REPUBLIC OF SLOVENIA
MINISTRY OF AGRICULTURE AND THE ENVIRONMENT
SLOVENIAN ENVIRONMENT AGENCY

DMCSEE
Drought Management Centre for Southeastern Europe

DROUGHT MONITORING –
A framework to support drought management in SEE Europe

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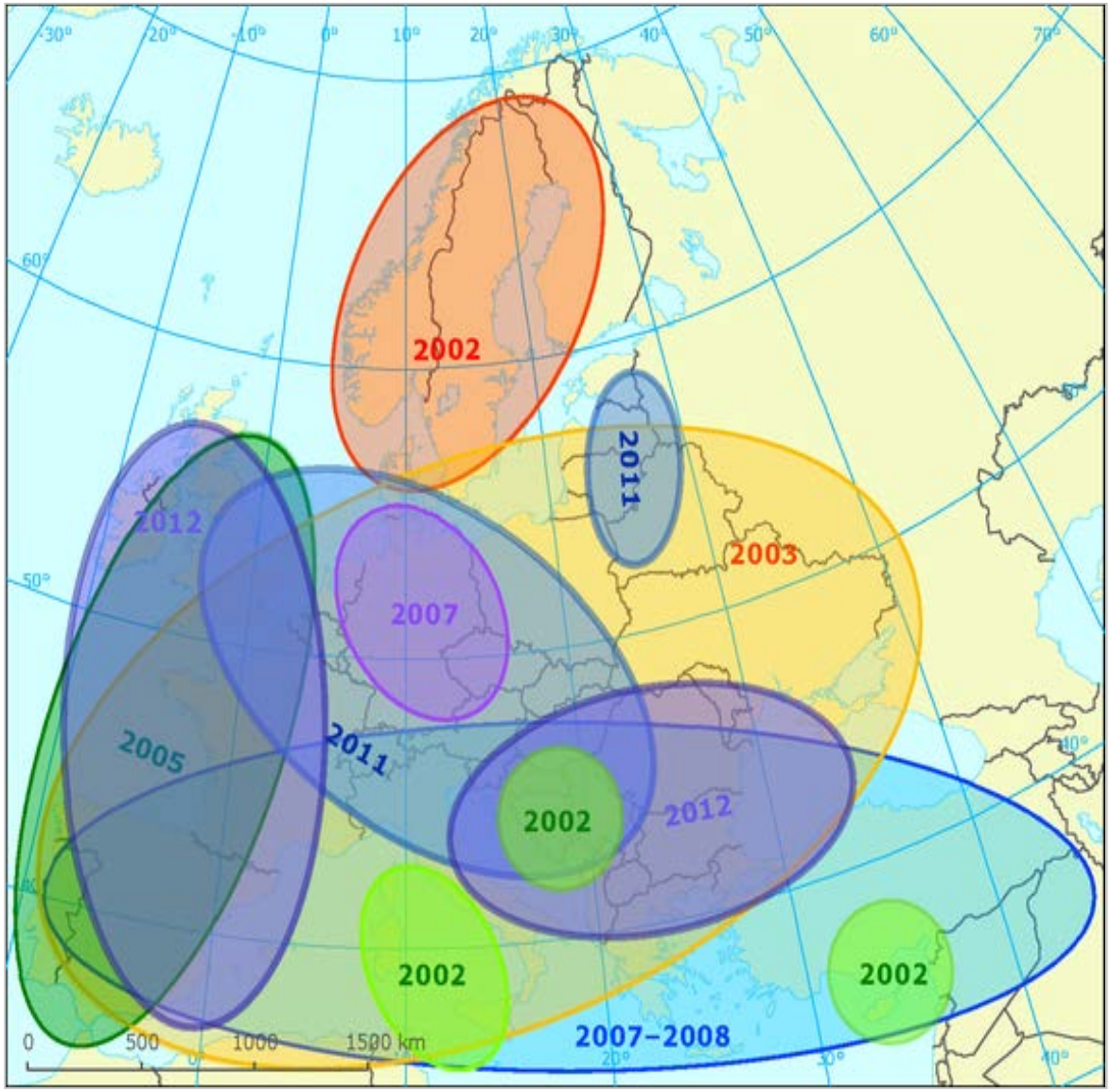
Training course on the use of satellite products for drought monitoring and agro-meteorological applications
Budapest,Hungary, 24-28 April 2017

Drought reality 2000–2012

(EEA ..., 2012)

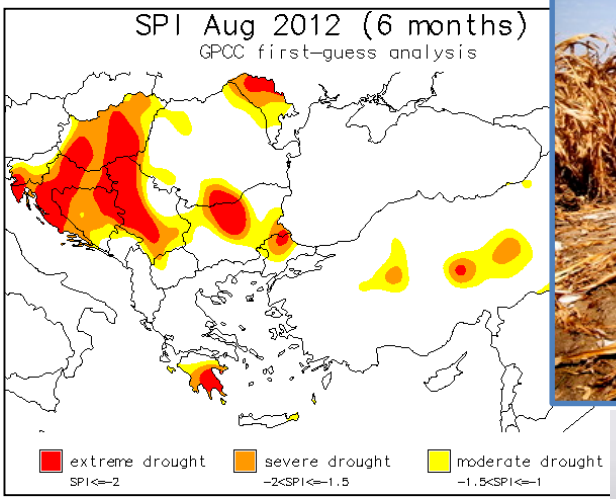


- Europe has been affected by several major droughts in recent decades.
- **Severity and frequency of droughts appear to have increased in parts of Europe**, in particular in southern and south-eastern Europe.
- Extended drought events have repeatedly affected also Western- and Central Europe (Rebetez et al., 2006), Scandinavia (Hisdal et al., 2006), Eastern Europe (Spinoni et al., 2013), and Russia (Arpe et al., 2012, Parry et al., 2010 and Parry et al., 2012).

Regional multisectoral drought impacts

Vir: Tuzla – problemi sa vodoopskrbo. Sutra, 2011

In past decades the drought-related damages in the region of South-Eastern Europe (SEE) have had large impact on the economy and welfare, **mainly reflected in destroyed crops and devastaded farmland**, disturbed water-supply, hydroenergy, transport, ….



Suša na Balkanu povzročila vsaj milijardo evrov škode

Celotna regija že več tednov ni imela dežja, temperature pa so se povzpele preko 40 stopinj Celzija.

Pl. K., Delo.si
sob, 25.08.2012, 13:43

Foto: Jože Suhadolnik /Delo

Beograd, Zagreb, Sarajevo - Balkan letos pesti

Suša "gasi" svjetla na Balkanu

Amerin M. | četvrtak, 06 September 2012 11:08

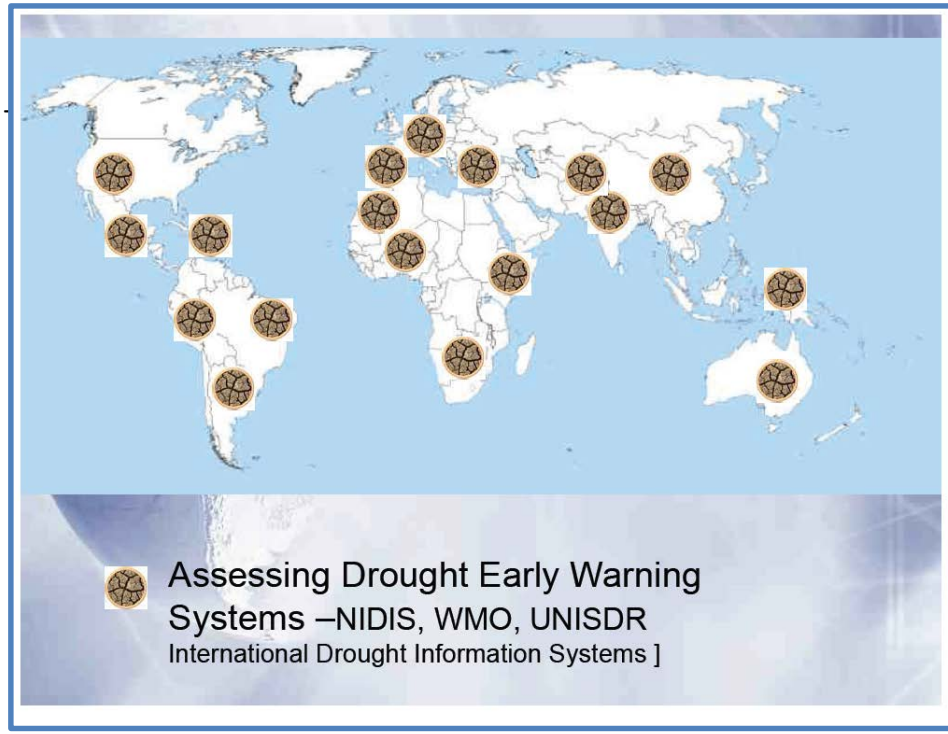
Sviđa mi se | Pošalji | Budi prvi među svojim prijateljima kome se ovo sviđa.

bh reporter

2006-2010
15% of the EU territory 17% of the EU population were affected by drought (EEA, 2012)

Drought management platforms - DMCs

- *Global Drought Monitor* (GDM): http://drought.mssl.ucl.ac.uk - UK,
- *SPEI Global Drought Monitor*: http://sac.csic.es/spei/map/maps.html - South America,
- *Chile drought monitor*: http://sac.csic.es/spei/map/maps.html - Chile,
- *The National Integrated Drought Information System (NIDIS)* and *National Drought Mitigation Center* (*NDMC*): http://drought.unl.edu/ - USA,
- ***European Drought Observatory (EDO):* http://edo.jrc.ec.europa.eu/ –Europe,**
- ***Drought Management Centre for Southeastern Europe (DMCSEE):* http://www.dmcsee.org/ – South-East Europe,**
- ***Integrated Drought Management Programme (IDMP)*: http://www.droughtmanagement.info/**
- etc.



