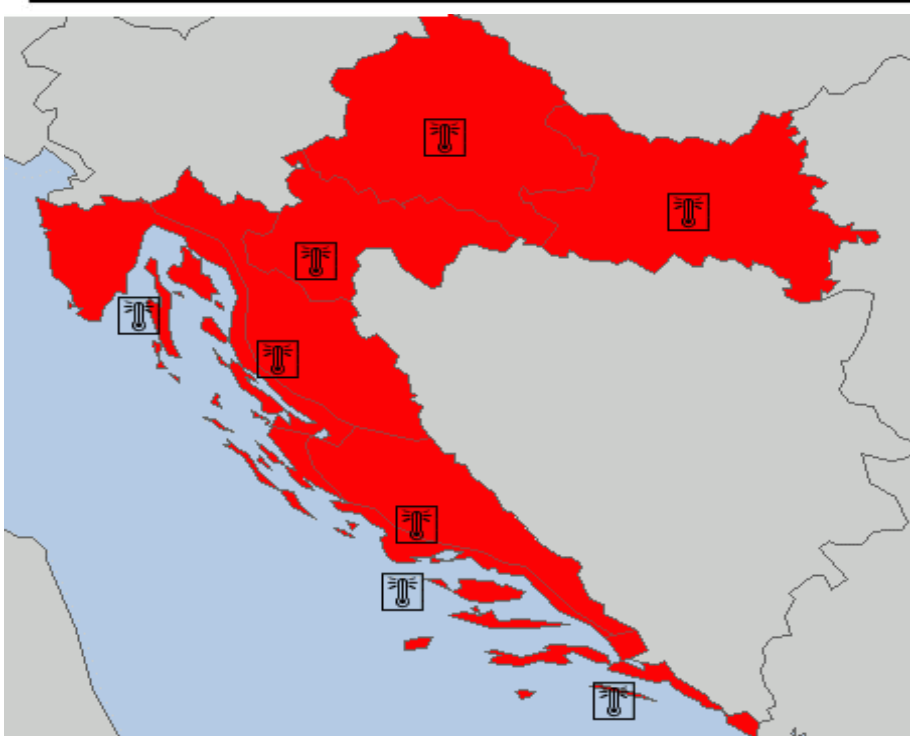
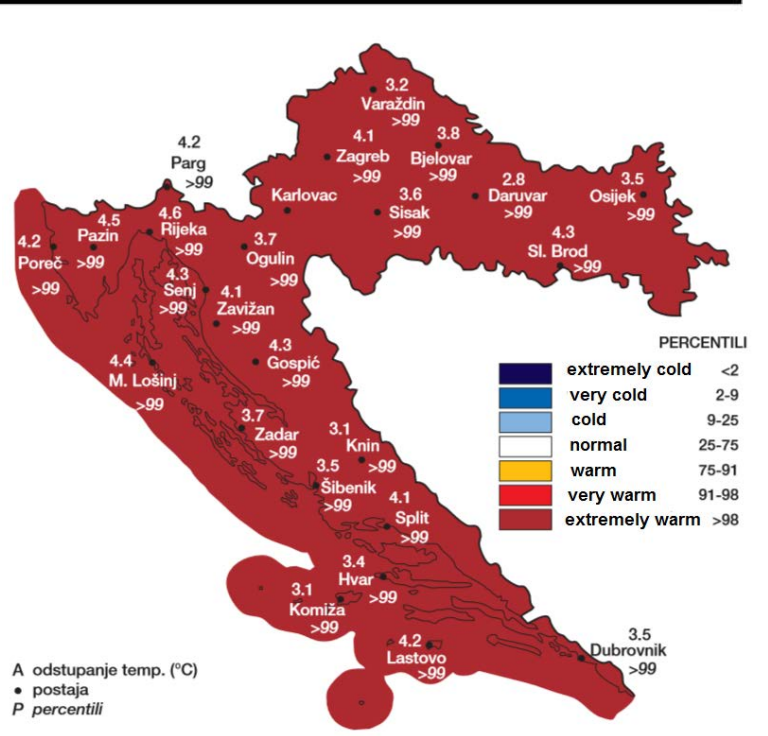
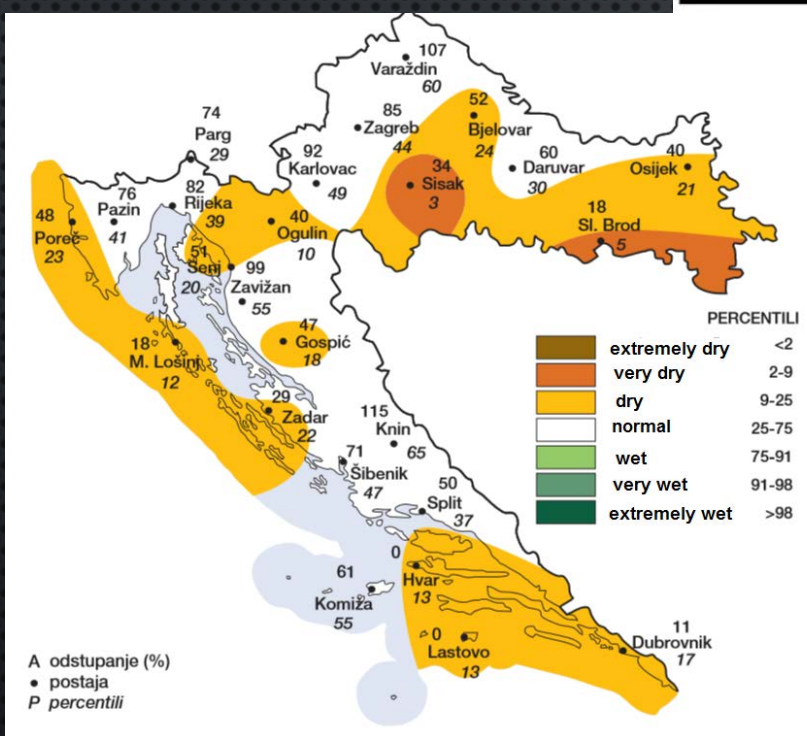
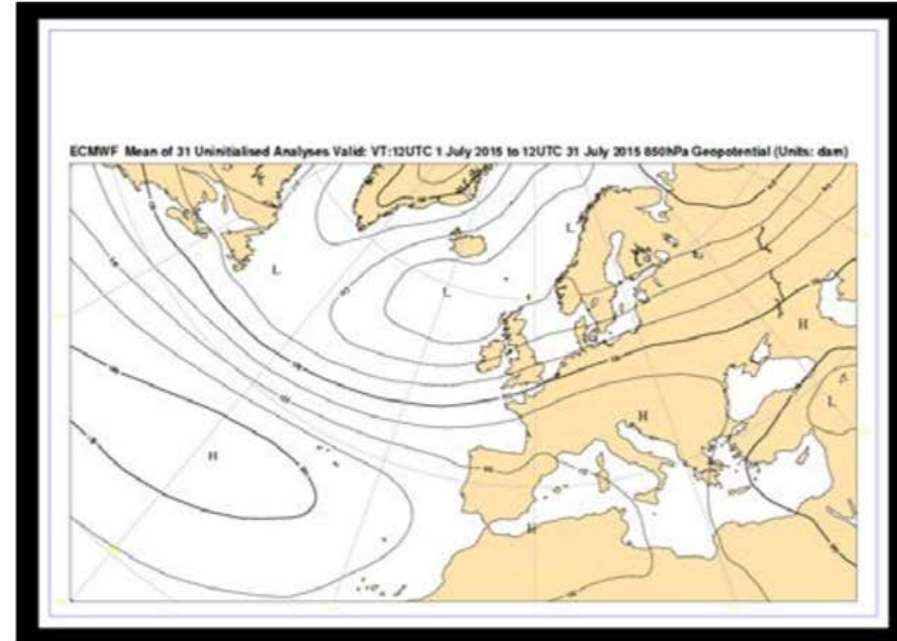
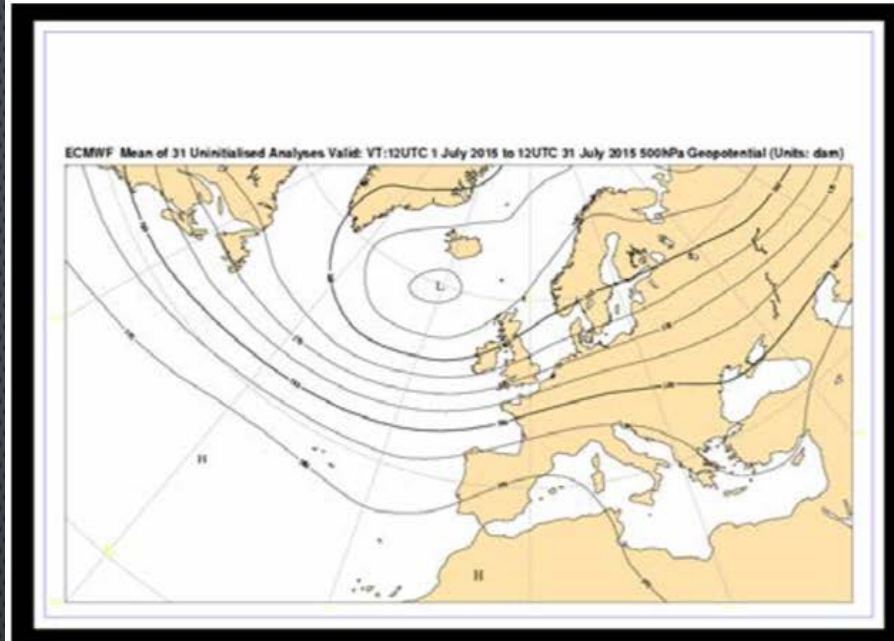
PELJEŠAC PENINSULA



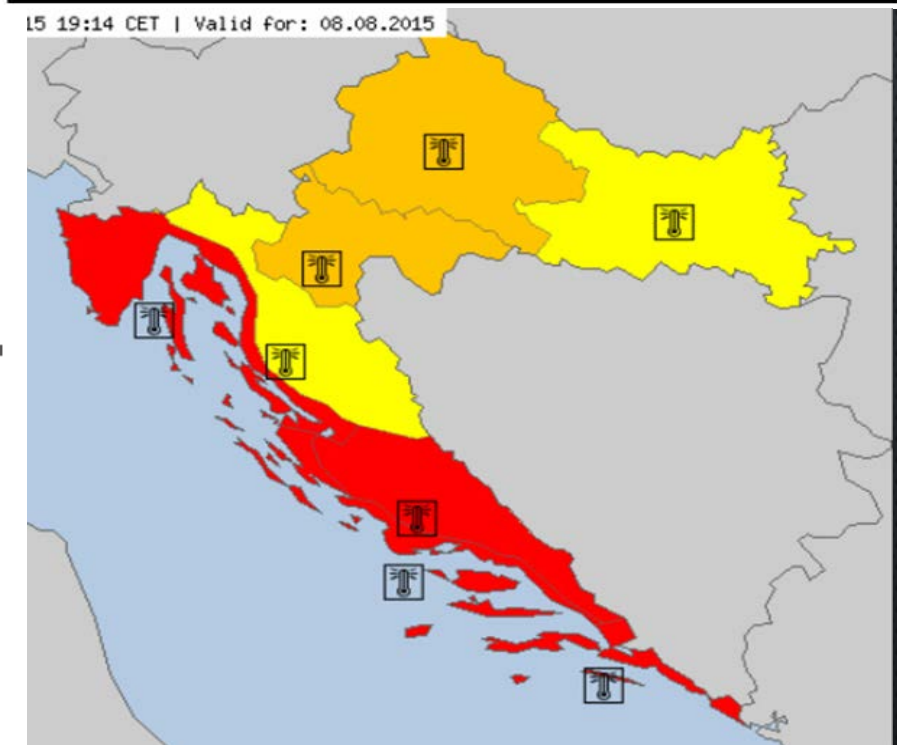
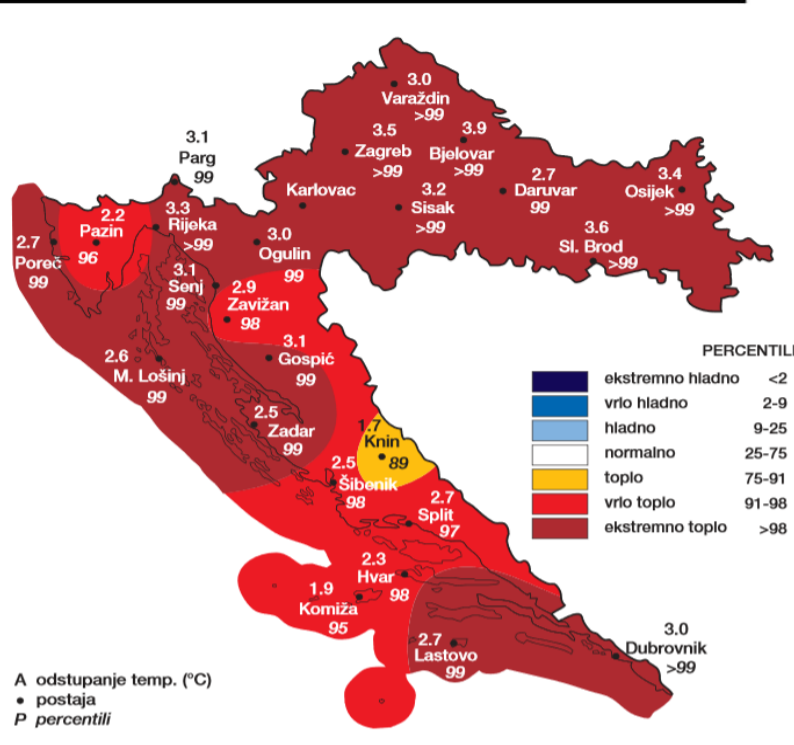
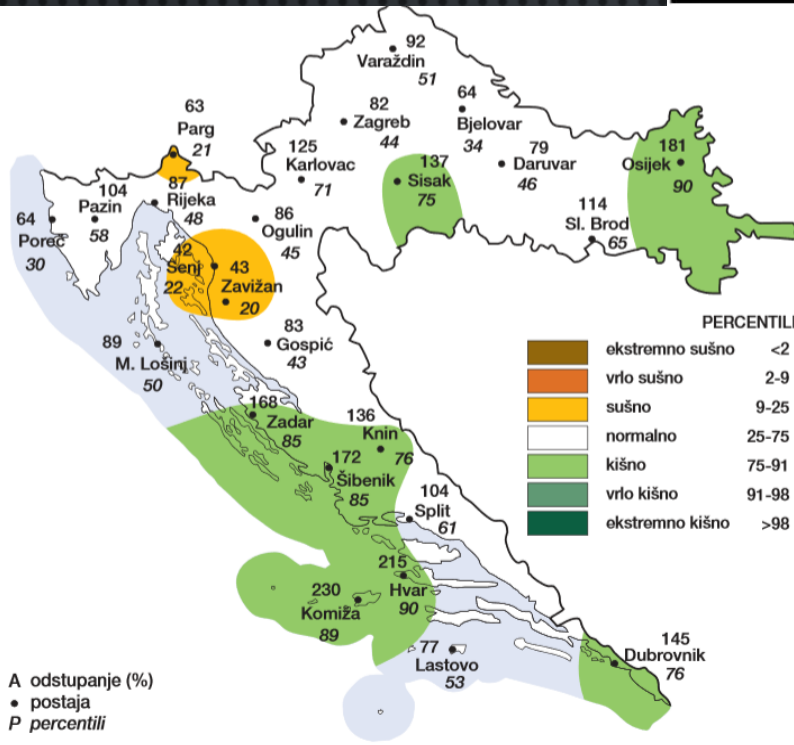
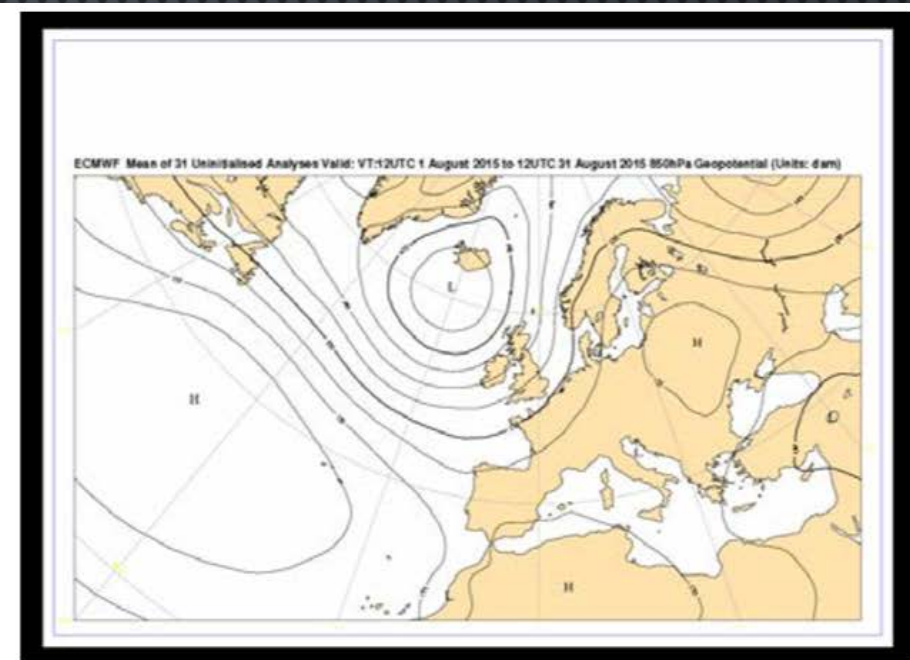
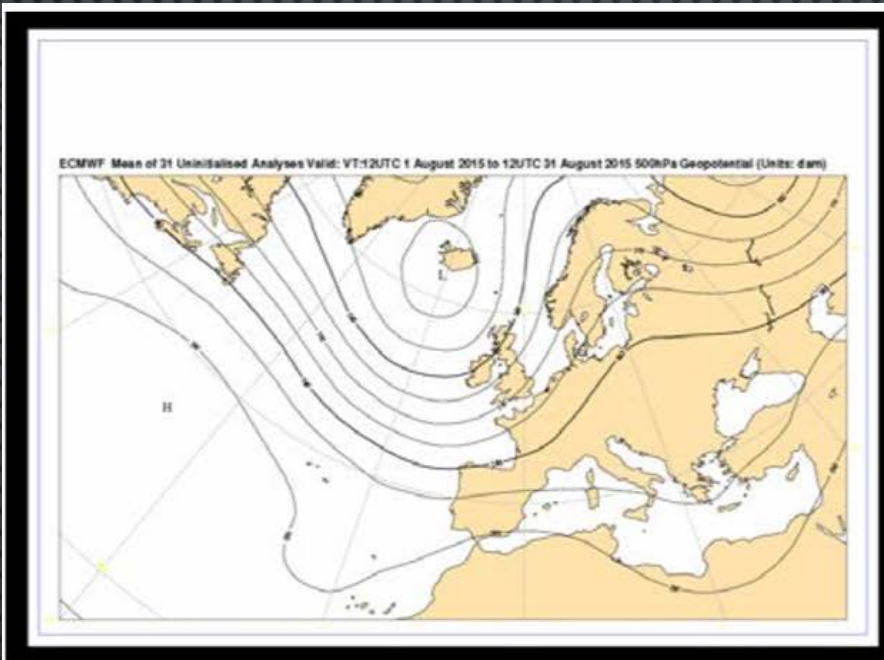
JUNE 2015

