Meteorological and Hydrological Service of Croatia
http://www.meteo.hr/

PRECIPITATION MONITORING SYSTEM IN CROATIA

SUSTAV ZA PRAĆENJE SUŠNOSTI I KIŠNOSTI U HRVATSKOJ

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Challenges in Meteorology 2
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overview

1. **Introduction**
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   - 2.2. (Multi)Monthly scale
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1. Introduction

- In Croatia **drought** causes highest economic losses (39%) among all hydromet events
- In last 2 decades it caused serious damage in agricultural sector (30% crop diminishing)
- Climate change (*IPCC, 2007*)– mean annual precipitation increases in northern Europe and **decreases further south, more intense and longer droughts**
- Drying trend in CRO due to **spring**

⇒ an increasing interest in developing a drought warning system in Croatia

Comprehensive drought early warning system should provide (*Lincoln declaration, 2011*):

- drought monitoring
- provide an early warning of drought onset and it's intensity in timely manner
- have **drought prediction**

DHMZ drought monitoring system:

- implemeted in 2009 (2007 intranet)
- **monthly scales** (maps and graphs):
  - Standardized Precipitation Index (SPI)
  - precipitation ratio against normal
  - difference from normal
  - associated percentiles
  - return periods
  - 1, 3, 6, 12, 24 and 48 months scales

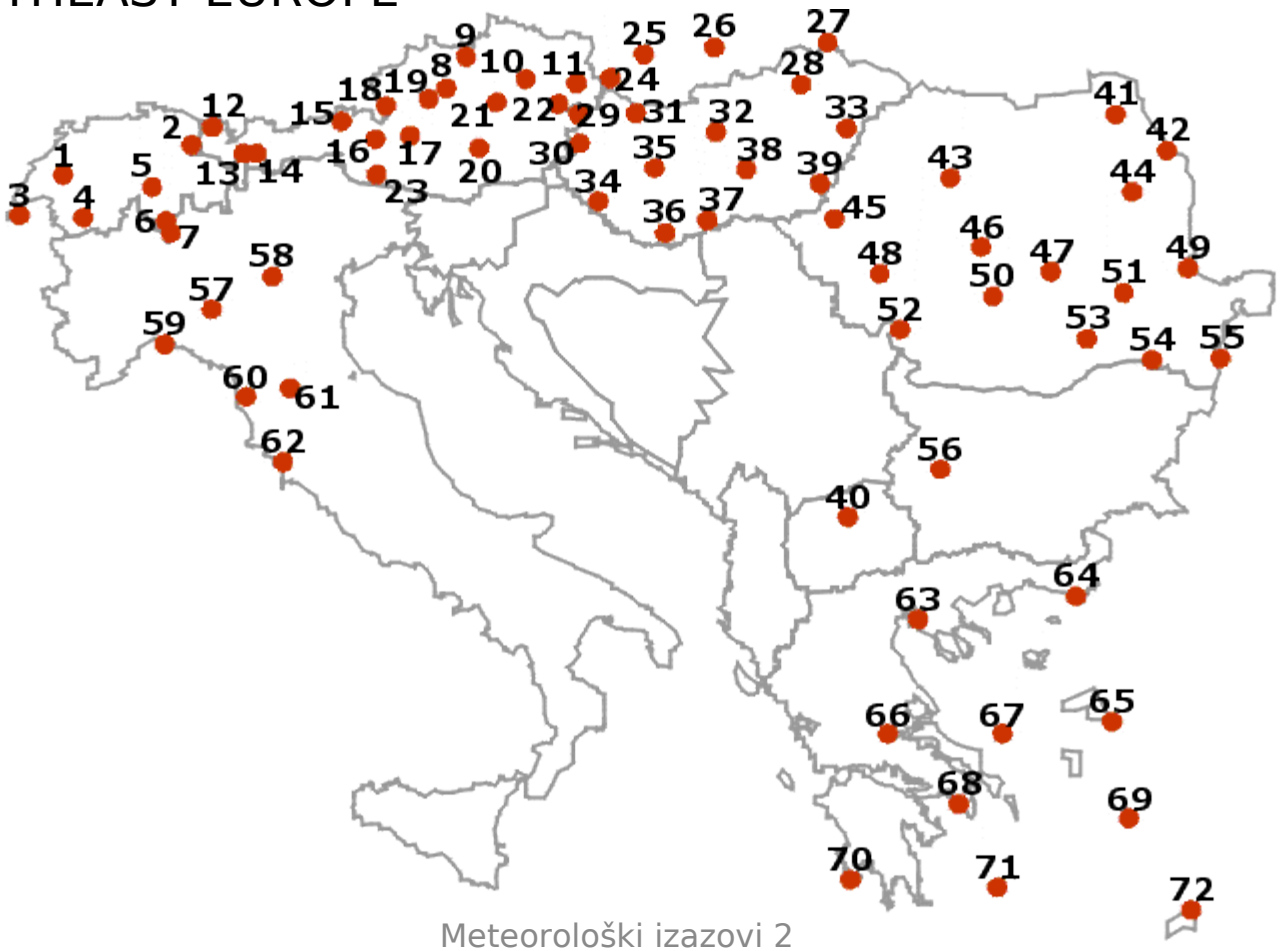
- DHMZ web site:

  - daily and monthly updated
- DHMZ monthly bulletin
  - few months delay
  - description of monthly situation
  - add. – dry/wet spells analysis
  - return periods due to daily SPI

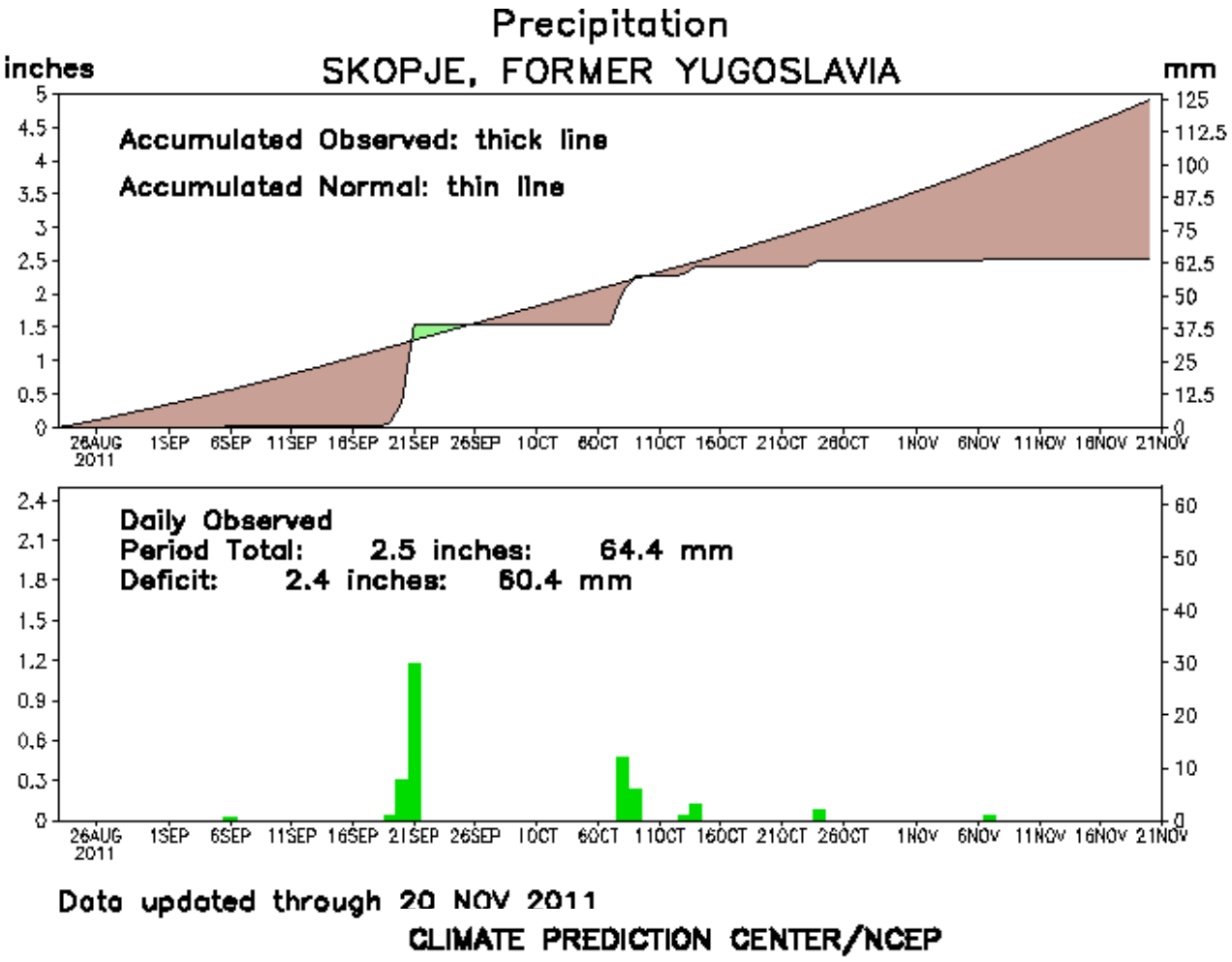
- Climate Prediction Center of NOAA

http://www.cpc.ncep.noaa.gov/products/global_monitorin

ALPINE & SOUTHEAST EUROPE



Time series of accumulated actual daily precipitation time series and accumulated normal precipitation are updated daily for stations in given regions.