(Source: Pulwarty, 2013)

need for Balkan subregional center

1998

Center initiative – **"top-down" approach**
International Commission on Irrigation and Drainage (ICID) adopted a declaration which expressed the need to establish this centre to alleviate problems caused by drought in the area "Balkan Drought Workshop" in Poiana/Brasov (RO), co-sponsored by the UNCCD

2004

2006

triangle approach: UNCCD focal points, permanent representatives with the WMO + observers from UNCCD and WMO)
Workshop for national experts and representatives of National Meteorological and Hydrological Services where they agreed on DMCSEE within context of UNCCD

decision on DMCSEE host institution (procedure led by WMO)

advocacy, management, steering committee, active institutions in consortium

2007

political commitment of Slovenian government (permanent budget for the governance)

first drought monitoring products, fund raising

2009

Transnational cooperation programme (TCP), cooperation with Eurogeoss project and European Drought Observatory portal

2013

GWP project

G-WADI

2014

2015

ad hoc group - project preparation

Application of DRiDanube project (Danube TP)

2016

DMCSEE domain & activities 2006-2016

Drought Management Centre for Southeastern Europe - DMCSEE

Drought is a normal part of climate in virtually all regions of the world. South Eastern Europe is no exception; in past decades the drought-related damages have had large impact on the economy and welfare. Therefore the need to establish a Drought Center for SE Europe to alleviate the problems caused by drought in the area became evident at the end of the past century. The idea was further elaborated by International Commission on Irrigation and Drainage (ICID) and UN Convention to Combat Desertification (UNCCD). The UNCCD national focal points and national permanent representatives with the World Meteorological Organization have agreed upon the core tasks of the Drought Management Center for South Eastern Europe (DMCSEE) and the proposed project document.

The mission of the proposed DMCSEE is **to coordinate and facilitate the development, assessment, and application of drought risk management tools and policies in South-Eastern Europe with the goal of improving drought preparedness and reducing drought impacts.** Therefore DMCSEE will focus its work on monitoring and assessing drought and assessing risks and vulnerability connected to drought.

DMCSEE Project Proposal

Founding countries:

- → Albania
- → Bosnia and Herzegovina
- → Bulgaria
- → Croatia
- → FYROM
- → Greece
- → Hungary
- → Moldova
- → Romania
- → Slovenia
- → Turkey
- → Montenegro
- → Serbia

Founding agencies:

- → WMO
- → UNCCD

Latest news

DMCSEE in economic delegation of the Slovenian Ministry for Foreign Affairs in the Kingdom of Morocco (11.04.2016)

Drought bulletin 17th November 2015 (18.11.2015)

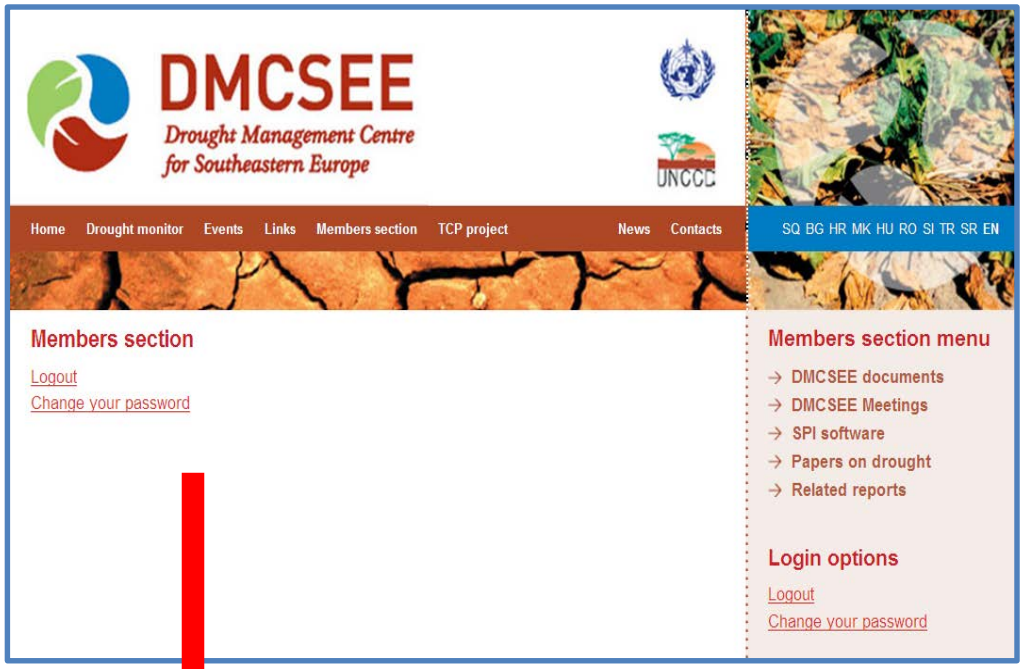
Drought bulletin 14th October 2015 (15.10.2015)

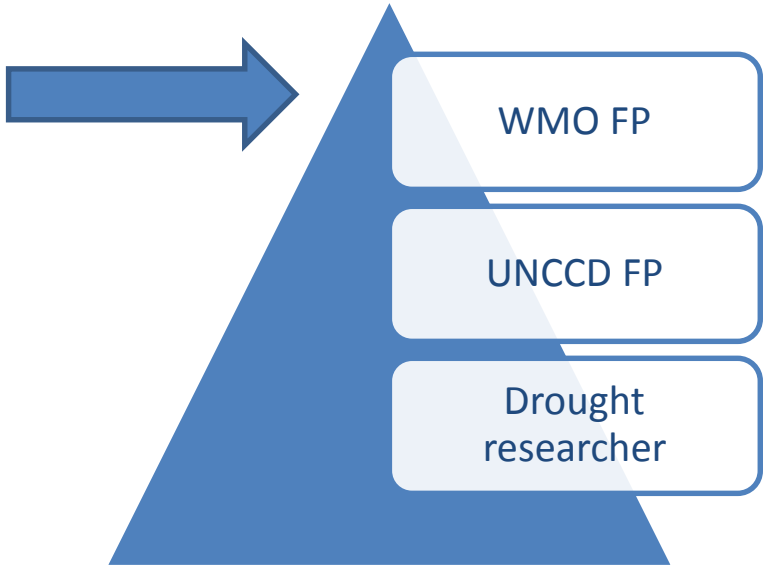
Links

›› UNCCD
›› WMO
›› SEE TCP

www.dmcsee.org

DMCSEE consortium and operational meetings



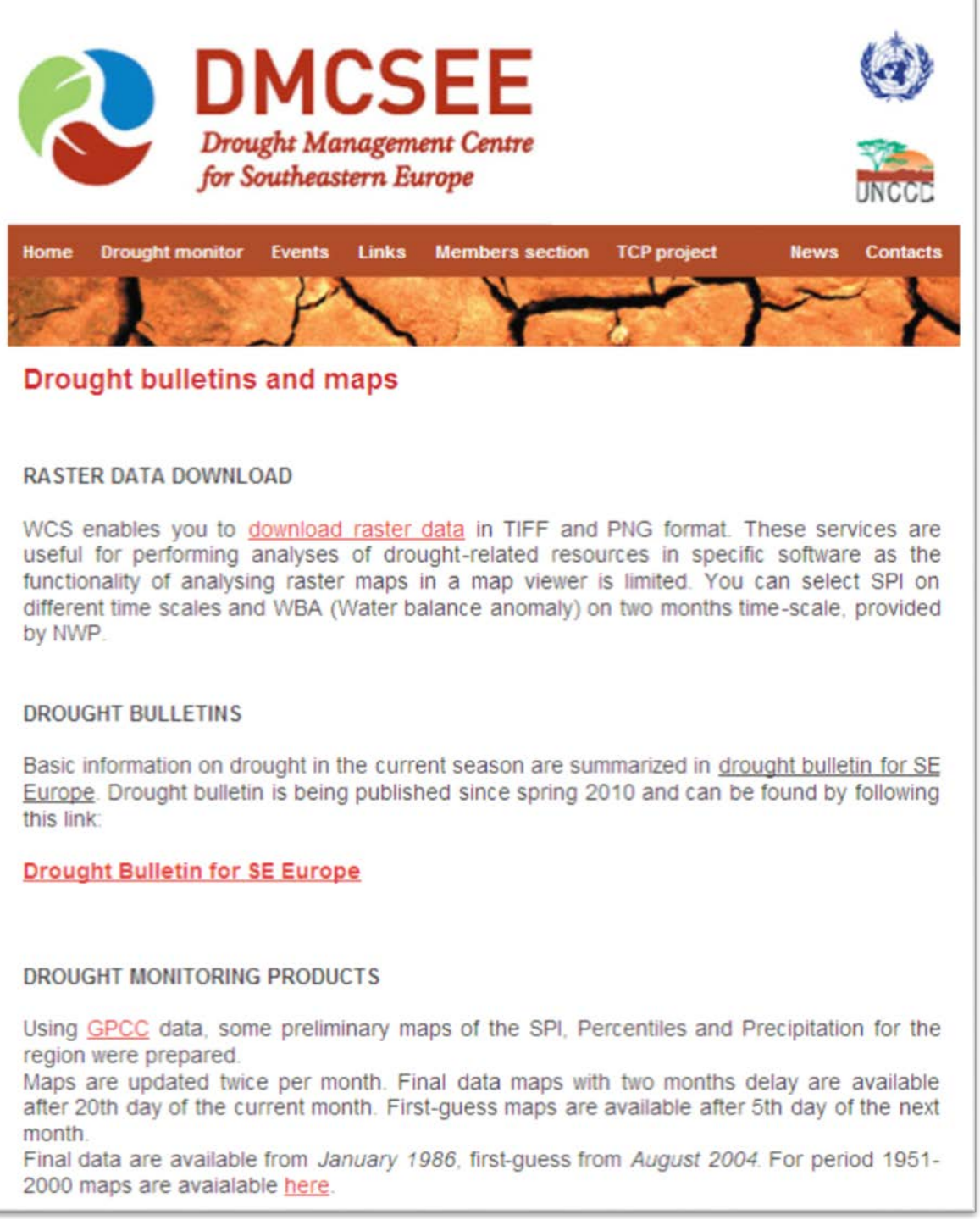


Members section
DMCSEE documents
DMCSEE meeting reports
Software for drought products

DMCSEE
Drought Management Centre for Southeastern Europe

Why DMCSEE and our products?

