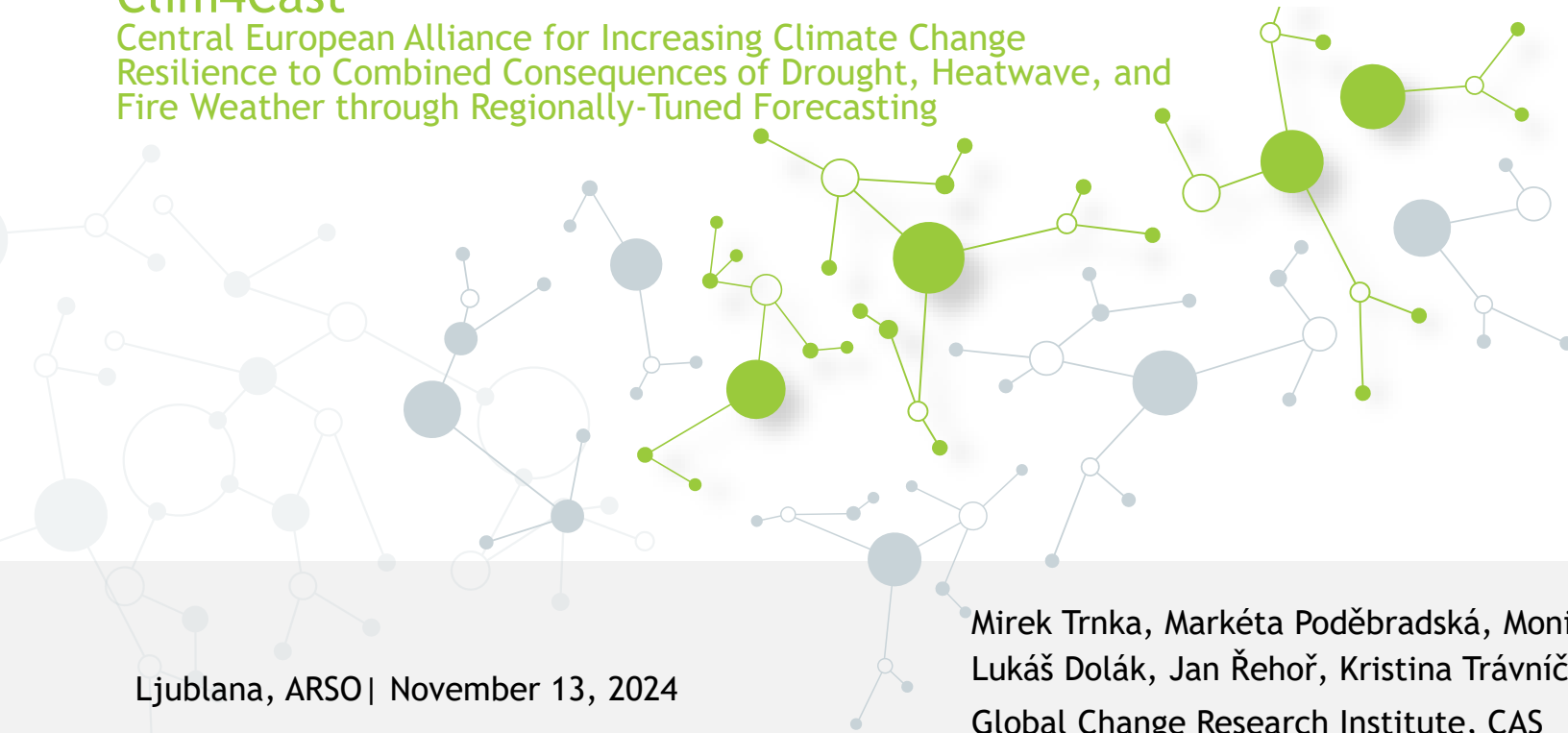


# Clim4Cast

Central European Alliance for Increasing Climate Change Resilience to Combined Consequences of Drought, Heatwave, and Fire Weather through Regionally-Tuned Forecasting



Ljubljana, ARSO | November 13, 2024

Mirek Trnka, Markéta Poděbradská, Monika Bláhová,  
Lukáš Dolák, Jan Řehoř, Kristina Trávníčková et al.  
Global Change Research Institute, CAS

