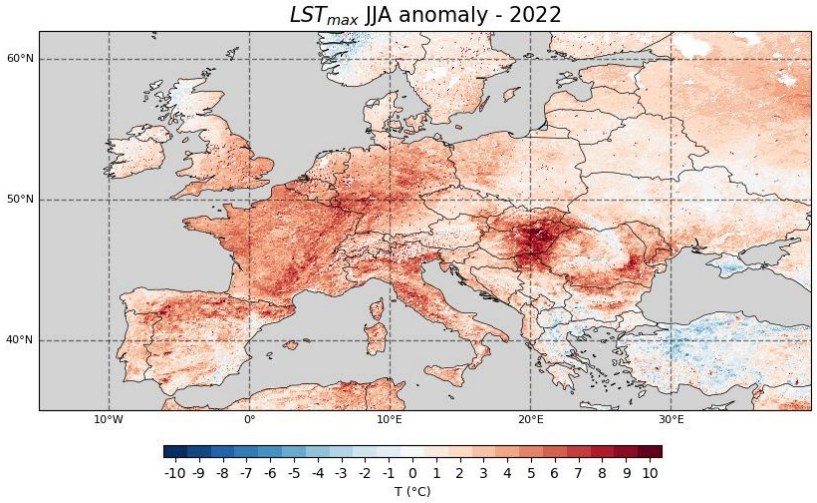
Event Week on Heatwaves and Droughts

29 May to 1 June 2023 - ONLINE



EUMeTrain will promote the Event Week on Heatwaves and Droughts, from 29th May to 1st June 2023. We have an exciting program with multidisciplinary speakers which will cover different aspects of heatwaves and droughts, mainly focusing on satellite observations that can be used to study their impacts and causes.

Heatwaves are becoming increasingly more frequent and more intense, with Europe being one of the areas where these increases are more significant. Changes in atmospheric patterns due to climate change and complex interactions between the land surface and the atmosphere, which are now better understood thanks to better models, but also better observations. Satellite climate data records are now reaching sufficient maturity and length to provide robust information on decadal changes in many variables involved in heatwaves and droughts, such as Land Surface Temperature, Soil Moisture and different vegetation indexes. Satellite information may also be used to study associated processes such as marine heatwaves, interactions with the carbon cycle, air pollution or enhanced impact on cities and human health.

Meeting link: https://knmi.webex.com/knmi/j.php?MTID=m12776b91e120711340f72a0199299f81

Meeting password: PSypmwPR734

Covered Topics

- Theoretical aspects
- Data services (GEE, EUMETSAT, Copernicus)
- Land Surface and impacts on vegetation
- Marine heatwaves
- Hydrological aspects (soil moisture, precipitation, river discharge)
- Urban heat islands

- Impacts on the Carbon cycle

Program

	Monday, 29 May	Tuesday, 30 May	Wednesday, 31 May	Thursday, 1 June
Morning **07h30 UTC** **–** **09h00 UTC**		**Temperature Extremes** Isabel Trigo - *How is LSA SAF helping in monitoring of HW & D* João Martins - *Land Surface Temperature and HW monitoring* Hayley Evers-King - *Marine Heatwaves - how can SST anomalies influence HW over land?*	**Impact on Human activities** Panagiotis Sismanidis - *Urban Heat Islands* Anke Duguay-Tetzlaff - *Climatological Drought Monitoring in Switzerland Using EUMETSAT SAF Satellite Data*	**Impacts on Carbon Cycle** Ana Bastos - *Theoretical aspects* Tiago Ermitão - *Practical Applications*
Afternoon **12h00 UTC** **-** **13h30 UTC**	**Introduction** João Martins – *Intro* Ryan Teuling - *Drivers of droughts and heatwave intensification mechanisms* Sofia Ermida - *Google Earth Engine - a powerful tool to study heatwaves & droughts*	**Hydrological Extremes** David Fairbairn - *Soil moisture and drought monitoring* Luca Brocca - *on the combined use of multiple satellite-derived variable (precip, evap, soil moisture, and snow) for monitoring drought and water resources*	**Vegetation responses to HW & D** Beatriz Martinez - *LSA SAF Vegetation products* Célia Gouveia - *Impacts of extremes on vegetation dynamics and crops* Bostjan Muri - *case studies using LSA SAF data*	**Air Quality** Ana Russo/Rita Durão - *Impacts on air quality* **EUMETSAT Climate Services** Carla Barroso - *EUMETSAT climate services* **Final Discussion and Wrap-up**