- SE Europe regional overview of information on drought,
- Tools (models) for visualization and analysis of drought event,
- Set of information resources organized for the collection, processing, maintenance, transmission, and dissemination of information in accordance with defined procedures to meet specific regional/national needs;
- Access to regional and national drought information;
- New approaches: development in RS in comparison to conventional measurements available in global/regional exchange trigerred common approaches;
- but country drought products prepared from local measurements are crucial for drought status assessment.
- DMCSEE support to stakeholders
  - EDO is developed by of Joint Research Centre (JRC)/a department of the European Commission providing independent scientific and technological support for EU policy-making: **http://edo.jrc.ec.europa.eu/edov2/**



ToR- mission

To assess the data available for effective drought monitoring and early warning system.

ToR- mission

To evaluate and select the most effective and reliable indices and indicators for drought assessment.

Short term forecast

Outlook (up to 10 days ahead)
NWP model forecast

Real time monitoring

SPI index (GPCC)
Station data (Slovenia only)
NWP analysis:
- precipitation anomaly
- water balance anomaly

Remote sensing: LSA-SAF

Long term forecast

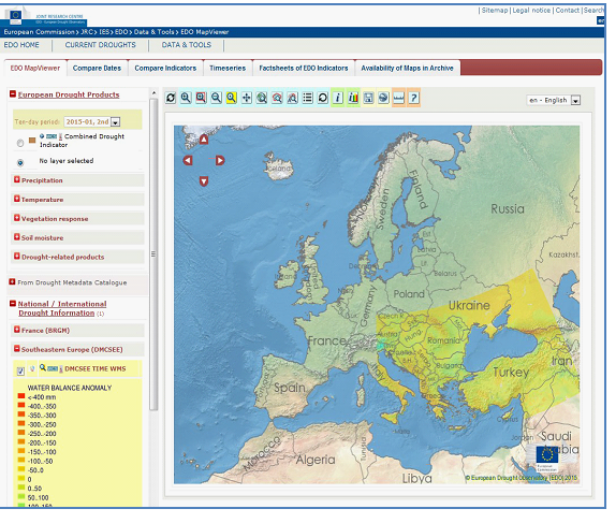
Not operational
Cooperation with VCCC (Serbia)

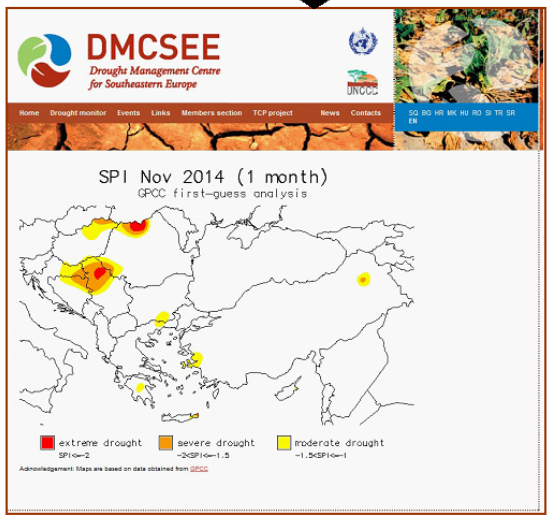
International exchange (EDO)

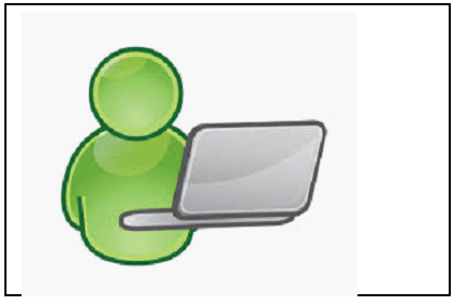
Database Map server

Historical reconstruction

Station and raster archive
Impact archive



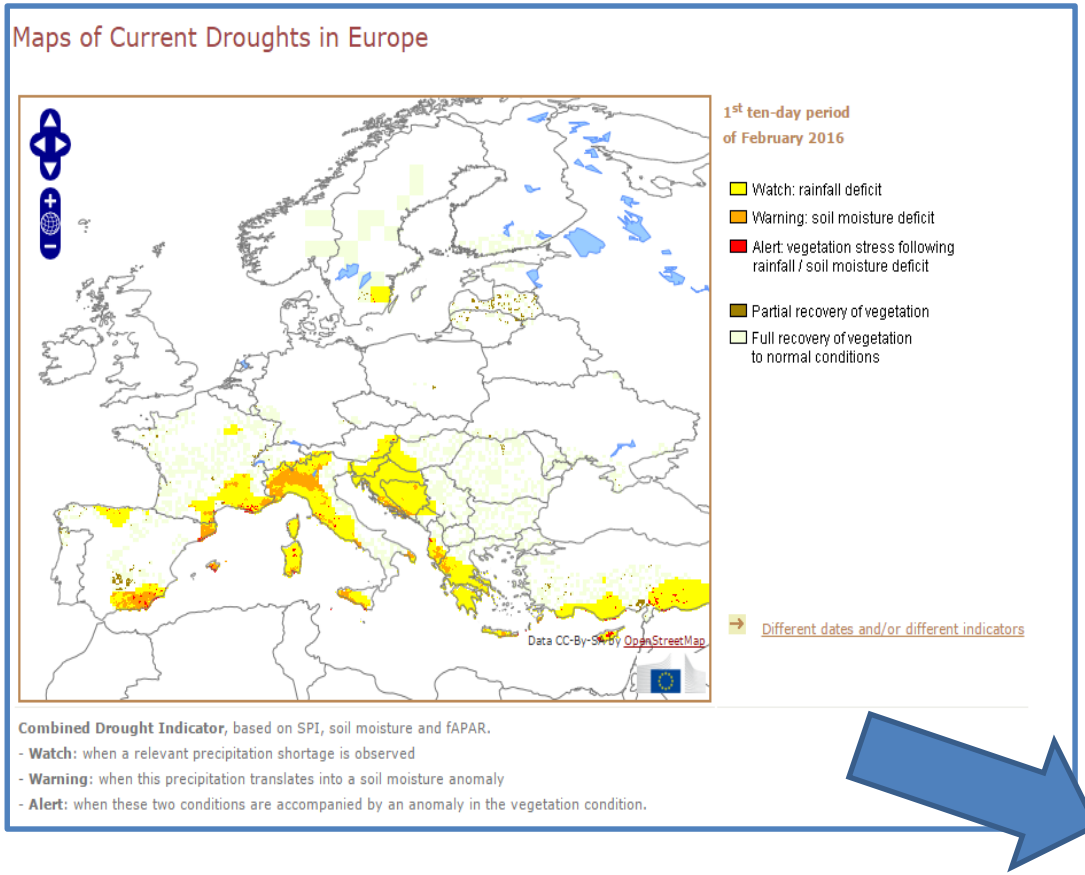




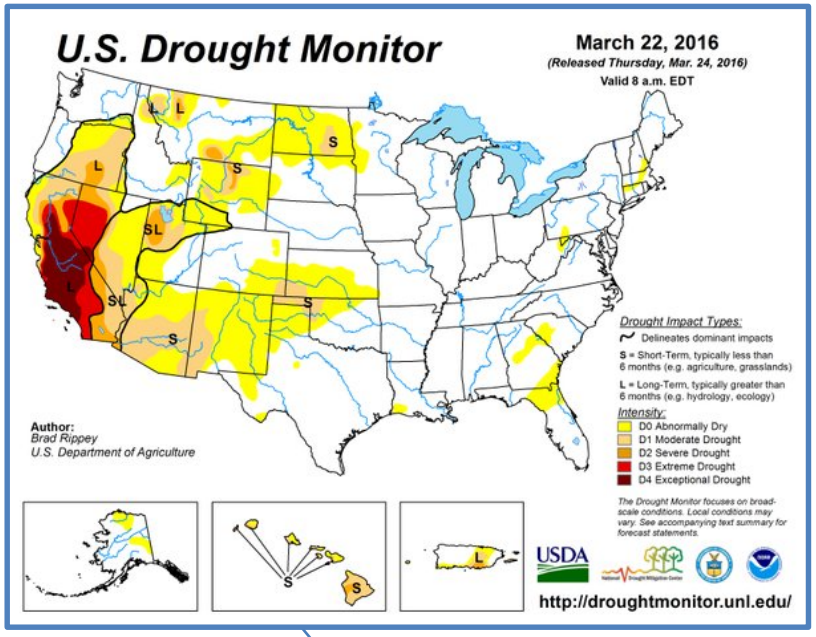
Drought indicators development

Situation of Combined Drought Indicator in Europe – CDI, february 2016, Europe

http://edo.jrc.ec.europa.eu



Drought situation USA, March, 2016



California drought 2011-2014 Folsom Lake, north of Sacramento, California

Including drought management center for SEE (DMCSEE) http://www.dmcsee.org

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Drought 2013 through EDO MapViewer/DMCSEE

Interoperability; INSPIRE Directive – infrastructure for Spatial Information in Europe