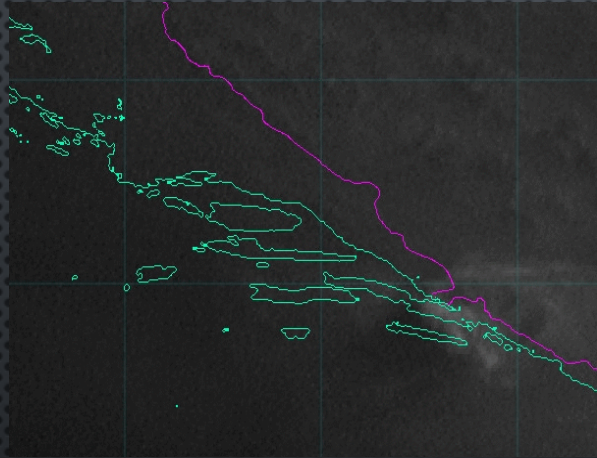
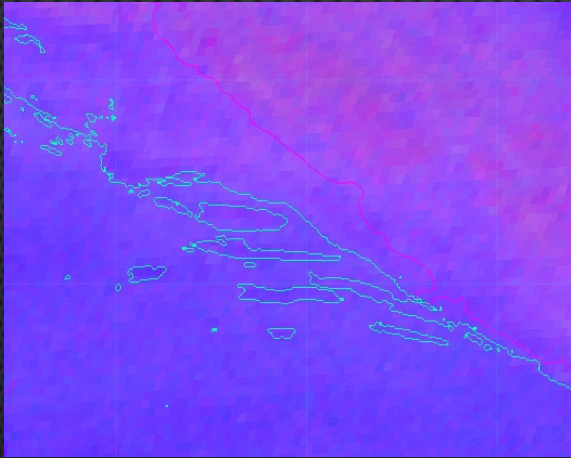


JULY 2015

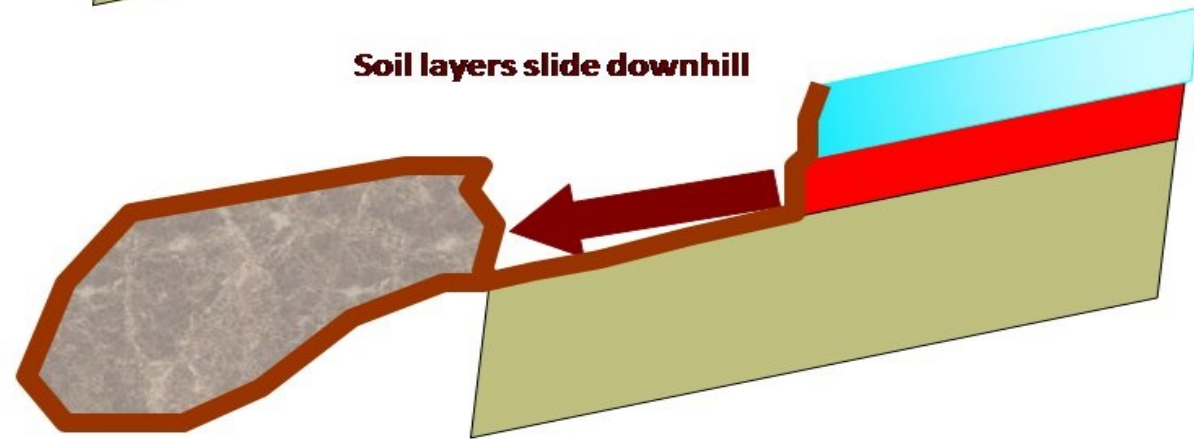
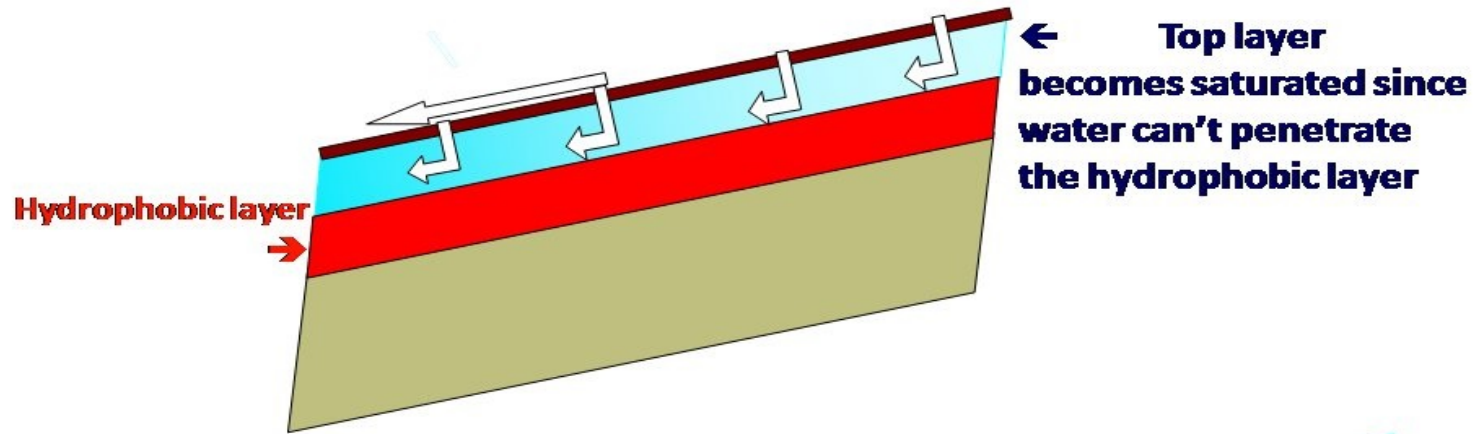


AUGUST 2015





What Happens with Heavy Rainfall





CASE STUDY

- VIDEO PELJEŠAC
- NOVEMBER 2015 WAS REALLY EXTREME.

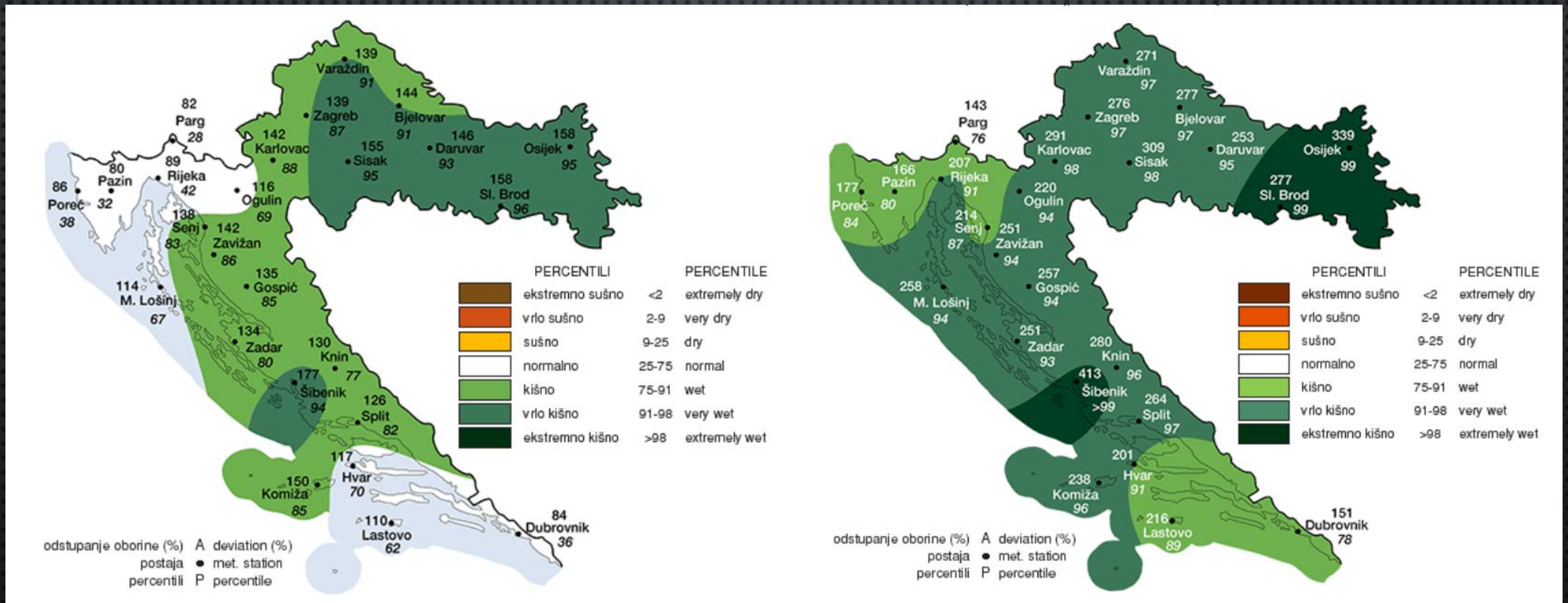
CASE STUDY

- 2015 WAS YEAR OF EL NIÑO (IN THE EQUATORIAL PART OF THE PACIFIC OCEAN) WHICH, IN SOME PARTS OF THE WORLD, IS RELATED TO EXTREME WEATHER SITUATIONS.
- CLIMATOLOGICAL ANALYSIS IN AUTUMN SHOWS THAT MORE THAN HALF OF THE COUNTRY WAS RAINY AND VERY RAINY. IN THE CATEGORY OF NORMAL WAS MAINLY THE AREA OF ISTRIA, KVARNER AND PART OF GORSKI KOTAR AND PART OF THE SOUTHERN ADRIATIC. IT SHOULD BE NOTED THAT SUCH AN ASSESSMENT OF THE SEASON MOST CONTRIBUTED TO ABOVE-AVERAGE PRECIPITATION RECORDED IN OCTOBER.

