Republic of Serbia
Republic Hydrometeorological Service of Serbia

Application of Products from Numerical Models in Agrometeorological Forecasts and Climate Watch System

Department for Applied climatology and agrometeorology
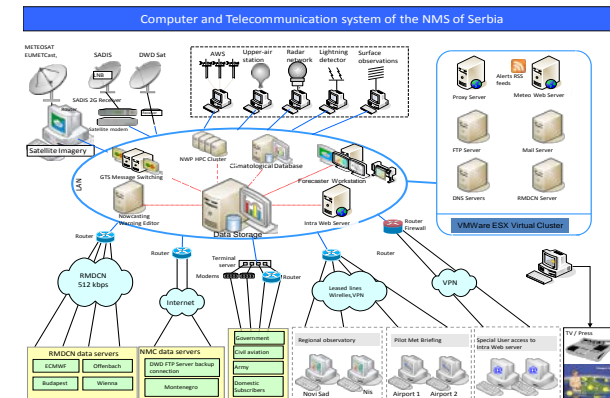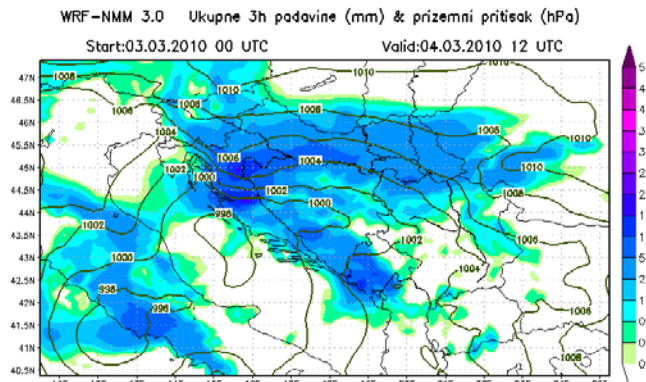**www.hidmet.gov.rs**

RHMSS Meteorological and Hydrological Early Warning System

Basic components of the Hydrometeorological Early Warning System:
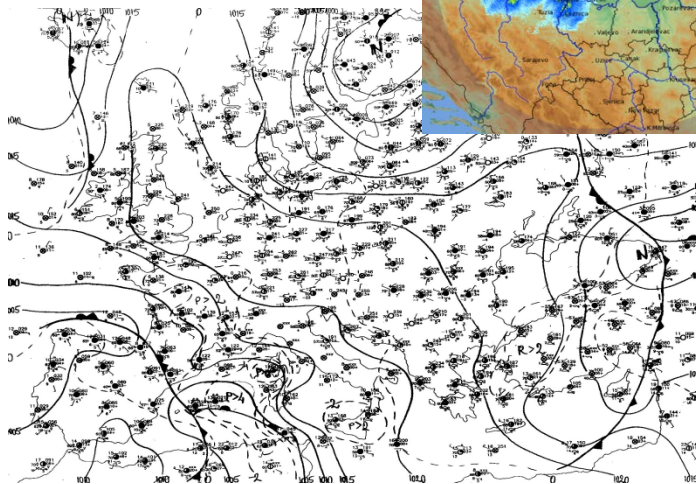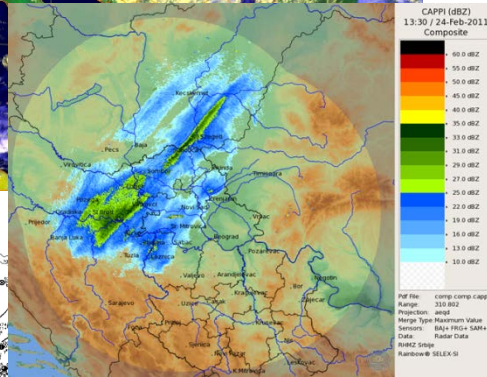
- Meteorological and Hydrological Observation System

- Analytical – Forecasting System

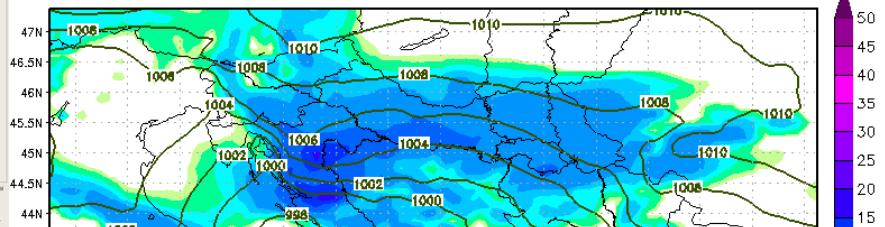- Computer – Telecommunication System

Meteorological Analytical - Forecasting System
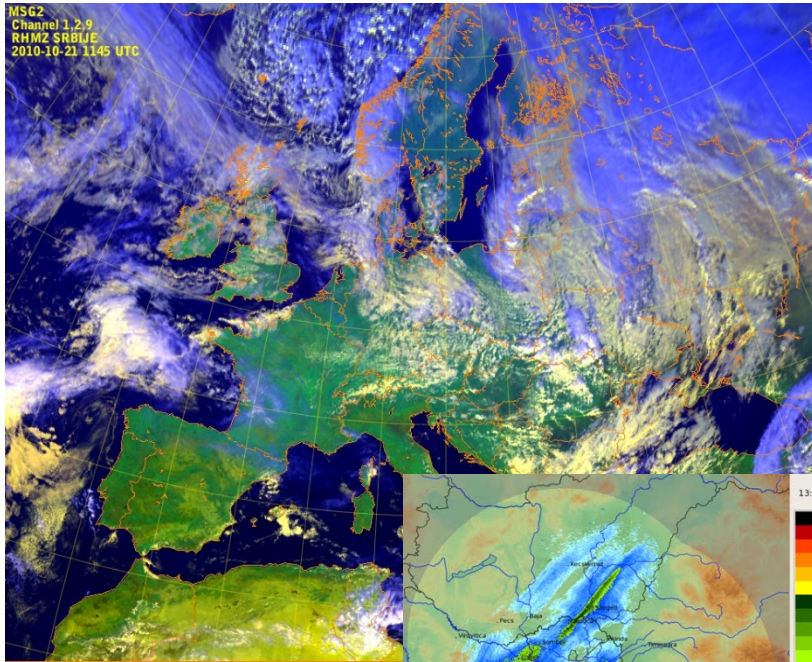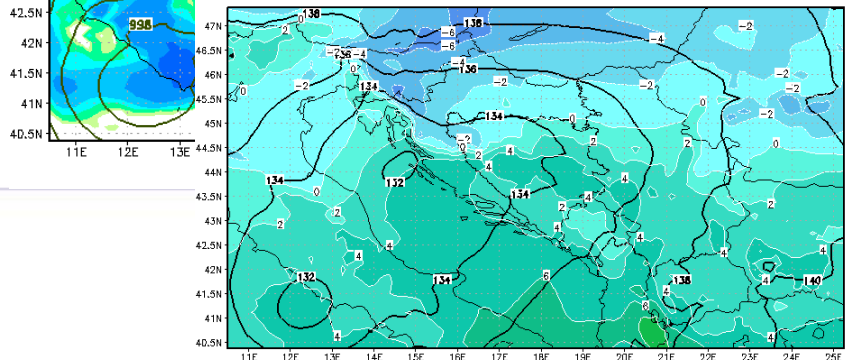
- − Eta – Europe domain
  - 26 km 32 vertical levels (+120 hrs)
- − NMM-WRF – Balkan domain
  - 10 km 38 vertical levels (+72 hrs)
- − NMM-WRF – Balkan domain
  - 4 km 45 vertical levels (+72 hrs)
- − NMM-WRF – Europe domain
  - 12 km, 38 vertical levels (+120hrs)
- − ECMWF
- − DWD

South East European Virtual Climate Change Center (SEEVCCC)

- SEEVCCCs participation in WMO RA VI-EUROPE RCC Network

- Mandatory operational functions:

  - Climate Data Node
  - Lead: KNMI/Netherlands (consortium member SEEVCCC/RHMS-Serbia)
    - South East European gridded model datasets for
      1961-1990, 2001-2030, 2071-2100 first version RCM-SEEVCCC (ready)
      1971-2000, 2071-2100 new RCM-SEEVCCC (in progress, NMMB)

