Earth observation-based monitoring and early-warning system for vegetation stress and drought conditions

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NOSTRADAMUS – Drought monitoring system

Within the EU Horizon project NOSTRADAMUS (Data Cube and Copernicus Data for Food Security and European Independence), a drought monitoring and early warning system is being developed. The application exploits multi-source EO data and derived products to provide spatially explicit information on vegetation stress and drought conditions. The monitoring framework is based on a Combined Drought Indicator (CDI) approach that integrates anomalies from several complementary variables (Figure 1). In addition, short-range to seasonal meteorological forecasts (precipitation, temperature) available from the ECMWF real-time forecast will be incorporated to support the prediction of drought evolution.

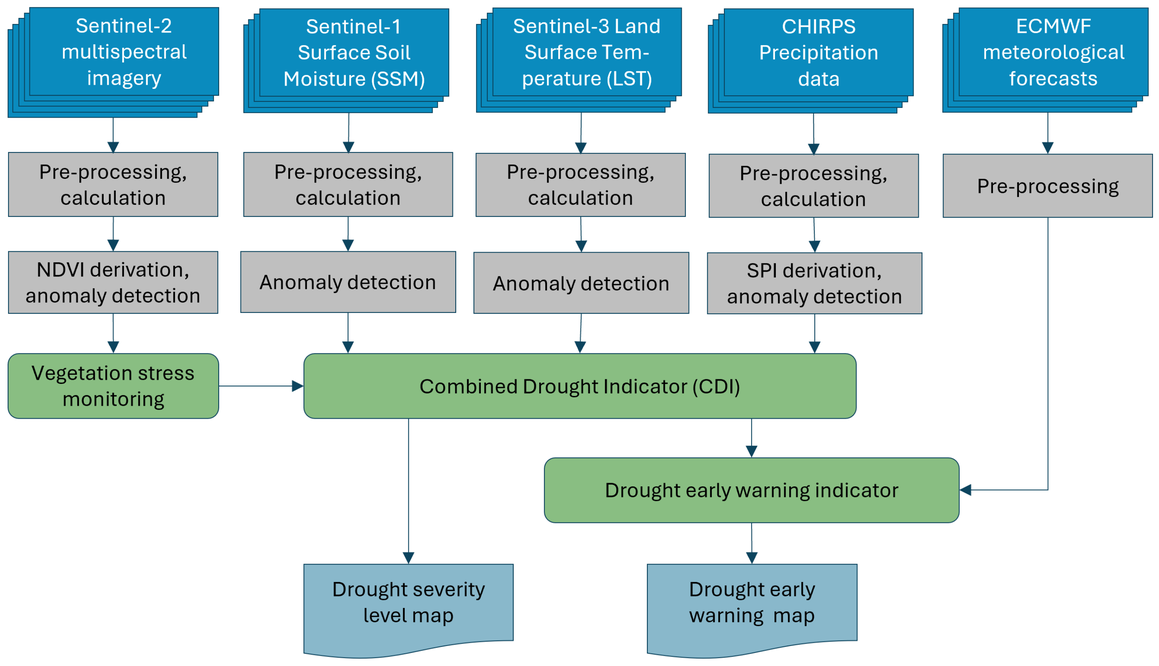


Figure 1: Flowchart for NOSTRADAMUS drought monitoring and early warning system.

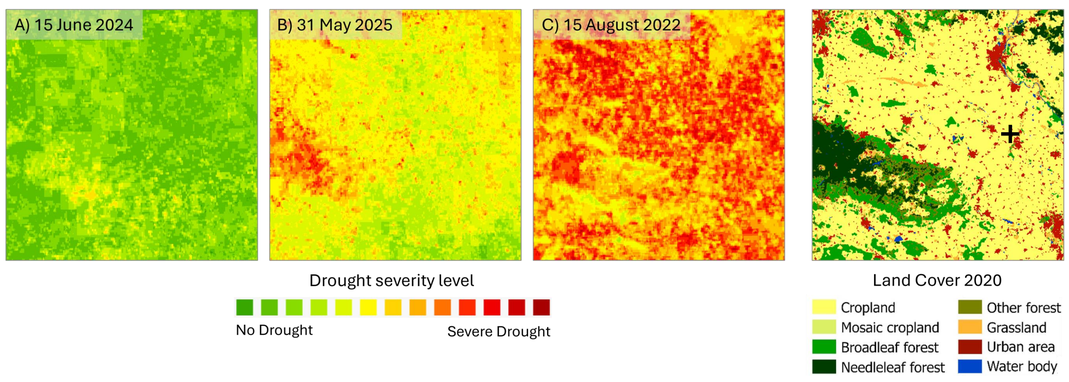


Figure 2: Example results for the test area in Germany, illustrating time periods with (a) non-drought conditions, (b) partial drought conditions, and (c) drought-affected conditions. The right panel provides land cover context (ESA CCI). The plus sign in the right panel indicates the location of the demonstration site.

Results

The application generates drought status maps at 10 m spatial resolution with multiple severity levels, using Sentinel-2-derived vegetation indicators as the spatial backbone (Figure 2). Given the temporal resolution of the input data, drought conditions can be updated at 5-day intervals (Figure 3). Evaluation of the model performance has been conducted against established drought monitoring products for a test area in Germany to assess plausibility, spatial agreement and temporal consistency in drought pattern evolution (Figure 4).

