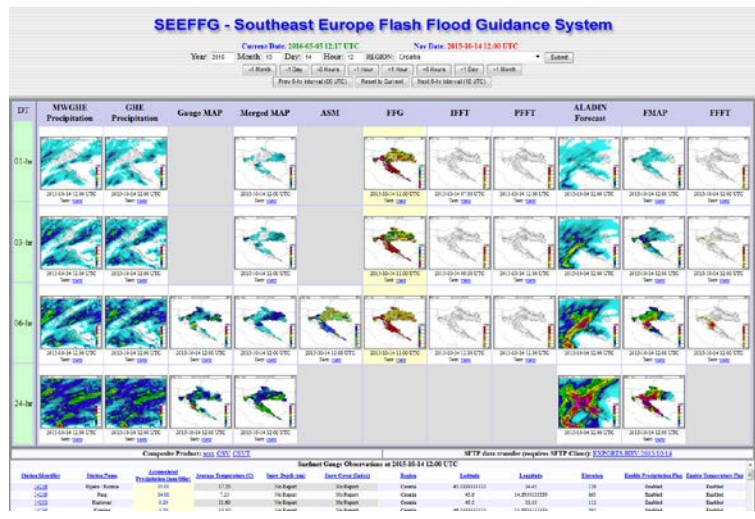


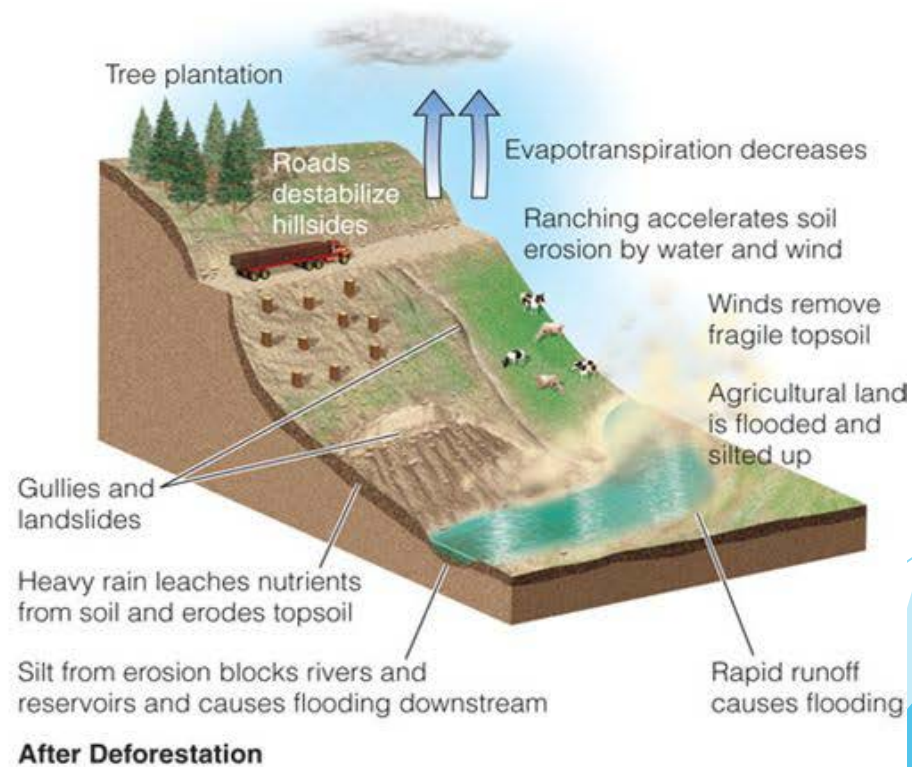
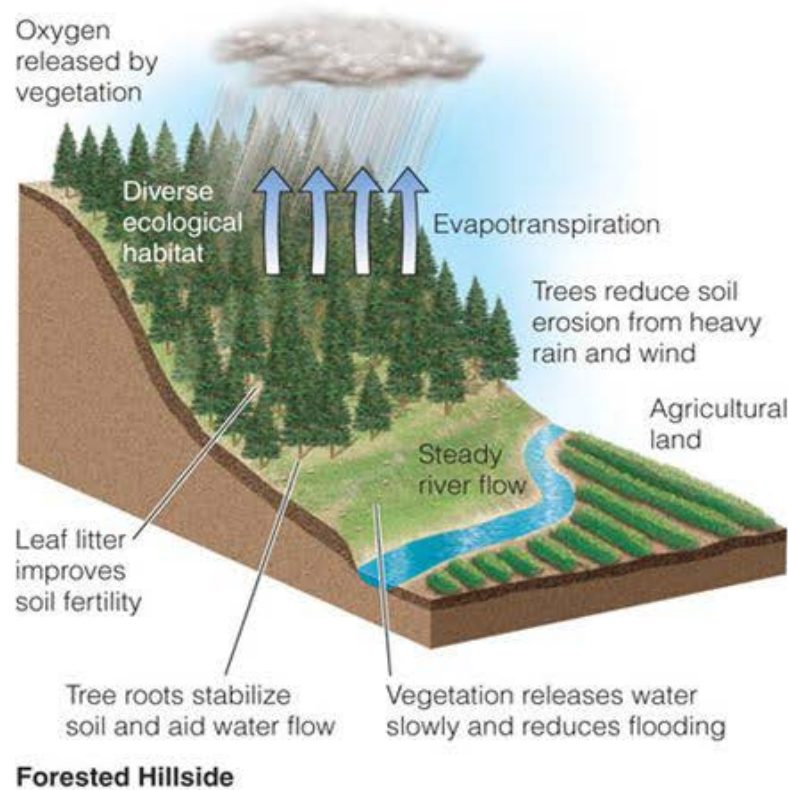
# Operational flash flood forecasting and early warnings in Croatia