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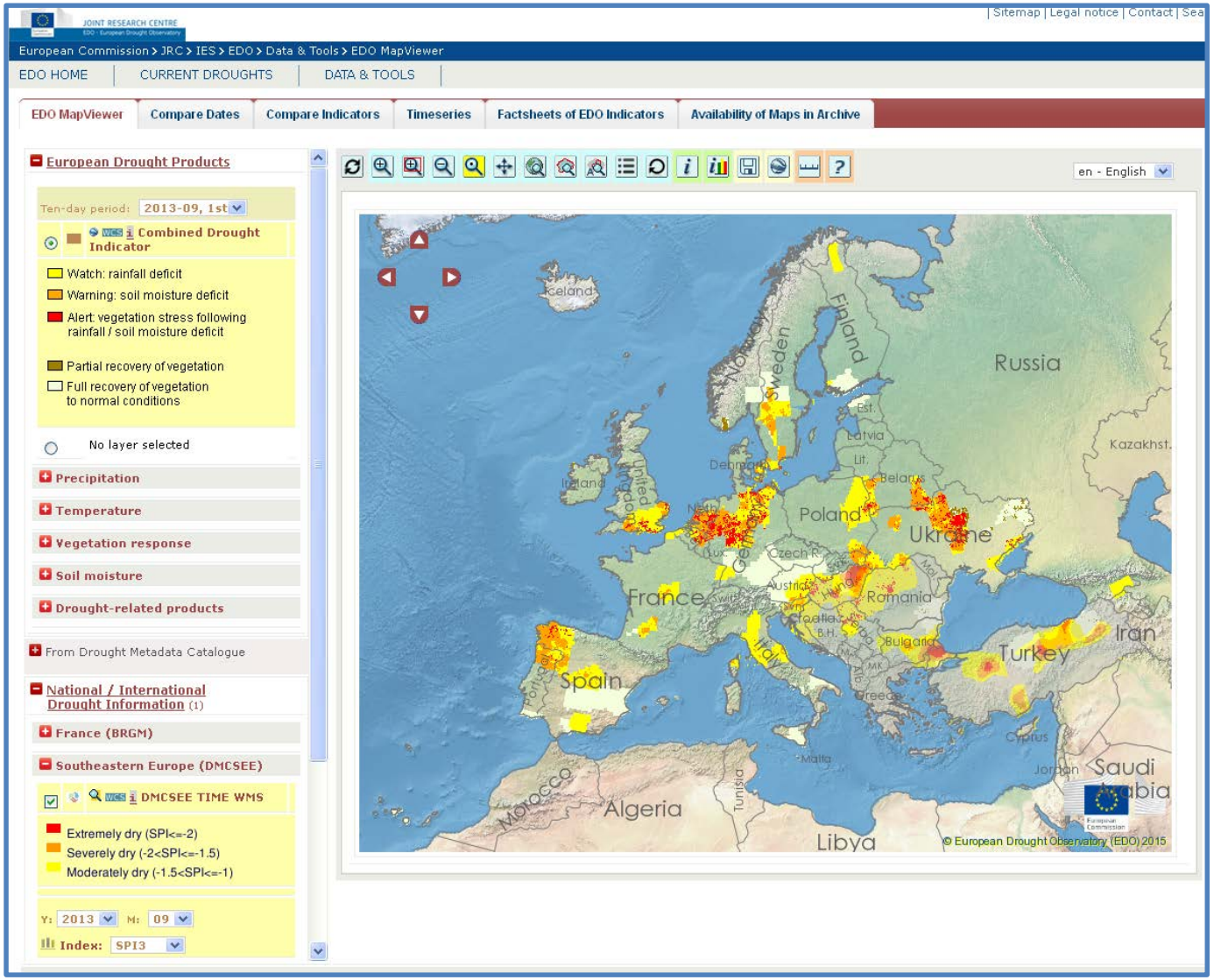

Drought bulletin

- ✓ **Implementation of standardized precipitation index**
- ✓ Maps of SPI, percentiles and precipitation for the SEE region
- ✓ **Historical maps (record 1951-2000)**
- ✓ **Data origin: GPCC data/ update once per month**

DROUGHT MONITORING PRODUCTS

Using GPCC data, some preliminary maps of the SPI, Percentiles and Precipitation for the region were prepared.
Maps are updated twice per month. Final data maps with two months delay are available after 20th day of the current month. First-guess maps are available after 5th day of the next month.
Final data are available from *January 1986*, first-guess from *August 2004*. For period 1951-2000 maps are avaialable here.
Latest maps for **2010** are available below.

SPI

One of the most robust drought indices is so called Standardized Precipitation Index (SPI). The SPI can be calculated at various time scales which reflect the impact of the drought on the availability of water resources. The SPI calculation is based on the distribution of precipitation over long time periods (30 years (1961-1990) was used). The long term precipitation record is fit to a probability distribution, which is then normalised so that the mean (average) SPI for any place and time period is zero.

SPI values above zero indicate wetter periods and values less than 0 indicate drier periods.

Please select year, month, time scale and data type:
2014 | January | 1 month
○ first-guess
○ final
Submit>>>

Percentiles and precipitation

Another way to define drought are percentiles. A percentile is the value of a variable below which a certain percent of observations fall. Long term precipitation record is sort by rank by month; 50 years period (1951-2000) was used. The 5th (10th, 15th etc.) percentile is the value below which 5 (10, 15 etc.) percent of the observations may be found. The 25th percentile is also known as the first quartile; the 50th percentile as the median.

Percentile values above 50 indicate wetter periods and values less than 50 indicate drier periods.

Please select data, year, month and data type:
Percentiles | 2014 | January
○ first-guess
○ final
Submit>>>

Drought Bulletin for SE Europe

- **Hot spot** - short summary, short insight of possible circumstances of drought at the time of issue.
- Additional and auxiliary information (such as methodology used, more detailed information on water balance or temperature situation)
- **Report on drought impacts (more about agricultural drought impacts is missing!)**
- **Outlook**

Check new bulletin issued on May 16, 2016 on web page

SOUTH EAST EUROPE
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DMCSEE
Drought Management Centre for Southeastern Europe

Programme co-funded by the EUROPEAN UNION

DROUGHT MONITORING BULLETIN

16th May 2016

HOT SPOT

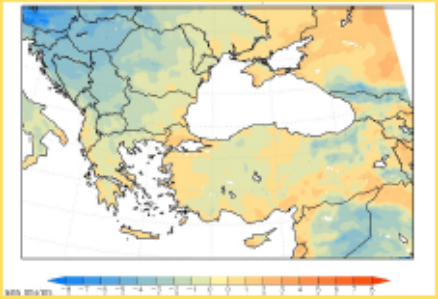
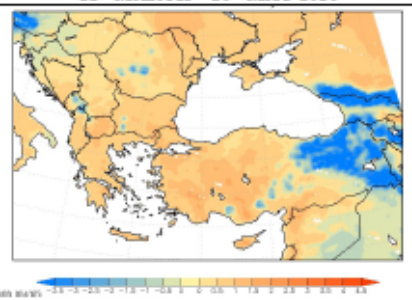


Figure show 10-day anomalies of average minimum air temperatures from April 21-30, 2016.
Extremely cold air mass spread across central Europe and major part of Balkan in third decade in April, after unusually warm period in April, which causes fast vegetation development. Air temperatures anomalies were negative almost in the whole region. The largest deviations were detected at the north-west, where minimum air temperature anomalies were from 2 to 5 °C. In some areas cold spell causes damages due to the frost.

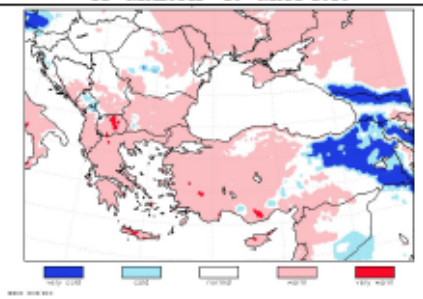
AIR TEMPERATURES AND SURFACE WATER BALANCE

Figures in this section present anomalies of the average air temperature and accumulated water balance and classified values of average air temperature and water balance in percentile classes for 60-days period from 12th March to 10th May 2016.

AVERAGE AIR TEMPERATURE ANOMALY (°C)
12th MARCH – 10th MAY 2016



AVERAGE AIR TEMPERATURE PERCENTILE CLASSES
12th MARCH – 10th MAY 2016



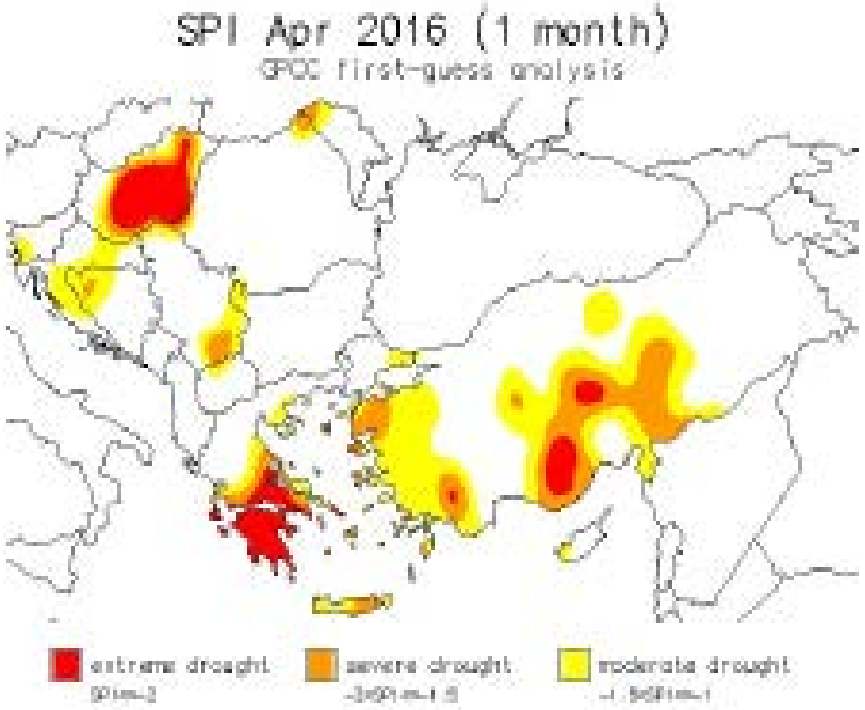
Figures of 60-day accumulated average air temperatures (from 12th March to 10th May) showed positive anomalies at the southern part of Balkan Peninsula and western part of Turkey. Despite the very cold spell at the end of April, first two Aprils decades were unusually warm, which predominate in this 60-days period. Air temperature anomalies in the southern Balkan Peninsula were up to 1 °C above the long term average, in western Turkey up to 1.5 °C. Meanwhile eastern part of Turkey was very cold, up to 3.5 °C below the ordinary values, mainly due to the very cold March and first decade in April.