# PROJECT FUNDING AND PURPOSE



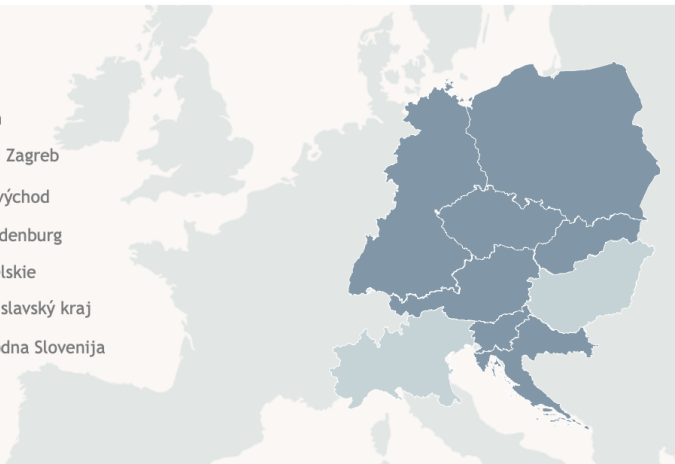
- Interreg Central Europe - transnational cooperation projects that help make CE regions and cities greener, smarter, better connected or more integrated
- Programme priority: Cooperating for a greener central Europe
- Programme specific objective: Increasing the resilience to climate change risks in central Europe





## COUNTRIES & REGIONS

AUSTRIA	Wien
CROATIA	Grad Zagreb
CZECHIA	Jihovýchod
GERMANY	Brandenburg
POLAND	Lubelskie
SLOVAKIA	Bratislavský kraj
SLOVENIA	Zahodna Slovenija



1.91

million €

Project budget

80%

ERDF co-financing

8

Partners

3

Pilots

03.2023

Start date

02.2026

End date



TU WIEN  
DEPARTMENT OF  
GEODESY AND  
GEOINFORMATION



Institute of Soil Science  
and Plant Cultivation  
State Research Institute



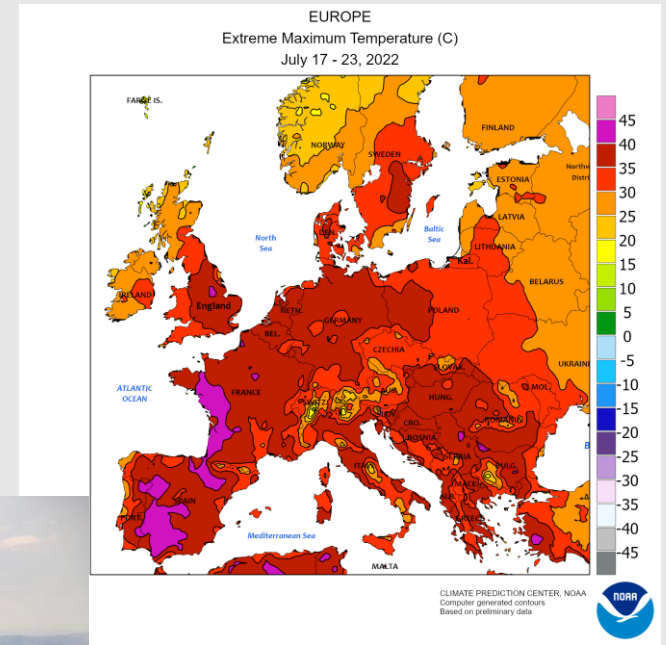
Leibniz-Zentrum für  
Agrarlandschaftsforschung  
(ZALF) e.V.