2. Drought monitoring methods

2.1. Daily scale – ‘peacock tail’

- year
- month
- station
- available since 2002

- square-root normal distribution
Juras (1994)
Juras&Cindric (2010)

daily updated

2.2. Monthly scales

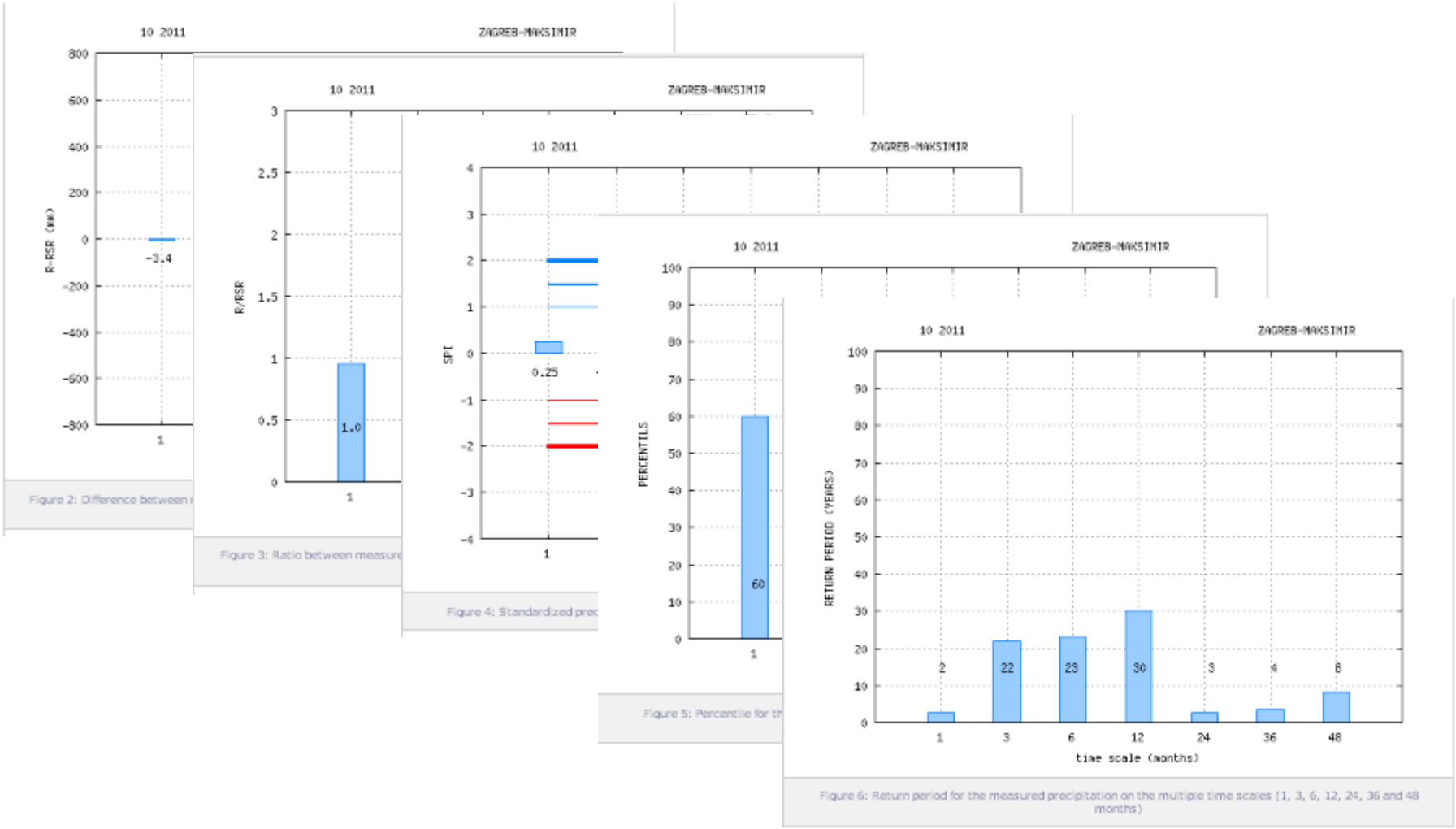


Figure 6: Return period for the measured precipitation on the multiple time scales (1, 3, 6, 12, 24, 36 and 48 months)