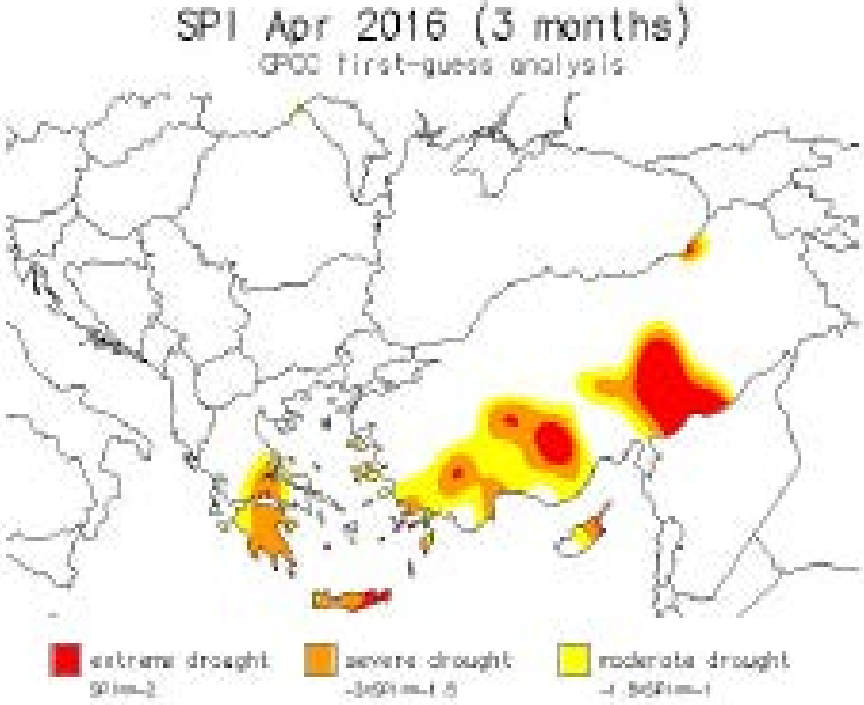
STANDARDIZED PRECIPITATION INDEX

The drought situation with regard to the precipitation accumulation is presented by Standardized Precipitation Index (SPI). The SPI calculation is based on the distribution of precipitation over long time periods (30 years, in our case long-term average 1961–1990 was used). The SPI can be calculated at various time scales which reflect the impact of the drought on the availability of water resources. The long term precipitation record is fit to a probability distribution, which is then normalized so that the mean (average) SPI for any place and time period is zero. SPI values above zero indicate wetter periods and values less than zero indicate drier periods. Only the dry part of the extreme anomalies is presented on the maps.

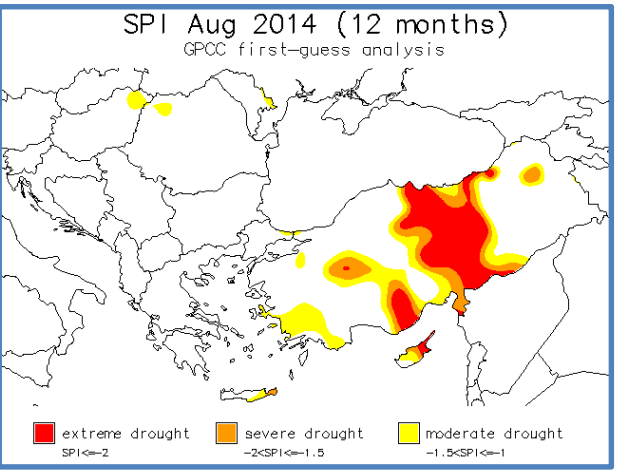
Standardized precipitation index showed larger lack of precipitation in April (left figure below) in major part of Hungary, southern Greece and moderate dry condition at the east and in southern Turkey. According to the SPI for three months, period from February to April (right figure below), lack of precipitation were detected at major part of southern Turkey and in southern Greece.

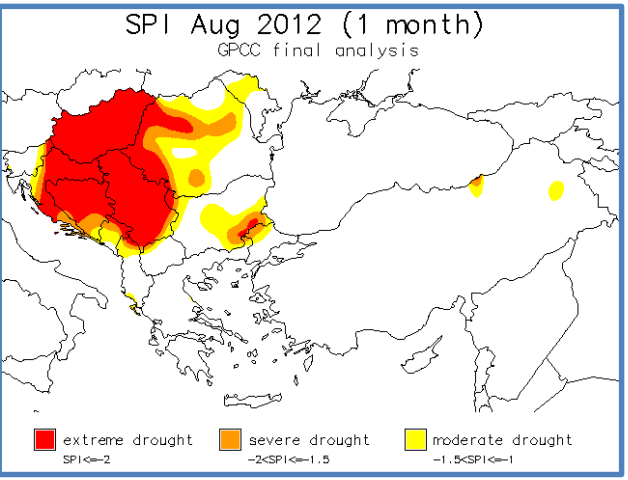
SPI manuals/ trainings performed by DMCSEE