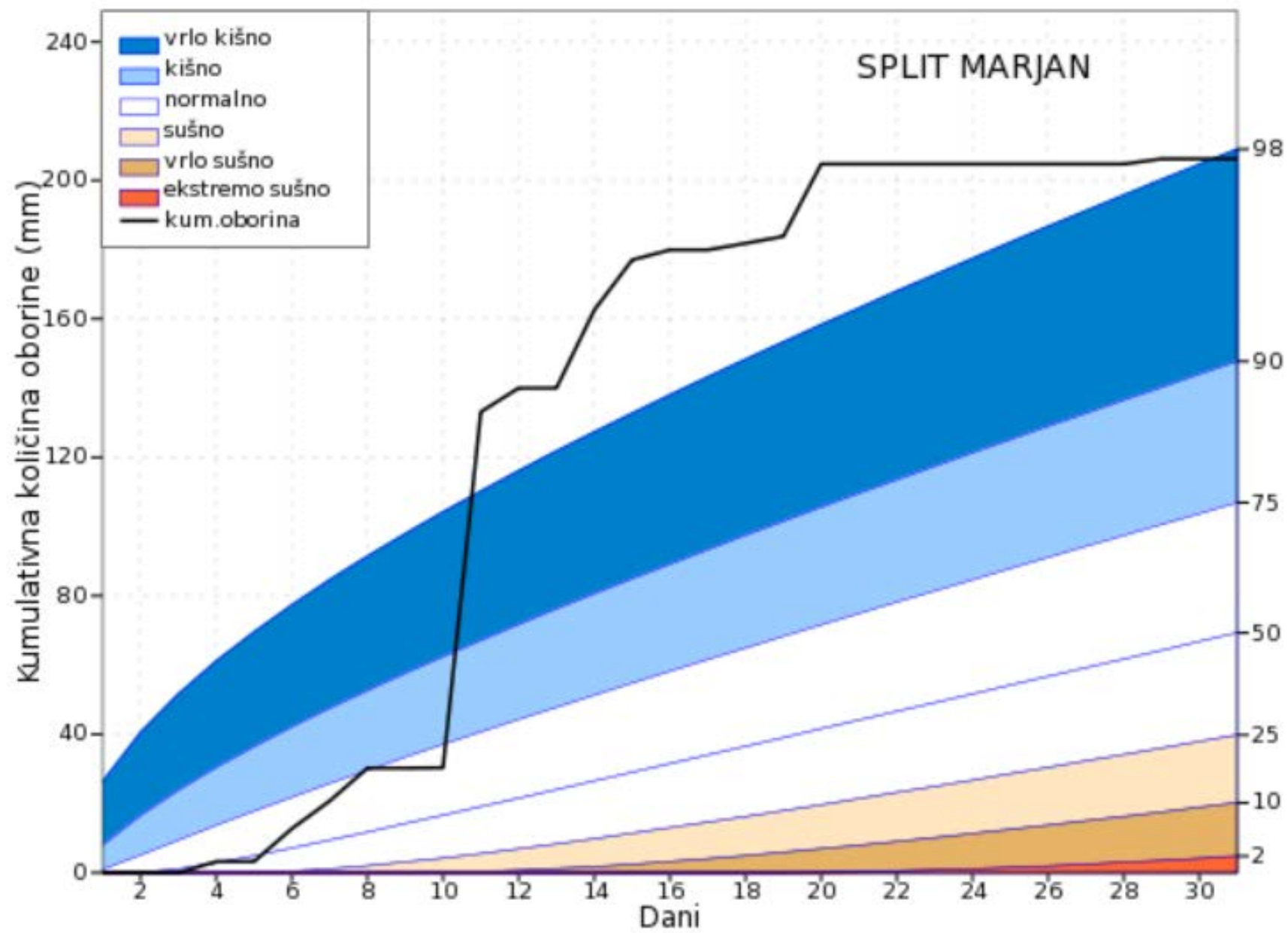
CASE STUDY

Autumn, 2015

October, 2015

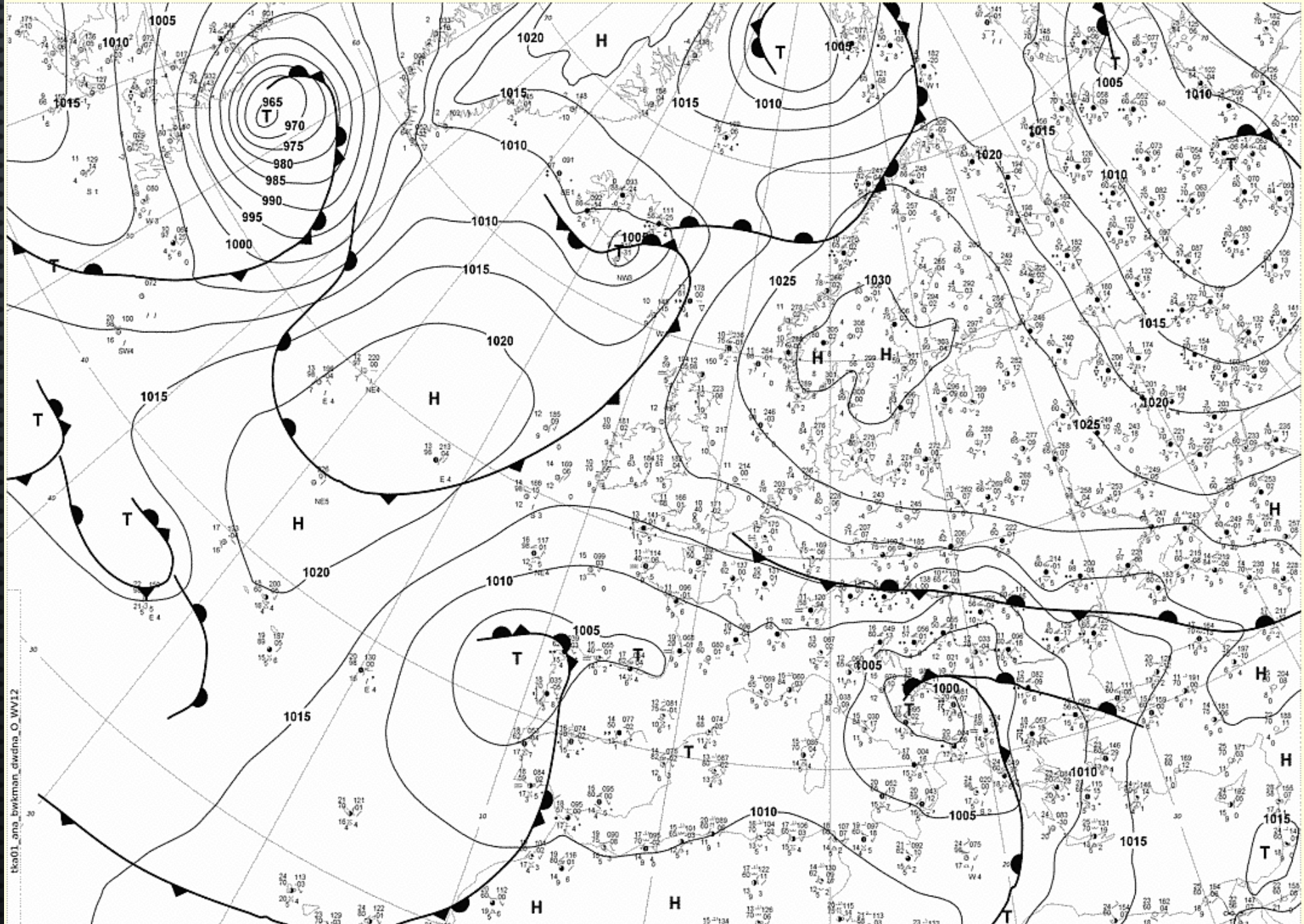


10 2015



CASE STUDY

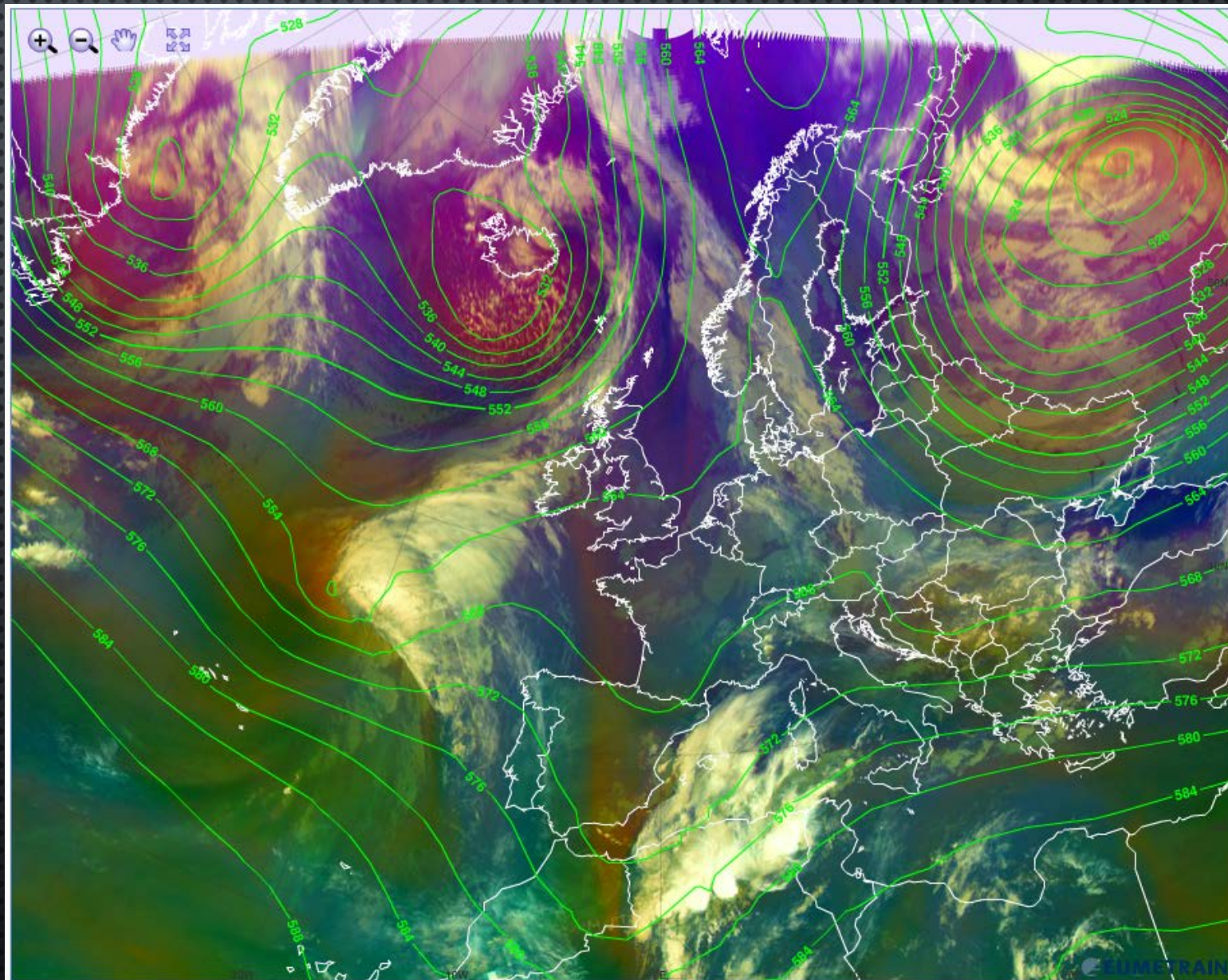
- THE FIRST PART OF OCTOBER WAS RELATIVELY WARM WITH LITTLE OR NO PRECIPITATION. THEN FROM OCTOBER 10TH TO 16TH THE REGION WAS INFLUENCED BY TWO PREVAILING CYCLONES FROM THE WESTERN MEDITERRANEAN. THERE WAS HEAVY RAIN AND ISOLATED SHOWERS, ESPECIALLY IN THE ADRIATIC AND IN AREAS ALONG THE ADRIATIC.
- BY MOVING CYCLONES THE SOUTH AND SOUTHWEST WINDS BLEW STRONG AND SEVERE BORA OCCURED. ACCORDING TO THE ANALYSIS OF CLIMATOLOGICAL PRECIPITATION OCTOBER IN MOST AREAS WAS RAINY AND VERY RAINY, AND IN SOME PLACES IN EASTERN SLAVONIA AND DALMATIA EVEN EXTREMELY RAINY.



