

German Remote Sensing Data Center (DFD)

Vegetation stress monitoring and drought impact prediction using remote sensing data

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MOTIVATION

Droughts represent a major stressor for terrestrial ecosystems, with significant impacts on vegetation condition, ecosystem functioning, and agricultural productivity. Climate change is expected to intensify drought frequency, duration, and spatial extent across Europe. Reliable and timely monitoring of vegetation stress is essential to capture the onset, severity, and spatial extent of drought impacts, quantify ecosystem responses, and support effective adaptation strategies. In addition, the ability to anticipate drought-induced vegetation impacts is crucial for early warning, risk management, and informed decision-making.

APPROACH

The monitoring and early warning system for vegetation stress and drought impacts is based on near real-time Earth observation data and derived products. It builds on a Combined Drought Indicator (CDI), which enables the classification of drought severity levels through anomaly-based analysis (Figure 1). Short/medium-range meteorological forecasts (temperature, precipitation) are incorporated to support the prediction of drought development.

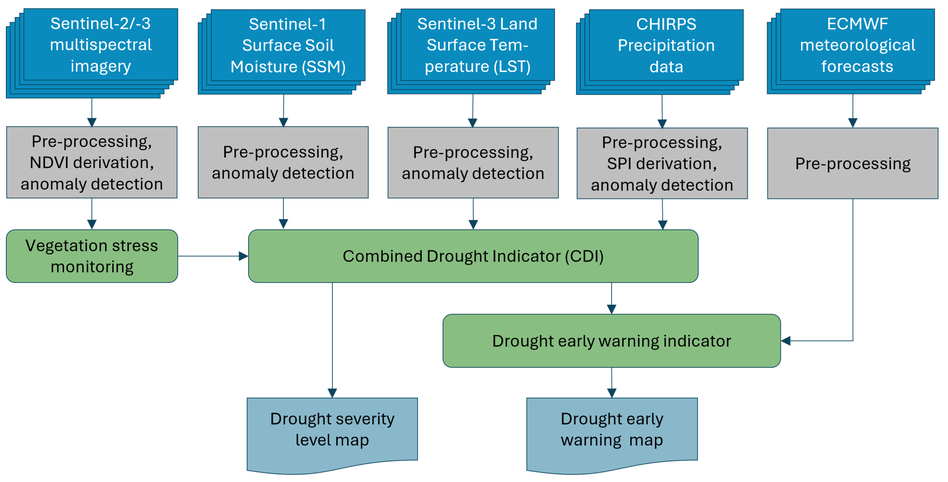


Figure 1: Flowchart for deriving vegetation stress dynamics, drought severity and early warning maps.

RESULTS

The application provides spatially explicit information on vegetation and water stress as well as early warnings for drought impact. The products are provided as raster data including different severity levels. Sentinel-3 based products are calculated at 300 m resolution (Fig. 3), while datasets based on Sentinel-2 are derived at 10 m spatial resolution (Fig. 4). The products are provided at 5-day intervals. They can assist in anticipating and managing drought impacts for stakeholders from agriculture, water management, civil protection, and other drought-affected areas.

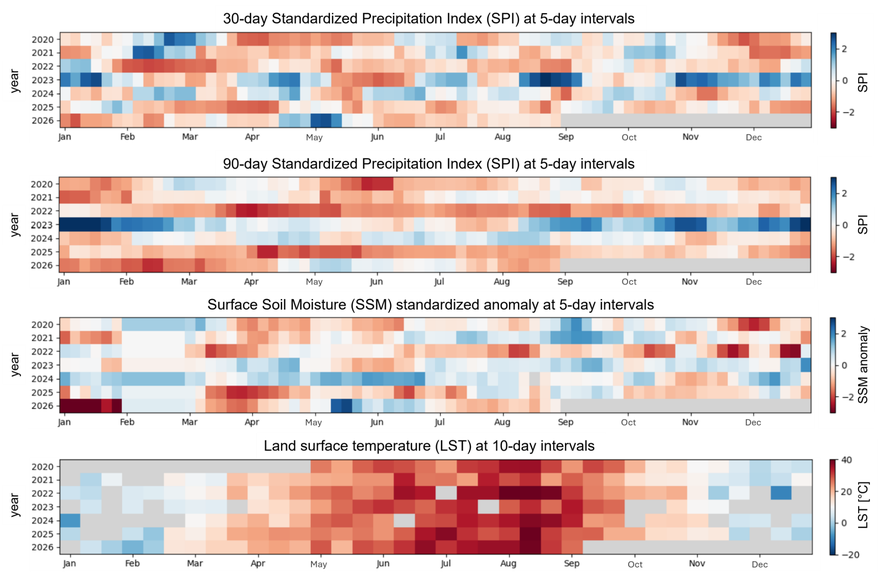


Figure 2: Exemplary time series of pre-processed input data used in the CDI at a project demonstration site near Bernburg (Saale), Saxony-Anhalt, Germany.

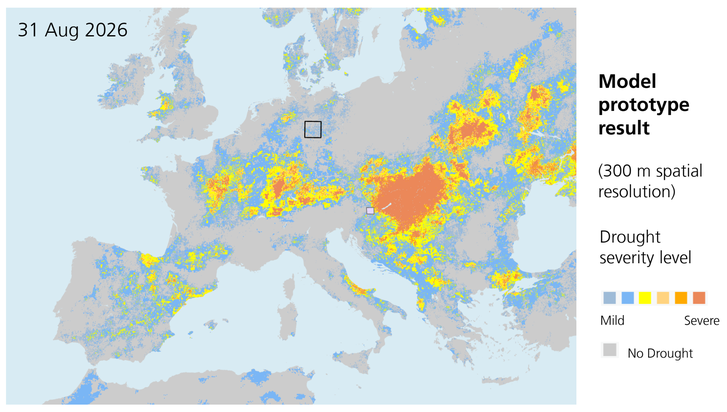


Figure 3: Model result showing drought severity levels across Europe for 31 August 2026. The black square gives the location of the test area shown in Fig. 4.

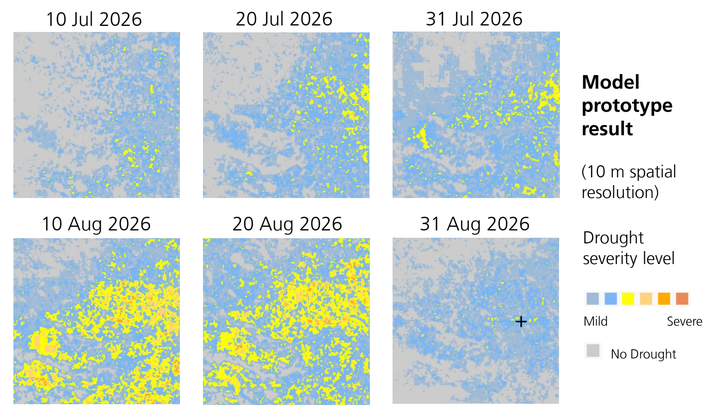


Figure 4: Drought severity level time series for July and August 2026 for the test area in Germany. The black plus sign indicates the location of the project demonstration site (coordinates for data in Fig. 2).

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