Petra Mutić, Toni Jurlina



# Operational flash flood forecasting

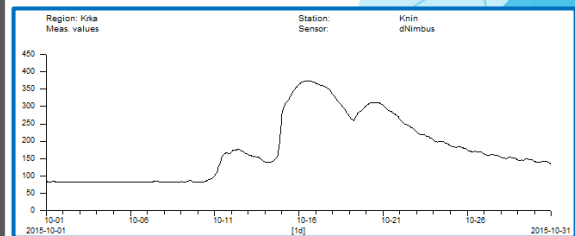
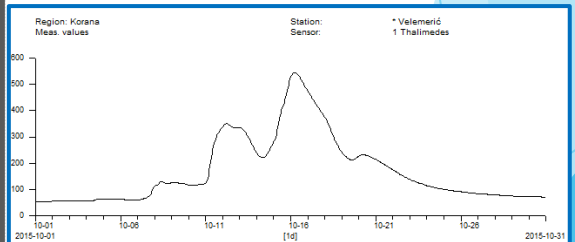
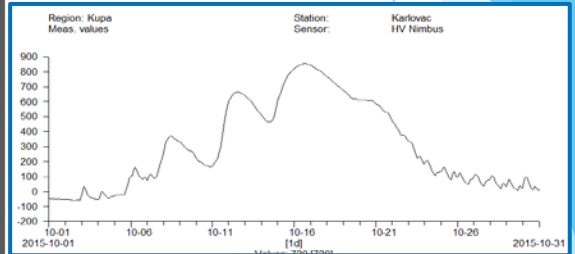
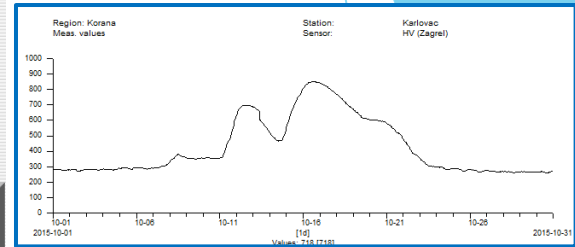
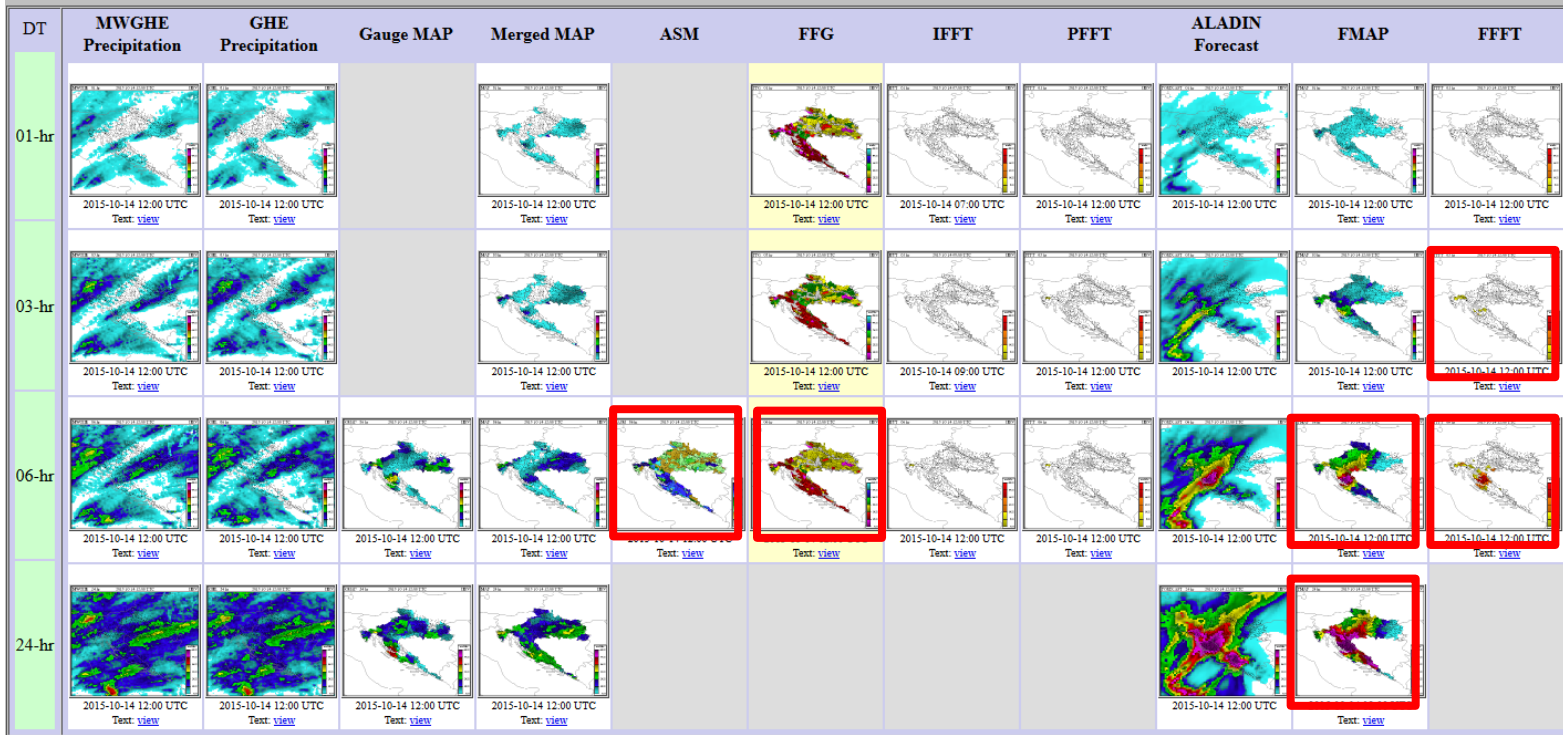
## Flooding After Deforestation of a Hillside