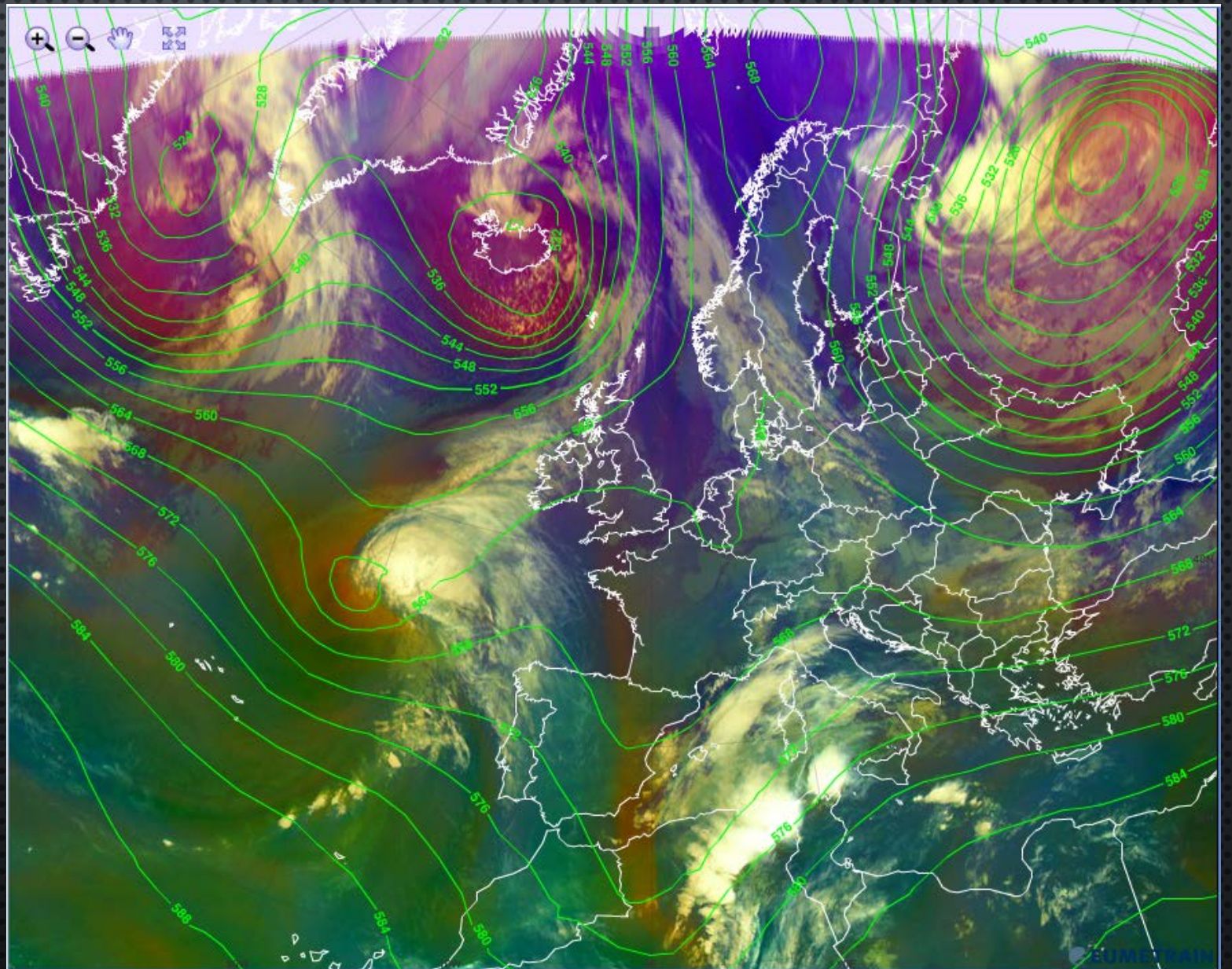
tko01_ana_bwkman_dwdna_O_WV12



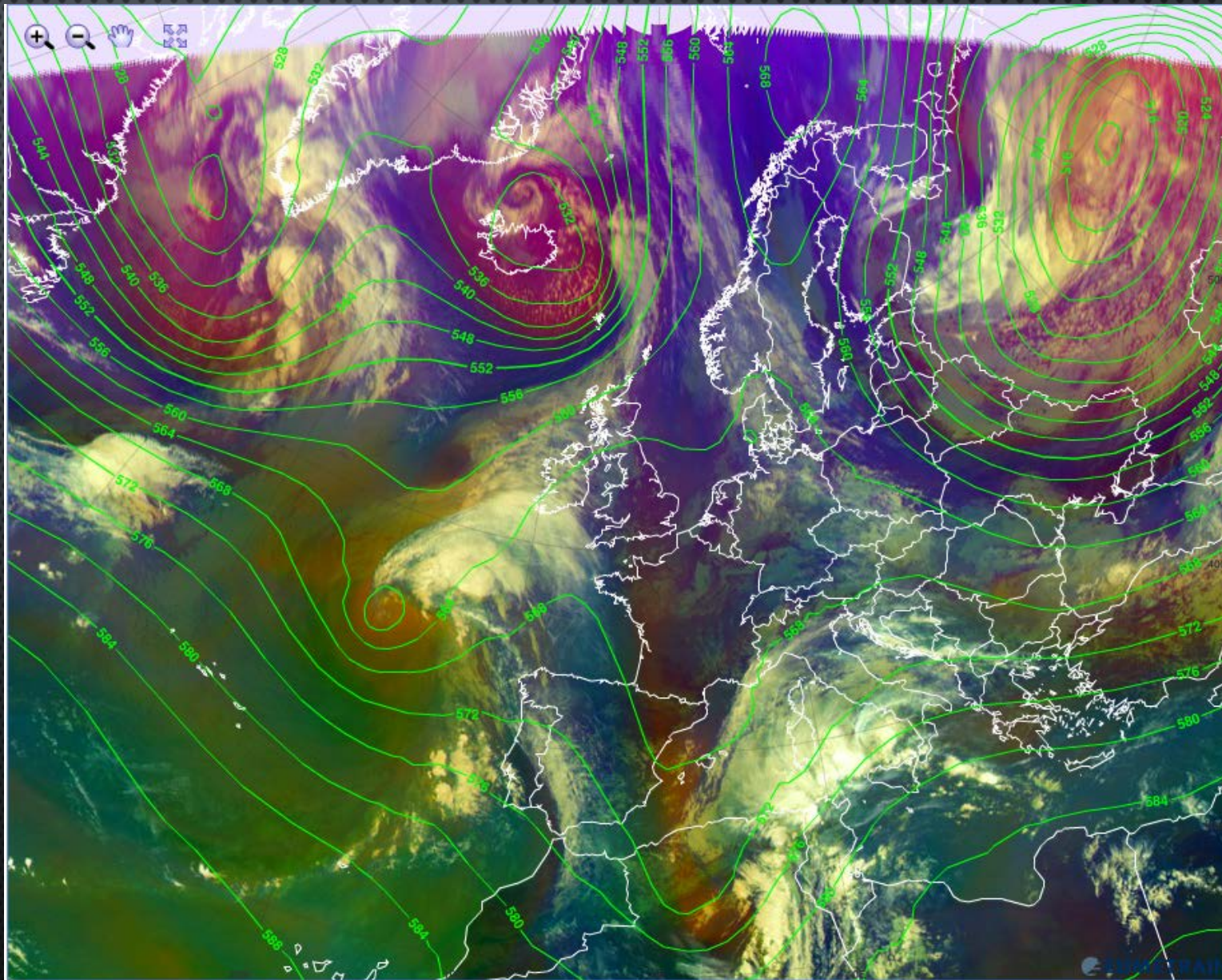
• 09/10/2015 00:00



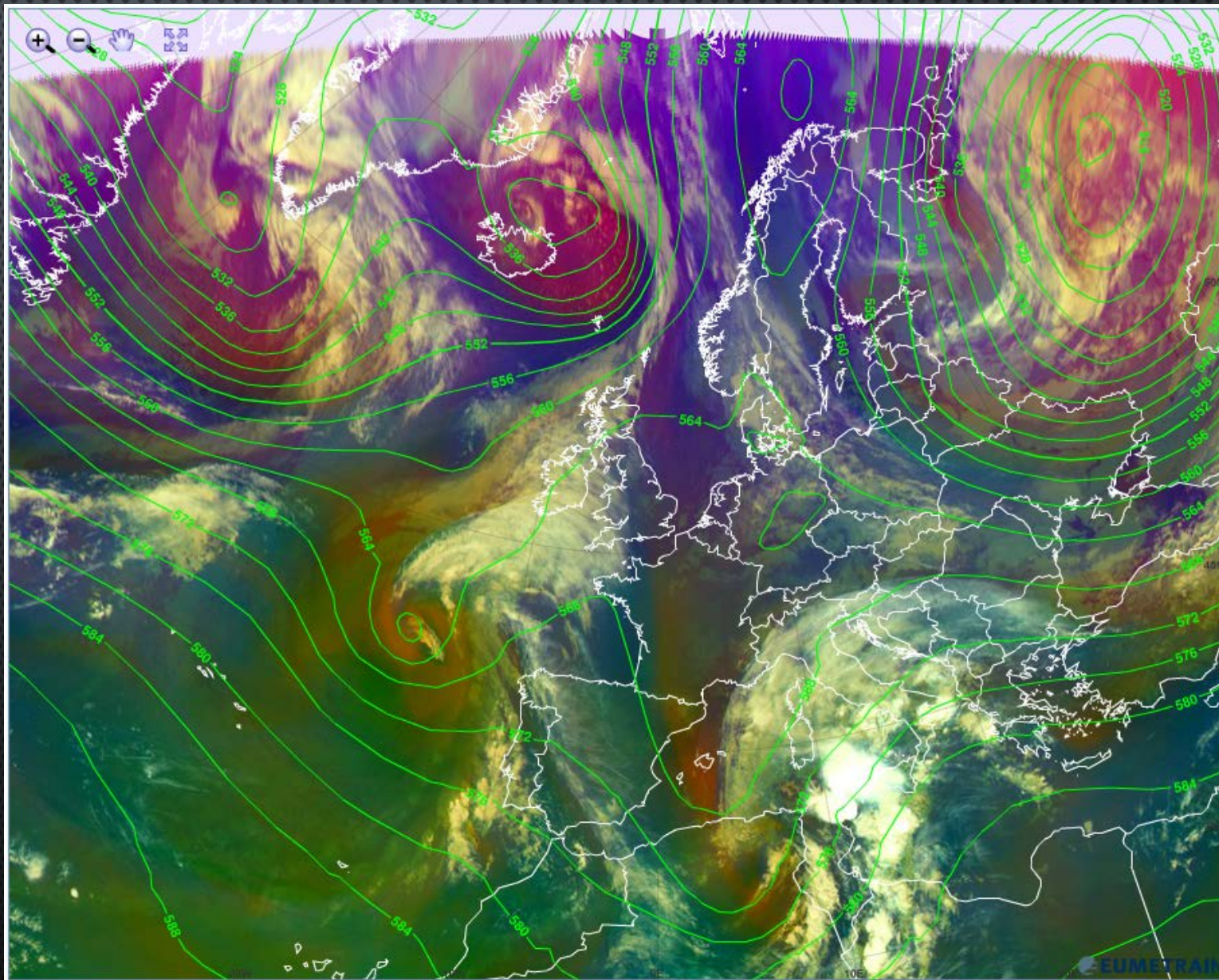
• 09/10/2015 06:00



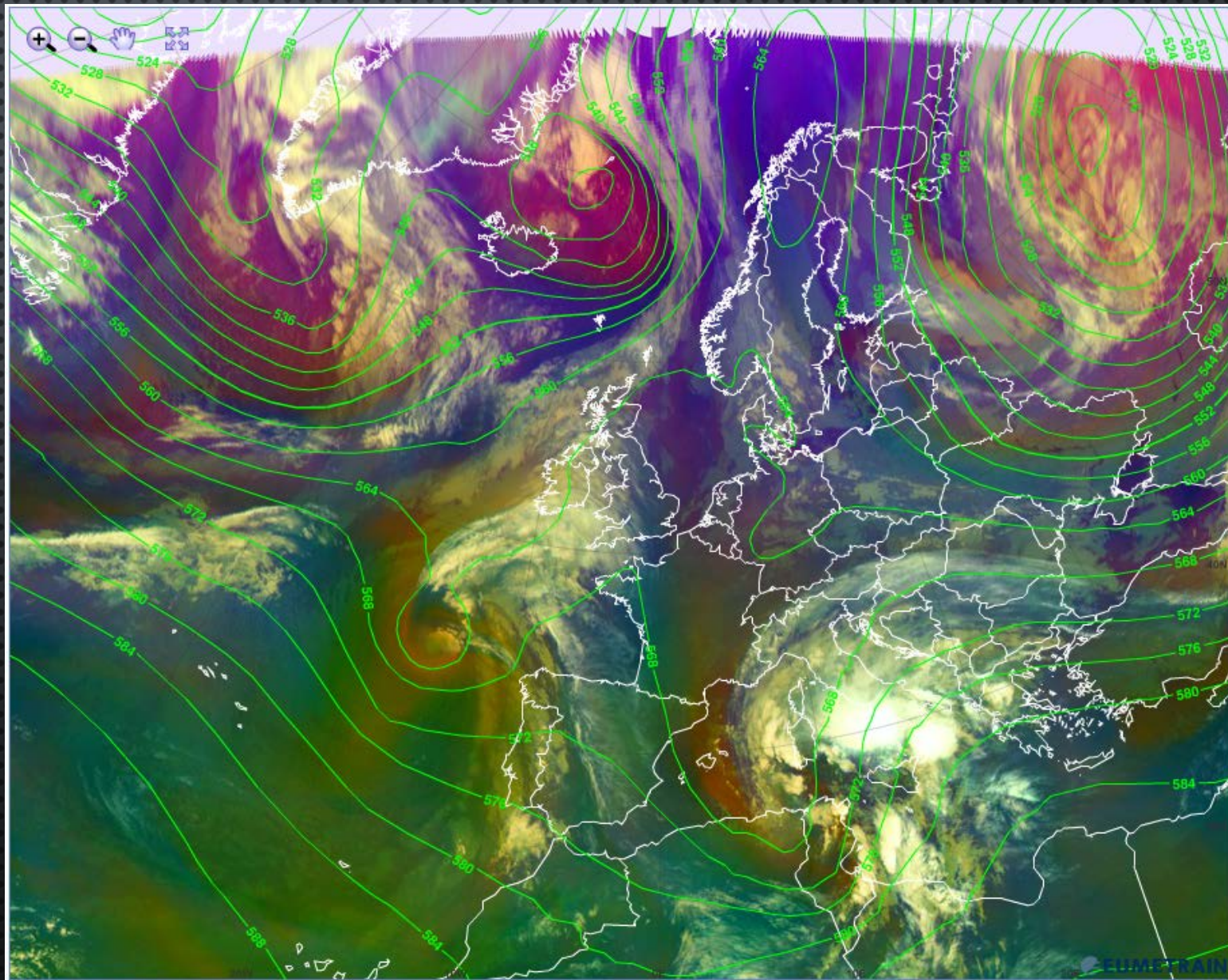
• 09/10/2015 12:00



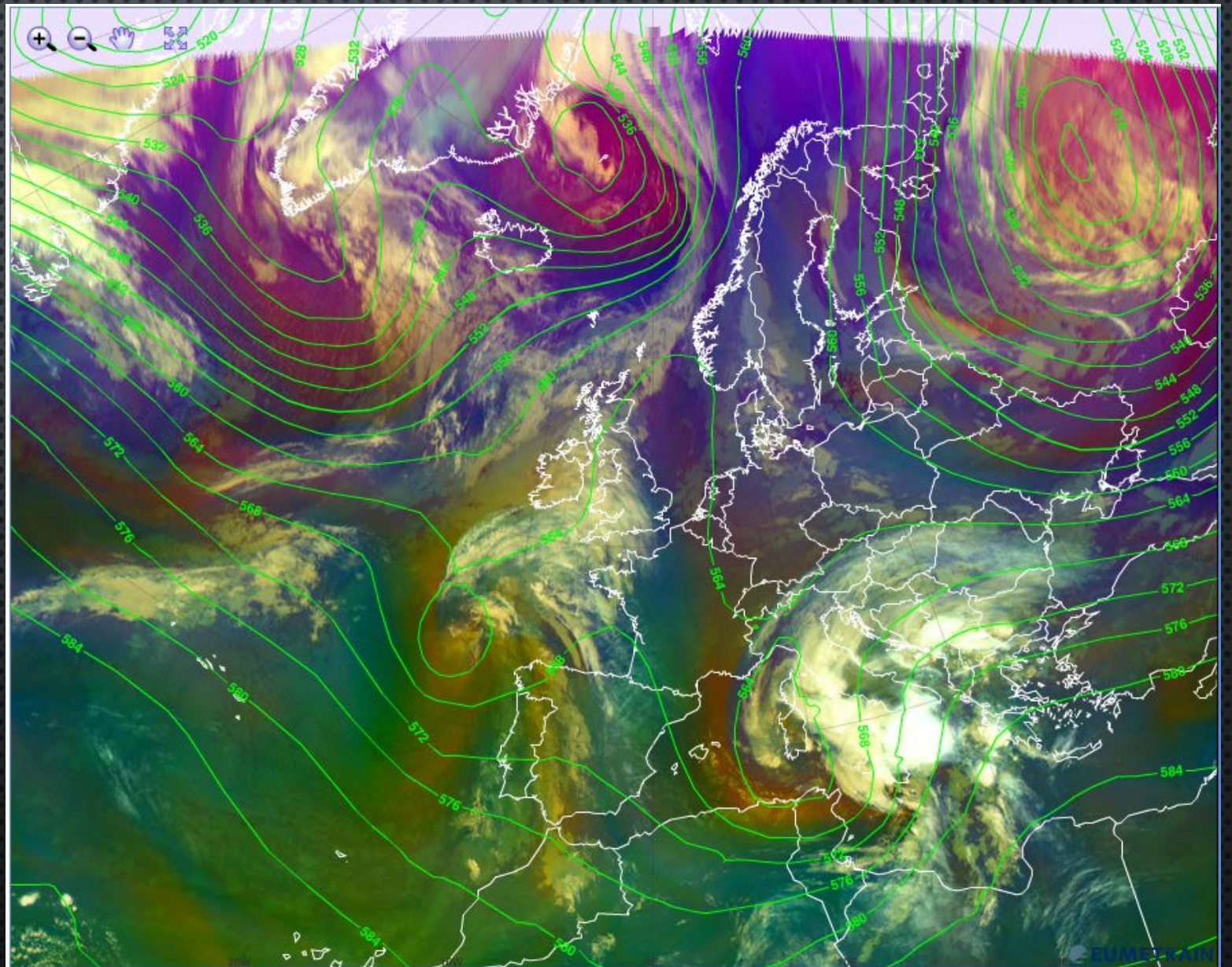
