

# DriDanube

## “Drought Risk in the Danube Region”

Wolfgang Wagner on behalf of the Project Team

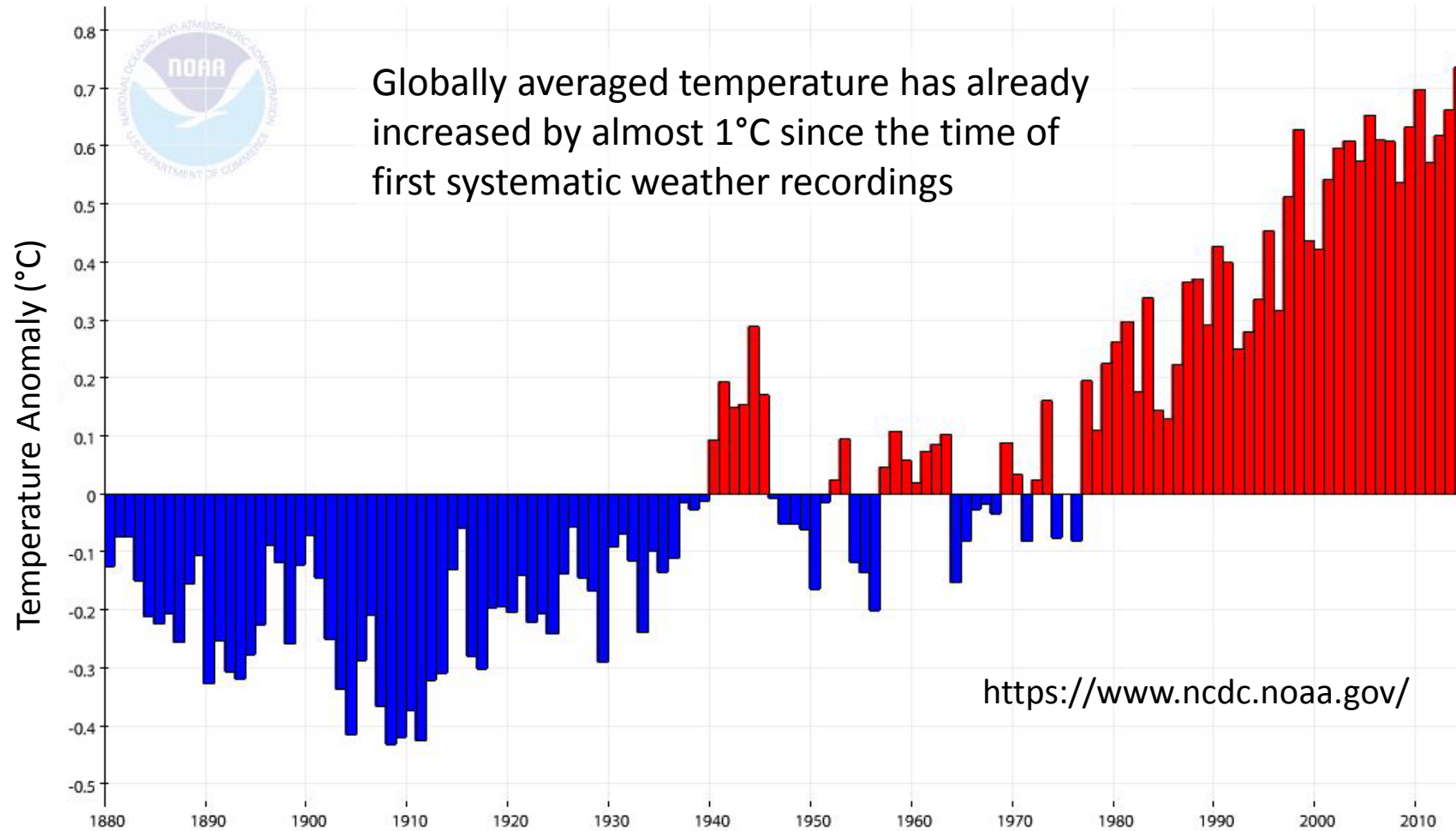


Department of Geodesy and Geoinformation (GEO)  
Vienna University of Technology (TU Wien)