ARSO METEO  
Slovenian Environment Agency

# CHALLENGE

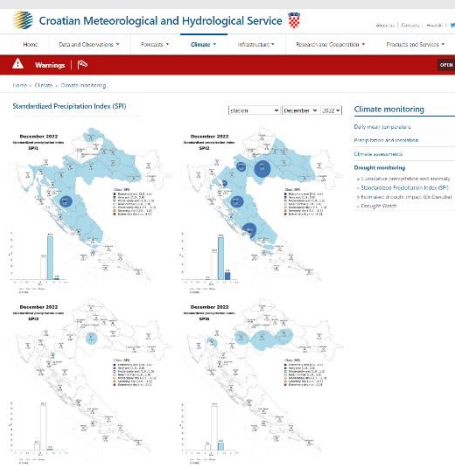
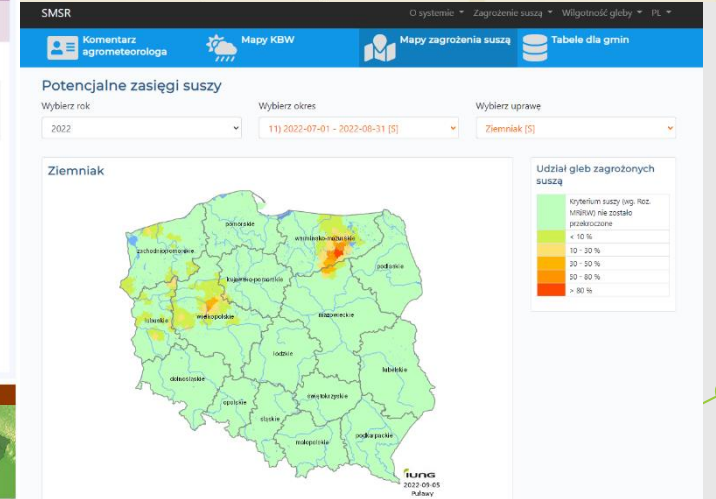
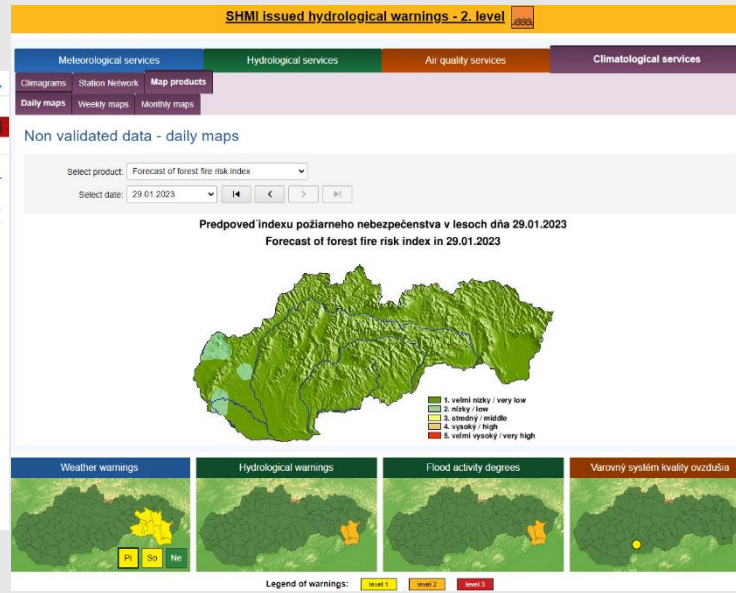
- Increased frequency, duration, and severity of drought, heatwaves, and fire weather (DHF) in CE as a result of changing climate – often cross-border impacts
- Drought monitoring, forecasting, awareness exists in partner countries
- Heat waves and wildfires have not been properly addressed in the region





# THE GOAL

Development and implementation of national and regional drought, heat wave, and wildfire (DHF) monitoring and forecasting products, communication, engagement and awareness strategies leading to an increased DHF resilience in 7 CE countries



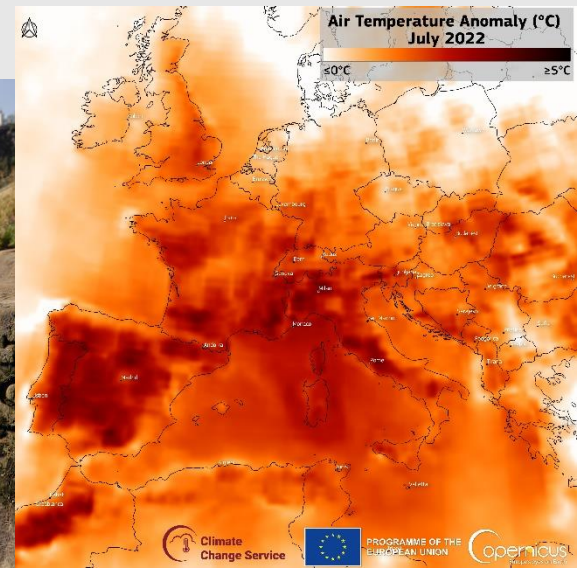
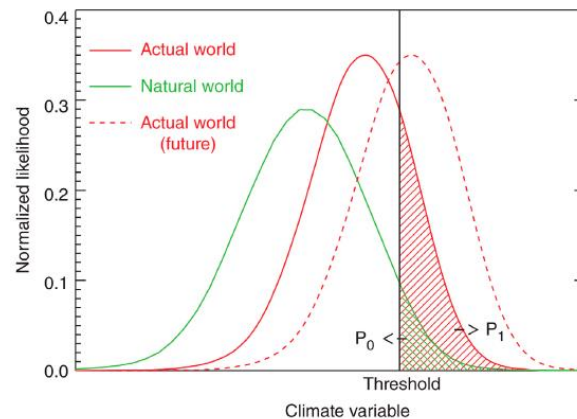
# THE GOAL

Carry out analysis of cross-border events in the past.