• 09/10/2015 18:00



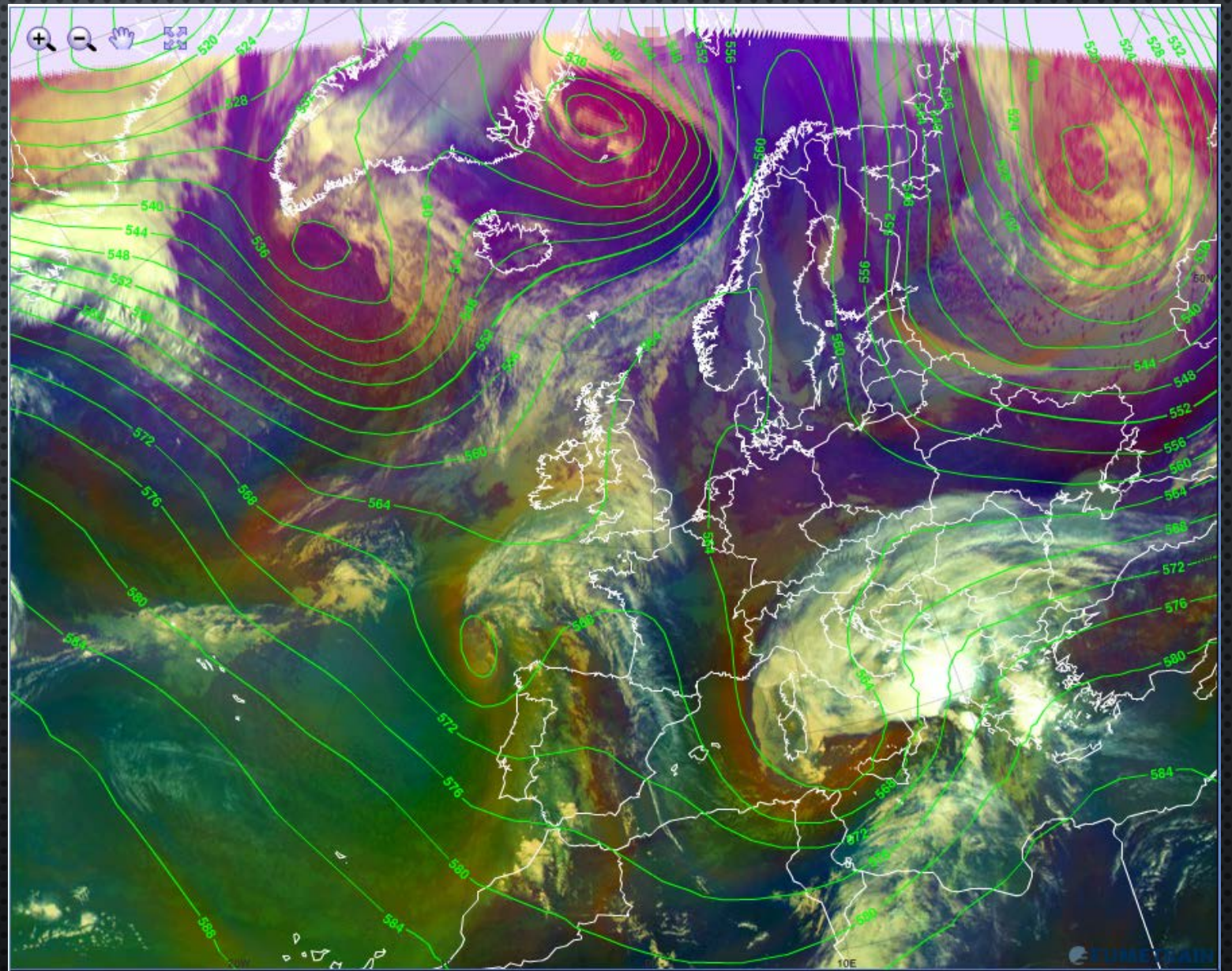
• 10/10/2015 00:00



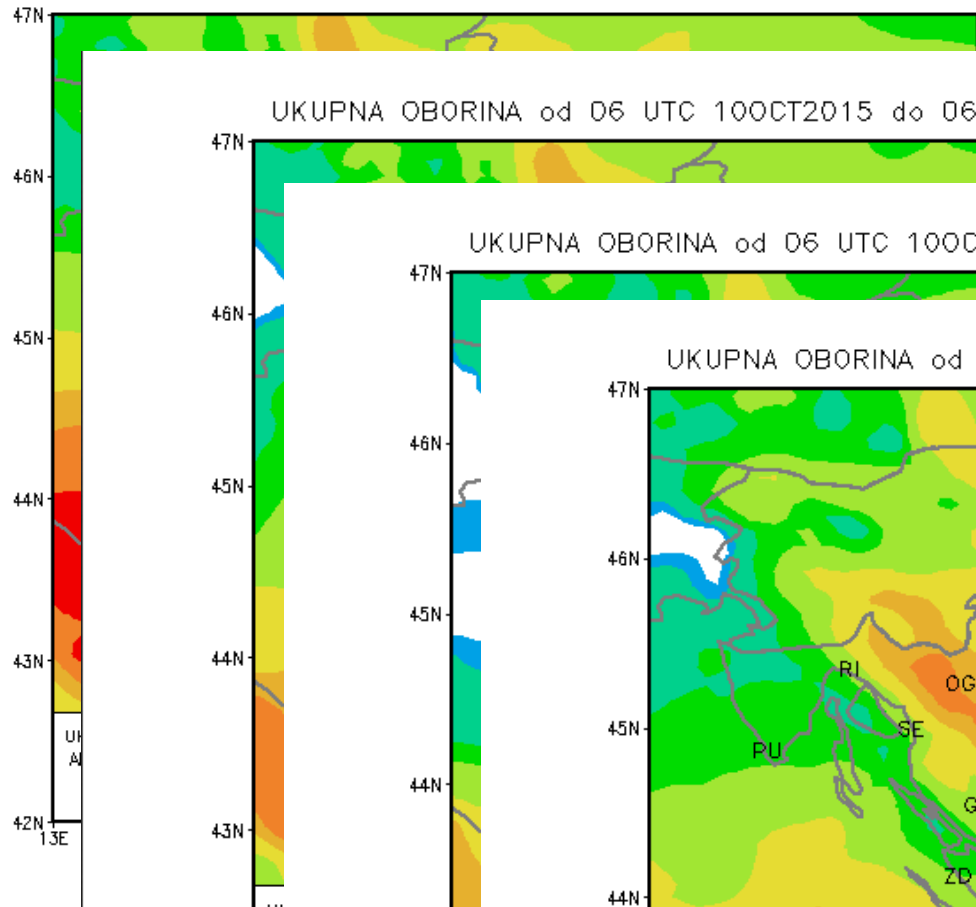
• 10/10/2015 06:00



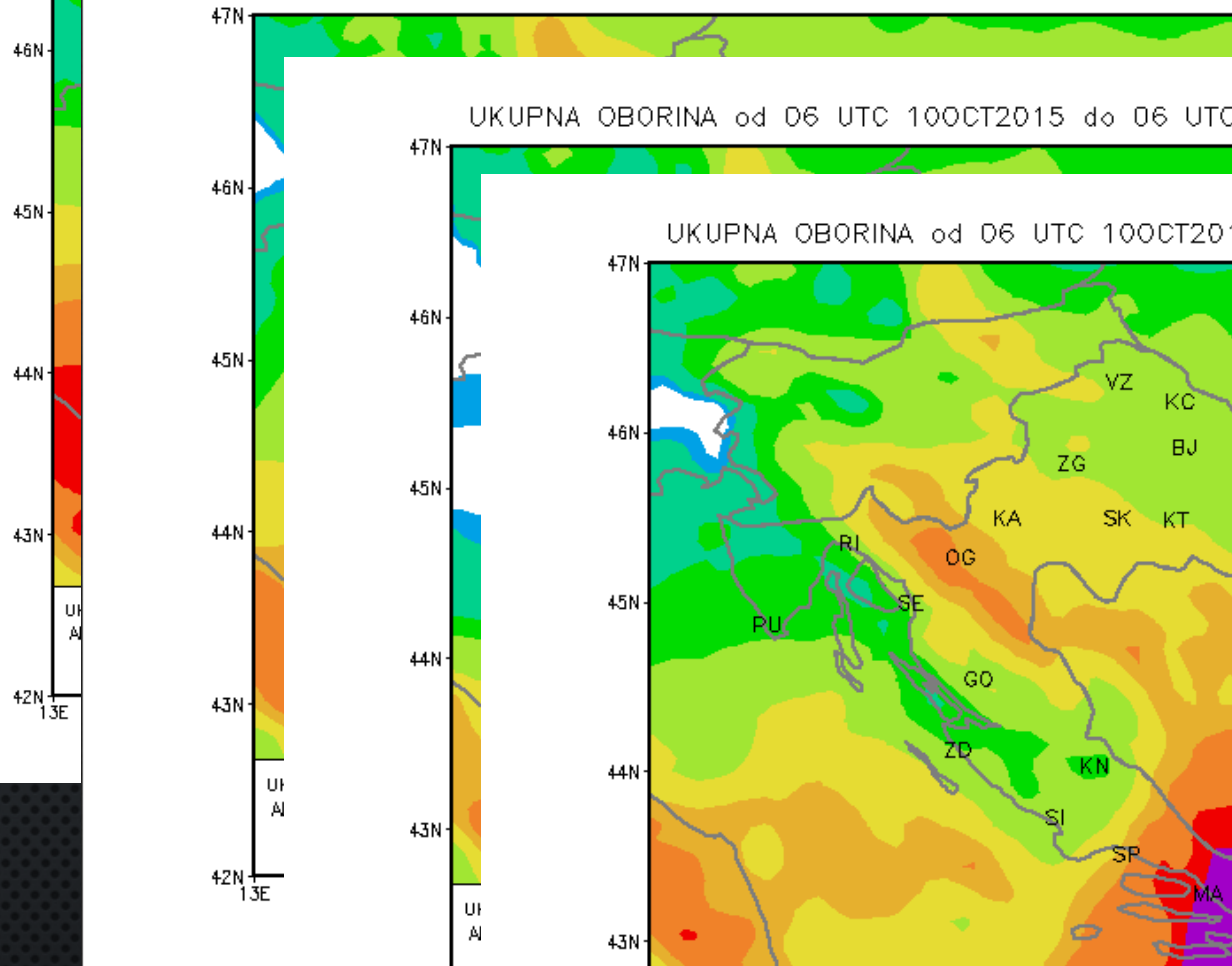
- 10/10/2015 12:00



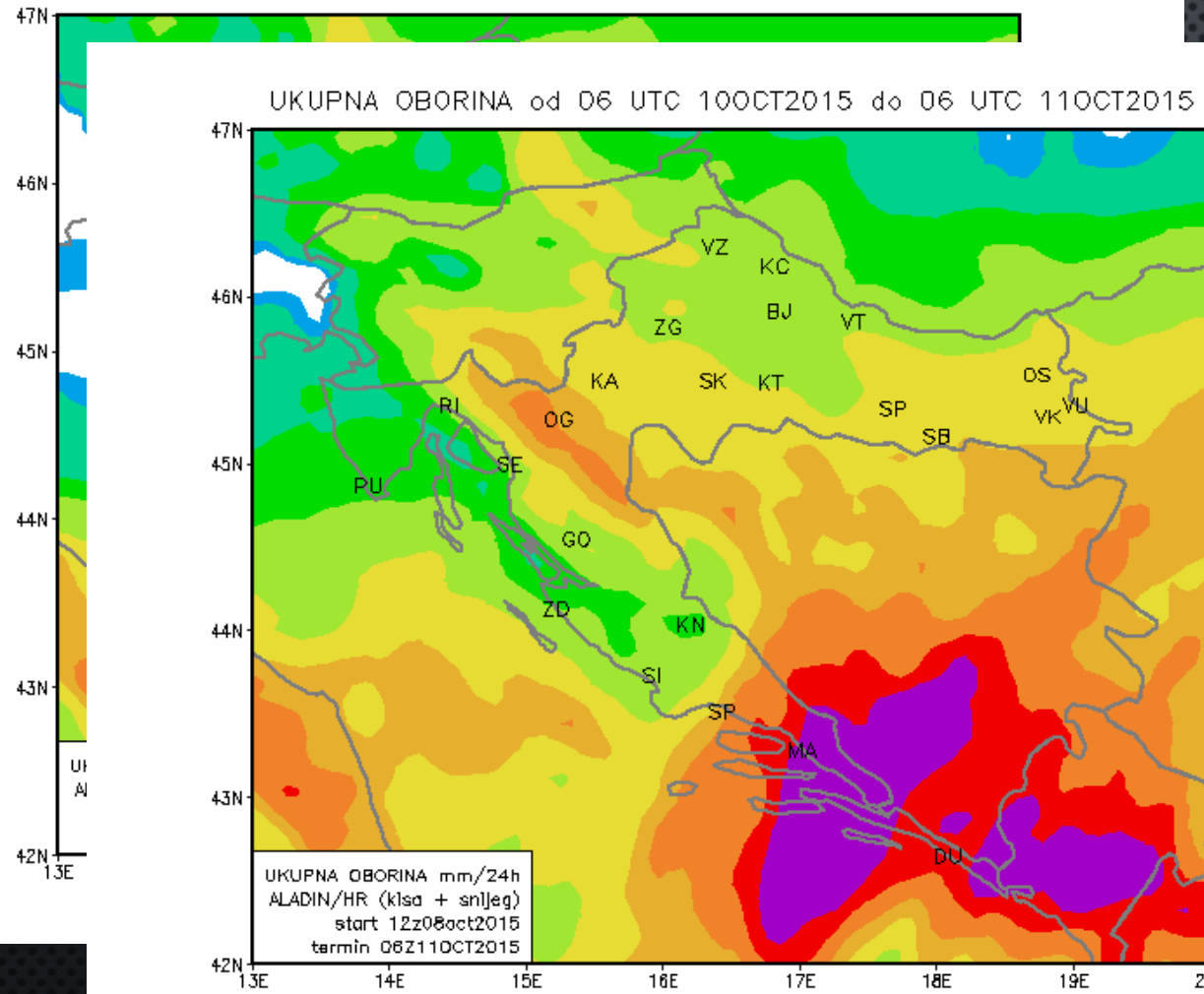
UKUPNA OBORINA od 06 UTC 10OCT2015 do 06 UTC 11OCT2015