Standardized Precipitation Index (SPI)

- universal measure of meteorological drought accepted by WMO
- developed by McKee et al (1993)
- suitable tool for assesing drougth intensity and duration
- uses only the precipitation data at given location
- can be calculated for different time scales -separates different types of drought (meteorological, hydrological, agricultural)

Gamma CDF is transformed to a standardized normal distribution

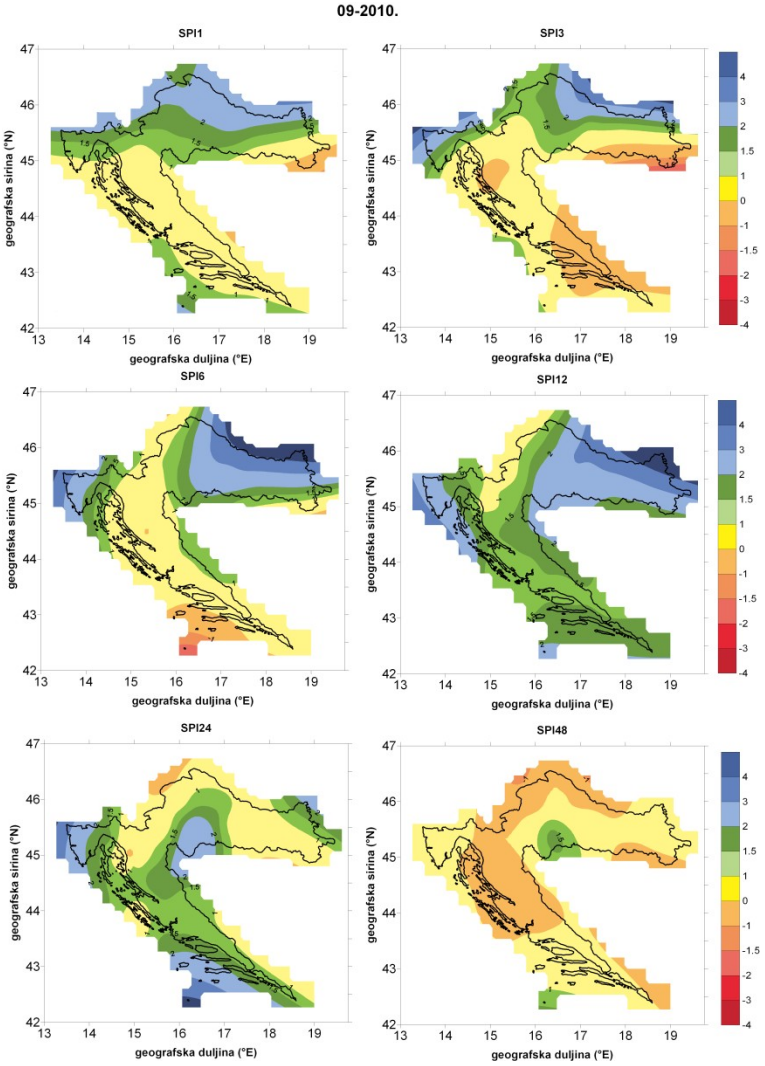
SPI > 0 : precipitation > median
SPI < 0 : precipitation < median

> 2.0	extremely wet
1.5 to 1.9	very wet
1.0 to 1.49	moderately wet
-0.99 to 0.99	normal
-1.0 to –1.49	moderately dry
-1.5 to –1.99	very dry
< -2.0	extremely dry

SPI
spatial distribution

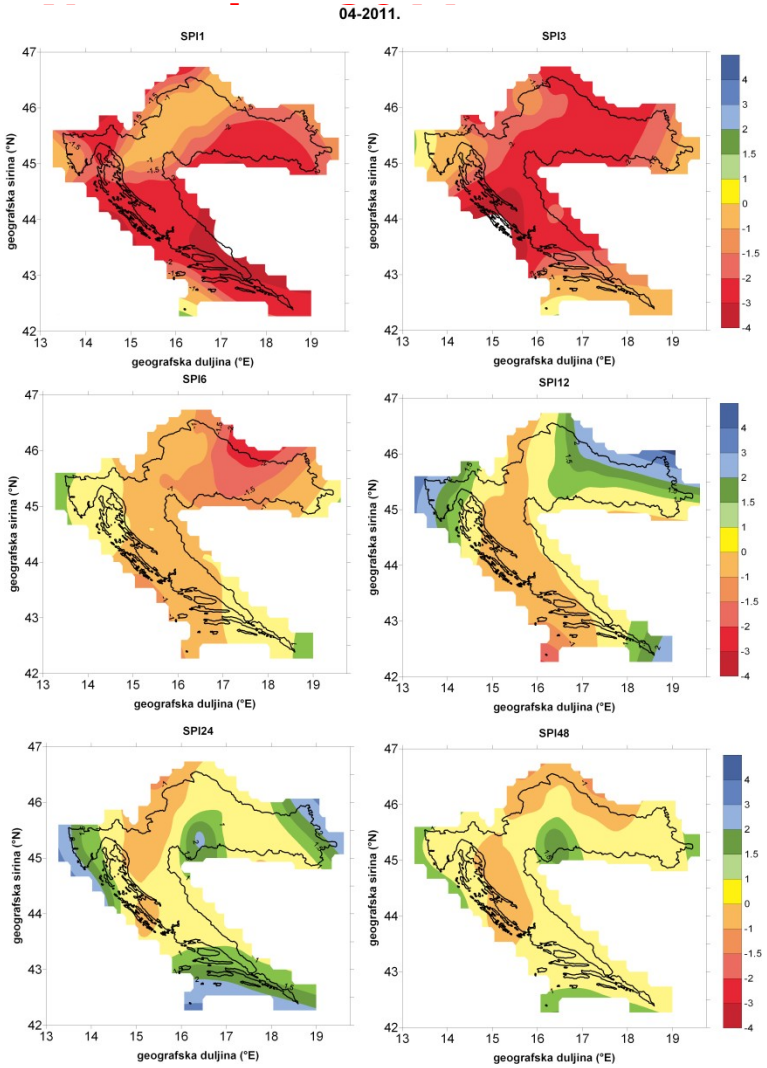
- 1,3,6,12,24,48 m
- calibration period: **1961-2000**
- monthly updated