Attribute the climate change influence.

Develop easy to use datasets and share the knowledge and data.

In collaboration with AP prepare for the future events.



# 1. GATHERING INFO

- Investigation of existing platforms/tools to create a set of best practices recommendations for improvement of national platforms
- Collecting past DHF events
  - Newspaper search (2000-2023) - one national daily newspaper - occurrences of DHF impacts

ID 2	Editor	Year	Season	Month	Day	Date begin (YYYY-MM-DD)	Date end (YYYY-MM-DD)	Country	NUTS 3 (1 event/1 event)	NUTS 2	Geographical unit	Wildfire location	River	Water body	Type of DHF	Impact category	Impact subcategory	Societal respon
LD0001	Lukas Dolak	2022	JJA	7	21	2022-07-21	2022-07-21	Czechia	CZ010, CZ020, CZ031			Brno			wildfire	Wildfires_and_fire_occurrence	Increased (wild)fire danger	call for
DE0002	Roland Baatz	2022	JJA	7	25	2022-07-25	2022-08-02	Germany				Falkenberg			wildfire	Wildfires_and_fire_occurrence		

- Yield data for NUTS3 regions - main crops
- Wildfire occurrence and burned area
- Mortality data with specific causes
- Status of existing mitigation and proactive response in partner countries + global initiatives and recommendations + EU best practices and standards - **ALMOST DONE**

## 2. ANALYSIS AND PLATFORM CREATION

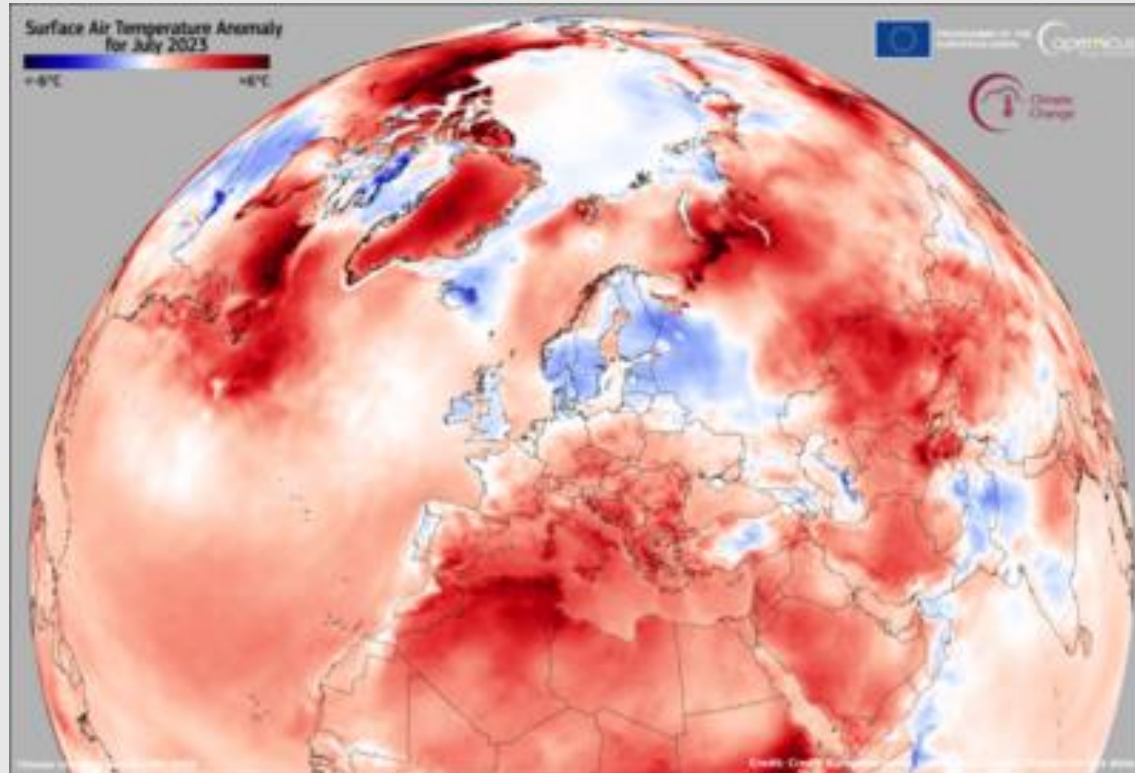
- Analysis of past DHF events and response practices with a special focus on cross-boarder and compound events
  - Discussions with stakeholders about past DHF events - societal and institutional response - differences in perceived impacts
- Estimating the effect of climate change on the occurrence and severity of DHF events
- **CE platform for DHF monitoring and prediction**
  - Reliability and accuracy evaluation through hind-casting (2020-2022) and near operational product (2024) on a national level for each type of an extreme event
  - Implementation into established national monitoring platforms
  - Building on existing and diverse partner knowledge, experience, and established network of stakeholders