UKUPNA OBORINA od 06 UTC 10OCT2015 do 06 UTC 11OCT2015



UKUPNA OBORINA od 06 UTC 10OCT2015 do 06 UTC 11OCT2015



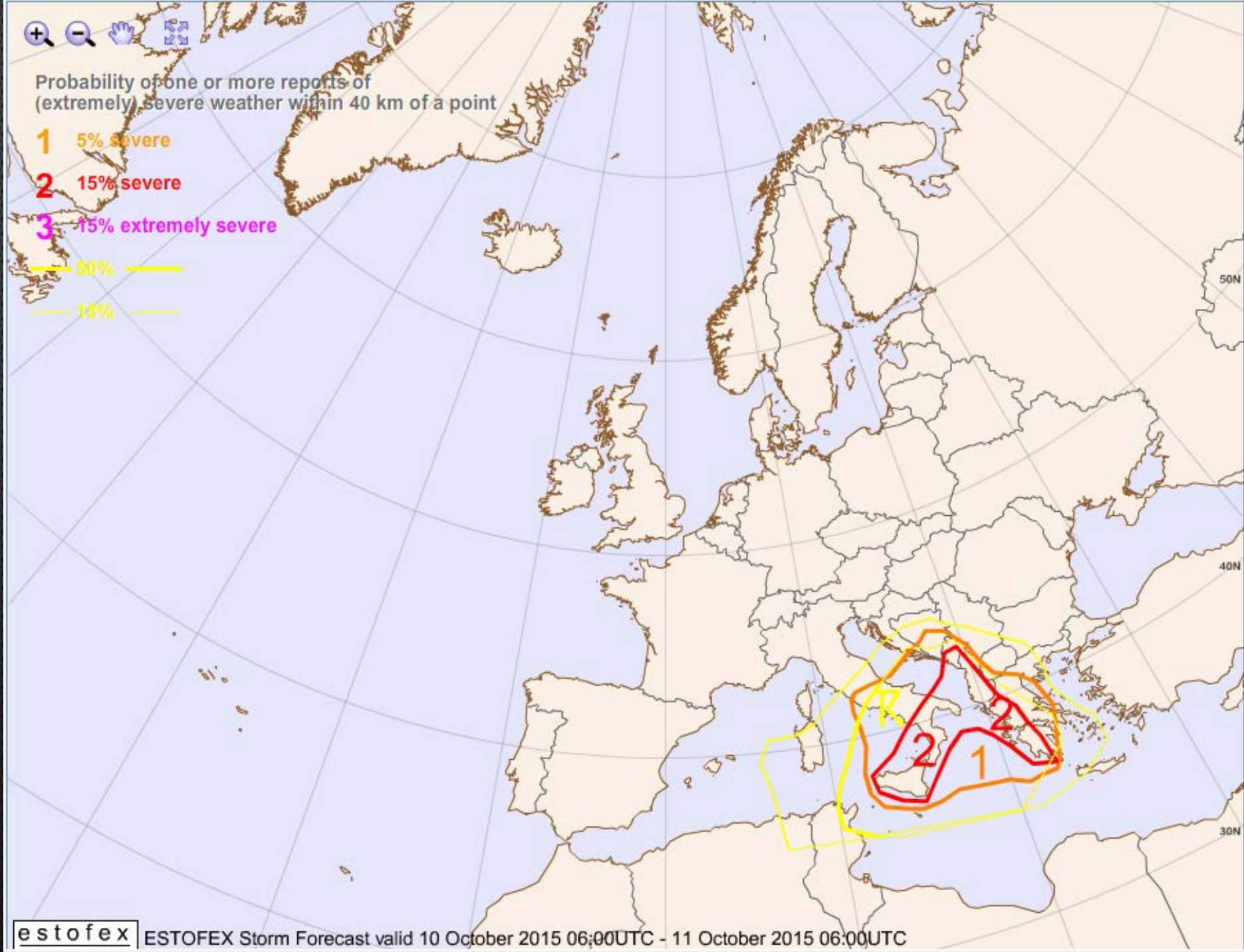
UKUPNA OBORINA mm/24h
ALADIN/HR (klsa + snl]eg)
start 12z08oct2015
termin 06z11OCT2015

0.5 1 5 10 20 35 50 75 100 (mm/24h)



Probability of one or more reports of
(extremely) severe weather within 40 km of a point

- 1** 5% severe
- 2** 15% severe
- 3** 15% extremely severe
- 50% ———
- 15% ———



CASE STUDY

- ESTOFEX PRODUCTS ARE ISSUED TO ASSIST OTHER METEOROLOGISTS IN FORECASTING SEVERE WEATHER. NATIONAL METEOROLOGICAL SERVICES ISSUE OFFICIAL WARNINGS FOR OUR REGIONS.

forecast hour: 0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72

Init Fri 09 OCT 2015 06Z NCEP/GFS forecast 2m temperatures in degrees Celcius (shaded)
Fcst Sun 11 OCT 2015 06Z Mean Sea-Level Pressure (hPa) (black).

2015100906

init. time

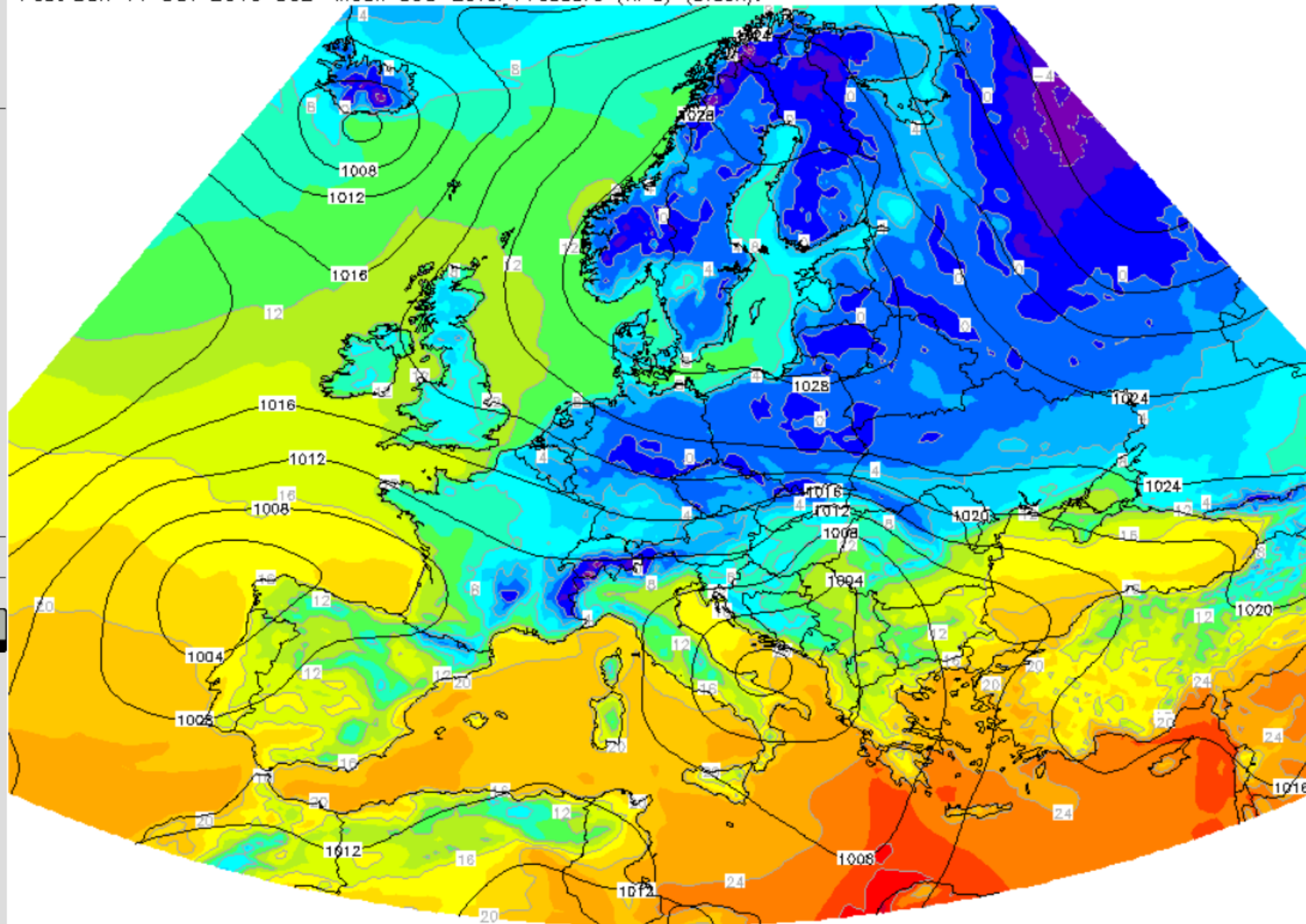
parameter

- 0-1shear
- 0-3shear
- 0-6shear
- 300
- 500
- 700
- 850
- cape
- capeshear
- el
- inindex
- ipv320
- lghail
- li700
- mixr
- nconvgust
- precip
- q-vector
- srh1
- srh3
- t2m
- td2m
- trop

surface maps



This work is licensed under a Creative Commons Attribution 3.0 Unported License.



deg. C



forecast hour: 0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72

Init Fri 09 OCT 2015 06Z NCEP GFS 0-30 hPa AGL MLCAPE (shaded) and MUCAPE (contours)
Fcst Sun 11 OCT 2015 06Z MUCIN (in J/kg, red contours), mean sea level pressure (black contours)

2015100906

init. time

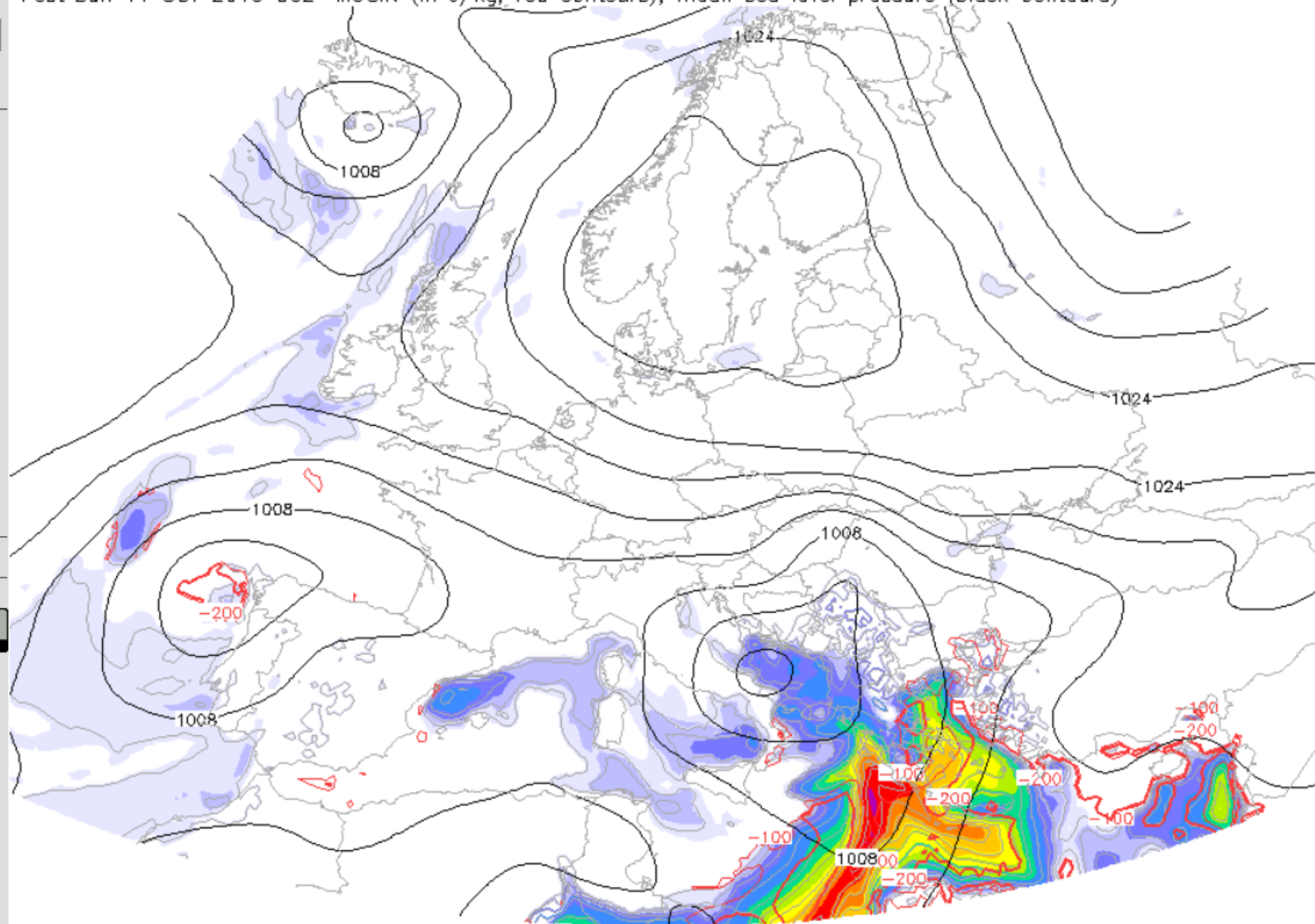
parameter

0-1shear
0-3shear
0-6shear
300
500
700
850
cape
capeshear
el
inindex
ipv320
lghail
li700
mixr
nconvgust
precip
q-vector
srh1
srh3
t2m
td2m
trop

surface maps



This work is licensed under a Creative Commons Attribution 3.0 Unported License.