  - Climate Monitoring Node
  - Lead: DWD/Germany (participate SEEVCCC/RHMS-Serbia)
    - Collecting data from stations (monthly, 400-500 stations)
    - Main source for data KNMI-ECA&D, other climate bulletins NCDC)
    - Mean temperature and accumulated precipitation
    - Temperature anomaly and precipitation percent of normal
    - All available monthly/three-monthly

  - Long Range Forecast Node
  - Lead: Météo-France & ROSHYDROMET (participate SEEVCCC/RHMS-Serbia)
    - Once a month ensemble run of a regional long range forecast - 7 months ahead:
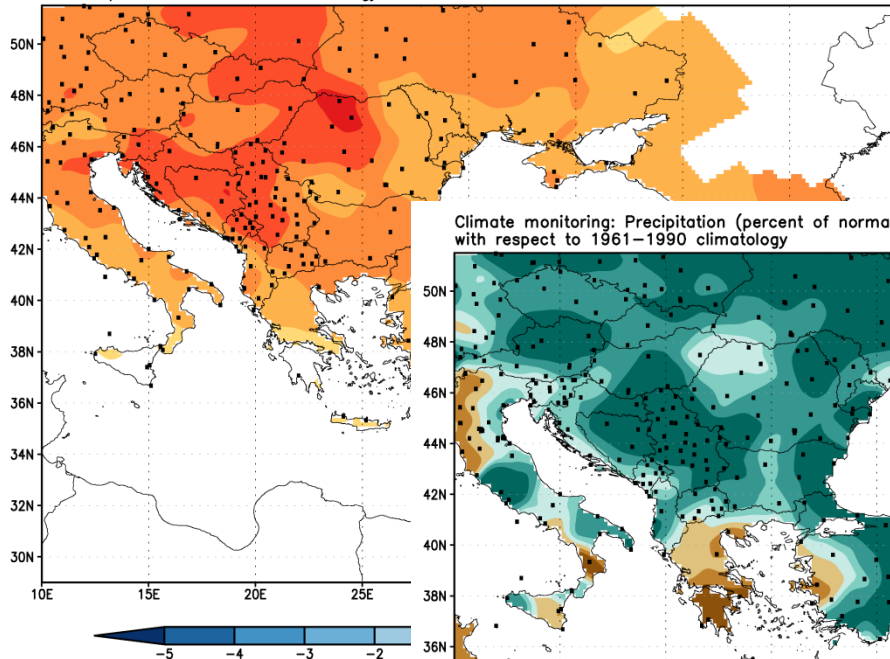   dynamical downscaling ECMWF 51 ensemble with RCM-SEEVCCC

www.seevccc.rs

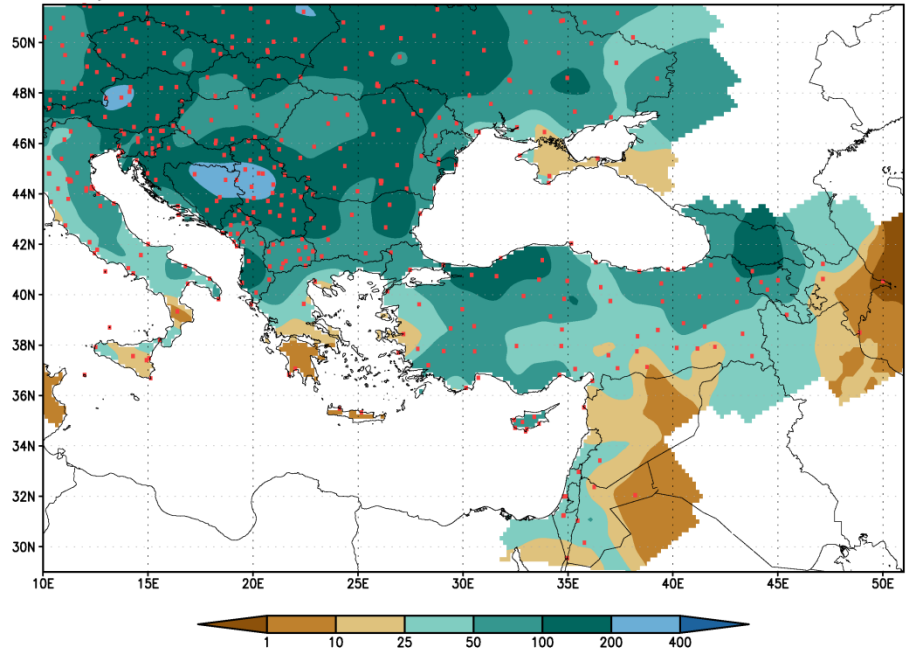# Climate Data and Monitoring Node

- Collecting climate data from ~500 stations within the region

- Mean air temperature and total precipitation

- Monthly and seasonal maps of climatological parameters and their anomalies

Long Range Forecast / Seasonal forecast

- **Probabilistic forecast** – provides statistical summary of the atmosphere and ocean state in forthcoming season

- **RCM – SEEVCCC** – regional dynamical downscaling using fully coupled atmosphere – ocean Regional Climate Model

  - model start: 08th of each month; operational since June 2009.
  - forecast duration: 7 months
  - model resolution: ~35km atmosphere ; ~20km ocean
  - model domain: Euro - Mediterranean region extended towards Caspian Sea
  - 51 ensemble members
  - initial & boundary conditions: ECMWF, ~75km
  - winter hindcast (1981-2010) – December run, 7 months

- operational forecast available in GRIB via WIS-DCPC-Belgrade
- Member of Med-CORDEX Initiative

RCM–SEEVCCC: Precipitation anomaly (%) for OCT 2010
Forecast start: 00Z01SEP2010
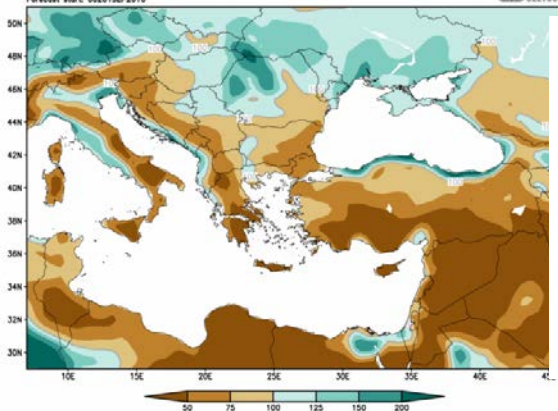
RCM–SEEVCCC: Sea surface temp. anom. (°C) for season JUN–JUL–AUG 2010
Forecast start: 00Z01MAY2010
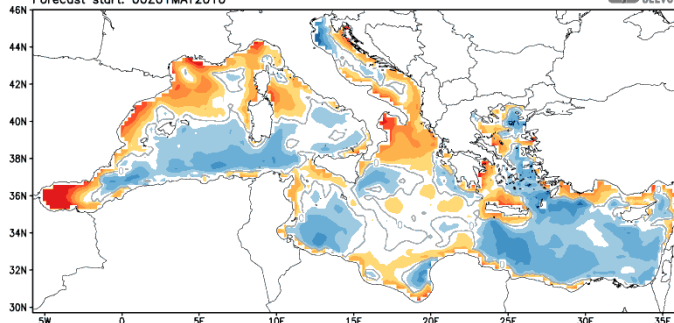
Monthly mean temperature
Forecast start at: 01-03-2010
Station: BELGRADE
RCM - SEE VCCC
normal (1961-1990)
observations

