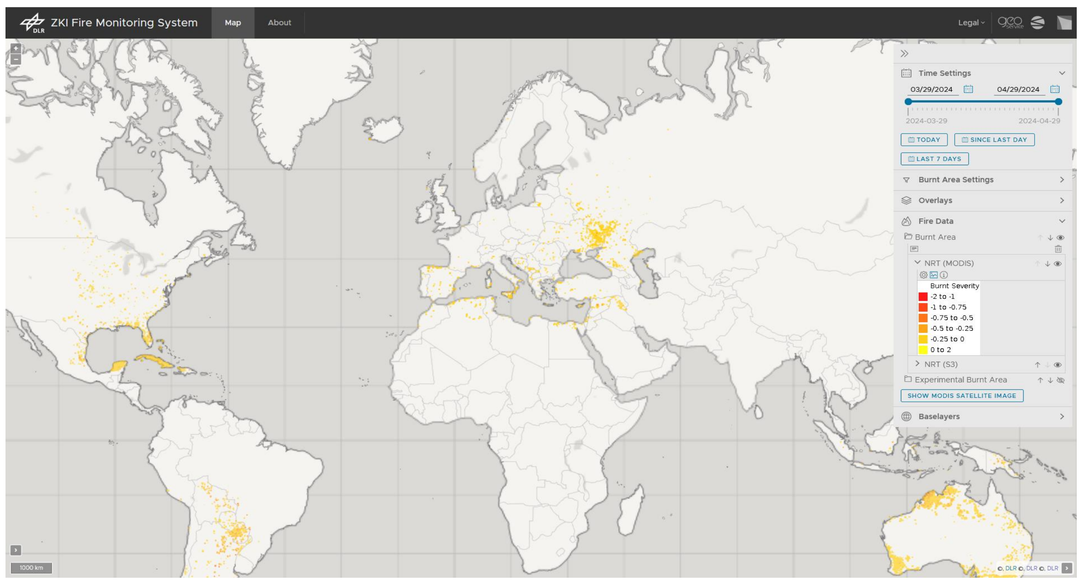
ZKI® Fire Monitoring Service of DLR

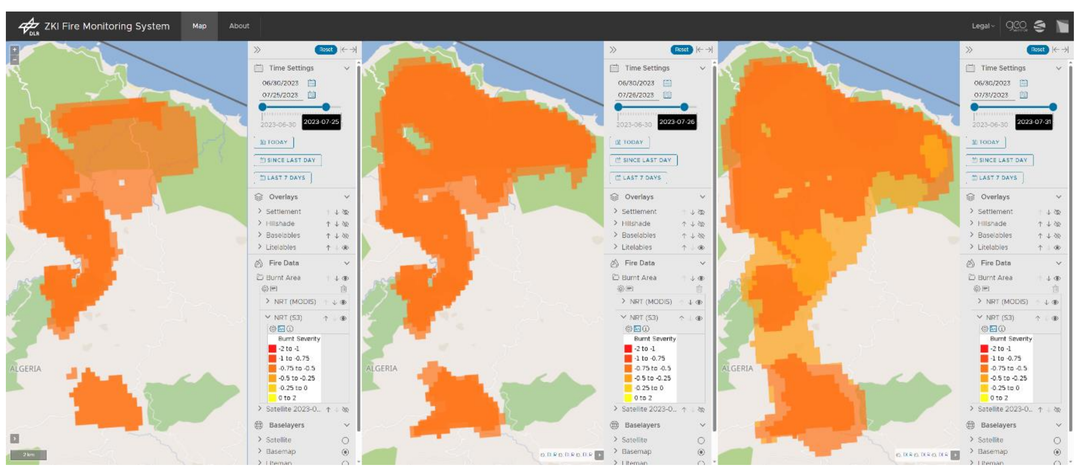
ISCRAM 2024
MÜNSTER, GERMANY

Up-to-date wildfire information

According to the European Copernicus Program EFFIS, Europe has seen its largest wildfire in recorded history last year: in Greece a single area of over 96,000 ha was burnt (European Commission et al., 2024). Satellites with near infrared (NIR) sensors are well suited for the monitoring of such large fires. Often area monitoring includes manual steps, which are slowing the delivery of wildfire information down. This work represents a fully automatic workflow for burnt area products, including data processing, delivery and web-based visualization. The proposed process is currently implemented in an experimental version for whole Europe and selected areas worldwide. Due to the automatic and fast processing, the satellite derived information products can be made available in near real time, supporting disaster response authorities and organizations in rapid damage assessment. The "ZKI® Fire Monitoring System" is operated by the Center for Satellite Based Crisis Information (ZKI®) of the German Aerospace Center (DLR).