Speakers

Ana Bastos – Max Planck Institute for Biogeochemistry
Ana Russo – University of Lisbon - Instituto Dom Luiz
Anke Duguay-Tetzlaff – MeteoSwiss / CM-SAF
Bostjan Muri – Slovenian Environment Agency (ARSO)
Beatriz Martinez - University of Valencia
Célia Gouveia – IPMA
Carla Barroso - EUMETSAT
David Fairbairn - ECMWF
Hayley Evers-King – EUMETSAT
Isabel Trigo – IPMA / LSA SAF
João Paulo Martins – IPMA / LSA SAF
Lucca Broca – Italian National Research Council / Research Institute for Geo-Hydrological Protection / H SAF
Panagiotis Sismanidis - National Observatory of Athens / Ruhr University Bochum
Rita Durão - IPMA
Ryan Teuling – Wageningen University
Sofia Ermida – IPMA / LSA SAF
Tiago Ermitão – IPMA / University of Lisbon - Instituto Dom Luiz

Drivers of droughts and heatwave intensification mechanisms (Ryan Teuling)

Heatwaves and droughts are often strongly linked due to the increased sensible heat fluxes at the land surface warming the atmosphere above. In this talk, I will discuss how soil moisture depletion changes the land surface energy balance, and how the evolution of changes in the land surface energy balance is different for different land cover types (i.e., forest and short vegetation). The use of high-resolution satellite soil moisture data for drought monitoring is also discussed.

Google Earth Engine - a powerful tool to study heatwaves & droughts (Sofia Ermida)

The Google Earth Engine (GEE) is a powerful tool for researchers providing easy access to a large array of environmental datasets, particularly from remote sensing, and the computational resources to analyzed them. Here we present an overview of the capabilities and datasets of the GEE useful for the study of heatwaves and droughts and provide some examples of applications.

How is LSA SAF helping in monitoring of Heatwaves & Droughts (Isabel Trigo)

Heat and water stress leave clear signatures on land surface variables that can be monitored from space. The LSA SAF has been providing satellite datasets and products that allow the characterization of the surface energy budget and the monitoring of vegetation growth and stress. We will show that the combination of information on the surface temperature diurnal cycle and on vegetation state provides a different perspective on the spatial extent and time evolution of droughts and heatwaves, and reveals underlying soil-vegetation-atmosphere feedbacks.

Land Surface Temperature and Heatwave monitoring (João Martins)

Land Surface Temperature (LST) Satellite data records are gaining increasing visibility as they start to provide time series with lengths large enough to derive significant temperature anomalies over land. In this talk we will cover the spectrum of available LST products, particularly those distributed by the LSA SAF. Moreover, we will demonstrate how useful these datasets may be to monitor heatwaves, especially the All-Sky LST from the LSA SAF. We will detail how heatwave diagnostics may differ if 2 m temperature is used instead of LST and by explaining those differences, to assess the added value of LST for heatwave monitoring.

Marine Heatwaves - how can SST anomalies influence HW over land? (Hayley Evers-King)

Heatwaves don't just happen on land, but also at sea. Periods of extreme regional ocean warming are becoming more frequent and more extreme, affecting our oceans most diverse ecosystems, and those upon which human society depends. In this presentation we'll see how satellite data can be used to identify marine heatwaves, via a practical demonstration in a Python Jupyter Notebook. We'll also consider the connections between heatwaves on land and those that happen at sea.

Soil moisture and drought monitoring (David Fairbairn)

H SAF soil moisture (SM) products are derived from ASCAT C-band backscatter measurements. In this presentation we compare the near-real-time products with long-term data records in order to demonstrate the exceptional severity and extent of recent droughts, including the 2022 summer drought over Europe.

On the combined use of multiple satellite-derived variable (precipitation, evapotranspiration, soil moisture, and snow) for monitoring drought and water resources (Lucca Broca)

How do we monitor drought? Is it enough to use only precipitation data and calculate the SPI (Standardised Precipitation Index)?
New satellite-derived products (precipitation, evaporation, soil moisture and snow) offer additional ways to monitor drought in space and time, to assess WHERE the water is (surface soil, root zone soil, snowpack), and thus to know WHEN the water will be available. Real-world case studies will be analysed together with the participants, also using an interactive platform (https://explorer.dte-hydro.adamplatform.eu/).
The objectives of the lecture are: (1) to assess drought risk based on (new) satellite observations, and (2) to translate drought risk information into real-world decisions for water resources management (e.g., reservoir management, irrigation, hydropower generation).