J/kg

SEEFFG - Southeast Europe Flash Flood Guidance System

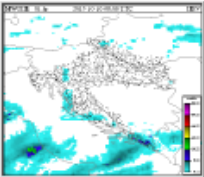
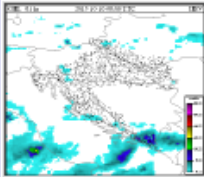
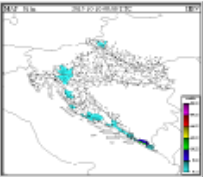
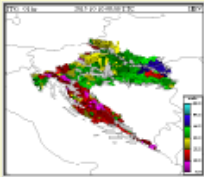
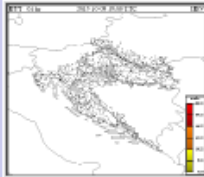
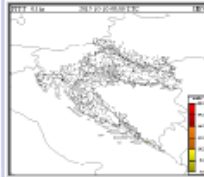
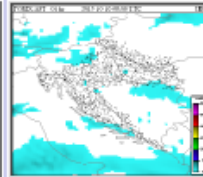
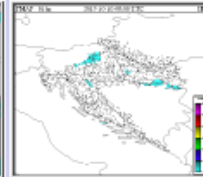
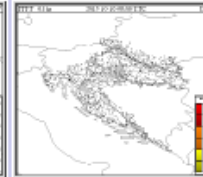
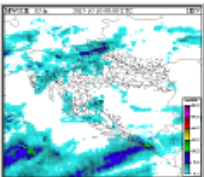
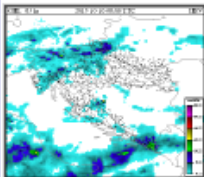
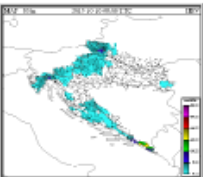
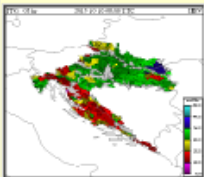
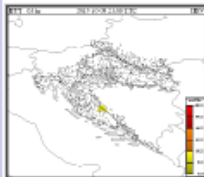
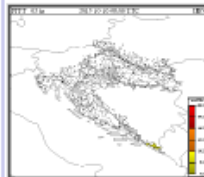
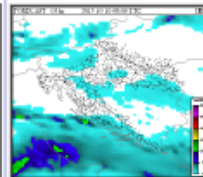
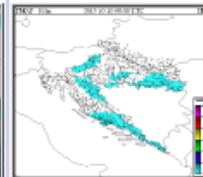
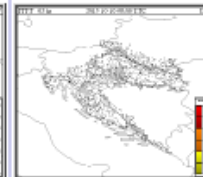
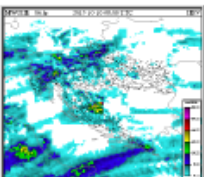
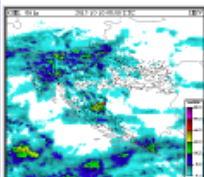
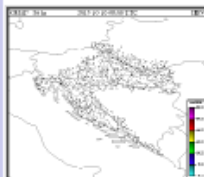
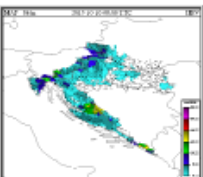
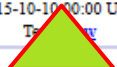
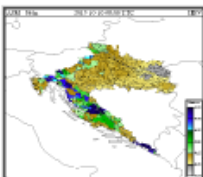
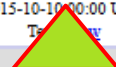
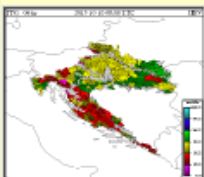
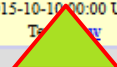
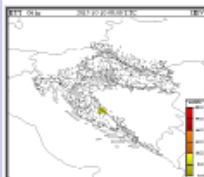
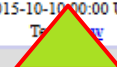
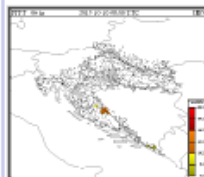
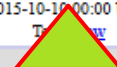
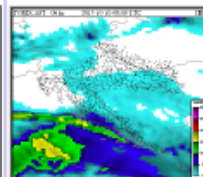
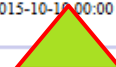
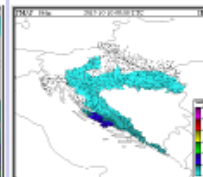


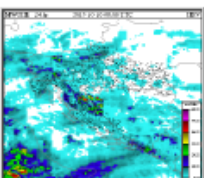
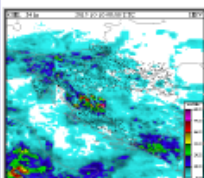
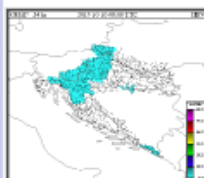
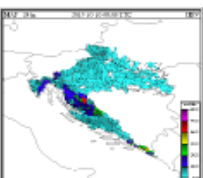
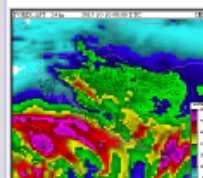
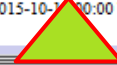
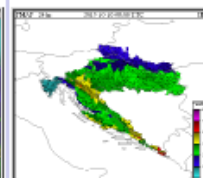
Current Date: 2016-05-09 18:04 UTC

Nav Date: 2015-10-10 00:00 UTC

Year: 2015 Month: 10 Day: 10 Hour: 00 REGION: Croatia

-1 Month -1 Day -8 Hours -1 Hour +1 Hour +6 Hours +1 Day +1 Month

Prev 6-hr Interval (18 UTC) Reset to Current Next 6-hr Interval (06 UTC)

DT	MWGHE Precipitation	GHE Precipitation	Gauge MAP	Merged MAP	ASM	FFG	IFFT	PFFT	ALADIN Forecast	FMAP	FFFT
01-hr	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view		 2015-10-10 00:00 UTC Text: view		 2015-10-10 00:00 UTC Text: view	 2015-10-09 19:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view
03-hr	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view		 2015-10-10 00:00 UTC Text: view		 2015-10-10 00:00 UTC Text: view	 2015-10-09 21:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view
06-hr	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: 	 2015-10-10 00:00 UTC Text: 	 2015-10-10 00:00 UTC Text: 	 2015-10-10 00:00 UTC Text: 	 2015-10-10 00:00 UTC Text: 	 2015-10-10 00:00 UTC Text: 	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: 
24-hr	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view	 2015-10-10 00:00 UTC Text: view					 2015-10-10 00:00 UTC Text: 	 2015-10-10 00:00 UTC Text: view	

SEFFFG - Southeast Europe Flash Flood Guidance System

Current Date: 2016-05-09 18:39 UTC

Nav Date: 2015-10-10 06:00 UTC

Year: 2015 Month: 10 Day: 10 Hour: 06 REGION: Croatia

DT	MWGHE Precipitation	GHE Precipitation	Gauge MAP	Merged MAP	ASM	FFG	IFFT	PFFT	ALADIN Forecast	FMAP	FFFT
01-hr	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view		 2015-10-10 06:00 UTC Text: view		 2015-10-10 06:00 UTC Text: view	 2015-10-10 01:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view
03-hr	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view		 2015-10-10 06:00 UTC Text: view		 2015-10-10 06:00 UTC Text: view	 2015-10-10 03:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view
06-hr	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view
24-hr	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view	 2015-10-10 06:00 UTC Text: view					 2015-10-10 06:00 UTC	 2015-10-10 06:00 UTC Text: view	

CASE STUDY

- QUESTION FOR YOU:
FOR WHAT REGIONS WOULD YOU
ISSUE FLASH FLOOD WARNING?



SEFFFG - Southeast Europe Flash Flood Guidance System

Current Date: 2016-05-09 10:41 UTC

Nav Date: 2015-10-10 12:00 UTC

Year: 2015 Month: 10 Day: 10 Hour: 12 REGION: Croatia

DT	MWGHE Precipitation	GHE Precipitation	Gauge MAP	Merged MAP	ASM	FFG	IFFT	PFFT	ALADIN Forecast	FMAP	FFFT
01-hr	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view		 2015-10-10 12:00 UTC Text: view		 2015-10-10 12:00 UTC Text: view	 2015-10-10 07:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view
03-hr	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view		 2015-10-10 12:00 UTC Text: view		 2015-10-10 12:00 UTC Text: view	 2015-10-10 09:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view
06-hr	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC 	 2015-10-10 12:00 UTC 	 2015-10-10 12:00 UTC	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC
24-hr	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view	 2015-10-10 12:00 UTC Text: view					 2015-10-10 12:00 UTC	 2015-10-10 12:00 UTC Text: view	

SEEFFG - Southeast Europe Flash Flood Guidance System

Current Date: 2016-05-09 19:49 UTC

Nav Date: 2015-10-10 18:00 UTC

Year: 2015 Month: 10 Day: 10 Hour: 18 REGION: Croatia

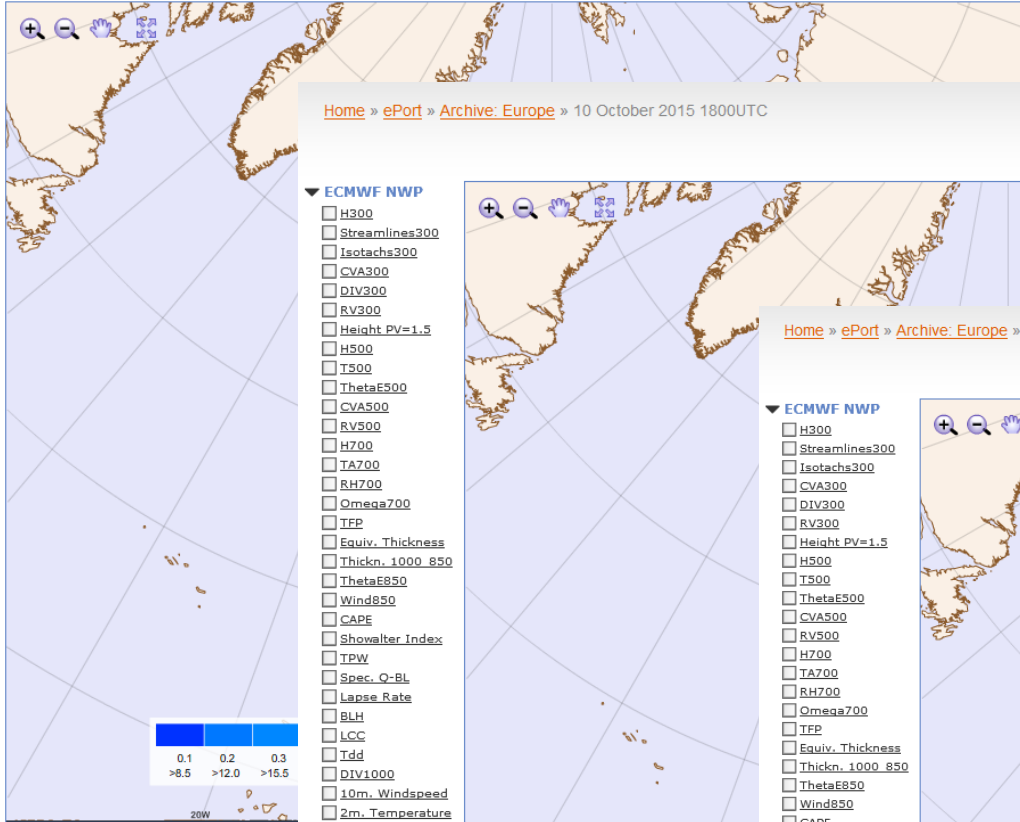
-1 Month -1 Day -6 Hours -1 Hour +1 Hour +6 Hours +1 Day +1 Month

Prev 6-hr Interval (12 UTC) Reset to Current Next 6-hr Interval (00 UTC)

DT	MWGHE Precipitation	GHE Precipitation	Gauge MAP	Merged MAP	ASM	FFG	IFFT	PFFT	ALADIN Forecast	FMAP	FFFT
01-hr	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view		 2015-10-10 18:00 UTC Text: view		 2015-10-10 18:00 UTC Text: view	 2015-10-10 13:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view
03-hr	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view		 2015-10-10 18:00 UTC Text: view		 2015-10-10 18:00 UTC Text: view	 2015-10-10 15:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view
06-hr	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view
24-hr	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view	 2015-10-10 18:00 UTC Text: view					 2015-10-10 18:00 UTC	 2015-10-10 18:00 UTC Text: view	

ECMWF NWP

- H300
- Streamlines300
- Isotachs300
- CVA300
- DIV300
- RV300
- Height PV=1.5
- H500
- T500
- ThetaE500
- CVA500
- RV500
- H700
- TA700
- RH700
- Omega700
- TFP
- Equiv. Thickness
- ThetaE850
- Wind850
- CAPE
- Showalter Index
- TPW
- Spec. Q-BL
- Lapse Rate
- BLH
- LCC
- Tdd
- DIV1000
- 10m. Windspeed
- 2m. Temperature
- MSLP