### 3. COMMUNICATION AND IMPLEMENTATION

- A transnational strategy on increasing climate change awareness in the area of DHF events and their compound effects
  - Communication toolkit (educational videos, pamphlets, webinars) translated to national languages with local examples
- Roll-out of the new regional and national DHF products with video tutorials for users
- **Proper communication of the risk, mitigation, and response strategies** to key stakeholders and the public through developed national action plans - addressing national level needs for an improved proactive response



# 1. DHF IMPACTS - CLIM4CAST IMPACT DATABASE



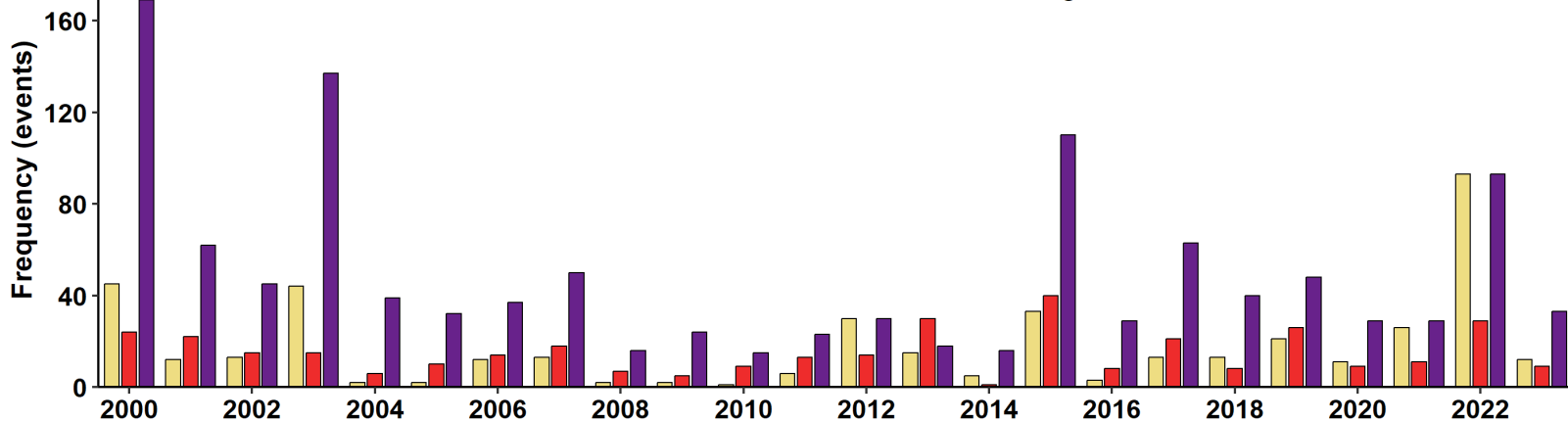
CRITICAL  
DHF

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by serial number of DHF event (total: 1930)