# Operational flash flood forecasting

## SEEFFG - Southeast Europe Flash Flood Guidance System

Current Date: 2016-05-05 12:17 UTC      Nav Date: 2015-10-14 12:00 UTC  
 Year: 2015    Month: 10    Day: 14    Hour: 12    REGION: Croatia      
                       
     



Composite Product: [text](#), [CSV](#), [CSV1](#)

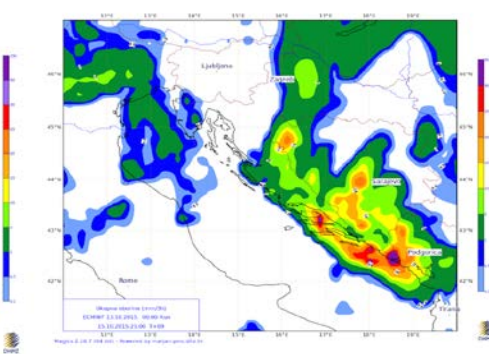
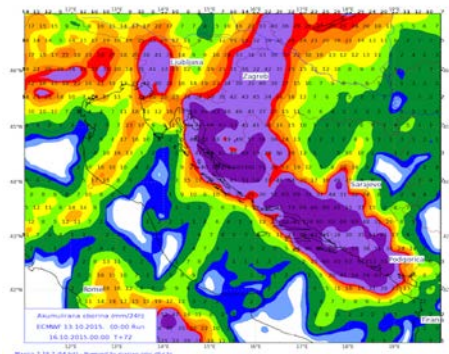
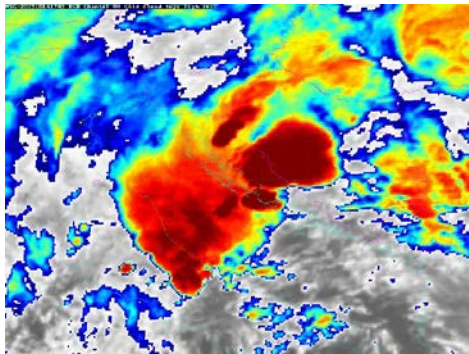
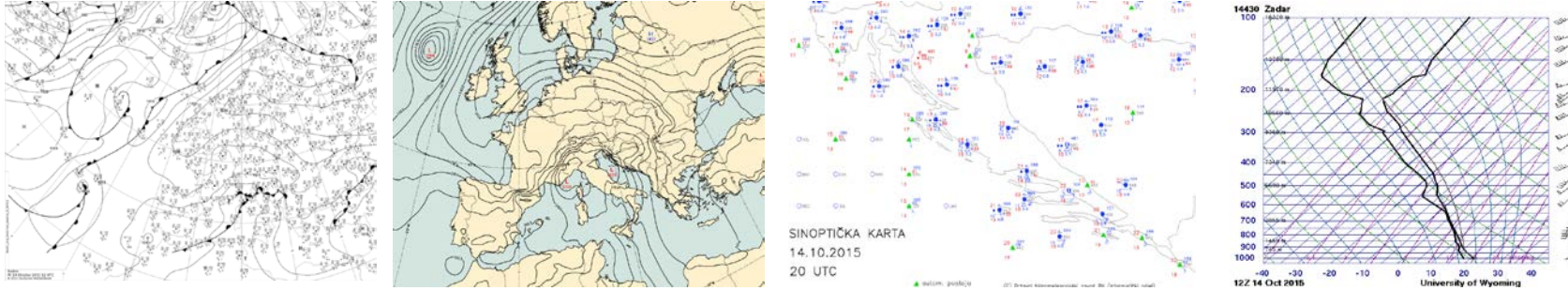
SFTP data transfer (requires SFTP Client): [EXPORTS/HRV/2015/10/14](#)

### Surfnet Gauge Observations at 2015-10-14 12:00 UTC

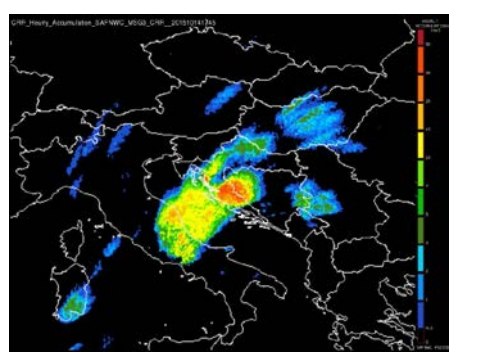
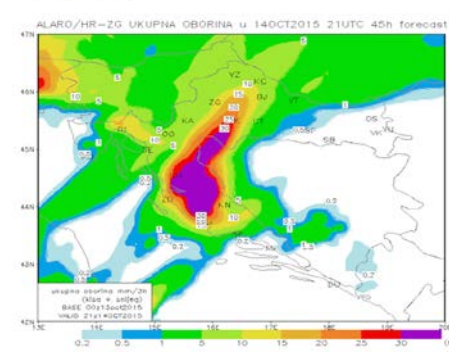
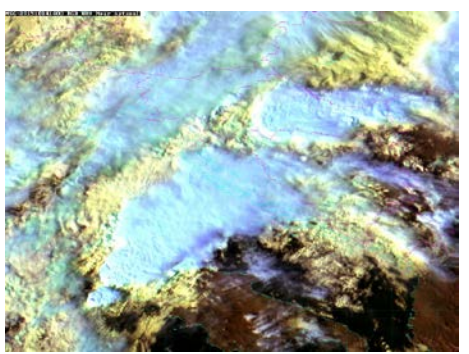
Station Identifier	Station Name	Accumulated Precipitation (mm 06hr)	Average Temperature (C)	Snow Depth (cm)	Snow Cover (Index)	Region	Latitude	Longitude	Elevation	Enable Precipitation Flag	Enable Temperature Flag
14216	Rijeka / Kozala	35.00	17.25	No Report	No Report	Croatia	45.333333333	14.45	120	Enabled	Enabled
14219	Purg	14.00	7.25	No Report	No Report	Croatia	45.6	14.633333333	863	Enabled	Enabled
14232	Karlovac	0.20	11.60	No Report	No Report	Croatia	45.5	15.55	112	Enabled	Enabled
14714	Kranjina	9.00	10.50	No Report	No Report	Croatia	46.133333333	15.883333333	202	Enabled	Enabled