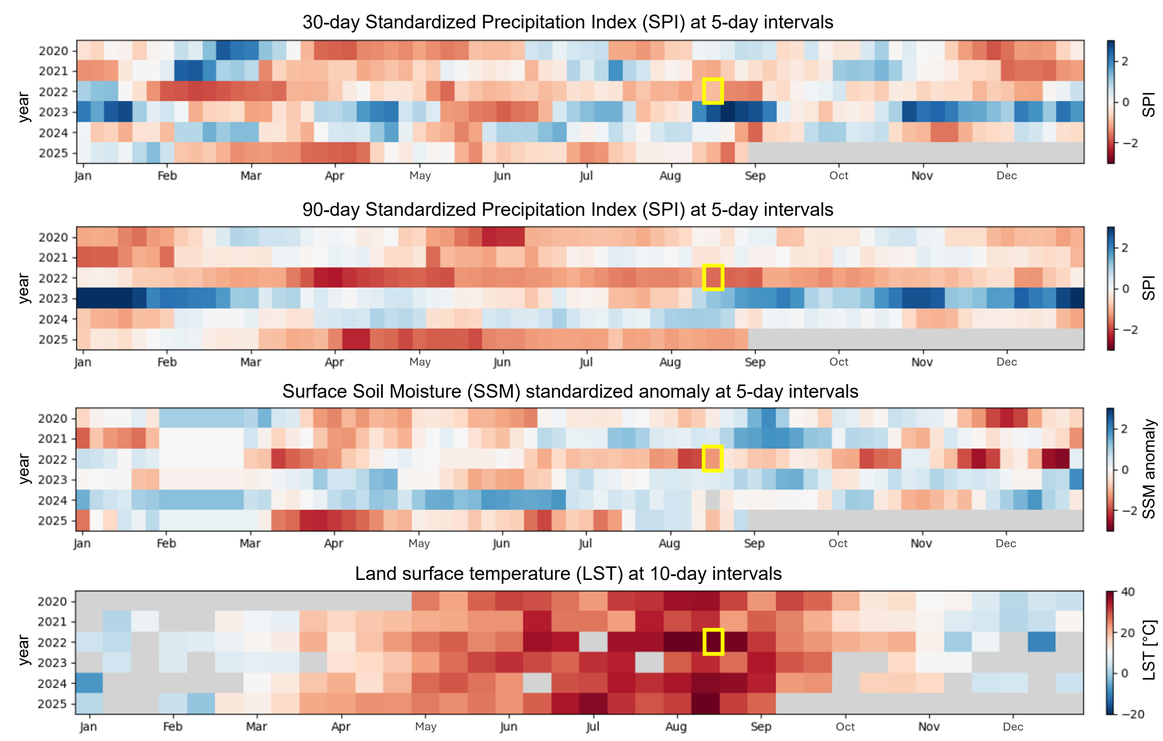


Figure 3: Exemplary time series of pre-processed input data used in the Combined Drought Indicator (CDI) at the demonstration site in Germany. The yellow rectangles highlight data for 15 August 2022, for which results are shown in Figure 1 C.

Outlook

Future work will focus on extending the system to additional project regions and integrating forecast products to support the prediction of drought development and strengthen early warning capabilities. The resulting EO-based information products aim to support agricultural decision-making, including crop management, irrigation planning, and implementation of appropriate adaptation measures.

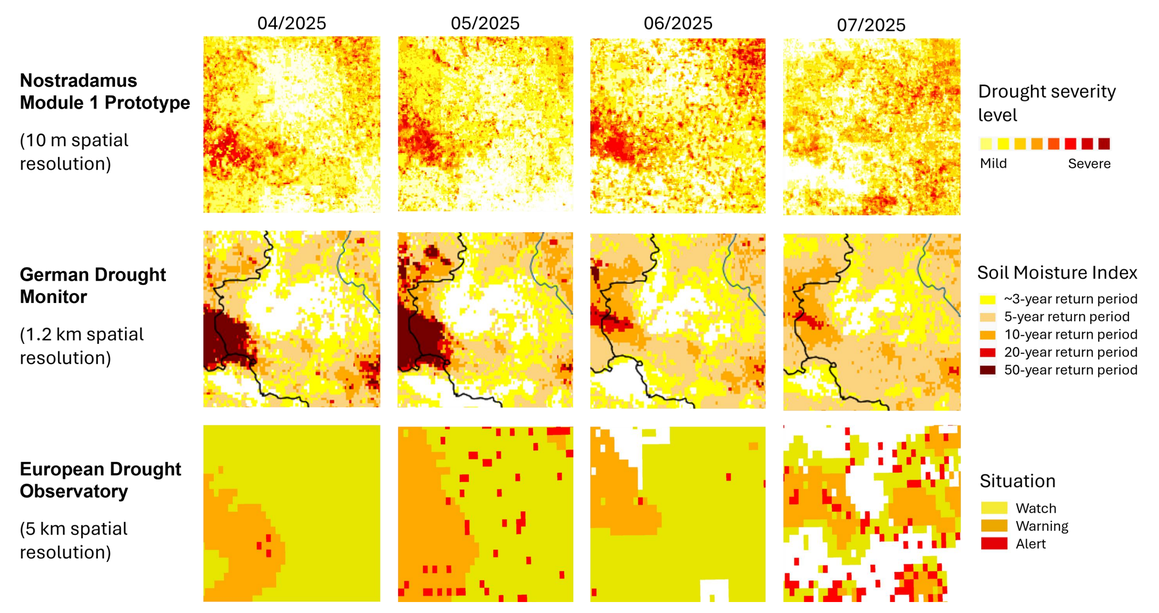


Figure 4: Comparison of model results with two independent drought datasets for four selected time steps in 2025 for the test area in Germany.

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