www.seevccc.rs
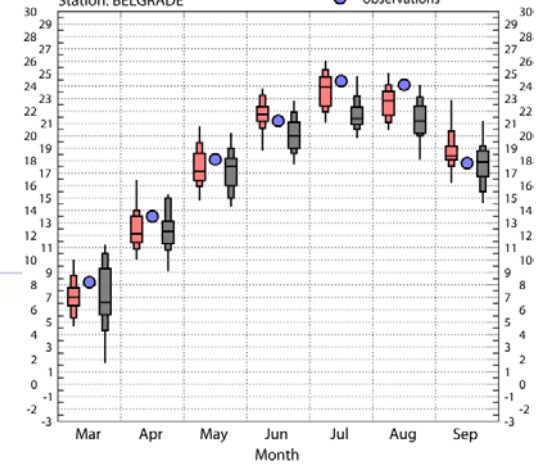
SPI and SPEI

- **SPI1; SPEI1**
- **SPI2; SPEI2**
- **SPI3; SPEI3**
- **SPI6; SPEI6**

  + percent of normal

  + percentiles

➢ Monitoring

      GPCC data

➢ Forecast 4 months ahead

      ECMWF seasonal forecast

➢ Probability forecast

      ECMWF seasonal forecast

www.seevccc.rs
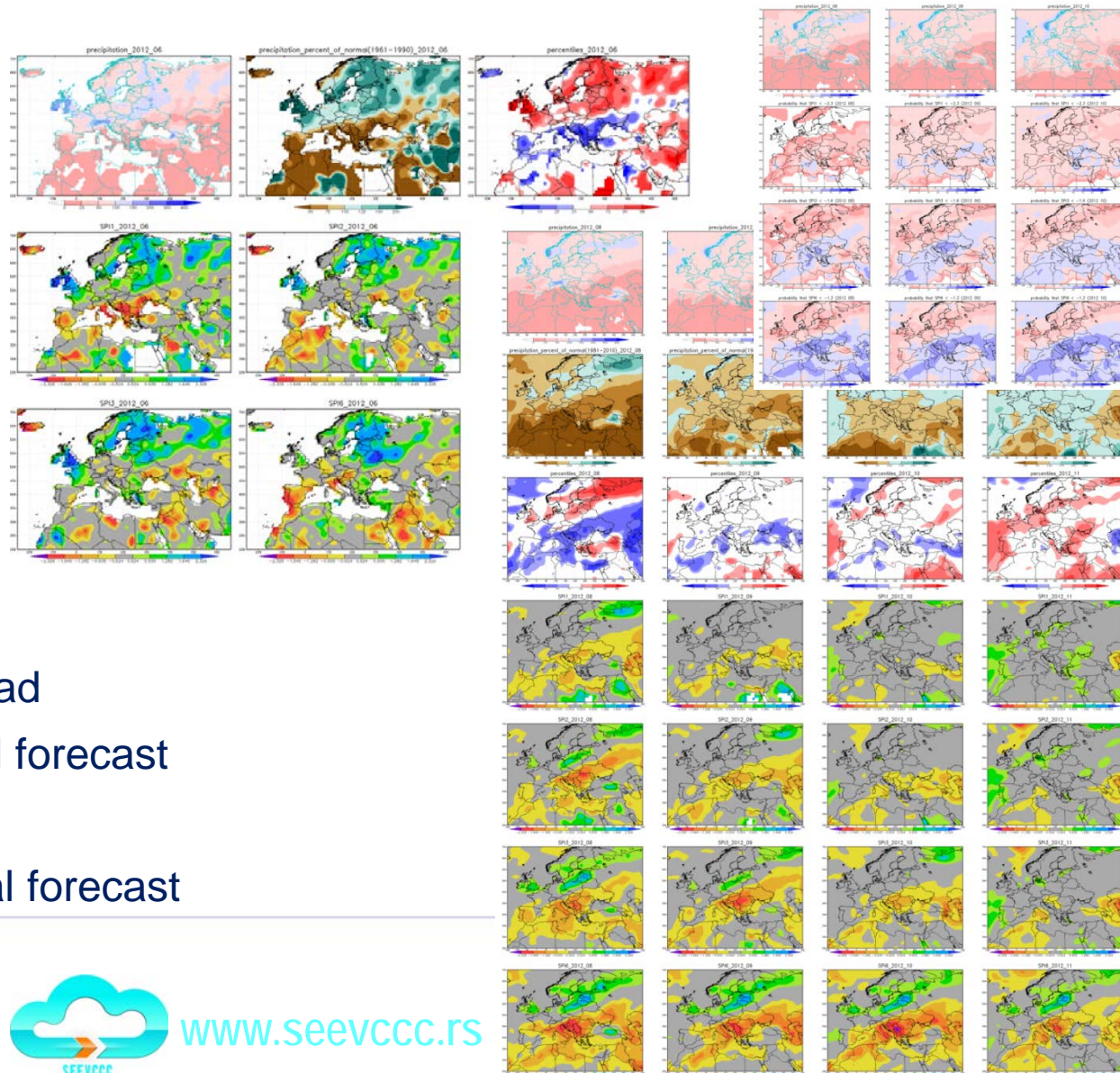
LRF - ECMWF sys4 – Precipitation & SPI Forecast

- Drought monitoring and forecast for Europe
- Drought August **2012**

Monitoring

Forecast
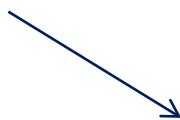
SPI - GPCC
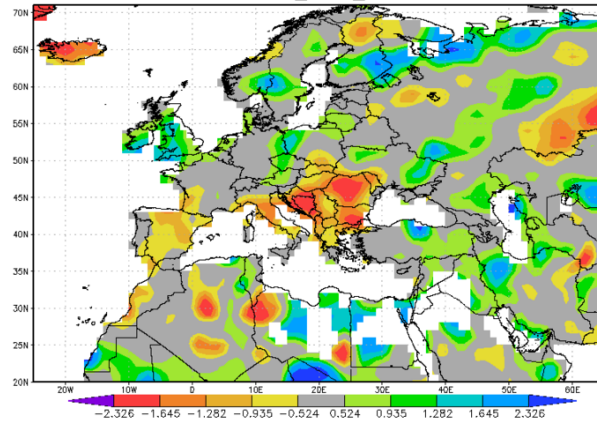
Prec. anomaly RHMSS/SEEVCCC

SPI2 – seasonal ECMWF

Prec. anomaly – monthly ECMWF

Prec. Anomaly seasonal SEEVCCC

Seamless Forecast ECMWF – Floods

- Devastating floods in **May 2014**

- Monthly forecast – 7 days ahead

  - good spatial distribution

  - estimated precipitation amount - 60 mm

  - (more than 300 % of normal)

  - observed precipitation amount - more than 215 mm

ECMWF seasonal forecast

ECMWF monthly forecast

Discharge at Beli Brod Kolubara May 2014.
Initial soil moisture experiment

- Q - ECMWF
- Q - at FC
- Q - between FC and SMC
- Q - obs

ECMWF monthly forecast

Monthly ECMWF Start: 08.05.2014. Valid: 12.05.2014. –18.05.2014.
Verovatnoce anomalije padavina po tercilima
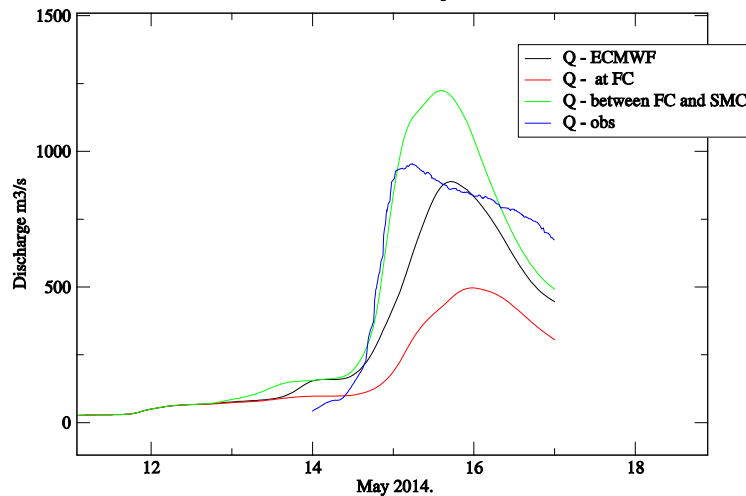
Hydrology with ECMWF short range forecast

Initial soil moisture

Loznica station: precipitation - 330 % of normal
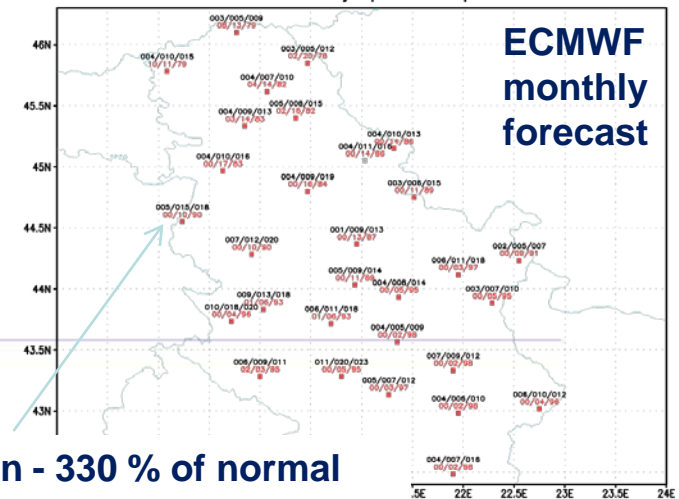
ECMWF monthly forecast