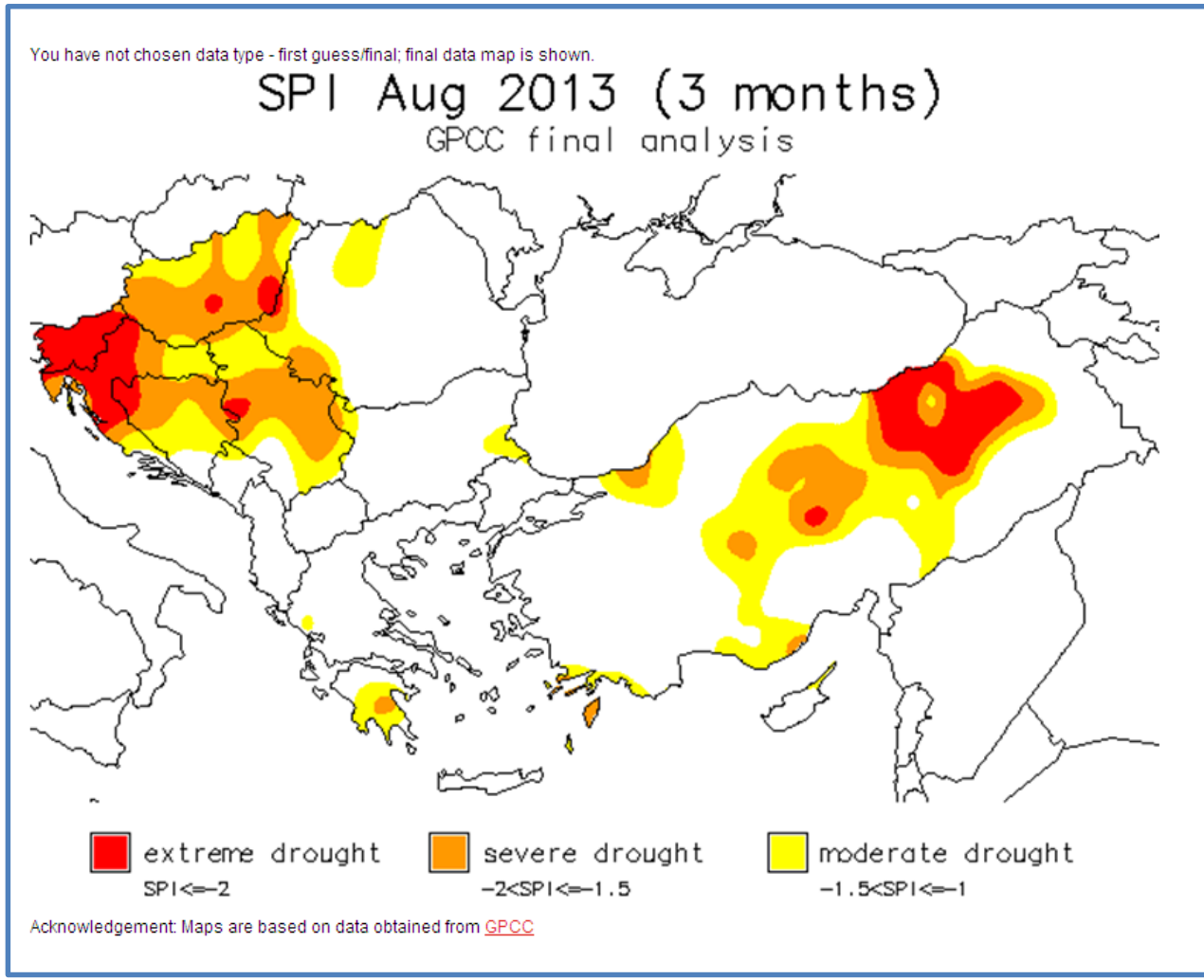




Drought monitor – meteorological drought







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OUTLOOK

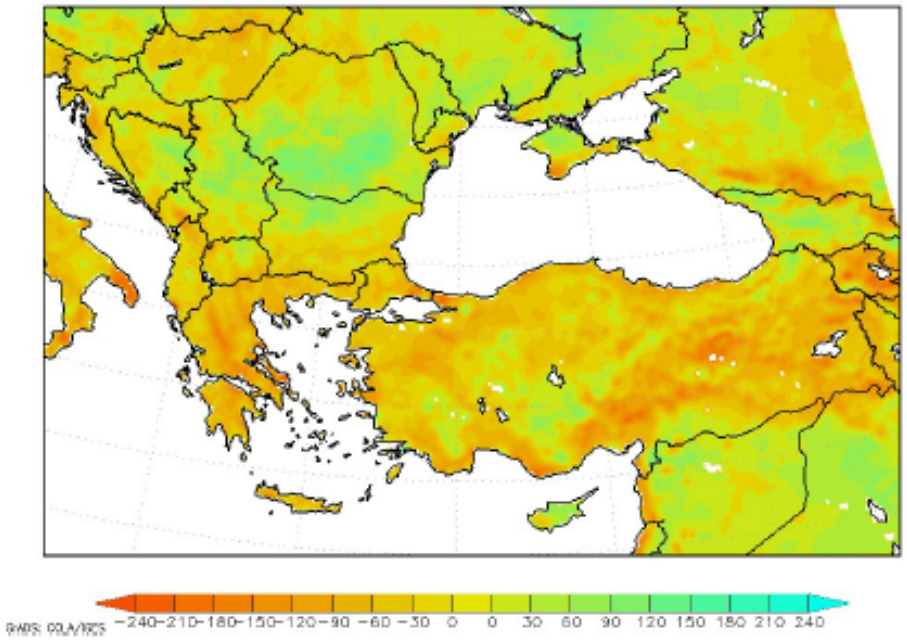


Figure presents the model simulations of the **60-days water balance anomaly** (mm) for the time period from **22nd March** to **20th May**. Water balance deficits in Turkey is supposed to deepen, present negative anomalies will become even larger. Similar outlook is for Greece, while central part of Balkan Peninsula will remain in wet range.

- **Drought related variables**

Water Balance anomaly

Soil moisture

Temperature (degree days)

- **Drought related time scale**

60 day accumulation,

10 day update

- **Drought related interpretation**

Deviation from normals, percentiles

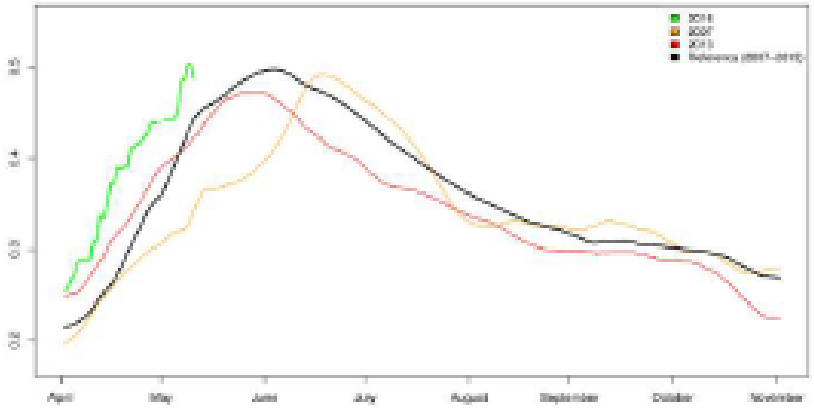
REMOTE SENSING – FRACTION OF VEGETATION COVER

Fraction of vegetation cover (FVC) is vegetation index, based on multi-channel remote sensing measurements (data from Eumetsat's LSA SAF data base is used for products in this bulletin). FVC shows fraction of the total pixel area that is covered by green vegetation, which is relevant for applications in agriculture, forestry, environmental management and land use, it has also proved to be useful for drought monitoring. Values vary according to the vegetation stage and of course to the damages of possible natural disasters (including drought). FVC values are lower at the beginning of the growth season, the highest at the full vegetation development and then FVC slowly drops with vegetation senescence. Line shape depends on sort of the vegetation.

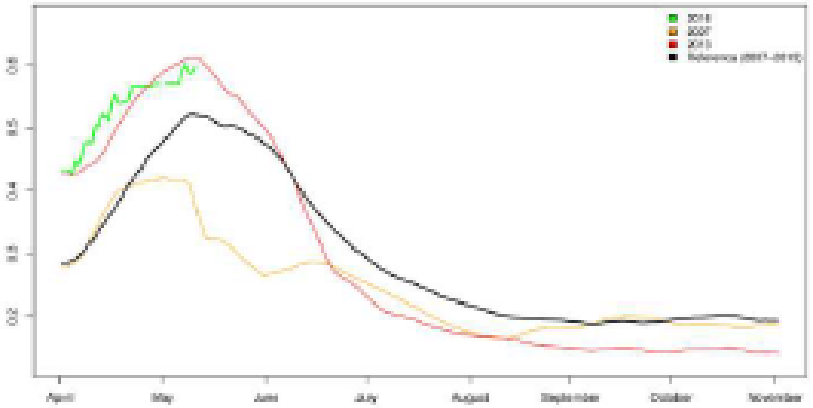
Graphs below present the **vegetation situation** recorded **on 10th May** in some regions of south-eastern Europe. FVC values for year 2016 are presented as green line. Graphs also include reference line (2007–2015) in black, and lines in red (year 2013), and orange (year 2007) for comparison.

FYRO MACEDONIA

Tikveš Region – Kavadarci

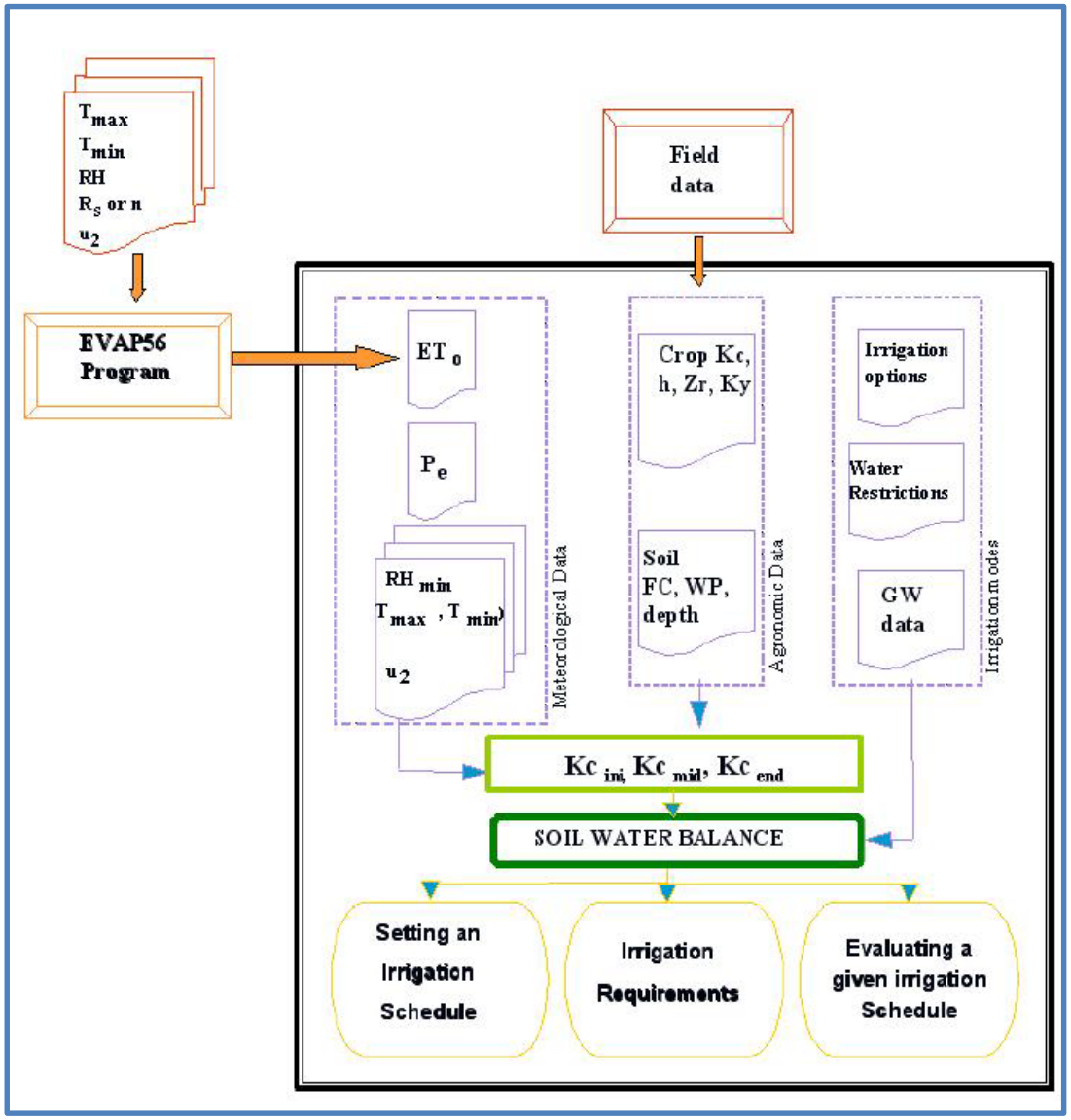


Ovče Pole Region – Lozovo



Vegetation development in the south (Tikveš Region) and central (Ovče Pole Region) part of the country also showed good vegetation start of the season according to the FVC. At beginning of the season were FVC values higher for about 5 % in Tikveš Region and 10 % in Ovče Pole Region, where vegetation development follows those from year 2013.