Screenshot of the ZKI® Fire Monitoring Service

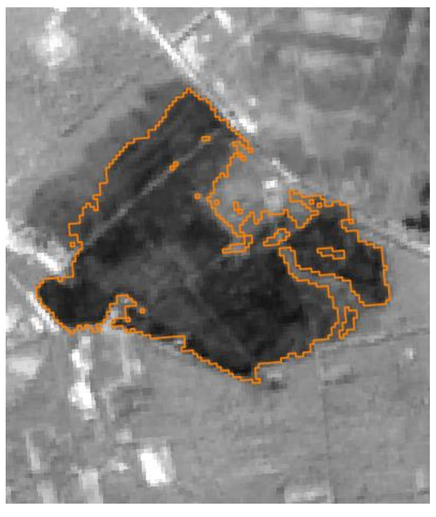


Timeline of the devastating fire in Algeria between 25.-31. July 2023, around 30km west of the town of Béjaïa.

Satellite based burnt area detection

The input for the processing is data from mid-resolution optical sensors in the red and NIR spectrum. In this approach mainly imagery from MODIS on the Aqua and Terra and OLCI on the Sentinel-3 satellites is used. An advantage of these satellite platforms is a relatively short revisit period, which makes it possible to calculate daily research products. Additionally, the covered ground of the instruments is quite large, which is ideal for large area monitoring. The detection of wildfire boundaries is based on a combination of a Normalized Difference Vegetation Index (NDVI) mosaic derived from the red and NIR bands and a subsequent Morphological Active Contour calculation (Nolde et al., 2020, Nolde et al., 2021).

Once a burnt area is identified, it is iteratively and automatically refined over a period of 10 days as new satellite data becomes available. This enables continuous improvement of the derived fire perimeters by minimizing the influence of disturbing factors such as cloud cover, smoke plumes and shadows. Beside the burnt area perimeter, other attributes such as the fire severity, the area affected, as well as the exact detection times are included in the output data. It is therefore possible to track the evolution of each burnt area in space and time.



Detected fire perimeter near Jüterbog on Sentinel-2 imagery

Data availability and dissemination

Directly after the processing the burnt area research products are published as standardized OGC web service by the Earth Observation Center (EOC) Geoservice (Dengler et al., 2013; https://geoservice.dlr.de) in these formats:

- Daily NRT: https://geoservice.dlr.de/web/maps/eoc:burntarea:efr:daily
- Monthly: https://geoservice.dlr.de/web/maps/eoc:burntarea:efr:monthly
- Yearly: https://geoservice.dlr.de/web/maps/eoc:burntarea:efr:yearly

Web-based visualization and exploration

In addition to the satellite processing component and the data delivery a public web application was developed to ease fast and interactive analysis and exploration of the generated research data products. After the wildfire data has been published by the EOC Geoservice, the web services are integrated in a dedicated frontend user interface. There the detected wildfires can be shown on a dynamic web map, built with DLR's Environmental and Crisis Information Systems (UKIS) software components for geoscientific data visualization (Muehlbauer, n.d.; https://github.com/dlr-eoc/ukis-frontend-libraries).

Literature

Dengler, K., Heinen, T., Huber, A., Molch, K., & Mikusch, E. (2013). The EOC Geoservice: Standardized Access to Earth Observation Data Sets and Value Added Products. Proceedings of PV, Frascati, Italy.

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Muehlbauer, M. (n.d.). UKIS – Environmental and Crisis Information Systems. German Aerospace Center, Earth Observation Center. Retrieved May 15, 2024, from https://www.dlr.de/de/eoc/ueber-uns/deutsches_fernerkundungsdatenzentrum/georisiken-und-zivile-sicherheit/informationssysteme-und-geomatik/ukis-umwelt-und-kriseninformationssysteme

Nolde, M., Plank, S., Riedlinger, T. (2020). An Adaptive and Extensible System for Satellite-Based, Large Scale Burnt Area Monitoring in Near-Real Time. Remote Sensing, 12, 2162. https://doi.org/10.3390/rs12132162

Nolde, M., Mueller, N., Strunz, G., Riedlinger, T. (2021). Assessment of Wildfire Activity Development Trends for Eastern Australia Using Multi-Sensor Earth Observation Data. Remote Sensing, 13, 4975. https://doi.org/10.3390/rs13244975

Link to the ZKI® Fire Monitoring Service:
https://services.zki.dlr.de/fire/

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