Urban Heat Islands (Panagiotis Sismanidis)

Cities are generally warmer than their surroundings. This phenomenon is known as the Urban Heat Island (UHI) and is one of the clearest examples of human-induced climate modification. UHIs increase the cooling energy demand, aggravate the feeling of thermal discomfort, and influence air quality. In this talk we will discuss the drivers and impacts of UHIs and showcase how to characterize the urban landscape in Local Climate Zones. We will also discuss the discrepancies between remotely-sensed land surface temperatures (LST) and near-surface air temperatures when studying the urban climate.

Climatological Drought Monitoring in Switzerland Using EUMETSAT SAF Satellite Data (Anke Duguay-Tetzlaff, Vincent Humphrey)

The Swiss government has started a drought monitoring project in 2023. The goal is to set an operational drought monitoring and warning system in the upcoming years. In a pre-study we have analyzed the potential of EUMETSAT satellite data for climatological drought monitoring in Switzerland. We will present possibilities and shortcomings of the different analysed soil moisture, land surface temperature and evaporation data and provide an outlook on how we plan to integrate EUMETSAT data in the system.

LSA SAF Vegetation products (Beatriz Martinez)

The scientific community requires consistent long-term data records with well-characterized uncertainty and suitable for modelling terrestrial ecosystems changes as consequence of current climate impact at global scales. The vegetation climate data records (CDRs) of FAPAR (LSA-426) and FVC (LSA-422) are freely available within the EUMESAT LSA SAF (http://lsa-saf.eumetsat.int). These CDRs offer more than fifteen years (2005-present) of homogeneous and continuous 10-day time series for climate and environmental applications. The main goal of this lecture is to present a few examples CDRs analysis to monitor and characterize areas mainly affected by severe drought events. Moreover, the potential in the assessment of ecosystem response to rainfall deficit events is also presented using the last operational product included in the VEGA portfolio,

the 10-day gross primary production (GPP; MGPP LSA-411). The robustness of this product is evaluated at both site and regional scales across the MSG disk using eddy covariance (EC) GPP measurements and Earth Observing (EO)-based GPP products, respectively, over a short period of three years.

Impacts of extremes on vegetation dynamics and crops (Célia Gouveia)

The frequency and intensity of extreme hot and dry events have increased worldwide, particularly over the past couple of decades. The interaction between co-occurring drought and hot conditions is often particularly damaging to vegetation and crop's health and may cause crop failure. This lecture will provide insights on the impacts of compounded and separated dry and hot extremes on vegetation activity, and crop production and yield. Examples of the detection, monitoring and evaluation of such impacts using remote sensing products will be shown.

Case studies using LSA SAF data (Bostjan Muri)

In this presentation, we explore numerous real world applications of the use of LSA SAF data. Our focus is identifying heatwaves and droughts based on satellite data. Vegetation anomalies can be particularly helpful for drought monitoring. These show cases are selected in order to highlight the benefits of specific applications using LSA SAF data and its added-value when compared with other existing sources of observations (either satellite or meteorological stations) as well as model output.

Impacts on Global Carbon Cycle (Ana Bastos and Tiago Ermitão)

Droughts and heatwaves have become more frequent and severe over the last years as a consequence of climate change. These events result in water stress conditions to vegetation, affecting photosynthesis and respiration from plant to ecosystem scales, impacting the net carbon balance of ecosystems. This lecture will provide insights on the impacts of climate extreme events on vegetation function and the carbon cycle, showcasing examples on how these impacts can be detected using remote sensing products how Earth System and other models can be used to project future impacts of extreme events on the Carbon cycle.

Impacts on air quality (Ana Russo / Rita Durão)

Heatwaves often lead to low air quality levels. Very high to extreme temperatures combined with stagnant air conditions increase air pollutants concentrations, such as tropospheric ozone. This effect might be emphasized when drought conditions also occur, which contributes to increasing fire danger and decreasing air quality levels too. Air pollution impacts on health are consequently an important issue, together with the drawbacks on ecosystems. This lecture will provide insights into the detection, monitoring, and evaluation of air quality impacts, using among others, remote sensing products.

EUMETSAT climate services (Carla Barroso)

The presentation will give an overview on EUMETSAT’s efforts to provide climate data records based on satellite measurements and how EUMETSAT supports the work of climate services through this. Focus will be on satellite products provided by EUMETSAT and the different Satellite Application Facilities (SAFs). During the presentation participants will learn how the creation of climate data records is different from

creating a near-real-time product and why EUMETSAT and the SAFs invests in this. Links to further information and learning material will be included.