

Service for monitoring drought conditions for the Baltic Sea Drainage Basin

– Example Poland area. FPCUP Open Data Framework

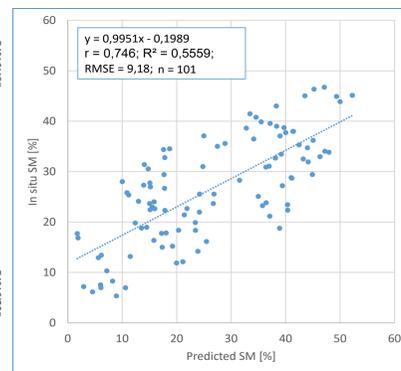
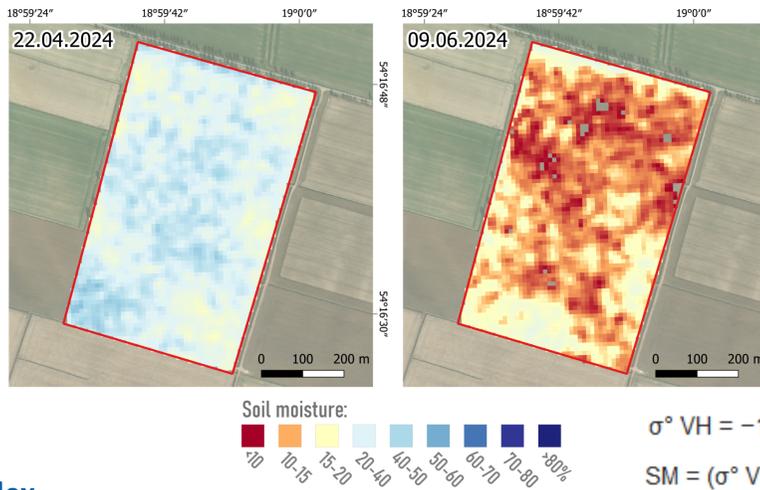
Katarzyna Dąbrowska-Zielińska, Maciej Bartold, Konrad Wróblewski
Remote Sensing Centre, Institute of Geodesy and Cartography

Abstract

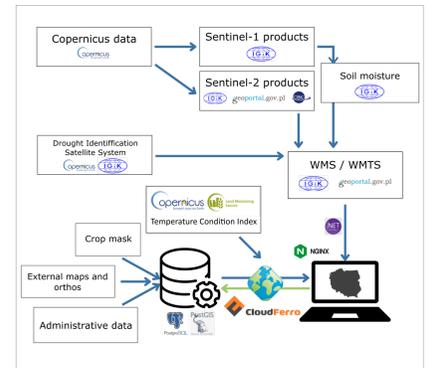
A system for monitoring crop growth conditions has been developed at the Remote Sensing Centre, Institute of Geodesy and Cartography. It determines crop conditions with the use of an index based on Copernicus data resampled to a 1 km² spatial resolution. The index, the Drought Identification Satellite System (DISS), is a function of the Temperature Condition Index (TCI) and meteorological index, characterizing climatic conditions on the territory of Poland, i.e., the hydrothermal coefficient (HTC). The DISS drought index is generated within a successive ten-day period during a vegetation season, starting from the end of March. The median of the HTC informs us about the average atmospheric conditions (in relation to precipitation and air temperature). These images refer to the growing season (from the end of April to September) and are formed with 10-day-step process. The spatial distribution of HTC median values in Poland is related to climatic conditions, which are influenced by Poland's topography. The daily values of soil moisture are input into the system using Sentinel1 with the polarization VH and VV. The vegetation descriptor is related to VH-VV, and the soil moisture is related to the index σ° VV/VH.

Soil moisture modelling with Sentinel-1

The soil moisture product for the FPCUP Baltic project utilized data from Sentinel-1A satellite (GRDH product in VV and VH polarizations) collected from March to October 2023 and from March to July 2024.



Service scheme



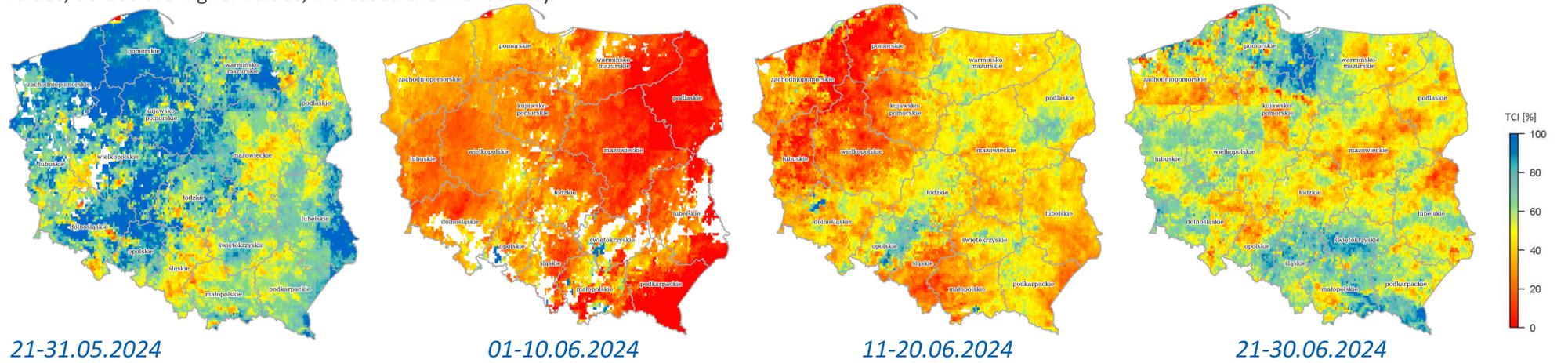
$$\sigma^\circ \text{ VH} = -18.9 + 0.33\tau^2 \text{ SM} - 0.14(1 - \tau^2) \cos(\theta) \sigma^\circ (\text{VH} - \text{VV})^2$$