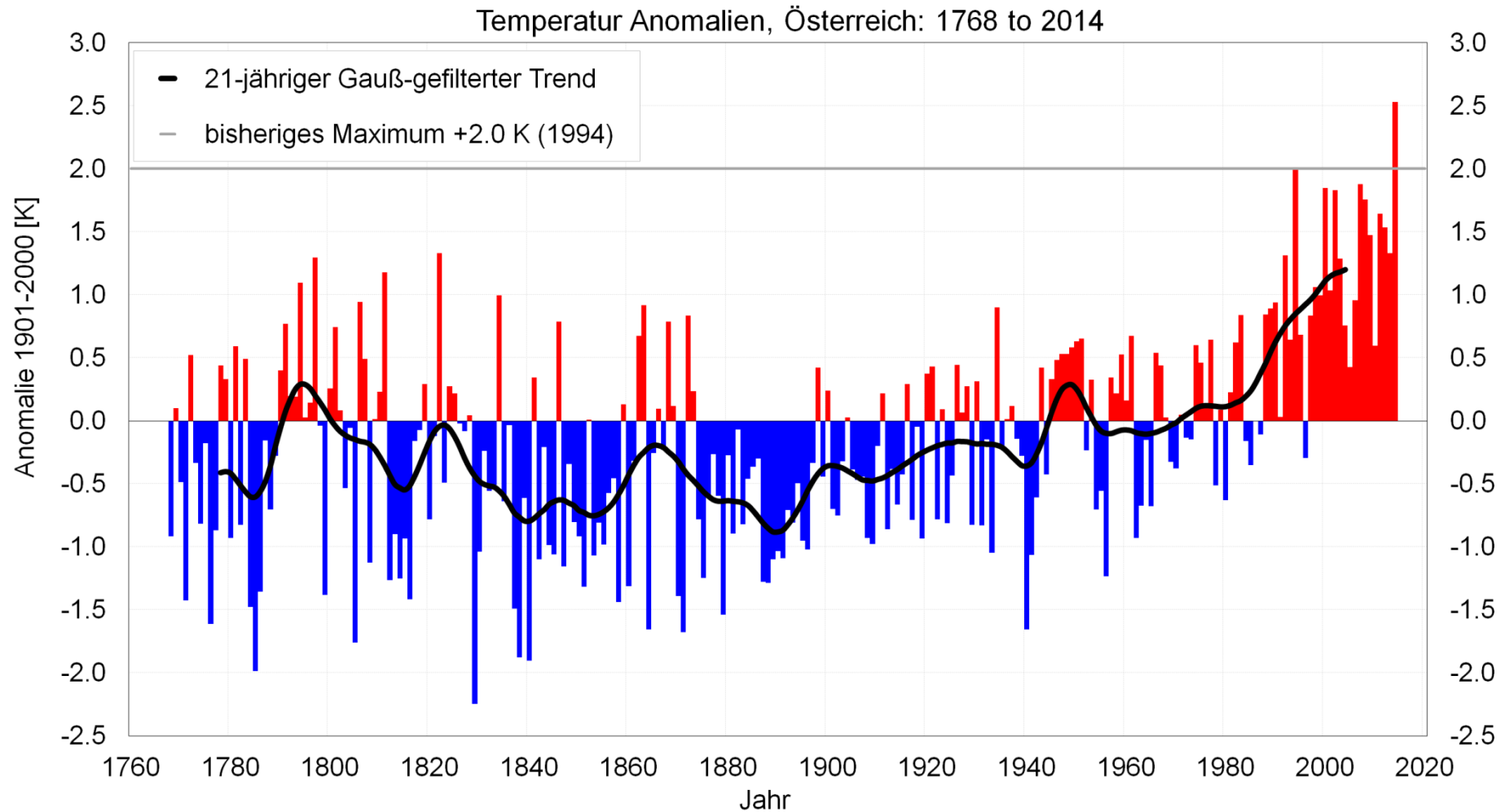
*Budapest, 26 April 2017*



# Global Warming Trend



# Warming Trend in Austria





Tauplitz 28 Dezember 2015







Maize field in Upper Austria 31 August 2015



# Adverse weather conditions for European wheat production will become more frequent with climate change

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Europe is the largest producer of wheat, the second most widely grown cereal crop after rice. The increased occurrence and magnitude of adverse and extreme agroclimatic events are considered a major threat for wheat production. We present an analysis that accounts for a range of adverse weather events that might significantly affect wheat yield in Europe. For this purpose we analysed changes in the frequency of the occurrence of 11 adverse weather events. Using climate scenarios based on the most recent ensemble of climate models and greenhouse gases emission estimates, we assessed the probability of single and multiple adverse events occurring within one season. We showed that the occurrence of adverse conditions for 14 sites representing the main European wheat-growing areas might substantially increase by 2060 compared to the present (1981-2010). This is likely to result in more frequent crop failure across Europe. This study provides essential information for developing adaptation strategies.

# General information

Project: **DriDanube - “Drought Risk in the Danube Region”**

Reference No: DTP1-182-2.4 - DriDanube

Programme: **Danube Transnational Programme (DTP)**

*Priority Area 2 (PA2): Environment and culture responsible  
Danube region*

*Specific Objective (SO2.4): Improve preparedness for  
environmental risk management*

Duration: January 2017 – June 2019 (**30 months**)

Project budget: **1.974.750,00 EUR**

# Partnership

- Lead partner: *Slovenian Environment Agency*
- ERDF & IPA partners (15)
- Associated Strategic Partners (ASP) (8)



## 7 EU countries:

- Austria (2)
- Czech Republic (1)
- Croatia (1)
- Hungary (2)
- Romania (1)
- Slovakia (2)
- Slovenia (2)

## 3 non-EU countries:

- Bosnia and Herzegovina (1)
- Montenegro (1)
- Serbia (2)



## Austria

Vienna University of Technology, **TU Wien**  
 EODC Earth Observation Data Centre for  
 Water Resources Monitoring GmbH, **EODC**  
**(ASP)** - Environment Agency Austria, **EAA**  
**(ASP)** - Austrian Federal Ministry of  
 Agriculture, Forestry, Environment and Water  
 Management, **BMLFUW**  
**(ASP)** - International Commission for the  
 Protection of the Danube River, **ICPDR**

## Slovenia

Slovenian Environment Agency, **ARSO**  
 Centre of Excellence for Space Sciences  
 and Technologies, **SPACE-SI**  
**(ASP)** - Administration of the RS for Civil  
 Protection and Disaster Relief, **URSZR**

## Croatia

Meteorological and Hydrological Service,  
**DHMZ**  
**(ASP)** - Ministry of Environment and Energy,  
 Water management directorate, **MZOIE**

## Czech Republic

Global Change Research Centre AS CR, v.v.i.,  
**CzechGlobe**  
**(ASP)** - The State Land Office, **SLO**



## Slovakia

Global Water Partnership Central and Eastern  
 Europe, **GWP CEE**  
 Slovak Hydrometeorological Institute, **SHMU**

## Hungary

Hungarian Meteorological Service, **OMSZ**  
 Szent Istvan University, **SZIU**,  
**(ASP)** - Ministry of Agriculture, **FM**

## Romania

National Meteorological Administration, **NMA**

## Serbia

**(IPA)** Faculty of Agriculture, University of Novi  
 Sad, **FAUNS**  
**(IPA)** Republic Hydrometeorological Service of  
 Serbia, **RHMSS**  
**(ASP)** - Agricultural Station/Forecasting and  
 Warning Service of Serbia in plant protection,  
**PIS**

## Bosnia and Herzegovina

**(IPA)** Republic Hydrometeorological  
 Service of Republic of Srpska, **RHMZ RS**

## Montenegro

**(IPA)** Institute of Hydrometeorology  
 and Seismology, **IHMS**

# Project: aim and objectives

- Project **aims** to increase the capacity of the Danube region to adapt to climatic variability by **enhancing resilience to drought** with recently developed tools and data sets;
- **Objectives:**
  - Develop a new operational drought monitoring service;
  - Prepare a unified drought risk protocol based on the Civil Protection Mechanism;
  - Improve drought emergency response in the Danube region.



# Project: target groups

- Hydro-meteorological national services
- Emergency response authorities
- Non-governmental organisations
- Water and farmer communities/chambers
- Industries

# Project: outcomes

## Main deliverables:

- Drought User Service
- Methodology for drought impact assessment and forecast
- Methodology for drought risk assessment
- Strategy to improve drought response

*Improve drought emergency response and enhance the cooperation between operational services and decision making authorities in the Danube region.*

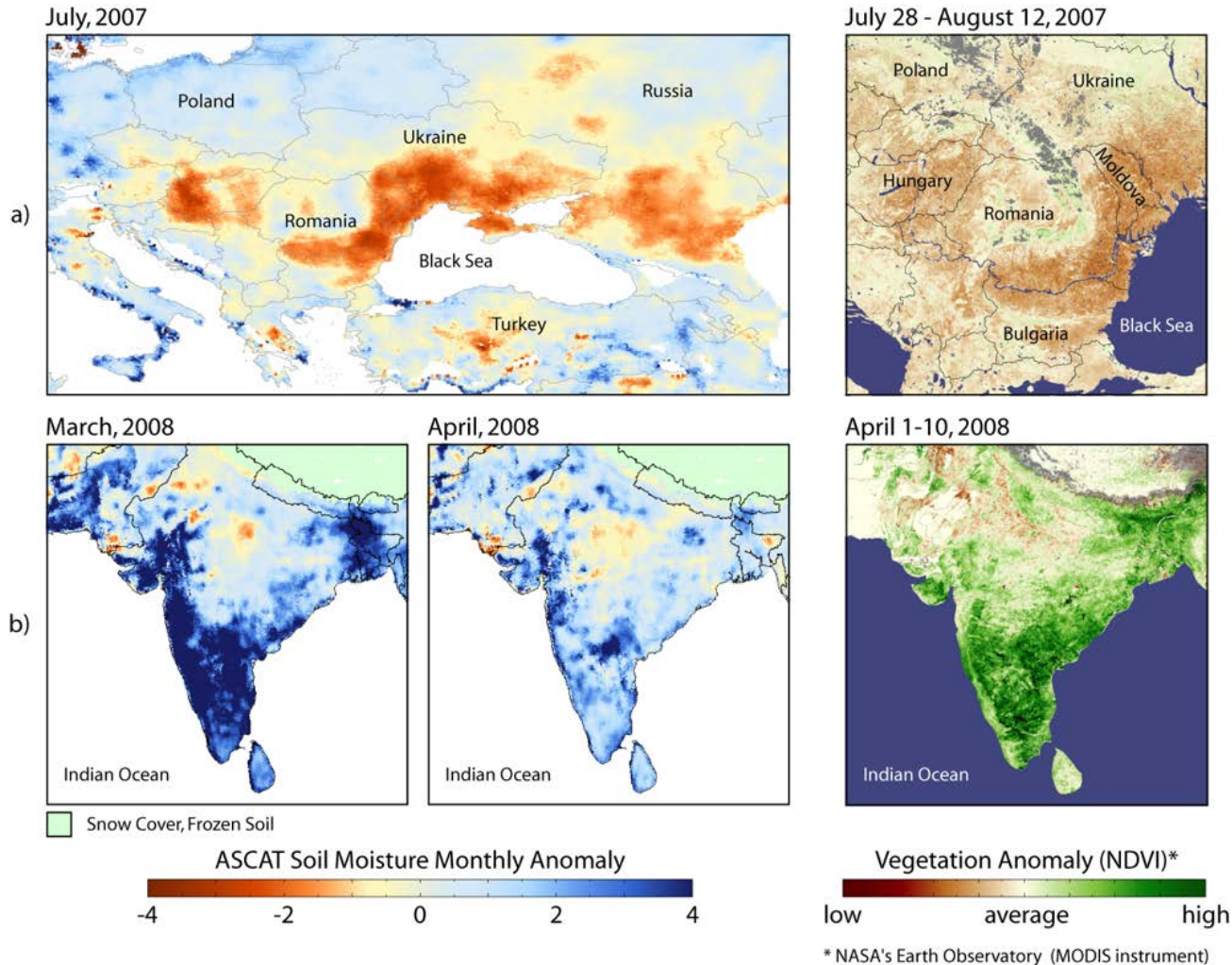


# Drought User Service

## An operational service based on exploitation of Earth Observation (EO) data:

- Easy-to-use interface:
  - Access in browser (operating system-independent)
  - Responsive interface (selecting different products, dates, geographic region)
- Functionality:
  - Display a suite of drought-related Earth Observation indices (vegetation, soil moisture, yield forecast, etc.)
  - Visual comparison between different products
- Specifications:
  - Region: Danube catchment
  - Temporal resolution: weekly images
  - Spatial resolution: 12.5km to 1km