# Operational flash flood forecasting



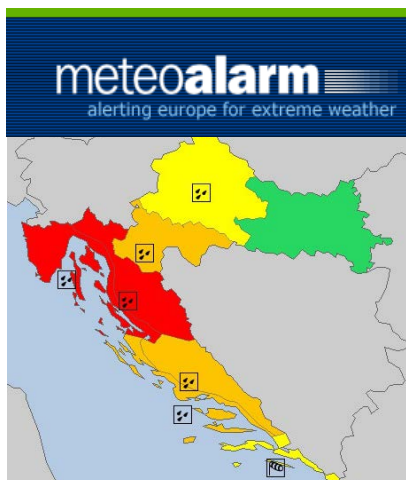
**HYDROLOGIST**



**METEOROLOGIST**

# Dissemination of Flash flood warnings

## I Via Meteoalarm



Stiže opasno nevrijeme, meteoalarm upozorava: Čuvajte se olujnog vjetera, obilne kiše i bujica



INDEX HOT

Naravnasto upozorenje Meteoalarm: Obilna kiša donosi bujice i poplave

14.10.2015. 07:30

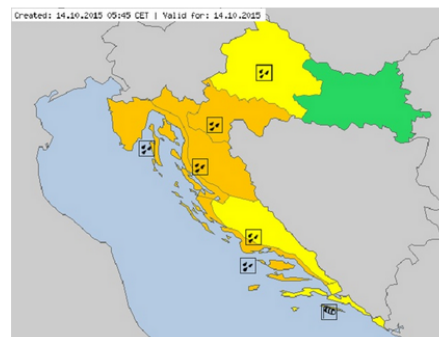
LOŠE VRIJEME

### HRVATSKA NA UDARU OPASNE OLUJE Na snazi niz upozorenja, čuvajte se orkansnog vjetera i mogućih bujičnih poplava



Subotnje jutro u najvećem dijelu Hrvatske osvanulo je uz oblake, a tek ponegdje i uz malo kiše, no meteorolozi najavljaju da će tijekom dana kiše biti posvuda. Prema prognozi Državnog hidrometeorološkog zavoda, subota će proteći uz umjereno do pretežno oblačno vrijeme povremeno s kišom, u Dalmaciji već ujutro, poslijepodne u većem dijelu zamlje.

- 1. RIZIKAN OHLAS: Vlasnici teš prodra Košić: Ne moše! 06.05.2016. u 09:10
- 2. INTERVJU S PREMIJEROM Orešković: Ne mo: službe zavrij! Na ce 06.05.2016. u 07:43
- 3. ŠEF HSKA Beljak: Orešković u Kanadu, nema os 05.05.2016. u 22:27
- 4. ŠEF ODGOVA ZA NAČ. i Ranko Ostojić o st sramota, Predsjed



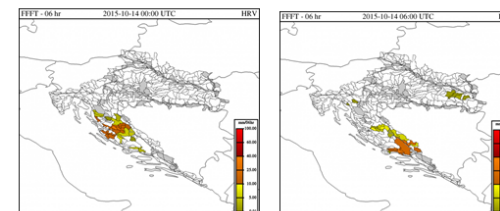
## II National Protection and Rescue Directorate



REPUBLIKA HRVATSKA  
DRŽAVNI HIDROMETEOROLOŠKI ZAVOD  
Grič 3, 10000 Zagreb  
tel. +1 4565 675, fax. +1 4851 901  
http://meteo.hr

POSEBNA VREMENSKA I HIDROLOŠKA PROGNOZA ZA PODRUČJE  
KARLOVAČKE ŽUPANIJE I OKOLICE  
OD 14.10. DO 16.10.2015.  
za potrebe Stožera zaštite i spašavanja RH

Za očekivati je da će se tijekom dana pojavljivati i izraženije opasnosti i za druge bujične slivove.