$$\text{SM} = (\sigma^\circ \text{ VH} + 18.9 - 0.14(1 - \tau^2) \cos(\theta) \sigma^\circ (\text{VH} - \text{VV})^2) / (0.33 \tau^2)$$

$$\tau^2 = \exp(-2(\sigma^\circ \text{ VV/VH}) / \cos(\theta))$$

Temperature Condition Index

Temperature Condition Index (TCI), a resource of the Copernicus Land Monitoring Service (CLMS), providing information on Earth's thermal conditions with a spatial resolution of 5km. Updated every 10 days, it combines surface temperature information from a variety of sources, including satellite observations and ground-based measurements, to provide an integrated picture of the planet's thermal dynamics. Displayed in the range 0-100, where 0-20 are lower temperatures, 20-60 are average values, 60-100 are higher values, increased thermal activity.



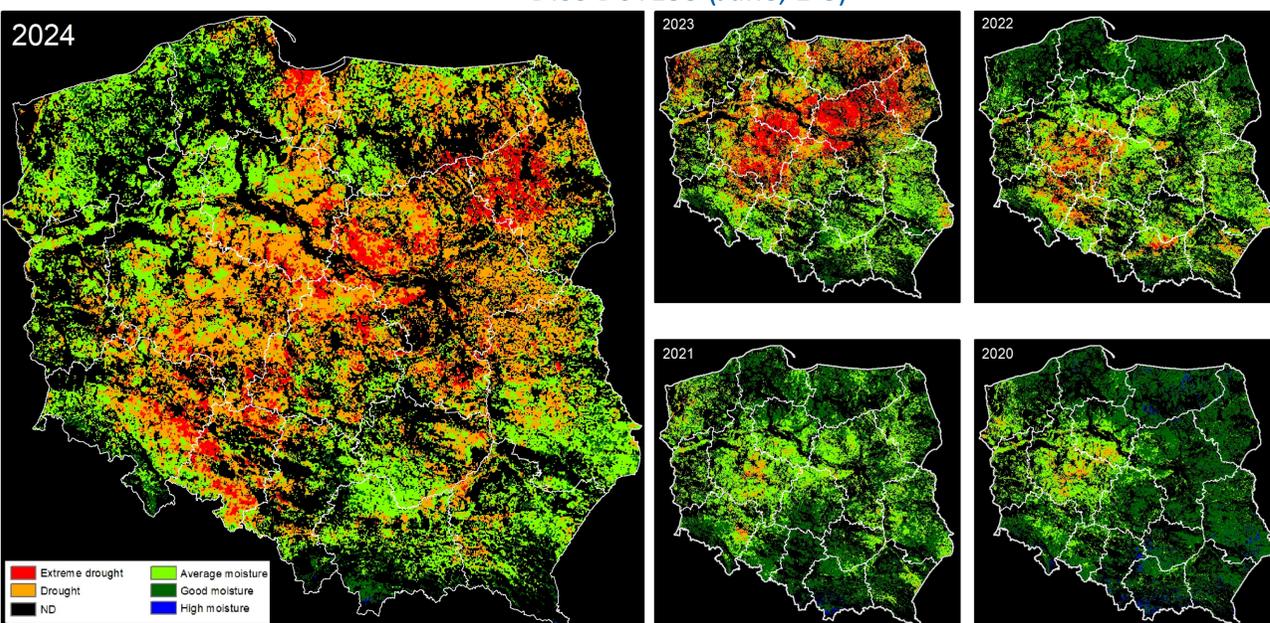
Drought Identification Satellite System

The Drought Identification Satellite System (DISS), with a spatial resolution of 5km², developed on the basis of Copernicus Land Monitoring Service (CLMS) data, is based on the TCI and the Hydrothermal Coefficient (HTC) meteorological index. DISS values are divided into five ranges: extreme drought, drought, average moisture, good moisture, high moisture.

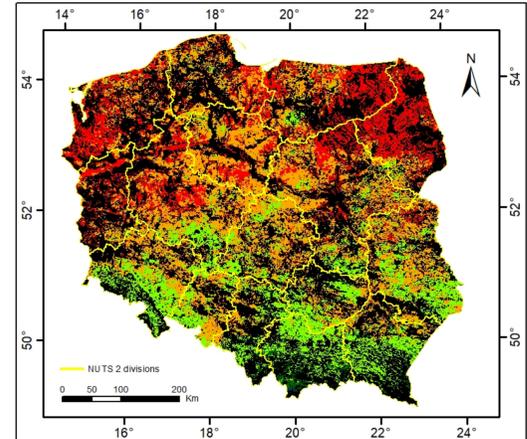
$$\text{DISS}_d = M_{\text{HTC}} * \exp(A * \text{TCI}_d + B * \text{TCI}_{d-1} + C * \text{TCI}_{d-2})$$

DISS DoY153 (June, 1-8)

where:
M_{HTC} - HTC median,
TCI - Temperature Condition Index,
d - ten-day period,
A, B, C - estimated parameters



September 13 - 20, 2024



In September 2024, while southwestern Poland battled devastating floods, the eastern and northern-central regions simultaneously faced severe droughts, resulting in water shortages, and agricultural losses.

Service:

