DROUGHT MONITORING IN CROATIA

Ksenija Cindrić Kalin

Croatian Meteorological and Hydrological Service (DHMZ)

Climatology Department

Training course on drought risk assessment
6-8 November 2018, Budapest

overview

- Introduction
- Drought monitoring
- Final remarks
  - current activities and future work



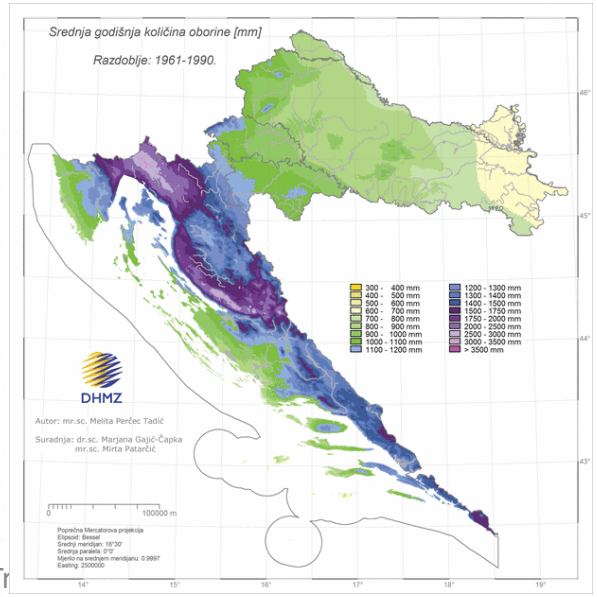

Drought 2012 in Croatia [source DHMZ Bulletin}

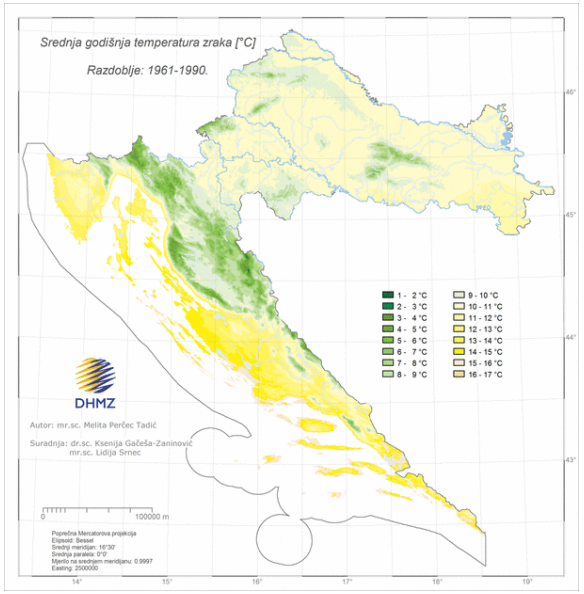
Introduction

Climate of Croatia

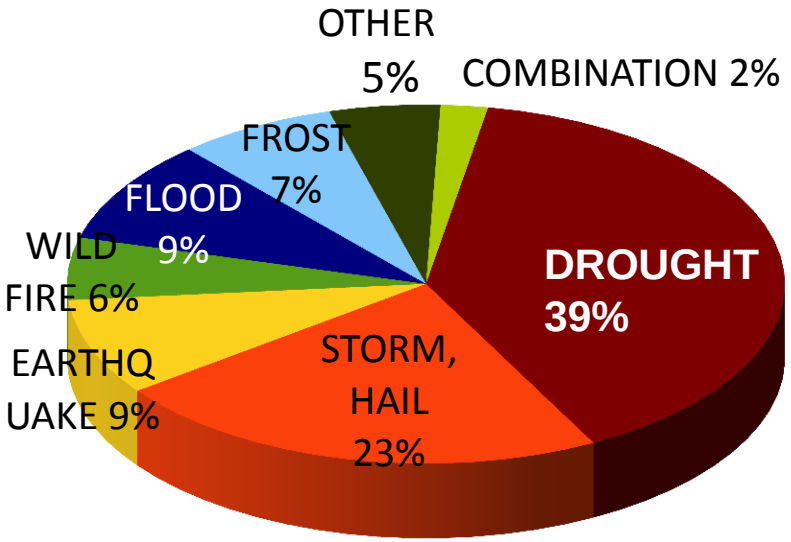
- determined by its specific geographical position
- modifiers: the Adriatic and the Mediterranean, the Dinarides, openness to the Pannonian plain (NE region)...

http://klima.hr/razno/publikacije/klimatski_atlas_hrvatske.pdf





Economic losses from damages caused by ***natural hazards*** in Croatia (1981-2012)



During extremely dry years (2000,2003,2007,2011/2012) losses ranged from 70% to 90% *(Cindrić et al. 2014)*

Agriculture sector is the most vulnerable:
large yield losses, up to complete damage

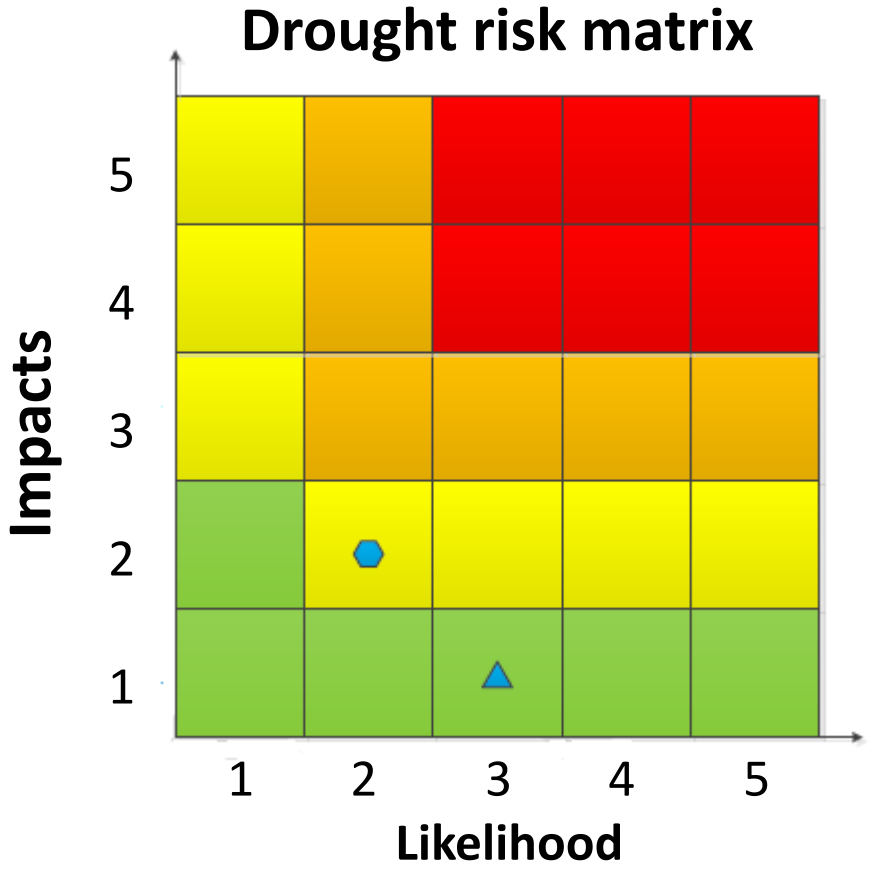
Drought 2017, Korčula island, Croatia

- Drought risk – included in **Disaster Risk Assessment in Croatia** (2015)
- Coordinated by National Protection and Rescue Directorate with many governmental institutions particapation (including DHMZ)

- *plant diseases, animal diseases, extreme temperatures, epidemics and pandemics, industrial accidents, floods, fire, earthquake, snow and ice, **drought**, saltwater intrusion*

Risk Assessment and Mapping Guidelines for Disaster Management EC (2010)

http://www.platforma.hr/images/dokumenti/Zavrsni_sazetak_2015_11.pdf

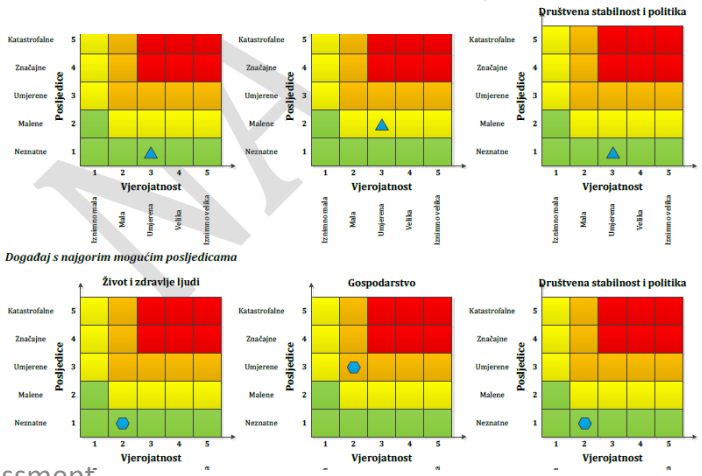


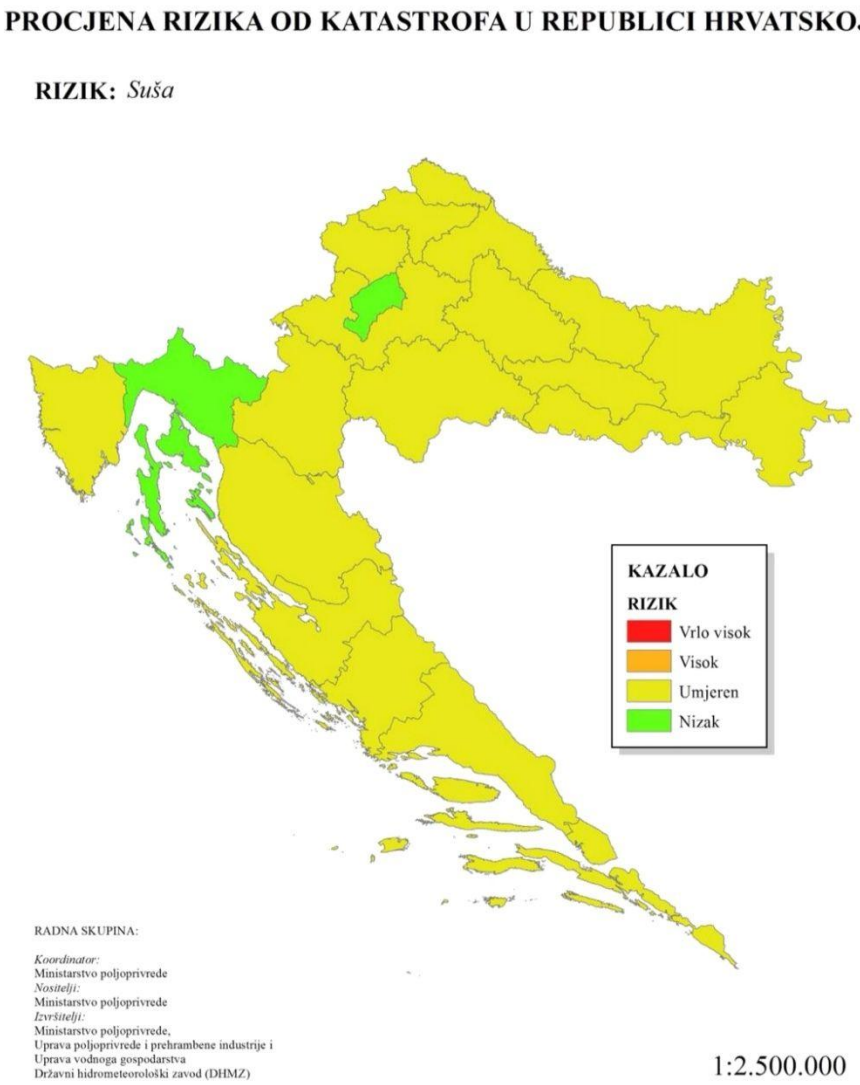
2 scenario:

- A worst-case scenario
- A most likely scenario

(1) limited/ insignificant
(2) minor/ substantial
(3) moderate/ serious
(4) significant/ very serious
(5) catastrophic/ disastrous

Impacts:
human
economic/environmental
political/social





DROUGHT RISK MAP OF CROATIA

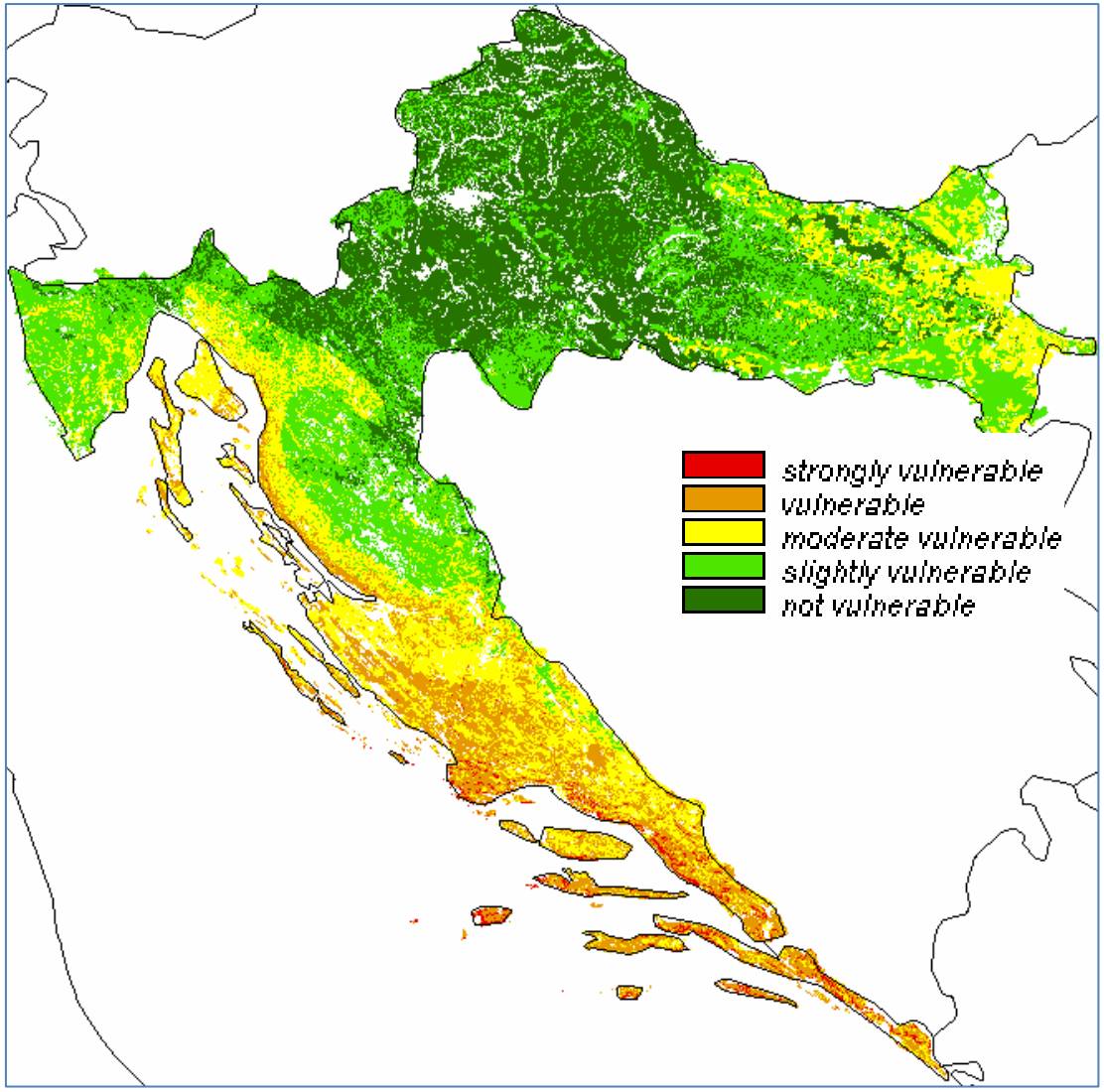
- Moderate risk prevails

Large uncertainity!

Tablica 6.10.-19. – Nepouzdanost rezultata procjene rizika

	Ne postoji dovoljna količina statističkih podataka, iskustva stručnjaka i ostalih podataka te pouzdana metodologija procjene posljedica zbog čega se očekuju značajnije greške.	
Vrlo visoka nepouzdanost	4	
Visoka nepouzdanost	3	X
Niska nepouzdanost	2	
Vrlo niska nepouzdanost	1	
	Postoji dovoljna količina statističkih podataka, iskustva stručnjaka i pouzdana metodologija procjene zbog čega je pojavljivanje grešaka vrlo malo vjerojatna.	

Drought vulnerability map in Croatia



Combination of slope map, solar irradiation, precipitation Cv, soil types and land cover classes

Southern Adriatic and Eastern lowland – most sensitive to drought

- first version
- improve – e.g. economic losses

Perčec Tadić et al. (ACS, 2014)

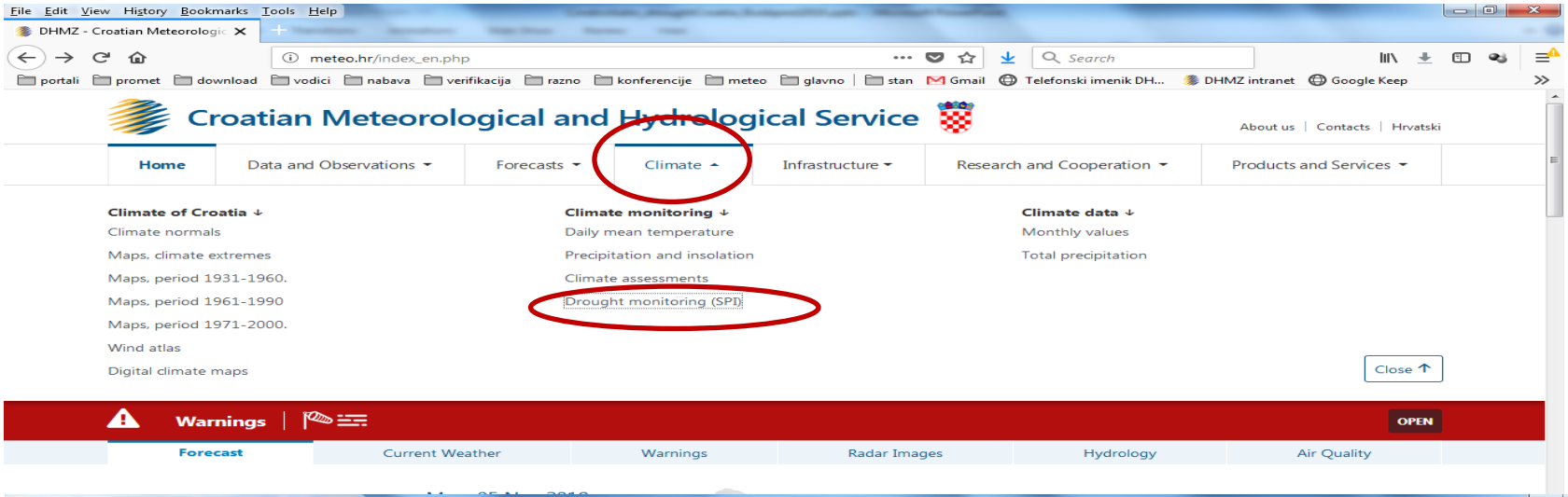
Drought monitoring

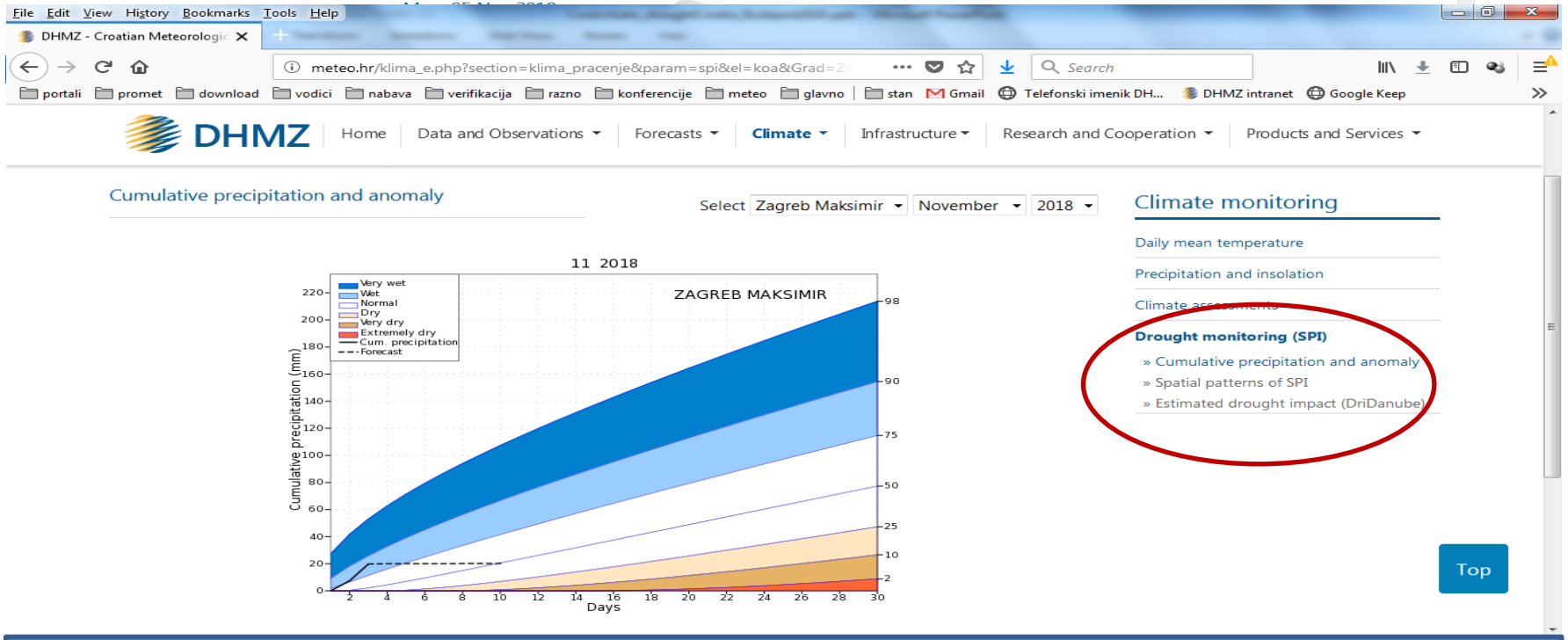
- an increasing interest in developing methods for *drought warning system* in Croatia
- Comprehensive drought early warning system should provide *(Hayes et al., 2011*):
  - *drought monitoring*
  - an early warning of drought *onset* and it's *intensity* in timely manner
  - drought *prediction* compoment

  (to protect crops, fire risk, water supply...)

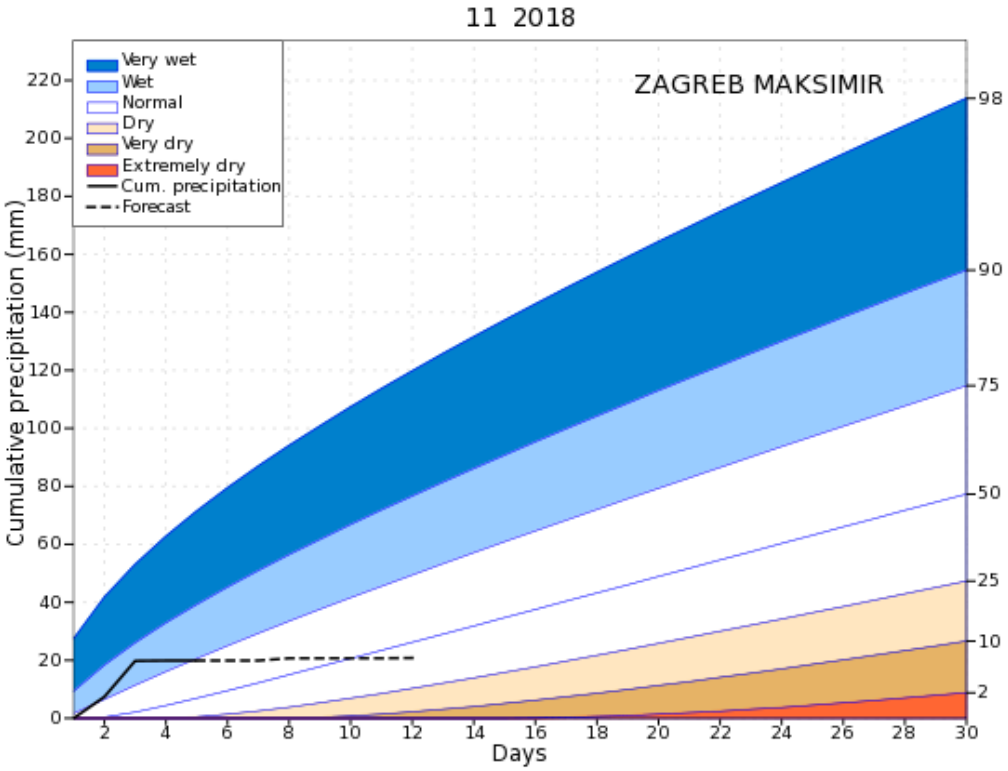
DHMZ - drought monitoring

http://meteo.hr





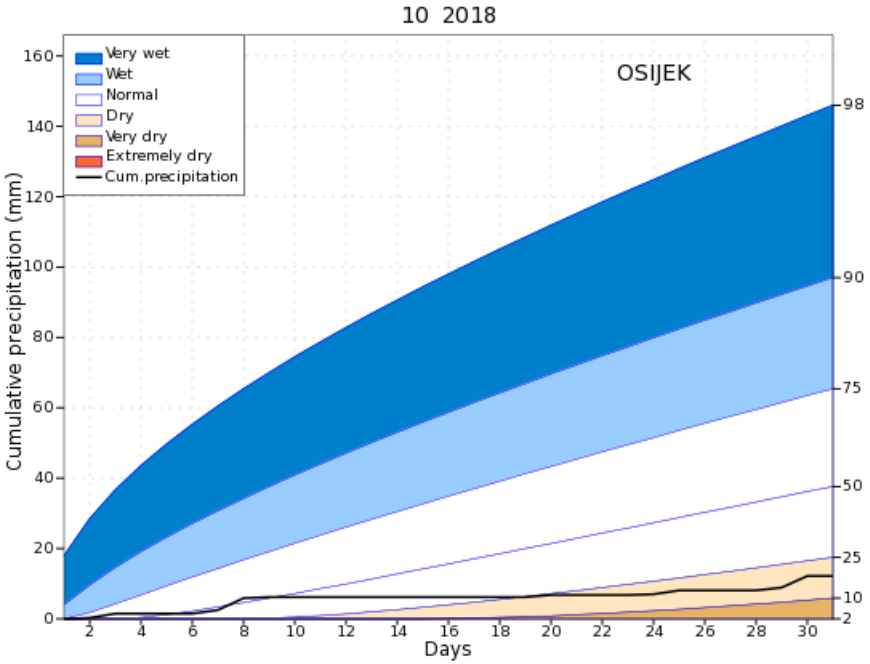
- **daily** scale:
  - Cumulative precipitation amounts up to the date
  - With 7-days ECMWF forecast

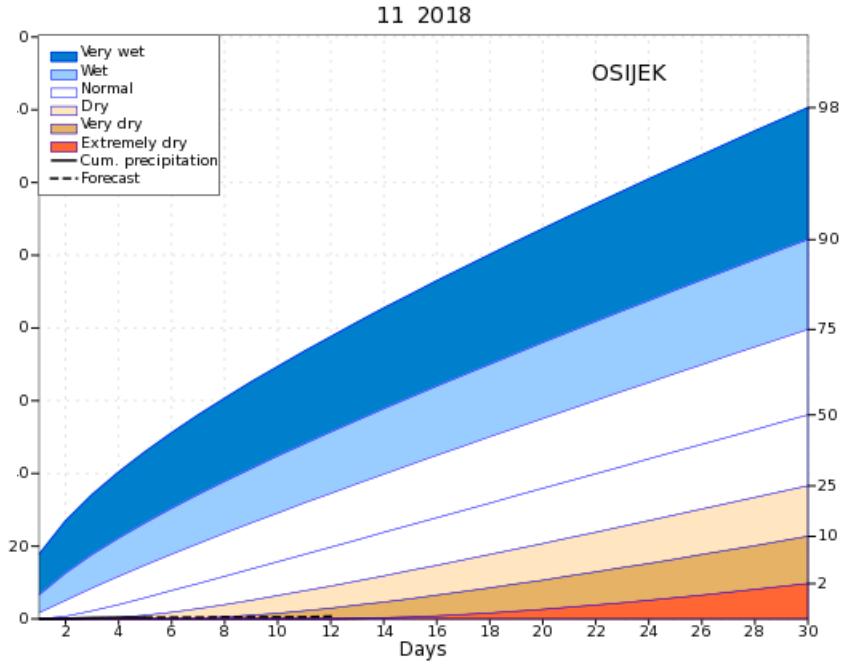


'Peacock tail'
Theoretical percentiles
(*Juras, TAAC 1994; Cindrić et al., TAAC 2018*)
- Daily updated!