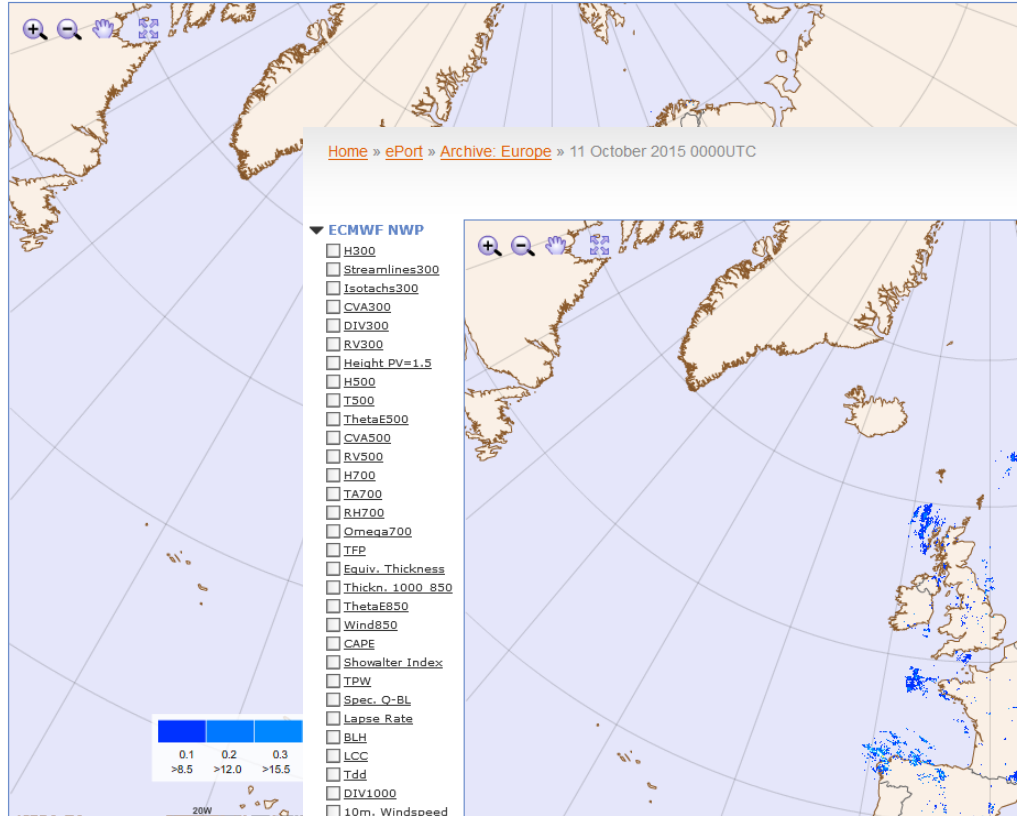


Meteosat Second Generation

- IR10.8
- WV6.2

ECMWF NWP

- H300
- Streamlines300
- Isotachs300
- CVA300
- DIV300
- RV300
- Height PV=1.5
- H500
- T500
- ThetaE500
- CVA500
- RV500
- H700
- TA700
- RH700
- Omega700
- TFP
- Equiv. Thickness
- Thicken. 1000 850
- ThetaE850
- Wind850
- CAPE
- Showalter Index
- TPW
- Spec. Q-BL
- Lapse Rate
- BLH
- LCC
- Tdd
- DIV1000
- 10m. Windspeed
- 2m. Temperature
- MSLP

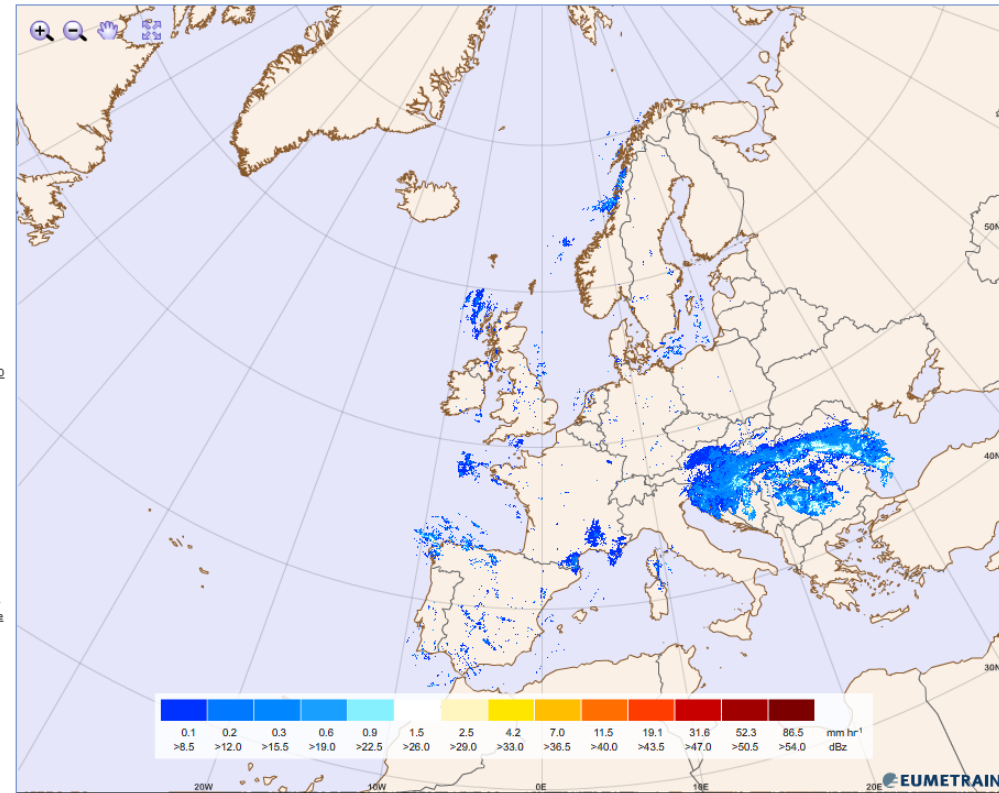


Meteosat Second Generation

- IR10.8
- WV6.2
- Enhanced IR10.8
- Pseudo IR
- Pseudo WV

ECMWF NWP

- H300
- Streamlines300
- Isotachs300
- CVA300
- DIV300
- RV300
- Height PV=1.5
- H500
- T500
- ThetaE500
- CVA500
- RV500
- H700
- TA700
- RH700
- Omega700
- TFP
- Equiv. Thickness
- Thicken. 1000 850
- ThetaE850
- Wind850
- CAPE
- Showalter Index
- TPW
- Spec. Q-BL
- Lapse Rate
- BLH
- LCC
- Tdd
- DIV1000
- 10m. Windspeed
- 2m. Temperature
- MSLP



Meteosat Second Generation

- IR10.8
- WV6.2
- Enhanced IR10.8
- Pseudo IR
- Pseudo WV
- Airmass RGB
- Dust RGB
- Night Microphys. RGB

NWC SAF

- CT
- CTTH
- CRR
- PC
- SPHR LPW BL
- SPHR LPW ML
- SPHR LPW HL
- SPHR LI

MPEF

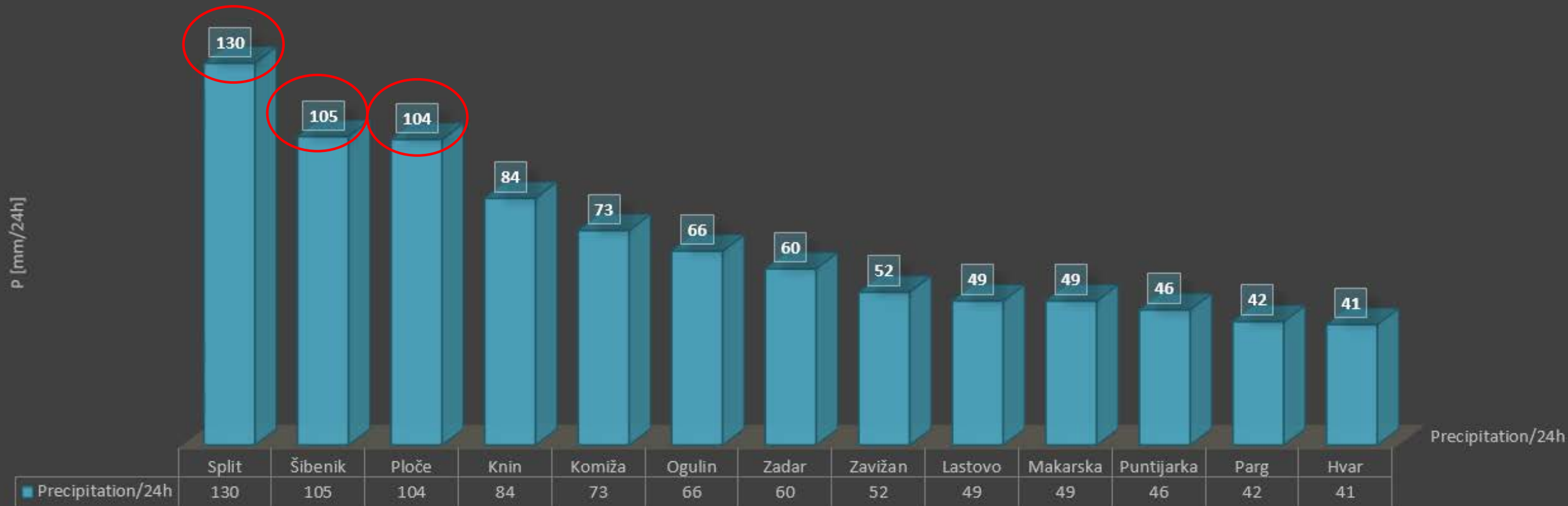
- GII
- TPW
- DIV
- MPE

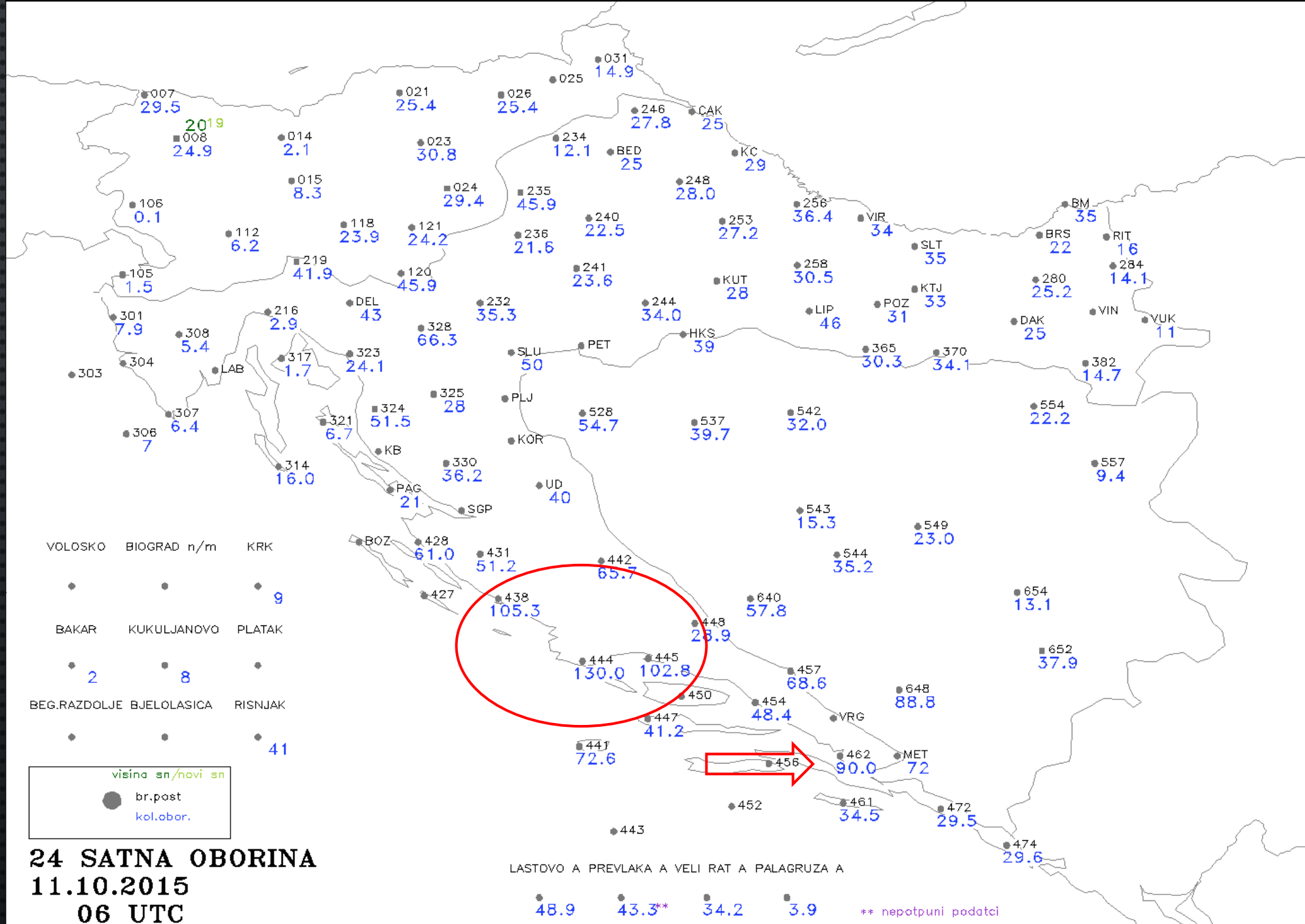
Products

- SYNOP
- Opera RADAR
- ASCAT
- JASON
- ESTOFEX
- VCS
- Vertical Profile

- MOST OF THE RAIN WAS AT THE CENTRAL AND SOUTHERN ADRIATIC, WHERE OCCURED TORRENTIAL FLOODINGS. CYCLONES FROM THE MEDITERRANEAN OVER THE TYRRHENIAN SEA AND THE APENNINE PENINSULA MOVED OVER CENTRAL AND SOUTHERN JADRAN.
- BIG AMOUNT OF PUMPED MOIST AND RELATIVELY WARM AIR WITHIN THE TROUGH (FROM THE SOUTHWEST). IN THE CENTRAL AND SOUTHERN ADRIATIC FELL 50 MM, LOCALLY MORE THAN 100 MM OF PRECIPITATION.
- IN THE NORTHERN ADRIATIC BLEW MODERATE AND STRONG, IN SOME PLACES SEVERE BORA. DHMZ RELEASED ORANGE AND RED WARNING FOR EXTREME RAINFALL AND VERY STRONG WINDS.

24H ACCUMULATED PRECIPITATION 10. - 11. OCT 2015.





24 SATNA OBORINA
11.10.2015
06 UTC

visina sn/novi sn
 ● br.post
 ● kol.obor.

LASTOVO A PREVLAKA A VELI RAT A PALAGRUŽA A

48.9 43.3** 34.2 3.9 ** nepotpuni podatci



CONCLUSION

- ANALYSIS OF THE AMOUNT OF PRECIPITATION IN OCTOBER 2015, EXPRESSED AS A PERCENTAGE (%) OF 30-YEAR AVERAGE (1961ST TO 1990TH) SHOWS THAT THE AMOUNT OF PRECIPITATION ON **ALL ANALYZED STATIONS WERE ABOVE AVERAGE**. COMPARED LONG-TERM AVERAGES SHOWS THAT THE AMOUNT OF PRECIPITATION FOR OCTOBER 2015 IS **143%** OF 30-YEAR AVERAGE IN PARG (279.8 MM) TO **413%** OF THIS AVERAGE IN ŠIBENIK (371.1 MM). STORM CONDITIONS IN CROATIA IN OCTOBER 2015, ARE DESCRIBED IN THE FOLLOWING CATEGORIES:
 - **EXTREMELY RAINY** (PART OF THE EASTERN CROATIAN AND WIDER AREA OF ŠIBENIK),
 - **RAINY** (PART OF THE NORTHERN AND SOUTHERN ADRIATIC COAST AND INNERLAND), AND
 - **VERY RAINY** (REMAINING PART OF CROATIAN).
- MAXIMUM MONTHLY AMOUNT OF PRECIPITATION (**452.4 MM**) FOR OCTOBER 2015, HAD ZAVIŽAN STATION.