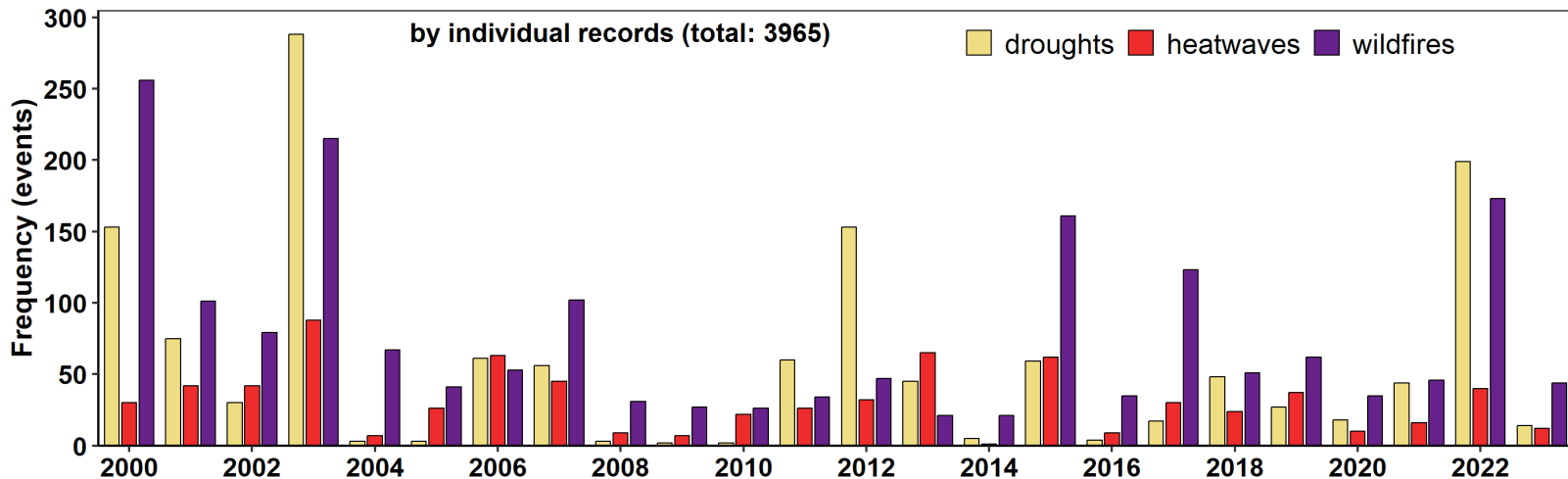
droughts heatwaves wildfires



IS

by individual records (total: 3965)

droughts heatwaves wildfires



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## CRITICAL EVALUATION OF PAST EXTREME EVENTS

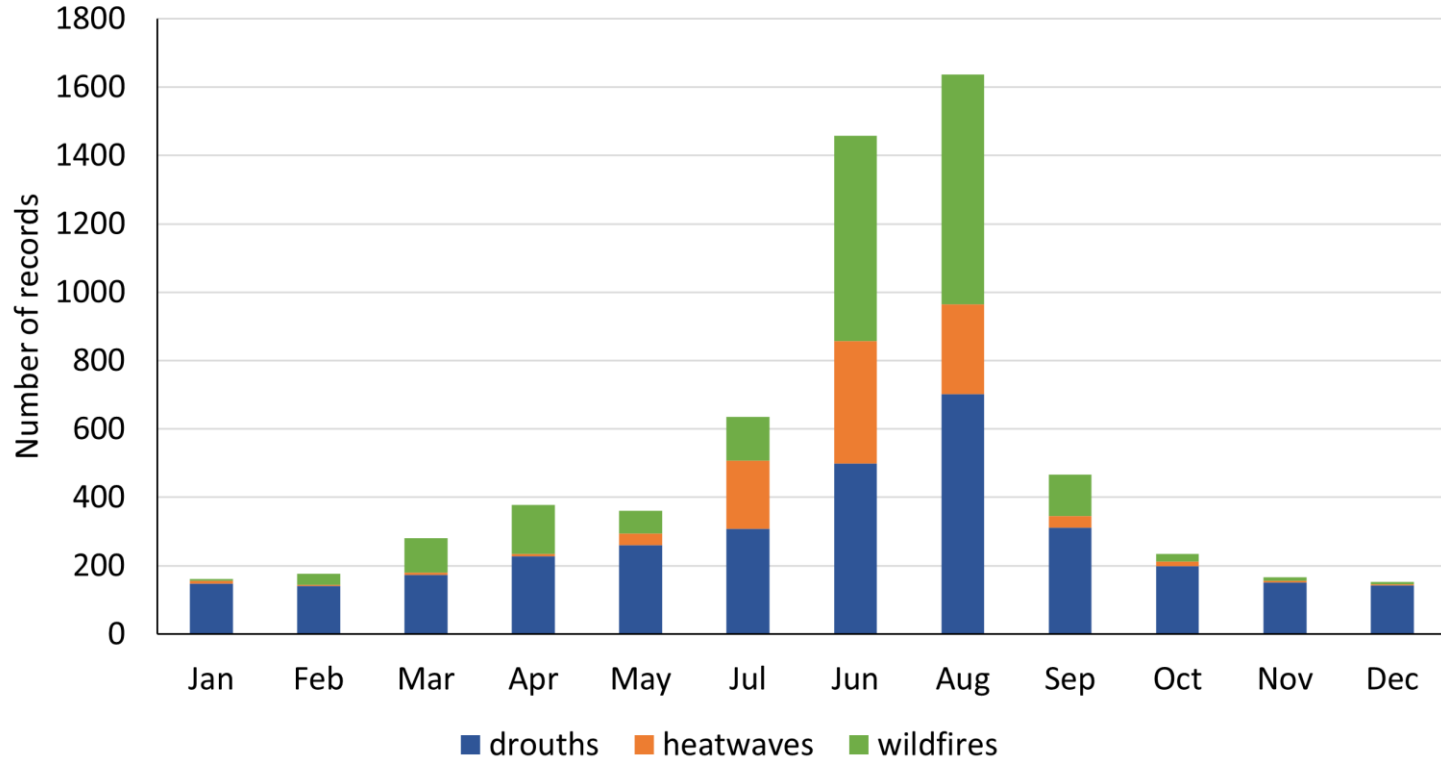
### Cross-border (CB) events (autumn 2024, NUTS2)