- Weekly / monthly basis – Tmin, Tmax, precipitation
- 2x per week; 46 days
- coupled atmosphere-ocean model; 51 ensemble members
- Resolution: first 10 days on 32 km, later 65 km
- Probabilistic forecast – terciles and median
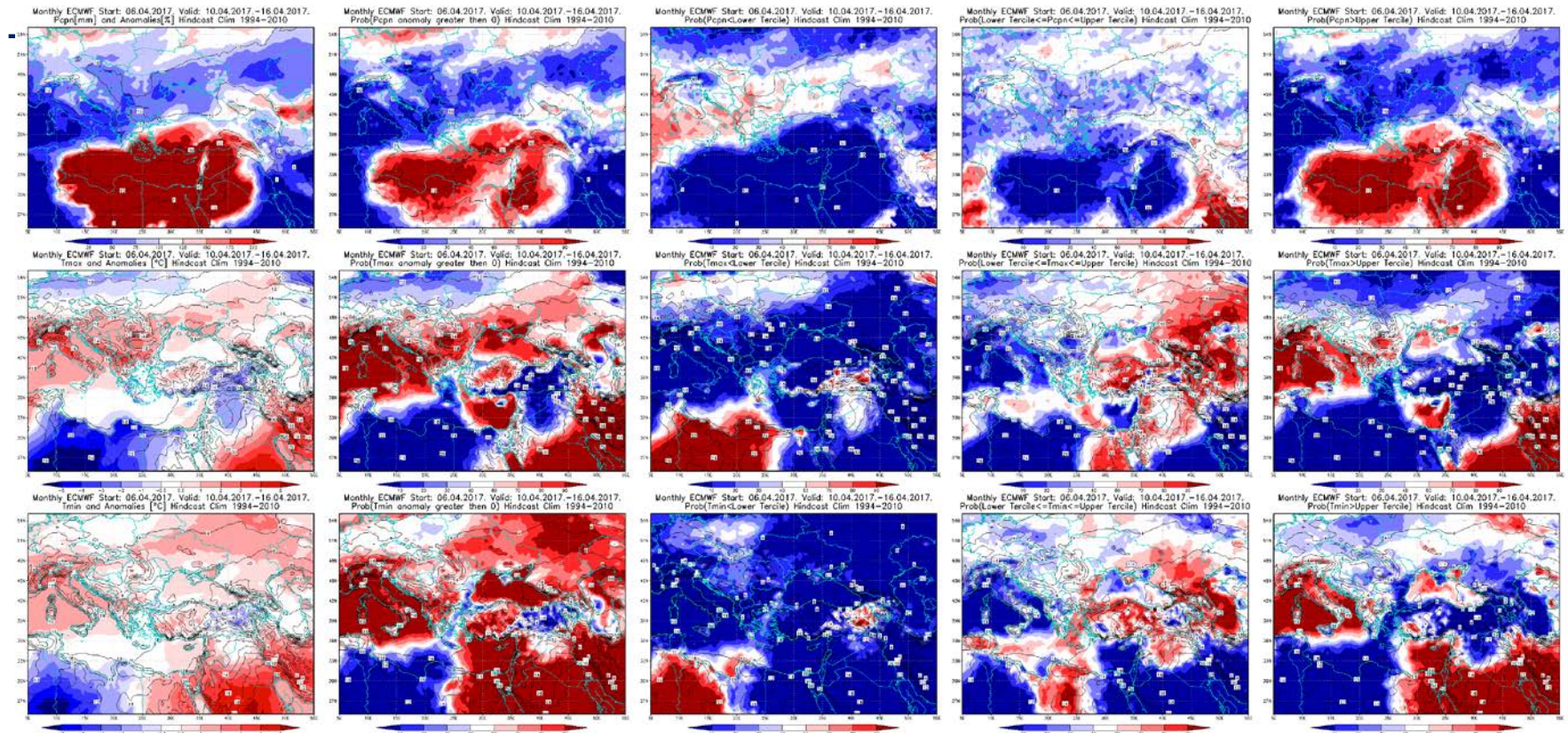
Forecast issued 06. April 2017 ; valid 10.04.-16.04.2017

Forecasts of moisture conditions and agrometeorological parameters

– Division for Agrometeorology, beside moisture condition monitoring, performs:

- Forecasts of Potential Evapotranspiration values

- Forecasts of moisture condition – SPI forecasts

- Forecasts of influence of assumed weather conditions on maize development and yields during growing season (using CropSyst model)

Evapotranspiration forecast

- **Operative tasks:**

  - Determining current daily reference evapotranspiration values based on the operational data obtained from the main meteorological stations

  - Preparation of the reference evapotranspiration forecasts for a 10-day period for the same locations

Forecast is based on the deterministic forecasts of maximum and minimum daily air temperatures (European Center for Medium Range Forecast ECMWF and RHMSS).

Reference evapotranspiration is calculated using Hargreaves method

Actual and forecasted daily values of Reference Evapotranspiration

Republika Srbija
Republički hidrometeorološki zavod

office@hidmet.gov.rs

Kneza Višeslava 66, 11000 Beograd

POTENCIJALNA EVAPOTRANSPIRACIJA, mm

Stanica	15.04.*	16.04.*	17.04.*	18.04.*	19.04.*	20.04.	21.04.	22.04.	23.04.	24.04.	25.04.	26.04.	27.04.	28.04.	29.04.
Beograd	3.4	2.0	2.2	2.9	1.9	1.7	2.1	2.9	2.1	3.7	3.9	4.1	4.4	4.5	3.7
Crni Vrh	2.7	2.1	2.0	1.4	1.0	1.4	1.2	1.9	1.1	2.5	3.0	3.2	3.1	3.0	2.8
Ćuprija	4.3	2.6	2.6	3.4	2.2	1.9	1.9	2.9	2.2	3.6	4.1	4.5	4.5	4.6	3.7
Dimitrovgrad	3.9	3.6	2.1	2.6	2.6	1.7	1.6	2.3	2.6	3.2	3.8	4.2	4.4	4.2	3.9
Kikinda	2.3	2.8	2.7	2.7	1.5	2.0	2.1	2.9	2.5	3.4	3.7	4.2	4.3	4.4	4.5
Kragujevac	4.2	1.8	2.3	3.4	1.9	1.7	1.6	2.6	1.8	3.4	3.8	4.2	4.3	4.3	3.6
Kraljevo	4.0	2.4	2.1	3.3	1.6	1.8	1.7	2.8	2.1	3.5	4.1	4.4	4.6	4.5	4.3
Kruševac	4.0	2.8	2.4	3.3	2.0	1.9	1.9	2.9	2.3	3.7	4.3	4.4	4.7	4.9	4.4
Leskovac	4.3	3.3	2.5	3.3	2.8	1.9	1.8	2.8	2.7	3.7	4.1	4.3	4.5	4.8	4.5
Loznica	3.6	1.8	2.5	2.9	1.5	1.5	1.8	2.9	2.3	3.7	3.9	4.4	4.8	4.5	4.6
Negotin	4.0	3.3	2.3	2.0	1.7	2.0	1.9	2.8	2.0	3.3	4.2	4.4	4.4	4.3	4.0
Niš	4.0	3.2	2.4	3.1	2.2	1.8	1.8	2.7	2.4	3.6	4.1	4.2	4.4	4.8	4.6
Novi Sad	3.2	2.6	2.7	2.8	1.5	1.8	2.1	2.9	2.4	3.5	3.6	3.8	4.2	4.7	3.8
Palić	2.0	2.6	2.5	2.2	1.5	1.5	2.2	2.8	2.3	3.3	3.5	3.9	4.3	4.4	4.2
Požega	4.1	2.4	2.4	3.4	1.6	1.7	1.6	2.5	2.1	3.5	3.8	4.1	4.6	4.4	4.4
S. Mitrovica	3.5	2.1	2.5	3.0	1.4	1.5	2.1	3.0	2.2	3.6	3.9	4.1	4.4	4.5	4.0
S. Palanka	4.2	2.4	2.5	3.3	1.9	1.8	1.9	2.8	2.2	3.8	4.1	4.4	4.6	4.8	4.1
Sjenica	2.8	2.6	1.6	2.6	1.3	1.3	1.2	1.7	2.0	2.6	2.7	3.0	3.4	3.7	3.1
Sombor	2.7	3.1	2.7	2.1	1.5	1.2	2.1	2.9	2.6	3.3	3.6	3.9	4.3	4.0	4.1
V. Gradište	3.9	2.5	2.6	3.2	2.1	2.0	2.0	2.7	2.0	3.4	3.8	4.2	4.2	3.7	3.3
Valjevo	3.7	1.7	2.3	3.5	1.2	1.5	1.6	2.6	2.2	3.7	3.8	4.2	4.2	4.6	4.2
Vranje	4.1	3.4	2.0	3.1	2.5	1.9	1.5	2.2	2.9	3.2	3.7	3.9	4.0	4.4	4.0
Zaječar	4.3	3.1	2.5	2.5	1.2	1.9	1.7	2.8	2.1	3.4	4.0	4.3	4.4	4.0	3.9
Zlatibor	2.9	1.7	1.4	2.4	1.0	1.1	1.1	1.9	1.6	2.8	2.9	3.2	3.6	3.7	3.5
Zrenjanin	3.3	2.6	2.6	3.0	1.6	1.9	2.2	2.9	2.5	3.4	3.9	4.1	4.2	4.1	3.8