# Verification

OBSERVED EVENTS

FORECASTED EVENTS

	Y	N	$\Sigma$
Y	21 (a)	1 (b)	22
N	7 (c)	113 (d)	120
$\Sigma$	28	114	142

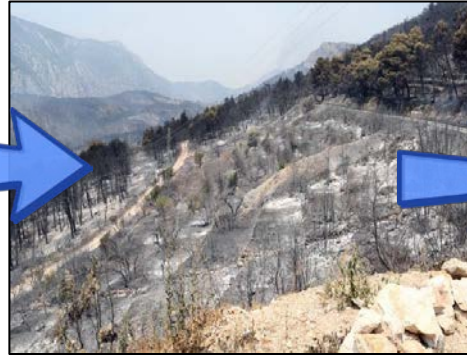
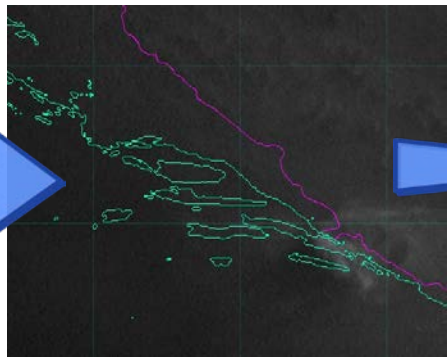
Contingency table of FF warnings for Croatia in the period 10.10.2015-29.02.2016

Hit Rate (POD):  $a/(a+c)$  0.75

False Alarm Ratio (FAR):  $b/(a+b)$  0.045

False Alarm Rate (POFD):  $b/(b+d)$  0.009

Threat Score:  $a/(a+b+c)$  0.72





# Flash Flood Guidance System (FFGS) in Croatia

- An enhanced cooperation between the hydrological and meteorological forecasters
- Continuous communication with HRC and neighboring countries in order to improve the System
- Cooperation with NPRD
- Because of the FFGS in CRO - DHMZ is currently developing the Hydroalarm for disseminating FF Alerts and Warnings, which will soon be on the web page



# Hydroalarm



**FLASH FLOOD ALERT**



**FLASH FLOOD WARNING**



**SEVERE FLASH FLOOD WARNING**

# Public education about FFGs



**Prognostični sateliti za prognoziranje bujičnih poplava**

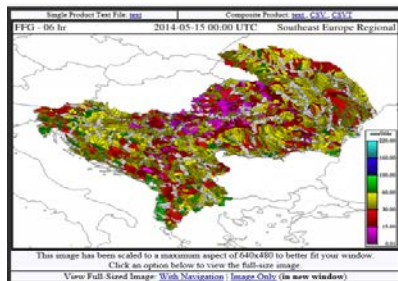
Toni Jurlina & Petra Mutić  
Državni hidrometeorološki zavod

DMHZ

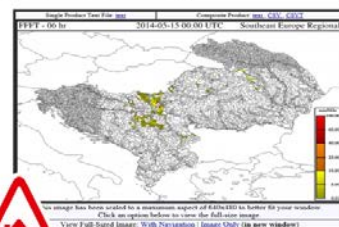
European Space Expo 12 - 21. lipnja 2015



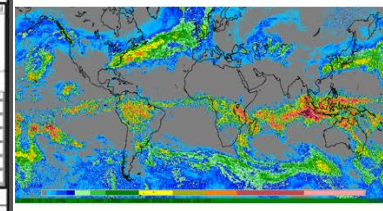
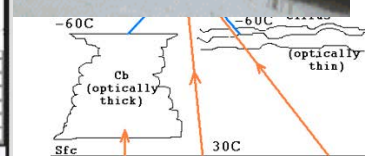
## Prognosa bujičnih poplava



FFG - UPOZORENJE

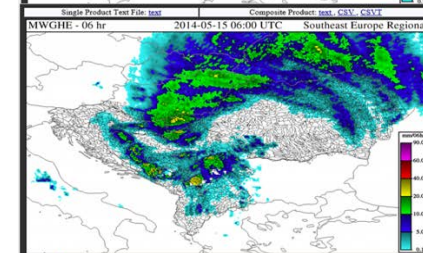
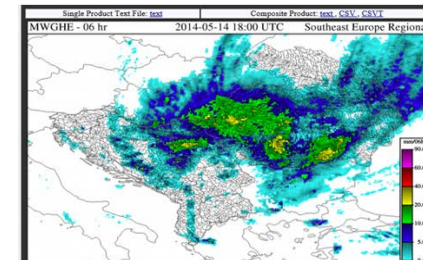


FFT - PRIJETNJA



GLOBAL HYDRO ESTIMATOR (GHE)

kti



MICROWAVED ADJUSTED GHE



# For conclusion

Because time is the most critical factor, collaboration and involvement is necessary for effective “end-to-end” flash flood forecasting and warning system.

The SEFFG System proved valuable for disseminating warnings in Croatia, and highlighted a great opportunity for enhancement of collaboration with response agencies in disaster risk reduction and raising community awareness.

Thank you