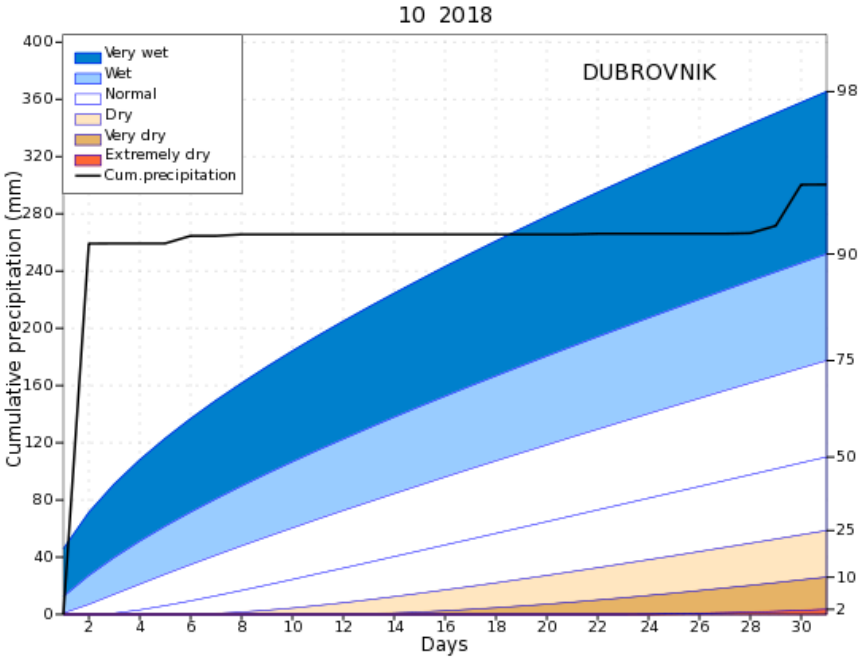
Cumulative precipitation amount (mm) in November 2018 and theoretical percentiles (2nd, 10th, 25th, 50th, 75th, 90th and 98th) curves from the period 1961-2000

Eastern Croatia





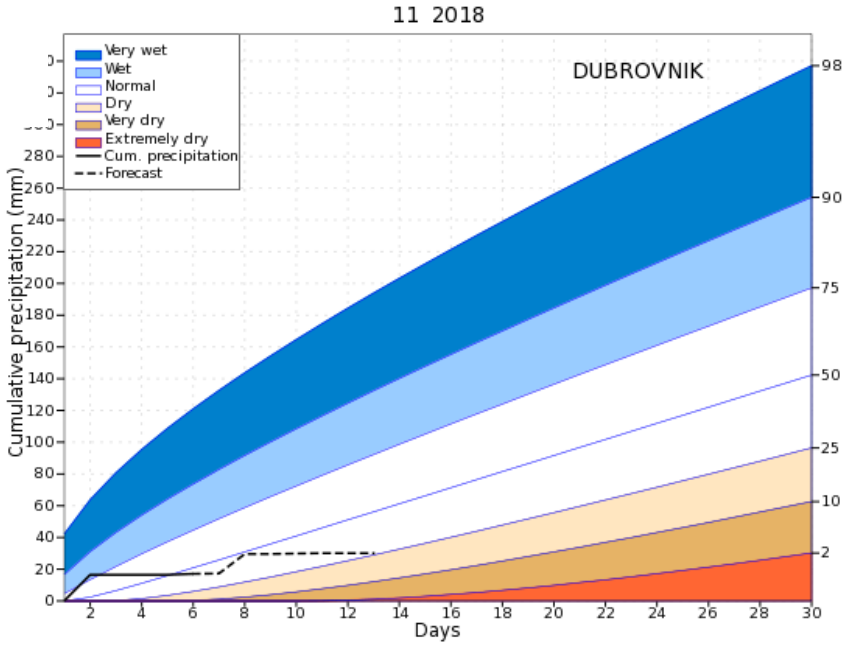
Cumulative precipitation amount (mm) in November 2018 and theoretical percentiles (2nd, 10th, 25th, 50th, 75th, 90th and 98th) curves from the period 1961-2000