* Prethodnih pet dana (aktuelne vrednosti)

http://www.hidmet.gov.rs/latin/meteorologija/agro_evapotranspiracija.php

SPI forecast

```
                    ┌──────────────┐
                    │     SPI      │
                    │  FORECASTS   │
                    └──────┬───────┘
             ┌─────────────┴─────────────┐
        ┌────┴────┐                 ┌─────┴────┐
        │  SPI1   │                 │   SPI2   │
        └────┬────┘                 └─────┬────┘
      ┌──────┴──────┐                     │
 ┌────┴─────┐  ┌────┴─────┐         ┌─────┴──────┐
 │Seven day │  │ Ten day  │         │  Monthly   │
 │ECMWF/    │  │ECMWF/    │         │  ECMWF/    │
 │SEEVCCC   │  │RHMSS     │         │  SEEVCCC   │
 └──────────┘  └──────────┘         └────────────┘
```
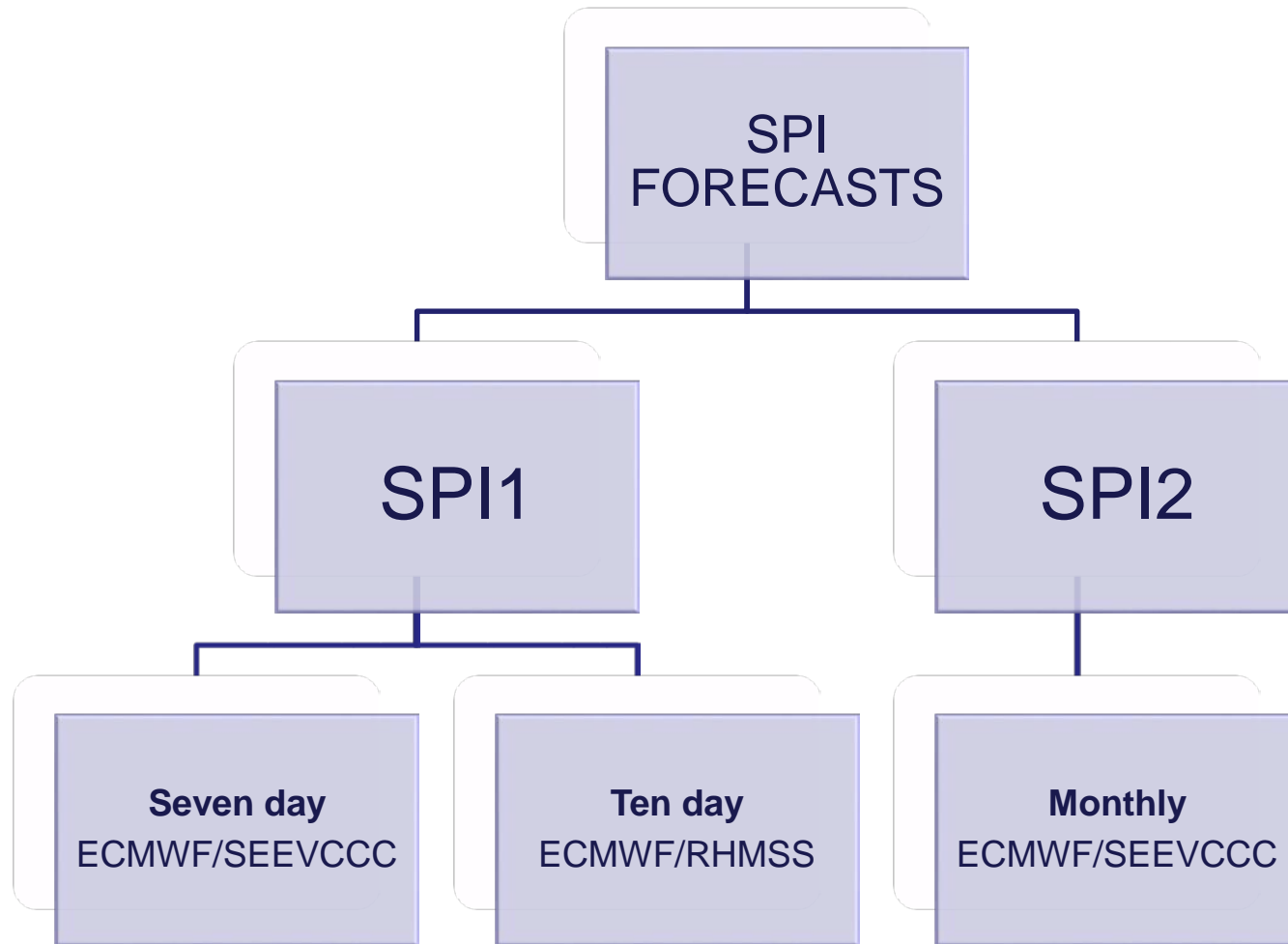
Example of SPI forecasts
- drought in 2015 -
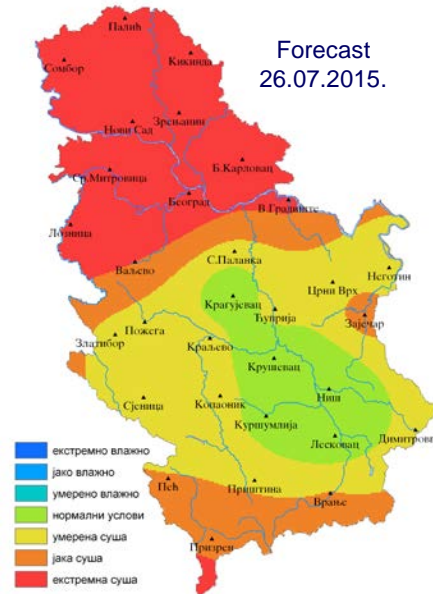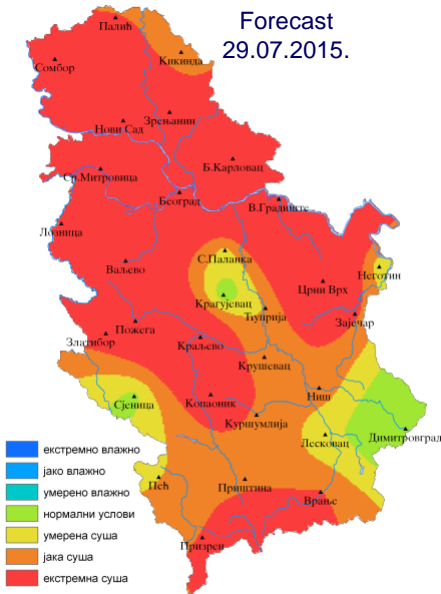
Forecast
29.07.2015.

Moisture conditions in Serbia estimated on the basis of the **Standardised Precipitation Index (SPI-1) forecast** *for next* **7 days***, based on precipitation forecast (ECMWF/RHMSS)*

Forecast
26.07.2015.