Attempts to detect agricultural drought



- ✓ DMCSEE attempts with irrigation scheduling model
- ✓ WinISAREG model (developed by L. S. Pereira at Technical Univeristy of Lisbon)
- ✓ Data availability (soil, crop, weather)

Simplified flow-chart of WinISAREG model

Recent developments –

Application of remote sensing data - EUMETSAT LSA SAF products

(Satellite Application Facility on Land Surface Analysis)

- ✓ FVC (Fraction of Vegetation Cover) can be used to detect “green” vegetation
- ✓ LSA SAF product – spatial resolution cca 4 km
- ✓ Vineyards – one of best options form homogene cultivated area in Slovenia

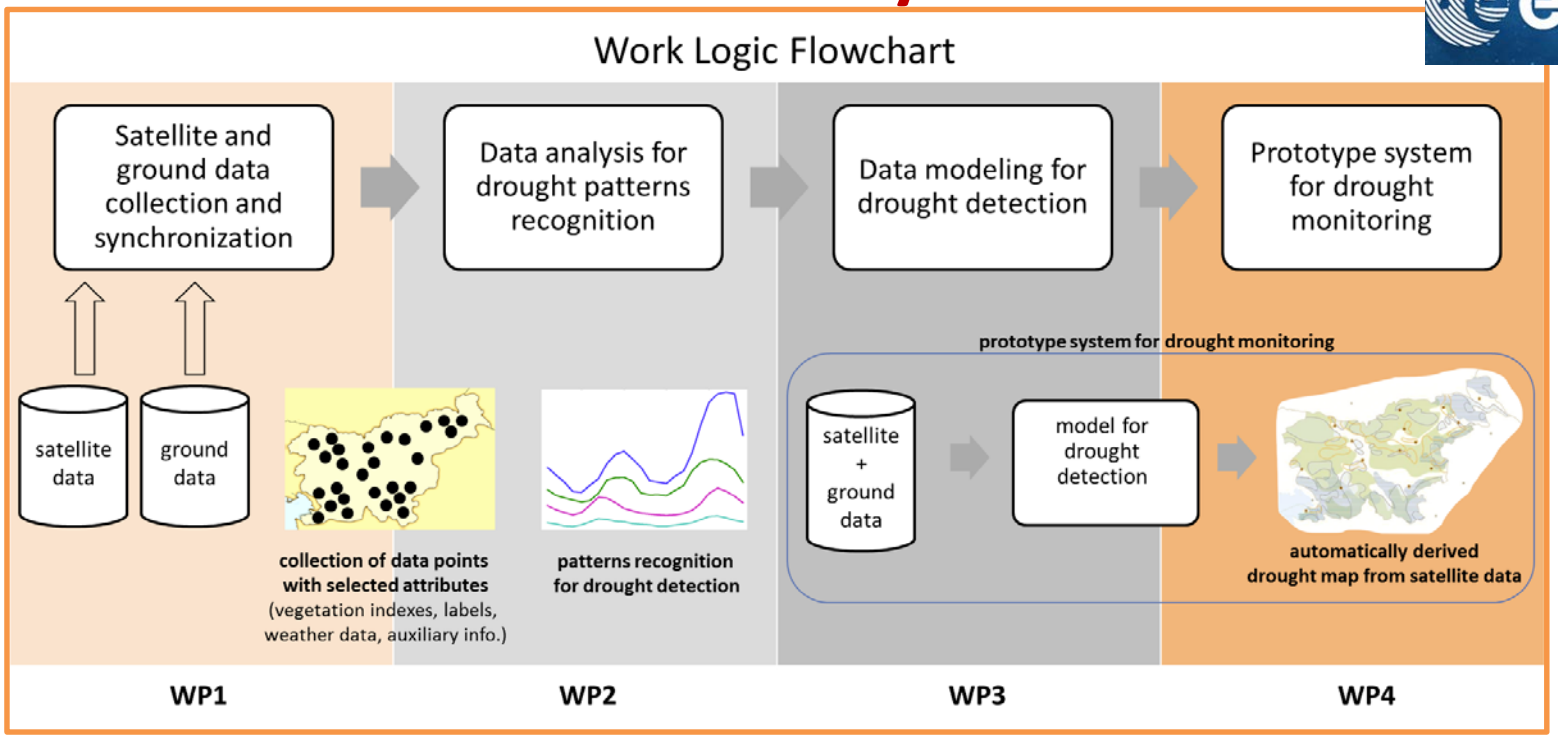
Vegetation indices found useful for monitoring possible drought-induced vegetation stress

FVC and LAI preferred over NDVI (possible ground truth)

LSA SAF valuable auxiliary information (despite coarse resolution)

Currently, most valuable information deduced from point time series. Need for objective recognition of drought patterns.

Implementation of the SatDroughtMon project funded by ESA



- project was launched in February 2013 by Slovenian Centre of Excellence SPACE-SI in cooperation with Slovenian Environment Agency, DMCSEE and University of Primorska, funded by ESA.
- The main aim of the research is to develop an automatic system for satellite drought monitoring.
- This is to be done with machine learning for building classification and prediction systems and will be based on satellite data as well as ground measurements collected by different authorities in Slovenia.
- The results of the project will have an impact on drought monitoring with a particular applicability in diverse landscapes.
- Work will be focused on Slovenia, but its implications are much broader and could be transferred to any other region of the world.

Widden the pool

World Meteorological Organization
Weather • Climate • Water

Regional/ international cooperation;

Research coordination across disciplines and national boundaries;

Strenghten and foster knowledge exchange on climate change and adaptation.

DMCSEE
Drought Management Centre for Southeastern Europe

Global Water Partnership
Central and Eastern Europe

Project work.

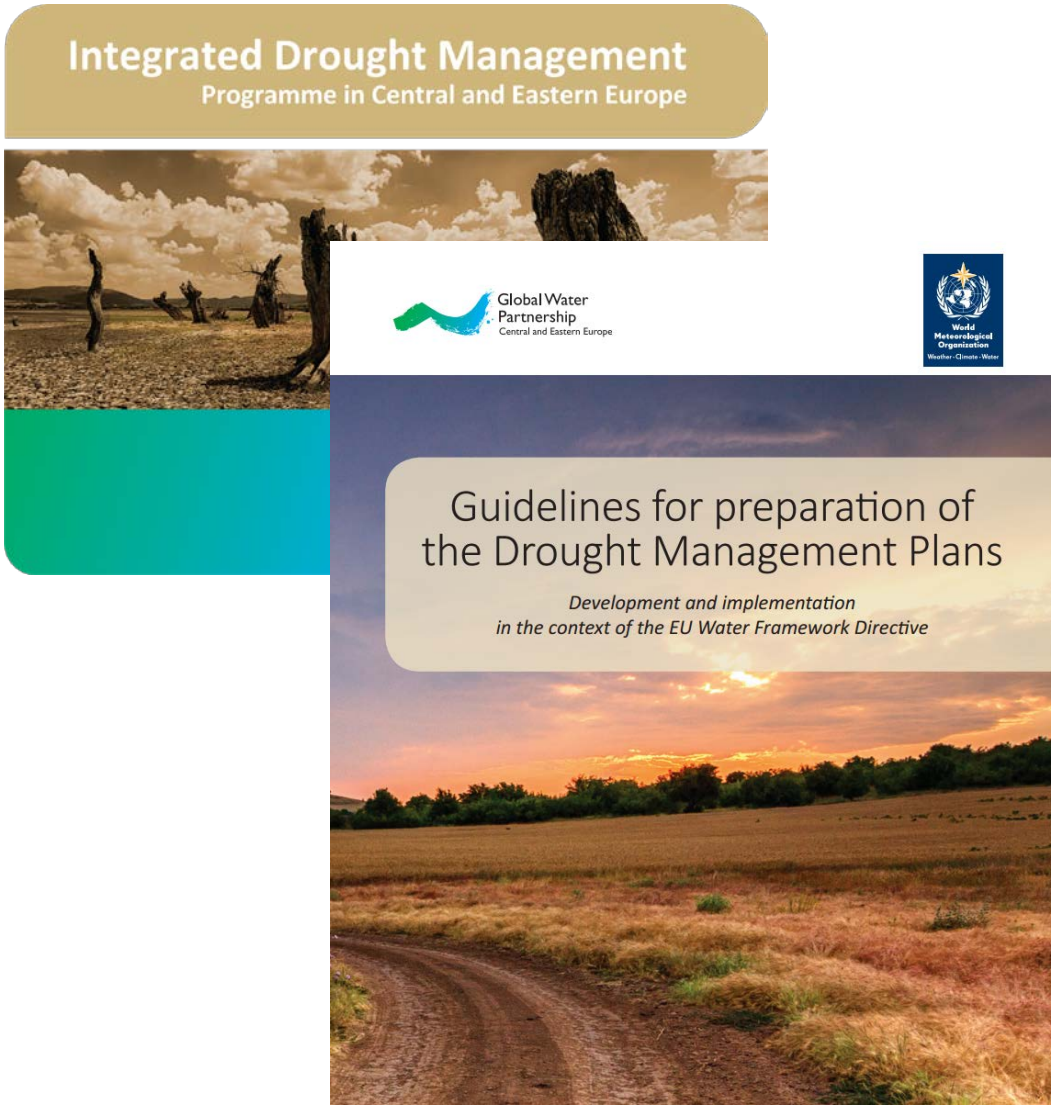
Project partners.