- **21 drought CB events (6x Croatia-Slovenia)**
  - the most of countries: 2006 (Austria, Croatia, Slovenia, Czechia, Slovakia)
  - the most of reports: 182 (2003), 103 (2012), 75 (2001)
- **23 heatwave CB events (7x Croatia-Slovenia)**
  - the most of countries: 2022 (Poland, Czechia, Germany)
  - the most of reports: 13 (2003, 2007), 11 (2003), 10 (2006)
- **28 wildfire CB events events (9x Croatia-Slovenia)**
  - the most of countries: 2022 (Slovenia, Czechia, Germany, Poland, Slovakia)
  - the most of reports: 75 (2003), 63 (2022), 53 (2001)



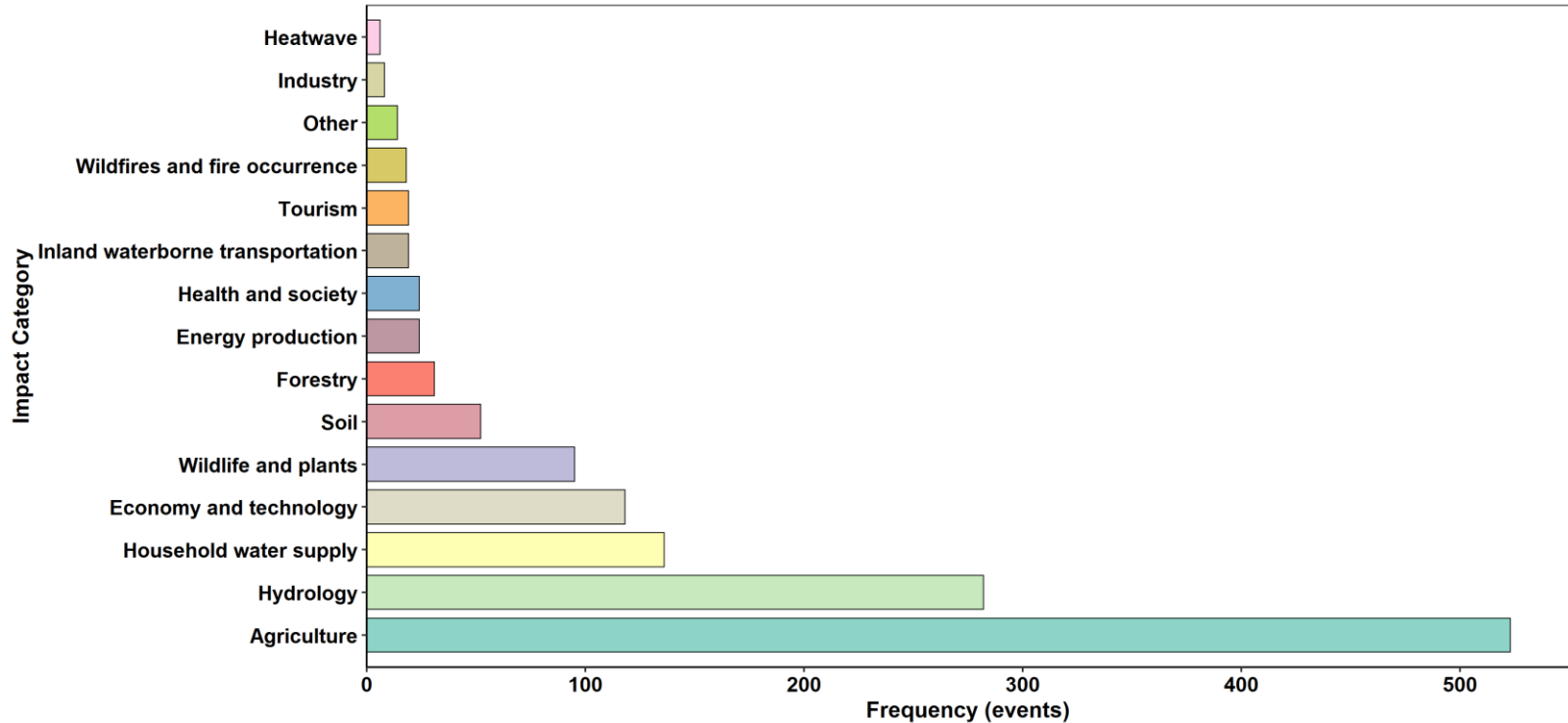
# CRITICAL EVALUATION OF PAST EXTREME EVENTS