Moisture conditions in Serbia estimated on the basis of the **Standardised Precipitation Index (SPI-2) forecast** *for next* **30 days***, based on precipitation forecast (ECMWF/RHMSS)*

Moisture conditions in Serbia estimated on the basis of the Standardised Precipitation Index (SPI-1) determined for 30 days period
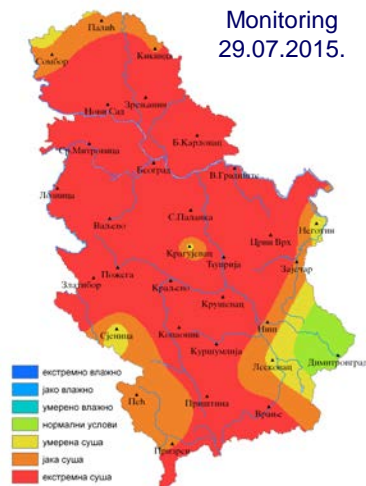
Monitoring
29.07.2015.

Moisture conditions in Serbia estimated on the basis of the Standardised Precipitation Index (SPI-2) determined for 60 days period

Monitoring
26.07.2015.

Climate Watch System

> ➤ Climate Watch System (CWS) - operative early warning system for climate warnings, based on the existing meteorological activities and infrastructure at the regional and national level.

> ➤ This system is established on the foundations of the existing Early Warning System with the focus on the extreme climate events (such as heat waves, cold waves, large precipitation amounts that may cause floods, etc.)

> ➤ The basic goal of this system is to support the Early Warning System by providing overviews of climate monitoring and long-range weather forecasts.
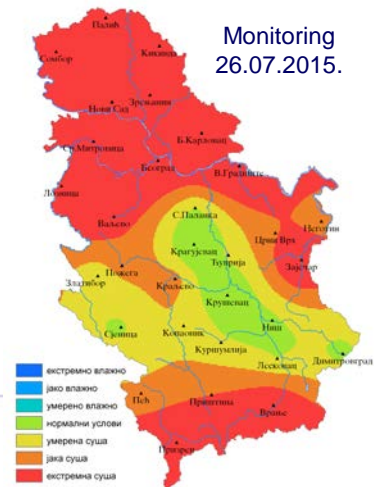
БИЛТЕН РАНЕ НАЈАВЕ КЛИМАТСКИХ ЕКСТРЕМНИХ ПОЈАВА И
АНОМАЛИЈА ЗА ПЕРИОД ОД 8.5. ДО 31.7.2015. ГОДИНЕ

Иницијални/Ажурирани/Финални билтен, број: 19/15
Датум издавања: 8.5.2015.
Важи до: 24.5.2015.
Датум ажурирања билтена: 15.5.2015.

БЕЗ УПОЗОРЕЊА

0 Ниска опасност	1 Потенцијална опасност	2 Опасна појава	3 Веома опасна појава

Topic: precipitation	
Organization issuing the statement:	SEEVCCC
Issued/ Amended / Cancelled	18-5-2015 12:00 P.M.
Contact:	E-mail: cws-seevccc@hidmet.gov.rs Phone: +381112066925 Fax: +381112066929
Valid from – to:	18-5-2015 – 31-5-2015 Next amendment: 25-5-2015

Region of concern: Greece, Turkey

„From May 18th to 24th 2015, above normal mean weekly air temperature is forecast for most part of the SEE region, with anomaly up to +4°C. Probability for exceeding upper tercile is in a range from 80% over the Balkans up to 90% in central and eastern Turkey. Precipitation surplus is forecasted over Ionian Sea, while deficit is expected in central Balkans, eastern parts of Turkey and south Caucasus. Probability for exceeding upper/lower tercile is up to 80%."

➤ The main CWS product is the Early warning bulletin on extreme climate events and anomalies, issued once a week: each Friday at the national level and each Monday for the region of South East Europe

➤ Early warning bulletin contains long term warnings, weekly monitoring, weather outlook (monthly/seasonal temperature, precipitation and SPI forecasts)

➤ Early warning bulletin aims to inform users (one/two weeks, month ahead) about the probability and severity levels of climatic hazards in order to ensure execution of mitigation plans and avoidance of severe events

– Forecasted influence of the assumed weather conditions on development and yield of corn in the rest of the upcoming growing season (using CropSyst)

Observations or Forecast

- Accumulated precipitation
- Minimum temperature
- Maximum temperature

CROPSYST

- Soil moisture
- Crop phenology
- Biomass
- Yield
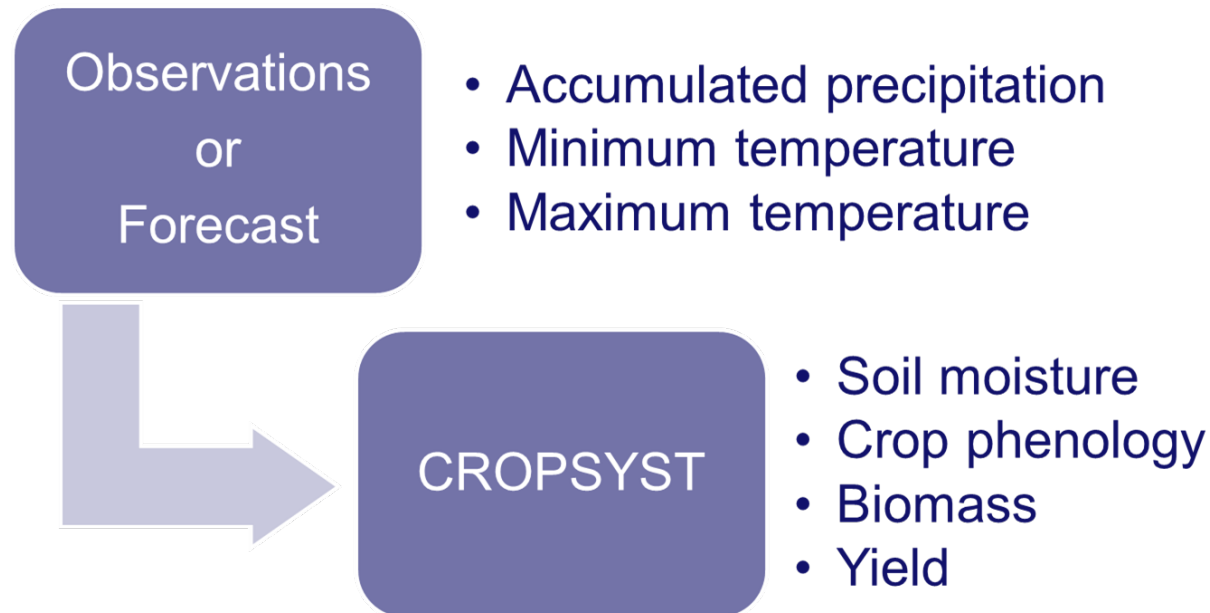
– Different weather scenarios (dry and hot, normal, cool and wet) are defined for period from 1 July to 31 August

CropSyst predictions
Weather scenarios

➢ Weather scenarios - based on daily meteorological temperature and precipitation data from the period 1990 – 2005