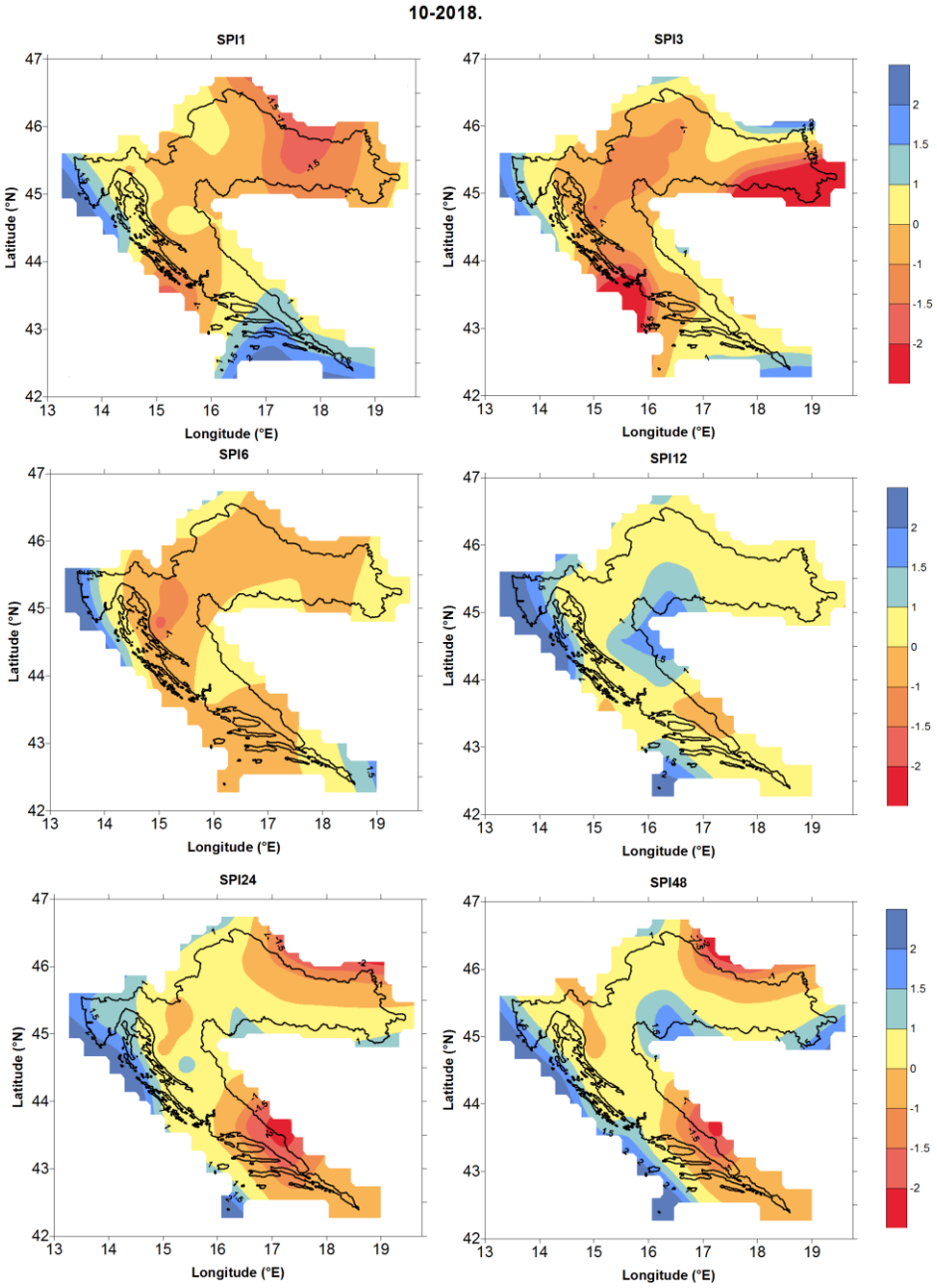


Southern Adriatic
Dubrovnik station

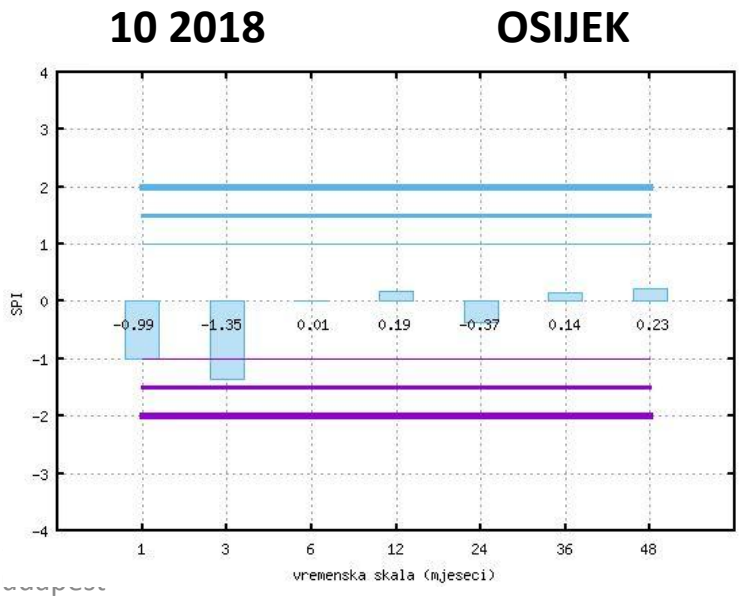
Extremely wet October
In 3hrs – 259 mm

Source: Grgo Jelavic/PIXSELL

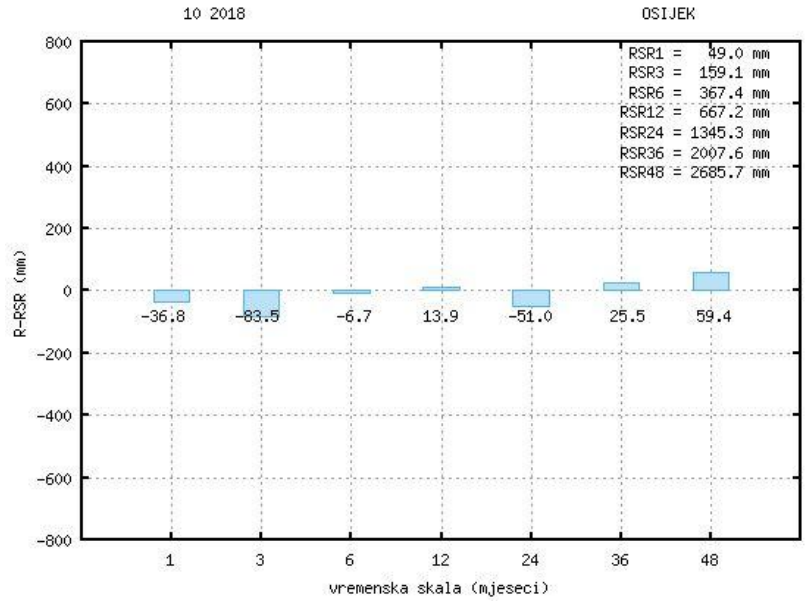




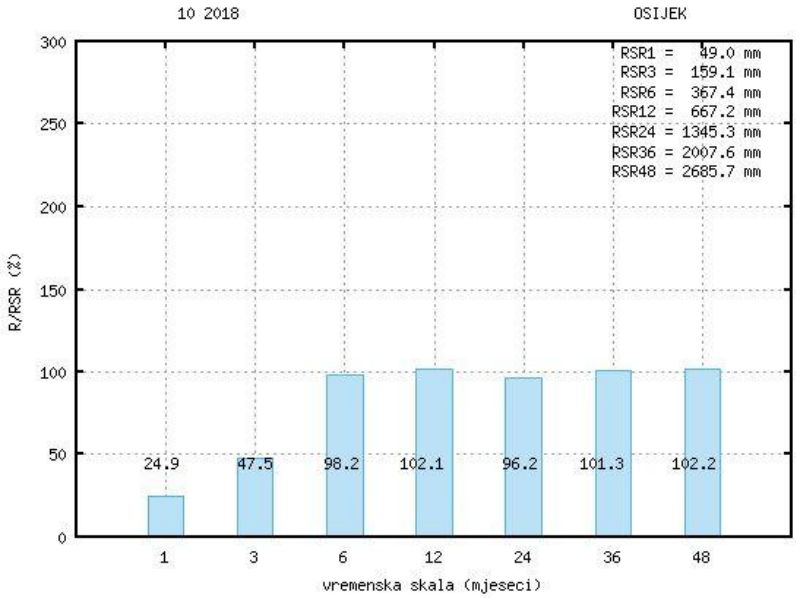
- **monthly** scales (maps and plots):
  - SPI
  - precipitation ratio against normal
  - difference from normal
  - associated percentiles
  - return periods
  - **1, 3, 6, 12, 24 and 48 months**