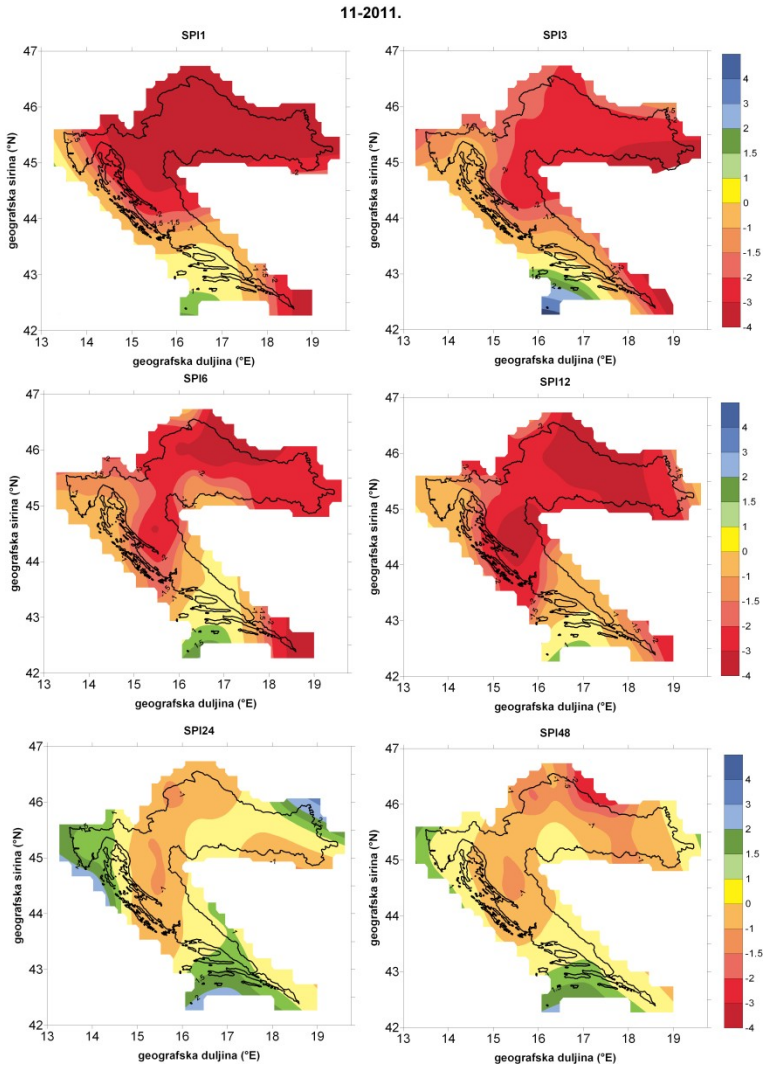
September 2010



Drought example – 2011

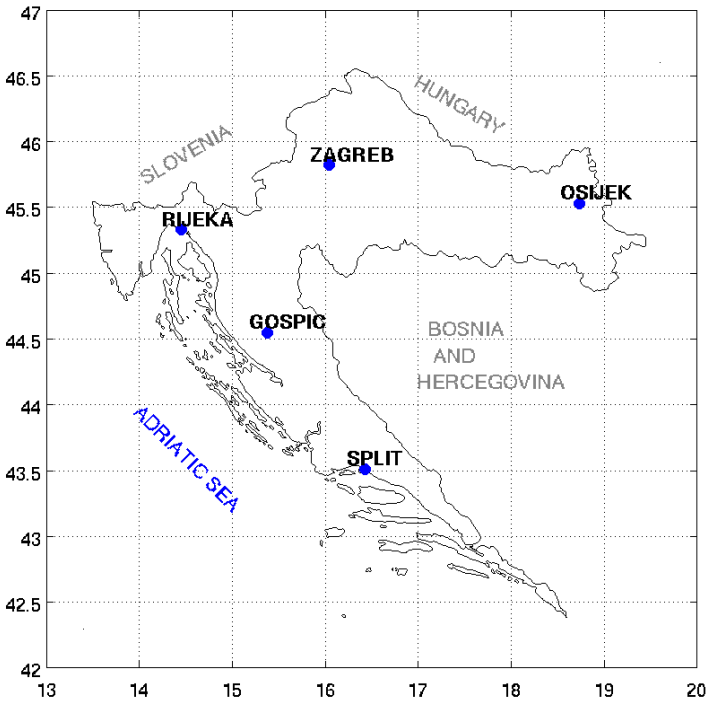
April 2011

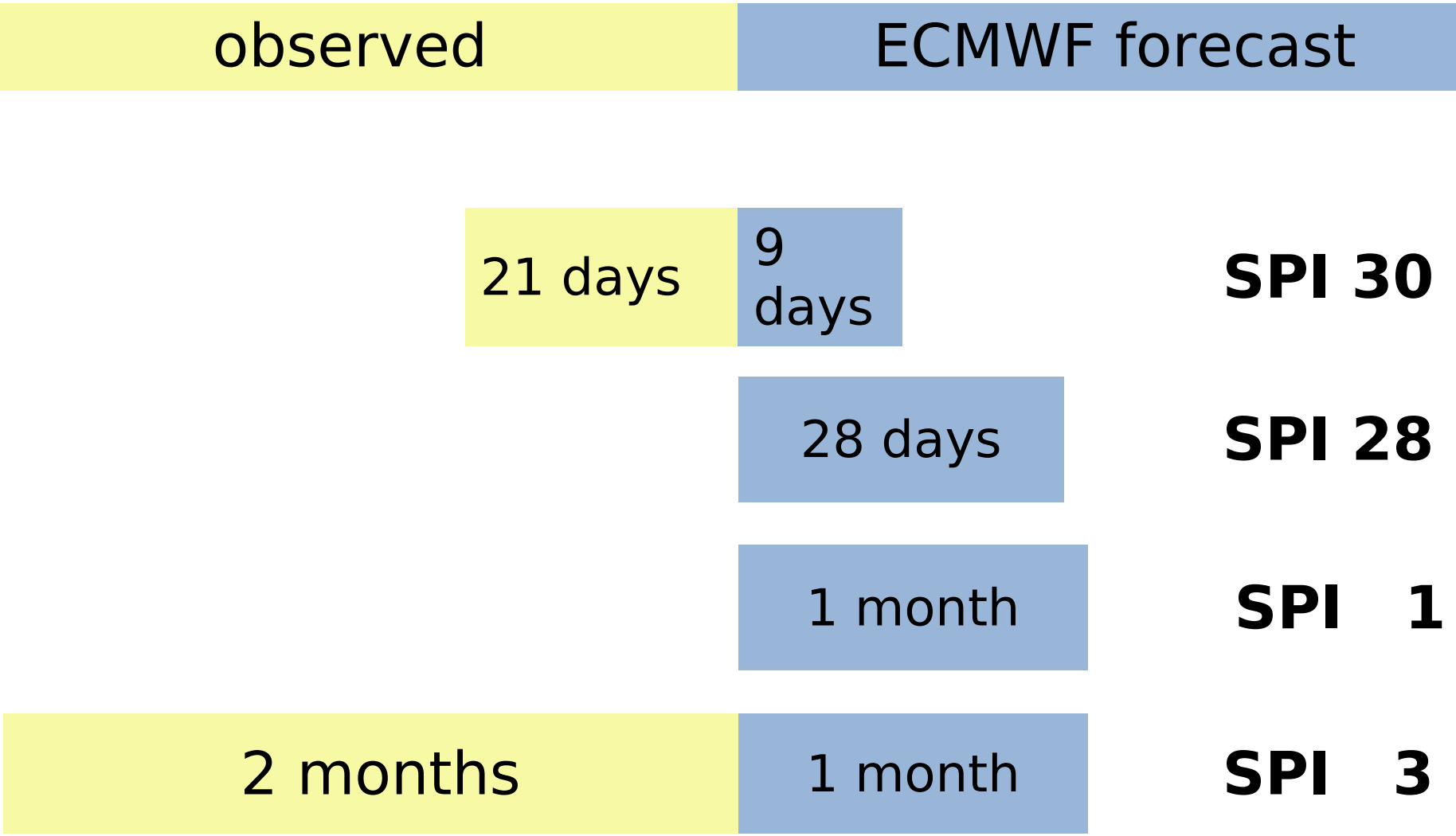


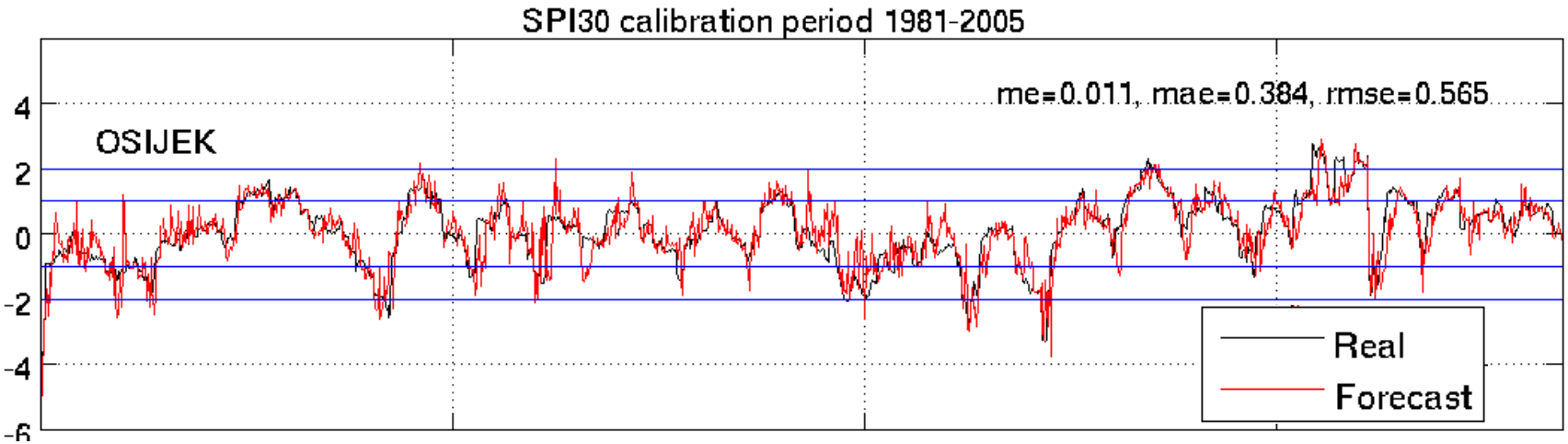


2.3. Drought forecast

- ECMWF precipitation forecast:
  - medium range (9 days)
  - monthly (28 days)
  - seasonal (1 month)
- daily and monthly precipitation records for 5 met. stations representing different climate regions in Croatia
- 2007 -2011