Average	Dry and hot	Cool and wet
Average daily values Tmin, Tmax, P	Precipitation 30% from the average	Precipitation 50% higher than the average
Period 1990 - 2005	Positive T bias 3°C	Negative T bias 2°C
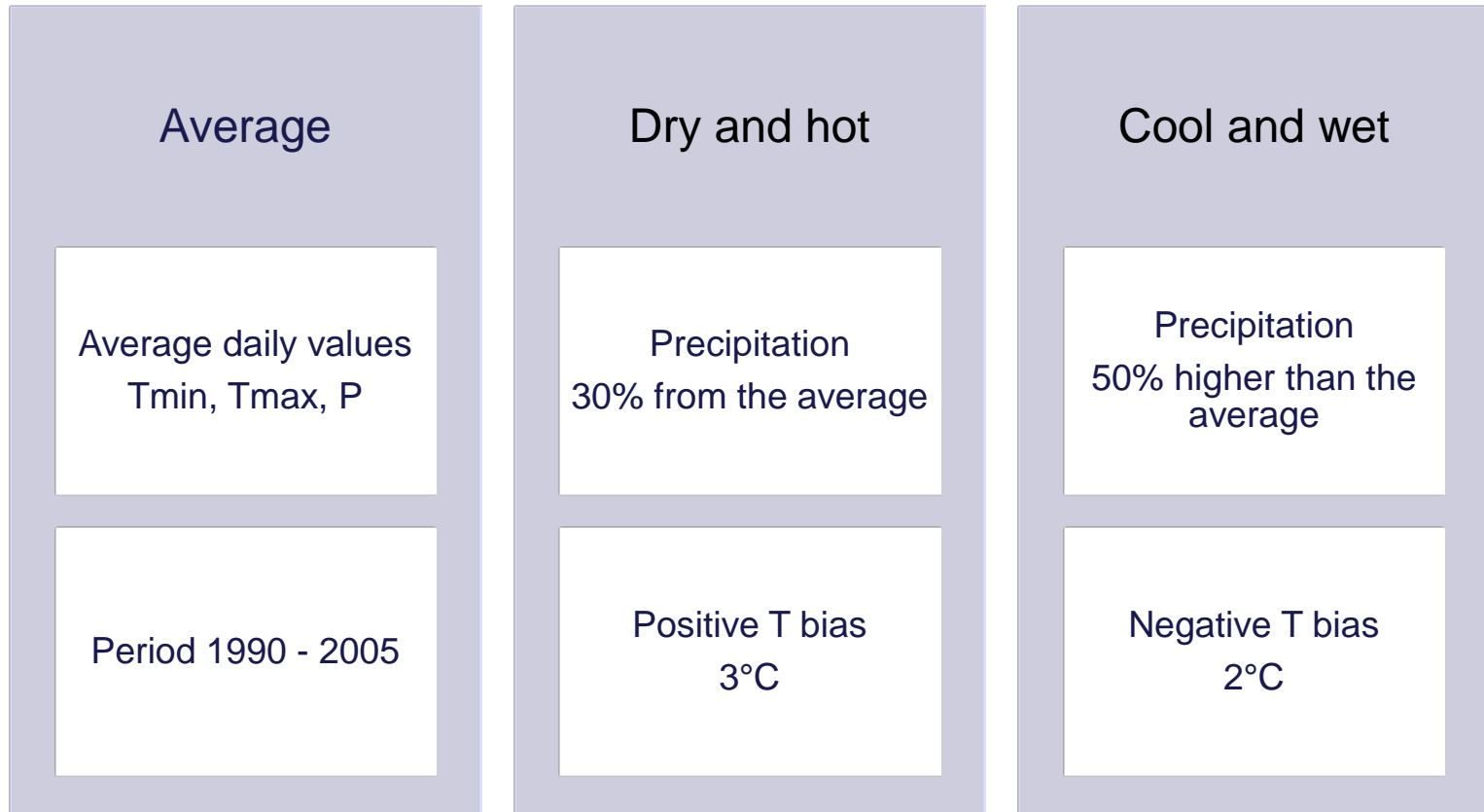
Example of ten day CropSyst Bulletin

REPUBLIC HYDROMETEOROLOGICAL SERVICE OF SERBIA
Department for Agriculture Meteorology
E mail:agromet@hidmet.gov.rs

AGRICULTURAL METEOROLOGY BULLETIN WITH MAIN COMPONENTS OF WATER BALANCE AND ASSESSMENT OF THE
INFLUENCE OF WEATHER CONDITIONS ON GROWING STAGE AND CROP YIELD

Location: Banatski Karlovac

Accumulated values from beginning
of vegetation period to simulation
date:

Pot.Et,mm	568.1
Act.Et,mm	381.2
Precip.mm	258.3

54mm

Water Content

Legend:
- Pot. Evapotranspiration
- Act. Evapotranspiration
- Precipitation
- Water Content
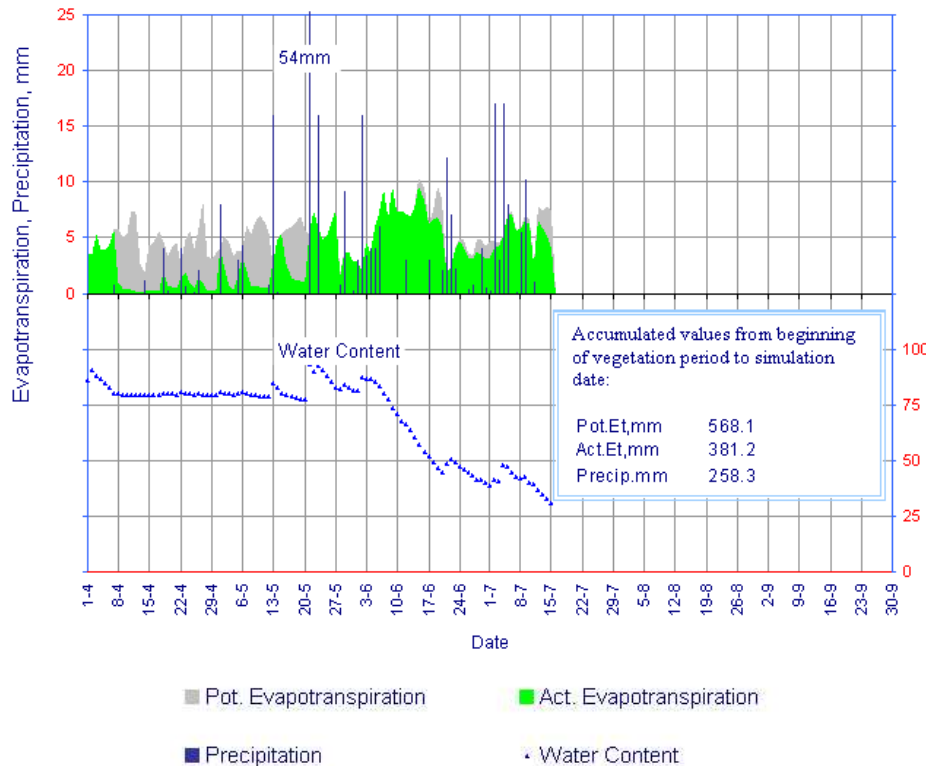
Simulation date		15-July
Dry and hot	Date:	
	Grain filling	28.07.
	Maturity	18.08.
	Harvest	03.09.
	Yield Assesment,kg/ha:	5701
	Accum. in vegetation period:	
	Pot.Et,mm	906.8
	Act. Et,mm	561.4
	Precipitation,mm	288.1
Normal	Date:	
	Grain filling	31.07.
	Maturity	27.08.
	Harvest	12.09.
	Yield Assesment,kg/ha:	8125
	Accum. in vegetation period:	
	Pot.Et,mm	901.5
	Act. Et,mm	617.7
	Precipitation,mm	375.0
Cool and Wet	Date:	
	Grain filling	03.08.
	Maturity	07.09.
	Harvest	23.09.
	Yield Assesment,kg/ha:	9711
	Accum. in vegetation period:	
	Pot.Et,mm	879.3
	Act. Et,mm	648.4
	Precipitation,mm	448.4

Bulletin of Analysis of moisture conditions on the territory of Serbia during growing season
CropSyst products

Cropping System Simulation Model - CROPSYST	Simulation with assumed the climatic conditions (01.07.2016)												Simulation at the end vegetation period			
	Dry and hot				Normal				Cool and wet				Actual values			
Location	P mm	PET mm	ET mm	Yield Kg/ha	P mm	PET mm	ET mm	Yield Kg/ha	P mm	PET mm	ET mm	Yield Kg/ha	P mm	PET mm	ET mm	Yield Kg/ha
B. Karlovac	277.6	689.9	424.4	3703	397.2	697.6	532.2	7499	499.6	721.6	654.3	11638	465.4	703.1	583.1	7791
V. Gradište	333.7	712.3	395.8	2875	448.0	717.0	477.6	5566	549.3	737.5	587.7	9533	512.7	716.0	534.0	7393
Vranje	189.6	774.1	314.0	2201	282.6	785.5	375.2	2373	364.4	803.6	417.3	3664	342.5	766.0	464.9	5372
Zaječar	200.8	791.8	376.6	2777	294.9	792.4	429.3	4329	385.8	812.0	513.5	7108	277.2	782.1	445.7	5034
Zrenjanin	295.2	662.3	398.3	4205	402.5	672.0	488.6	7659	492.0	696.6	586.2	11752	441.2	663.5	540.1	9340
Kikinda	271.6	678.4	387.3	3482	367.4	687.9	467.7	6236	453.6	710.1	571.9	10504	367.3	695.8	466.0	6117
Kragujevac	264.1	705.0	443.9	2652	378.9	711.0	443.9	4981	492.8	732.1	572.8	9623	389.0	700.9	454.5	5268
Leskovac	181.9	687.9	431.3	4215	273.9	789.2	398.8	2679	348.7	811.3	448.8	4082	342.9	776.1	443.4	3991
Negotin	181.9	687.9	431.3	4215	252.4	691.5	455.5	4882	310.9	704.6	527.9	7152	316.4	676.4	530.0	7098
Novi Sad	335.5	667.0	440.4	4424	471.4	682.3	562.5	8802	520.0	705.0	667.7	13198	424.7	672.5	531.1	7726
S. Palanka	264.9	720.5	391.7	2964	377.8	729.6	464.2	5459	481.3	751.5	573.5	9317	350.6	720.1	425.8	4431
Sombor	225.6	702.4	367.5	3263	360.1	710.2	462.2	6419	454.5	734.5	601.9	11570	423.9	703.2	544.8	8830
S. Mitrovica	206.1	709.5	365.9	2972	312.3	718.1	425.2	4995	410.5	745.5	520.8	8659	317.3	702.9	444.9	5456
Ćuprija	259.6	769.6	389.0	2448	359.8	771.9	426.7	3062	448.4	791.7	501.7	5493	414.7	751.1	459.3	4138