# Drought EO-based characterisation



Monthly anomalies of **soil moisture** (ASCAT, EUMETSAT) and **NDVI** (Modis, NASA)

## (a) Moldova

- Year 2007 with the most severe drought ever recorded
- Cereal production ~70% lower than average of previous 5 years (FAO)

## (b) India

- Wet soil provided suitable condition for plant growth,
- Lead to record harvest yield in April

Naeimi, V., W. Wagner (2010). C-band Scatterometers and their Applications, Chapter 13 of "Geoscience and Remote Sensing New Achievements", Pasquale Imperatore and Daniele Riccio (Ed.), INTECH, Vukovar, Croatia, 230-246.



# Drought User Service - EO data sets

## Input data:

### **METOP-A/B ASCAT**

- Surface Soil Moisture data, 12.5km Swath Grid
- 2007-now
- Originating from EUMETSAT

### **Sentinel-1A/B CSAR L1**

- Radar backscatter data, 25x25m pixel spacing
- 2015-now
- Originating from Copernicus Global Land Service

### **TERRA MODIS**

- Surface Reflectance, 250m
- 2000-now
- Originating from NASA

## Auxiliary data:

### **Sentinel-2A MSI L1C**

- Top of atmosphere reflectance
- 10m spatial resolution
- 2016-now
- Originating from Copernicus Global Land Service

### **HWSD (Harmonised World Soil Database) v1.2**

- Global
- Vector format
- Originating from FAO

## Output/Results:

### **Soil Water Index (SWI) images**

- Plant Available Water (in %), including anomaly from long-term mean minimum: 10-day product (“dekadal”) at 12.5 km resolution, optimum: daily product, at 1km resolution

### **Normalised Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI)**

- Weekly images
- 5 km resolution
- With difference maps to previous week

### **Yield forecast maps**

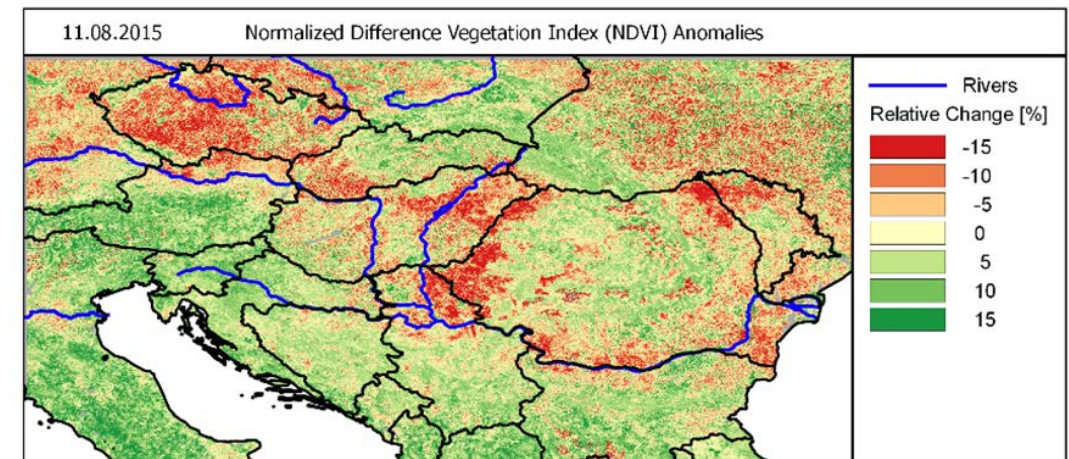
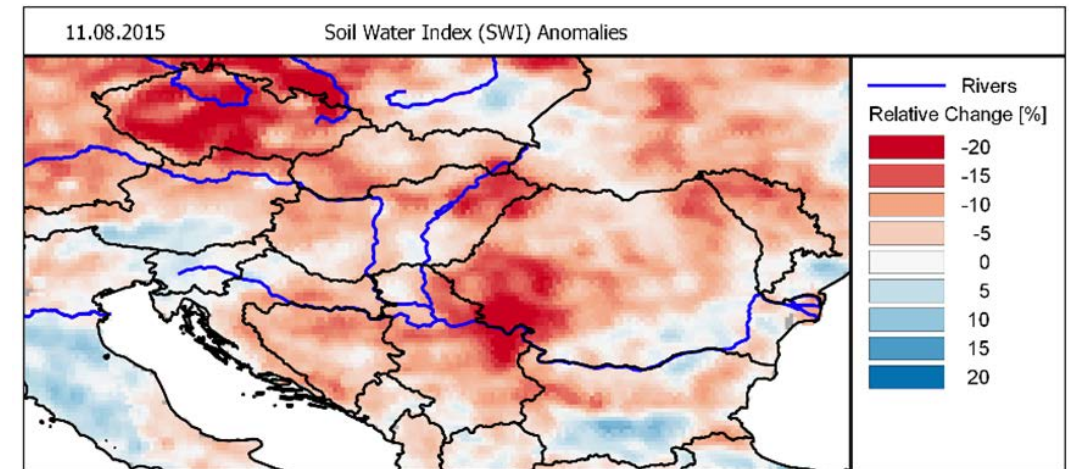
- 7-day trend, 5 km resolution
- Based on vegetation indices (e.g. NDVI, EVI)

# Drought User Service

## Example output:

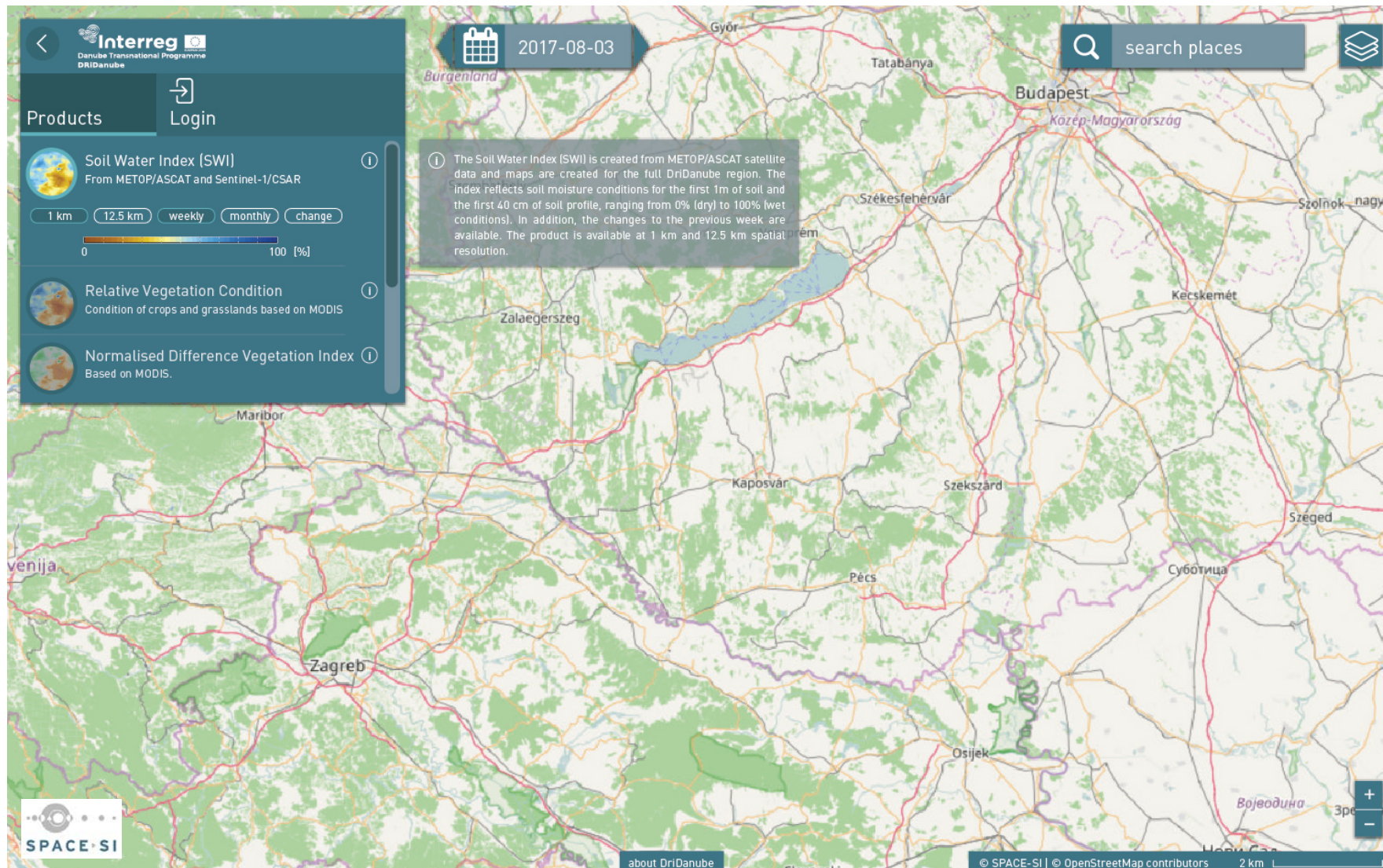
- **Major drought event reported in the Danube region in August 2015**
- SWI anomaly image (difference from long-term mean value) with a spatial sampling of 0.1 degrees (top)
- NDVI anomalies with a spatial sampling of 1/112 degrees (~1km) (bottom)

*(WGS84/Pseudo Mercator projection (EPSG: 3857))*





# Drought User Service (draft design)





# Build on previous developments

**DMCSEE**  
Drought Management Centre for Southeastern Europe

Home Drought monitor Events Links Members section TCP project News Contacts

**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](#)

**Latest news**

**Founding countries:**

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

**Founding agencies:**

- WMO
- UNCCD

CzechGlobe | CZECH REPUBLIC | SLOVAKIA | CENTRAL EUROPE

**INTERSUCHO** | Current state of drought | Predictions | Drought in regions | cz | sk

Drought intensity | Deficit | Relative soil saturation | Vegetation condition | Impacts on yield | Drought days

2. 4. 2017 | 12th week

Play animation: last 4 weeks | week 10, 2017 - week 13, 2017

The soil saturation deviation of average condition in 1961-2010

- no drought occurrence
- S0 lowered soil moisture stage
- S1 starting drought
- S2 moderate drought
- S3 significant drought
- S4 abnormal drought
- S5 extreme drought

Expressed by drought stage for the depth soil 0-40cm and 0-100cm

Download | Show maps

JOINT RESEARCH CENTRE | EDO - European Drought Observatory

Welcome to the European Drought Observatory!

The EDO pages contain drought-relevant information such as maps of indicators derived from different data sources (e.g. precipitation measurements, satellite measurements, modelled soil moisture content). Different tools, like Graphs and Compare Layers, allow for displaying and analysing the information and irregularly published "Drought News" give an overview of the situation in case of imminent droughts.

Situation of Combined Drought Indicator in Europe - 2nd ten-day period of March 2017

Watch: rainfall deficit | Warning: soil moisture deficit | Alert: vegetation stress following rainfall / soil moisture deficit | Partial recovery of vegetation | Full recovery to normal conditions

13-MAR-17 | CDI by country in CSV format

Explorative MapViewers | Web GIS to map and query different indicators provided by EDO and partner institutions

Drought Management Centre for Southeastern Europe

INTERSUCHO

JRC European Drought Observatory

# Summary

## Improve drought emergency response in the Danube region:

- With an operational monitoring service based on EO data
  - New EO-based data included: soil moisture from ASCAT
- Take advantage of the technological development, e.g. cloud services:
  - Process, analyse and display results of multiple large data sets (EO, meteorological data, in-situ data) and their combination
  - Facilitate interaction between stakeholders
- Facilitate trans-border information exchange on good practices in drought management between all stakeholders at national and regional level
- Implement drought management policies in the existing frameworks (e.g. in the Danube River Basin Management Plan)



Info and updates:  
*[www.interreg-danube.eu/dridanube](http://www.interreg-danube.eu/dridanube)*