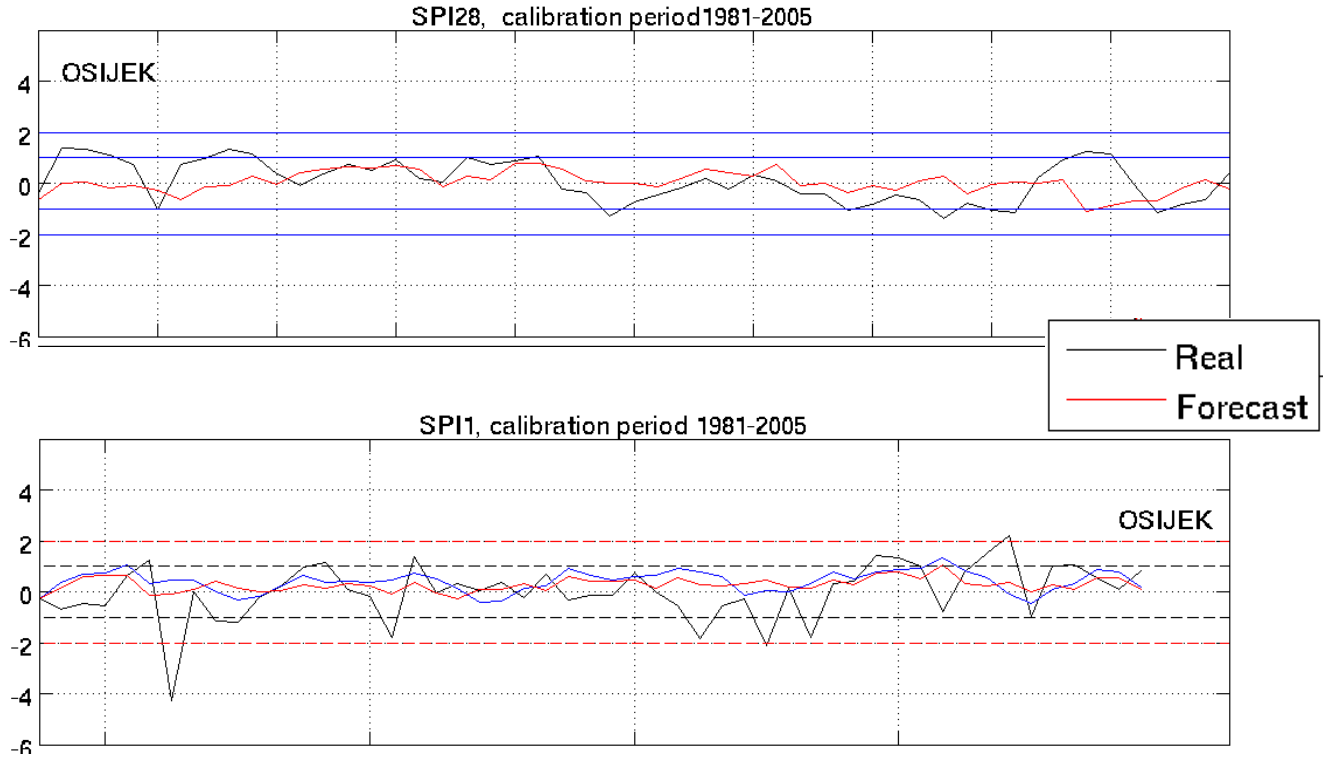



observed
ECMWF forecast
21 days
9 days
SPI 30
28 days
SPI 28
1 month
SPI 1
2 months
1 month
SPI 3



SPI30 (21 observed + 9 forecasted)

- skillful
  - slight overestimating of SPI (too wet)
  - sometimes still not catching extreme events



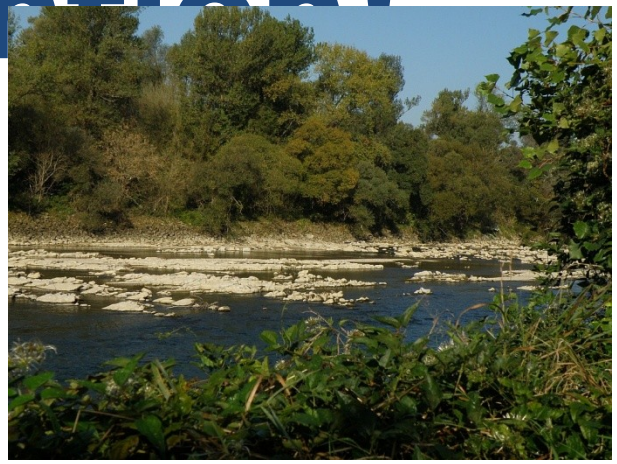
Monthly and seasonal forecasts (SPI28, SPI1 and SPI3) significantly less skill

signal too weak (no extreme forecasts)

3. Future improvements

- Comprehensive operational precipitation monitoring system in DHMZ
- Feedback from endusers (irrigation?)
- Improve monitoring system
- Establish operational SPI forecast (SPI30) combining observations and forecast
- Develop operational drought warning system

Thank you for your attention!



Hvala na pažnji!