Monthly forecasts in CropSyst simulations

- Analysis of the results from CropSyst model whit inserted monthly forecasts instead of three weather scenarios

- Analysis was made for 3 locations (Banatski Karlovac, Sombor and Smederevska Palanka) and time period 2012 – 2016

- CROPSYST model simulations were carried out on the basis of:

  - observed meteorological data

  - ensemble monthly forecast produced by ECMWF

- Forecasted values of precipitation and min and max temperatures - mean values of ensemble forecast

- Monthly forecasts for July and August

- Results from simulations using forecasted values during July and August were compared to results from simulations at the end of growing season

Monthly forecasts in CropSyst simulations Results

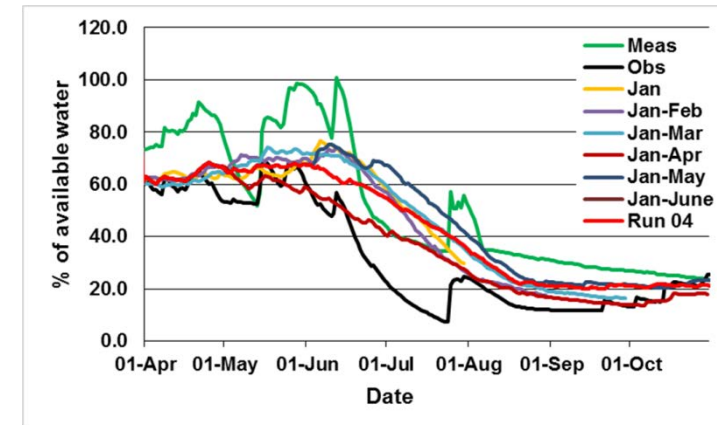| Station	Year	Yield			Date of harvest		
		Estimated	Forecast July	Forecast August	Estimated	Forecast July	Forecast August
Banatski Karlovac	2012	2101	2276	2101	28-Aug	26-Aug	27-Aug
	2013	3685	5831	3542	31-Aug	3-Sep	29-Aug
	2014	9848	6943	10221	22-Sep	13-Sep	19-Sep
	2015	3089	3353	3050	31-Aug	31-Aug	30-Aug
	2016	8067	4132	7633	13-Sep	4-Sep	10-Sep
Sombor	2012	1067	1957	1878	30-Aug	29-Aug	27-Aug
	2013	2318	5326	3421	4-Sep	9-Sep	2-Sep
	2014	7801	5538	8253	24-Sep	16-Sep	20-Sep
	2015	3064	3167	3089	1-Sep	1-Sep	2-Sep
	2016	8830	3844	8352	19-Sep	7-Sep	15-Sep
Smederevska Palanka	2012	1491	2015	1897	5-Sep	2-Sep	31-Aug
	2013	2165	5758	3189	5-Sep	11-Sep	4-Sep
	2014	8878	5964	9656	20-Sep	17-Sep	21-Sep
	2015	3199	3581	3014	2-Sep	5-Sep	1-Sep
	2016	4431	3264	4349	12-Sep	6-Sep	11-Sep

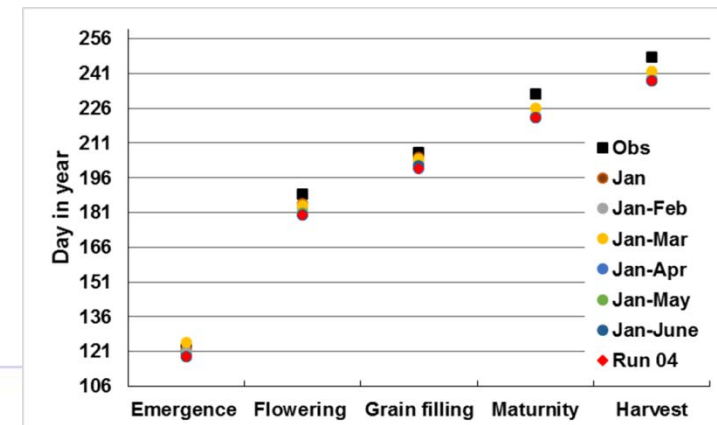# The use of seasonal forecasts in agrometeorology: Smederevska Palanka 2012 case study

➢ CROPSYST model simulations were carried out on the basis of observed meteorological data and ensemble seasonal forecast produced by regional climate model RCM-SEEVCCC

RESULTS

Soil moisture

Location	Smederevska Palanka	- high quality and continuity of temperature and precipitation observations since 1944 - possesses soil moisture measurements
Year	2012	Characterized by: - very cold winter - very high air and soil temp. with little rain and low soil moisture during summer Decrease in yields of more than 40%.
Maize hybrid	ZP704 (FAO700)	medium late hybrid with an average length of the growing season 145 days and the average sum of effective temp. of 1269°C
Forecast	Seasonal forecasts from Jan to June with merging first months of previous forecasts	April run 11 ensemble members + ens. mean
ET model	Priestley-Taylor	
Seeding date	15th April	fixed
Other	Agro-technical measures and irrigation not applied	

Corn phenophases

Future plans and needs

- Optimization and automatization of the existing stations (ordinary climatological stations and precipitation stations)

- Expansion of the program and automation of agrometeorological **observation**

- Expansion of **remote sensing observations** in agrometeorology to other products beside FVC

- **Agroclimatic classification and agroclimatic zoning** of the territory of Serbia for certain agricultural crops; researching a study on thermal regime of the soil in Serbia

- Integration of **meteorological forecasts** (short, medium, long term - seasonal) in **CROPSYST** model; use of products from regional climate models (SEEVCCC) in CROPSYST model

- Development and improvement of the **agrometeorological early warning system** based on integration of meteorological forecasts and **agrometeorological indices**

DRiDanube

- **Drought Risk in the Danube Region**

- Project is co-funded by **Danube Transnational Programme**

- Total project budget: € 1,974,750.00

- Project duration: January 2017 – June 2019

- Project aims to:

✓ improve capacity of the region for **drought emergency response** and enhance **preparedness** for drought management by introducing recently developed monitoring and risk assessment tools

✓ enable more accurate and efficient **drought early warning**

✓ harmonize the currently heterogeneous methodologies for **risk and impact assessments**, based on existing achievements in participating countries and on EU guidelines in the frame of the Civil Protection Mechanism

Climateurope

- **European Climate Observations, Modelling and Services - 2**
- Project is funded by **H2020**
- Total project budget: € 3,052,435.00
- Project duration: December 2015 – November 2020
- Project aims to:

✓ Develop a Europe-wide framework for **Earth-system modelling and climate service activities**

✓ Coordinate and integrate **on-going and future European climate** modelling, climate observations and climate service infrastructure **initiatives**

✓ Establish **multi-disciplinary expert groups** to assess the state-of-the-art in Earth-system modelling and climate services in Europe, and identify existing gaps, new challenges and emerging needs

✓ Enhance **communication and dissemination activities** with stakeholders

https://www.climateurope.eu/

THANK YOU FOR

YOUR ATTENTION !

Division for Applaied climatology and agrometeorology
Ana Šovljanski
ana.sovljanski@hidmet.gov.rs
Slavica Radovanović
slavica.radovanovic@hidmet.gov.rs

SEEVCCC
Aleksandra Kržić
Aleksandra.krzic@hidmet.gov.rs
Goran Pejanović
goran.pejanovic@hidmet.gov.rs

www.hidmet.gov.rs
www.seevccc.rs