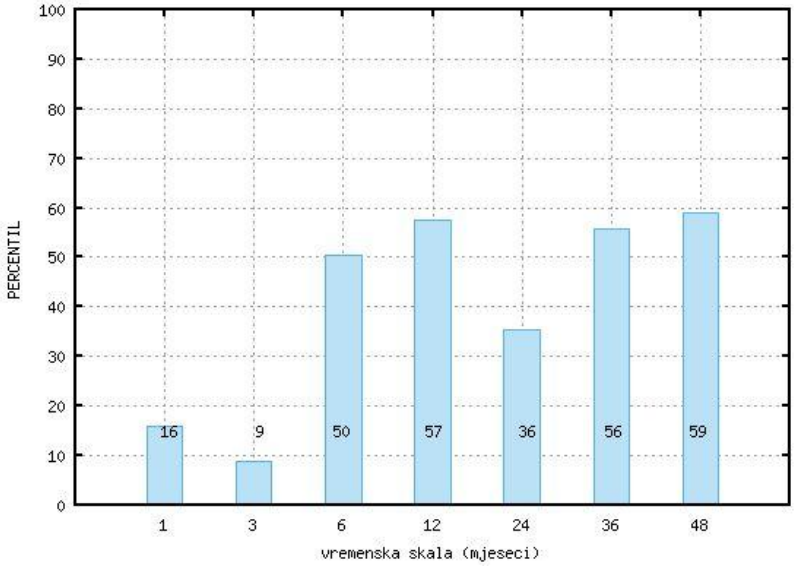
R – RMEAN



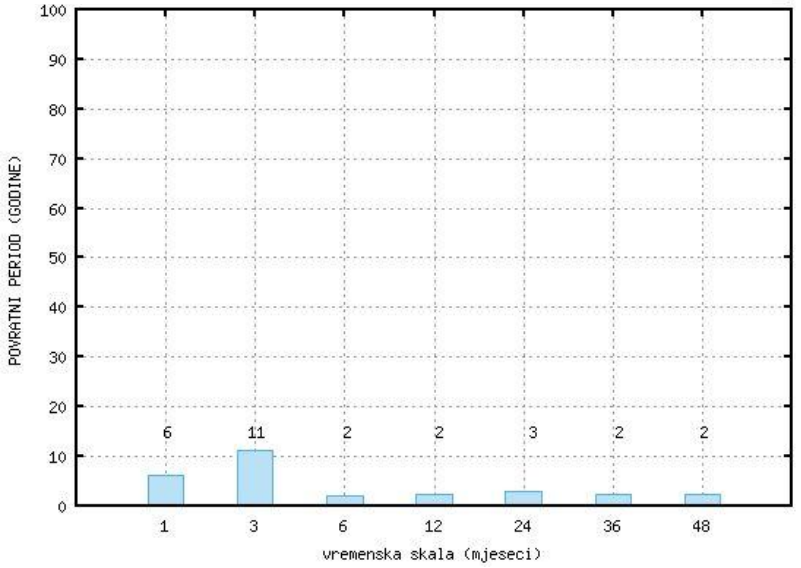
R / RMEAN



PERCENTILE



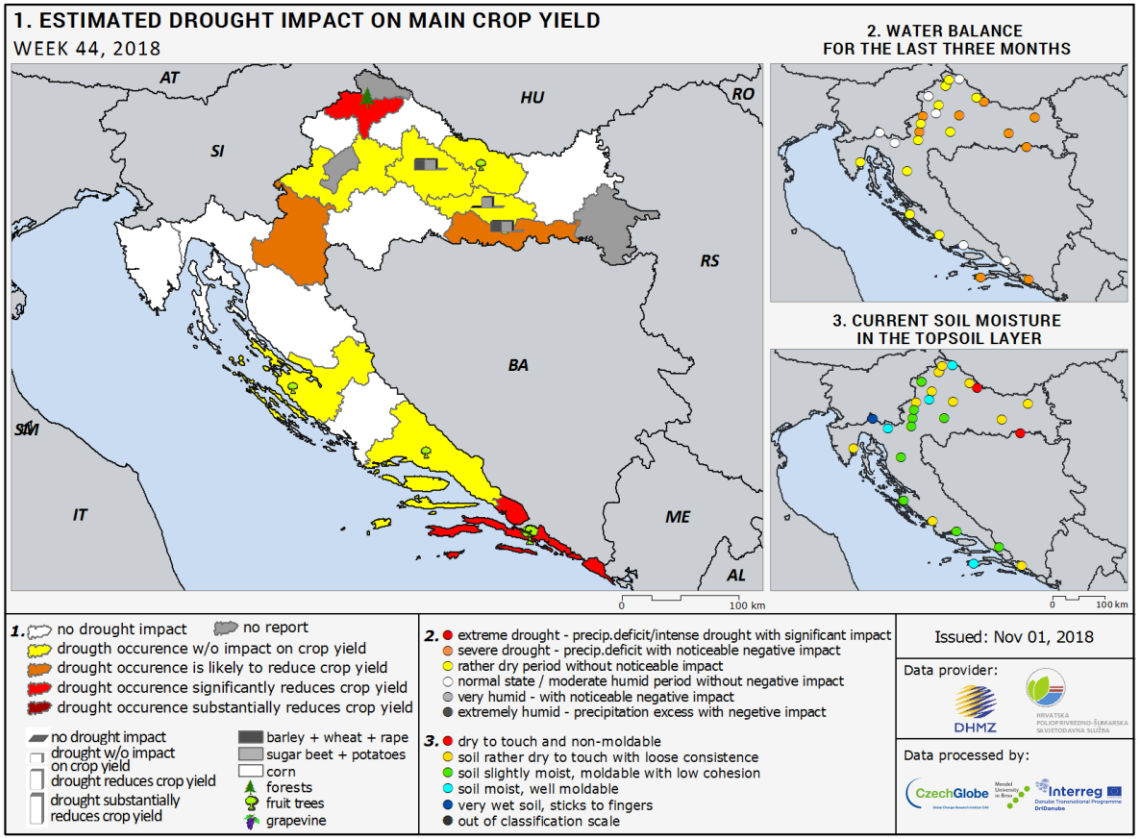
RETURN PERIOD



Maps of estimated drought impact on crop yield, fruits, viticulture, olives and forest - Croatia

Interreg
Danube Transnational Programme
DriDanube

22-28 October 2018



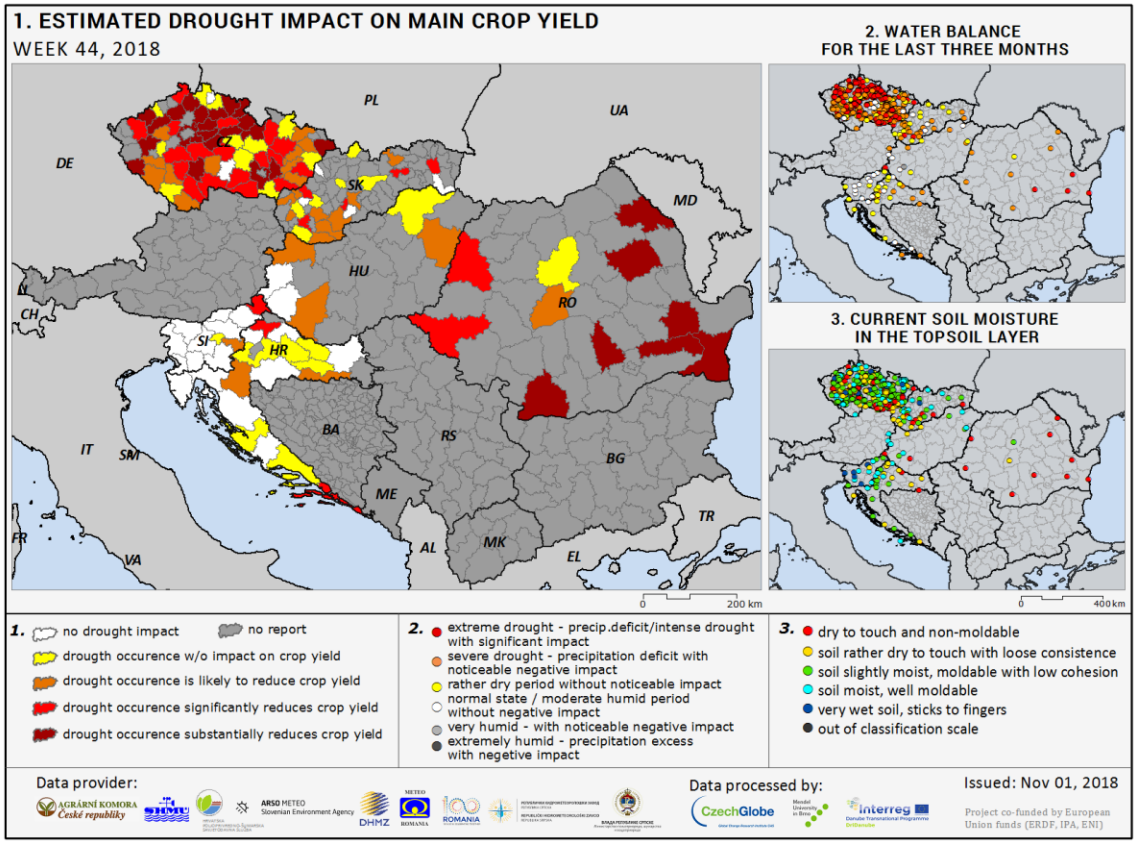
Maps are created according to the questionnaires fulfilled by reporters once a week, always at the same location.
Reporting is a part of the activities within DriDanube project.