http://www.dmcsee.org/en/tcp_project/

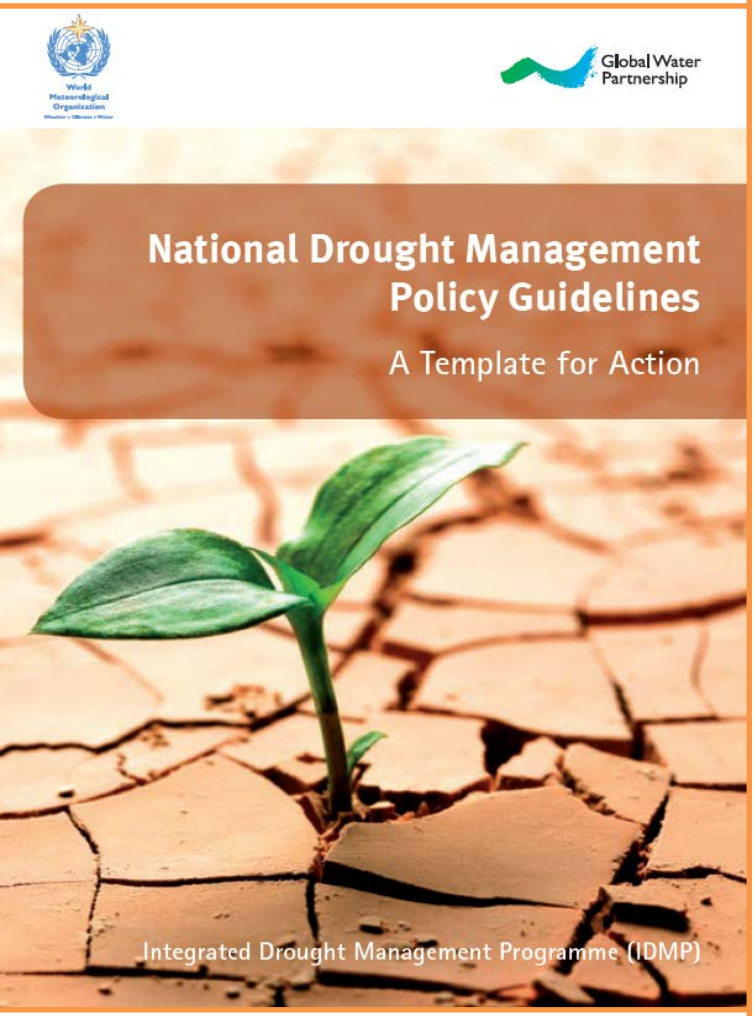
The objective of the DMCSEE TCP project was to coordinate and facilitate the development, assessment, and application of drought risk management tools and policies in South-Eastern Europe with the goal of improving drought preparedness and reducing drought impacts.

- **from September 2009 till May 2012**
- a project in the frame of Transnational Cooperation Programme of SE Europe (TCP)
- since 2013 it is partially operational, and supported by the Slovenian Government
- DMCSEE cooperate with the WMO and GWP funded Integrated Drought Management Programme (2013-2015)

WMO/GWP Integrated Drought Management Programme in CEE (IDMP) – platform & good practice compendium, 2013- 2015



- **Integration of national data into DMCSEE portal**
- Better quality of products and composites, calculated automatically
- **Importance of national focal points and data providers**



The 10 steps in the drought policy and preparedness process are:

Step 1: **Appoint** a national drought management policy commission

Step 2: **State** or **define** the goals and objectives of a risk-based national drought management policy

Step 3: **Seek** stakeholder participation; **define** and **resolve** conflicts between key water use sectors, considering also transboundary implications

Step 4: **Inventory** data and financial resources available and **identify** groups at risk

Step 5: **Prepare/write** the key tenets of the national drought management policy and preparedness plans, including the following elements: monitoring, early warning and prediction; risk and impact assessment; and mitigation and response

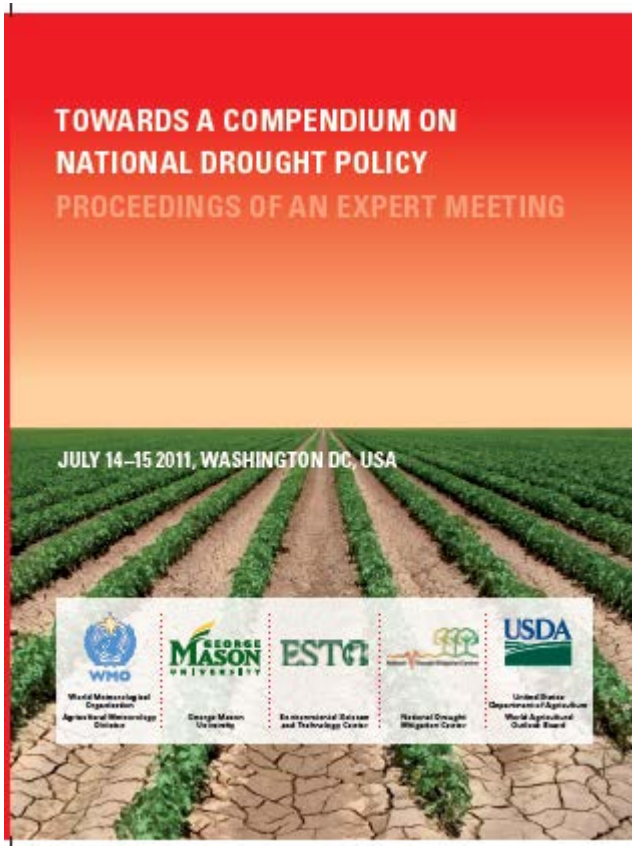
Step 6: **Identify** research needs and **fill** institutional gaps

Step 7: **Integrate** science and policy aspects of drought management

Step 8: **Publicize** the national drought management policy and preparedness plans and **build** public awareness and consensus

Step 9: **Develop** education programmes for all age and stakeholder groups

Step 10: **Evaluate** and **revise** national drought management policy and supporting preparedness plans



Instructions for better drought management and drought policy

Recent project application: Drought Risk in the Danube Region - DRiDanube

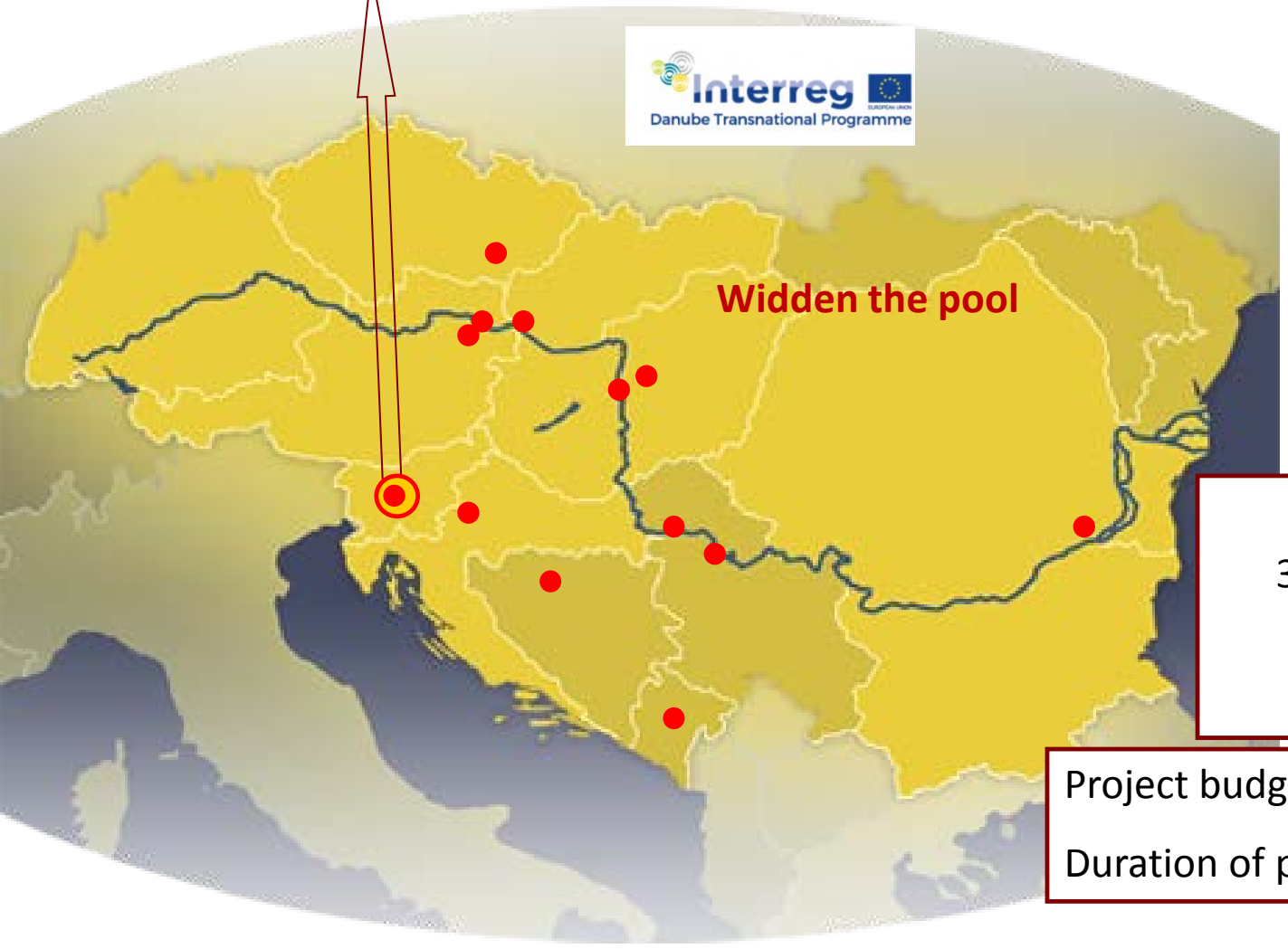
Lead Partner: Slovenian Environment Agency

(Drought Management Centre for Southeastern Europe)

DMCSEE
Drought Management Centre for Southeastern Europe

REPUBLIC OF SLOVENIA
MINISTRY OF AGRICULTURE AND THE ENVIRONMENT
SLOVENIAN ENVIRONMENT AGENCY

Interreg
Danube Transnational Programme



Slovenia 2
Austria 2
Czech Republic 1
Slovakia 2
Hungary 2
Romania 1
Croatia 1
Serbia 2
Montenegro 1
Bosnia and Herzegovina 1

7 EU countries

3 Non-EU countries

15 partners

8 ASP partners

Project budget: 2 mio EUR

Duration of project: 30 months