40 repoters
Croatian Agricultural and Forestry Advisory Service
DHMZ
Others

Maps of estimated drought impact on crop yield, fruits, viticulture, olives and forest - Danube region

Interreg
Danube Transnational Programme
DriDanube

22-28 October 2018



Drought monitoring

DHMZ *monthly* bulletin (in Croatian)

- few months delay
- meteorological and climate detailed analysis
- dry/wet spells analysis, SPI
- extreme weather impacts from newspapers


siječanj


veljača


ožujak


travanj


svibanj


lipanj


srpanj


kolovoz

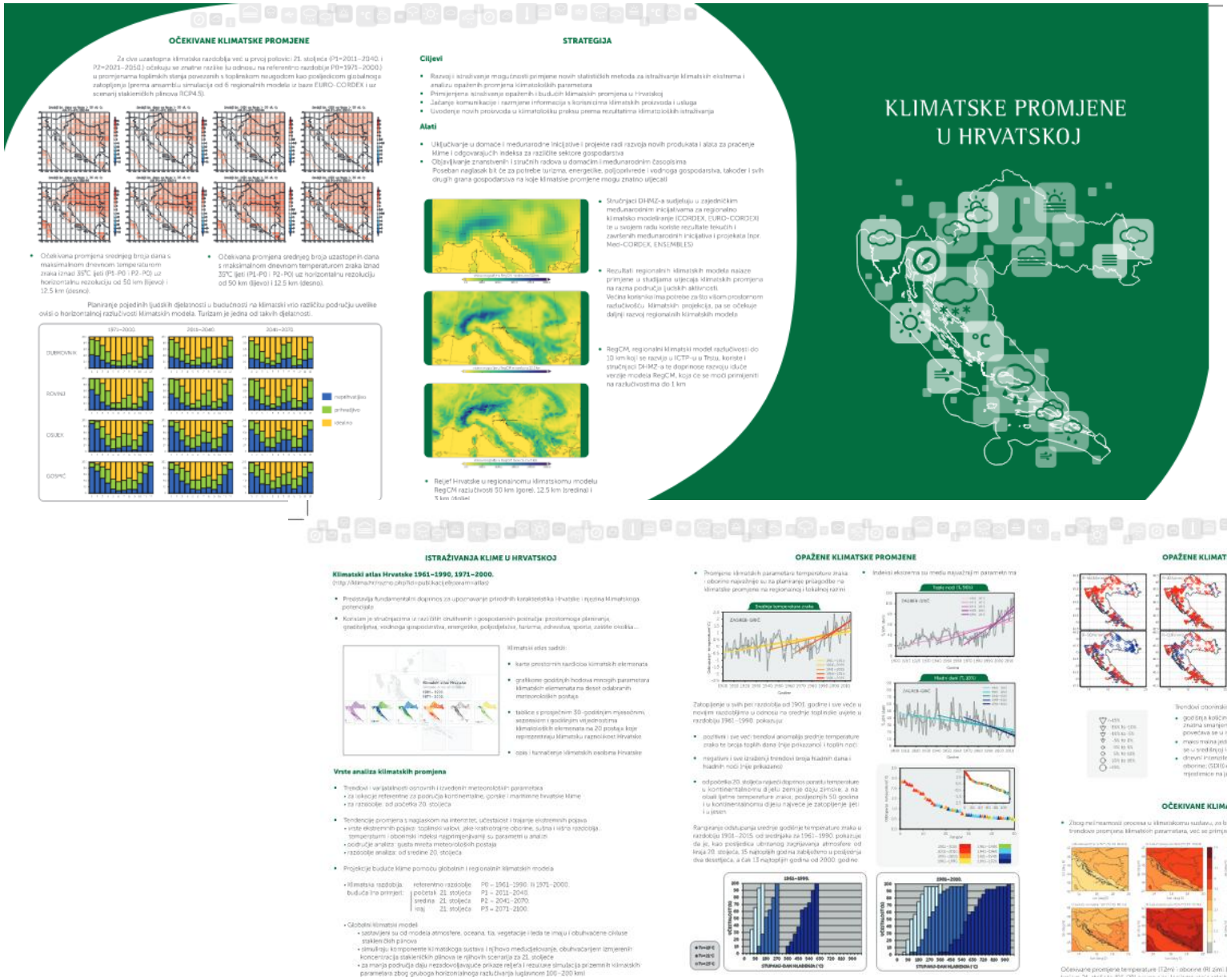

rujan


listopad


studeni


prosinac

CLIMATE CHANGE IN CROATIA - BROCHURE



Current work and future plans

- implement the SPEI
- to use satellite data – *DriDanube project*
- operational forecast of SPI in DHMZ
- modelling dry spells by extreme value theory

(*Pasarić & Cindrić 2018; Cindrić & Pasarić 2018*)

- to increase synergy among meteorology, hydrology and agronomy
- additional national efforts should be made in drought risk assessment in Croatia - *DriDanube project*

Thank you!

http://meteo.hr

cindric@cirus.dhz.hr

Perčec-Tadić M, Gajić-Čapka M, Zaninović K, Cindrić K (2014) Drought vulnerability in Croatia. *Agriculturae Conspectus Scientificus* Vol. 79 (2014) No. 1 (31-38)

Cindrić K, Telišman-Prtenjak M, Herceg-Bulić I, Mihajlović D, Pasarić Z (2014) Analysis of the extraordinary 2011/2012 drought in Croatia. *Theoretical and Applied Climatology*, Vol. 123, Issue 3-4, pp. 503-522

Cindrić K, Juras J, Pasarić Z (2018) On precipitation monitoring with theoretical statistical distributions. *Theoretical and Applied Climatology*, DOI: 10.1007/s00704-018-2477-6

Pasarić Z, Cindrić K (2018) Generalised Pareto distribution: impact of rounding on parameter estimation. *Theoretical and Applied Climatology* DOI: 10.1007/s00704-018-2494-5

Cindrić K, Pasarić Z (2018) Modelling Dry Spells by Extreme Value Distribution with Bayesian Inference. *Pure and Applied Geophysics* DOI: 10.1007/s00024-018-2007-6