## Number of DHF records

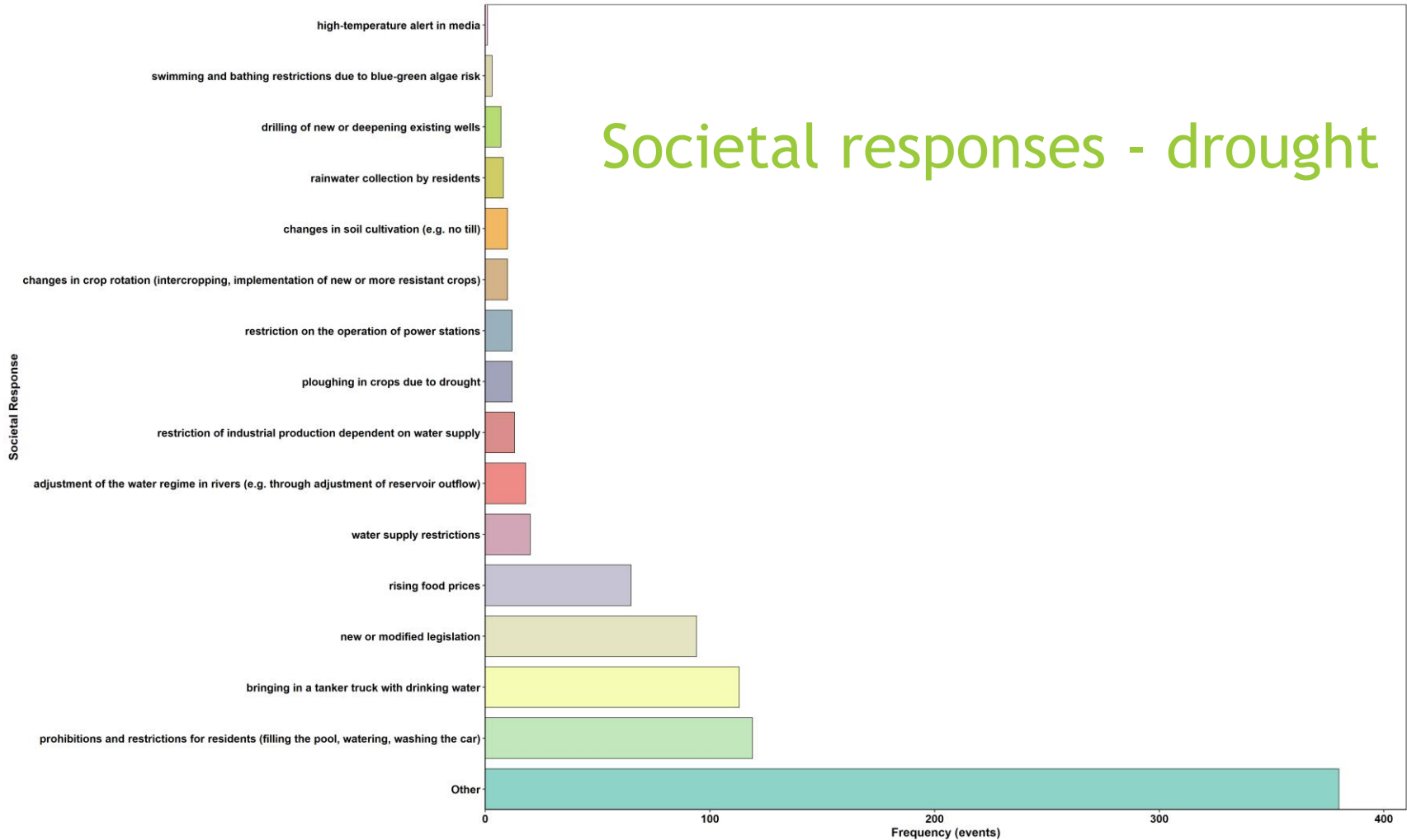


# CRITICAL EVALUATION OF PAST EXTREME EVENTS

## Impact categories - drought

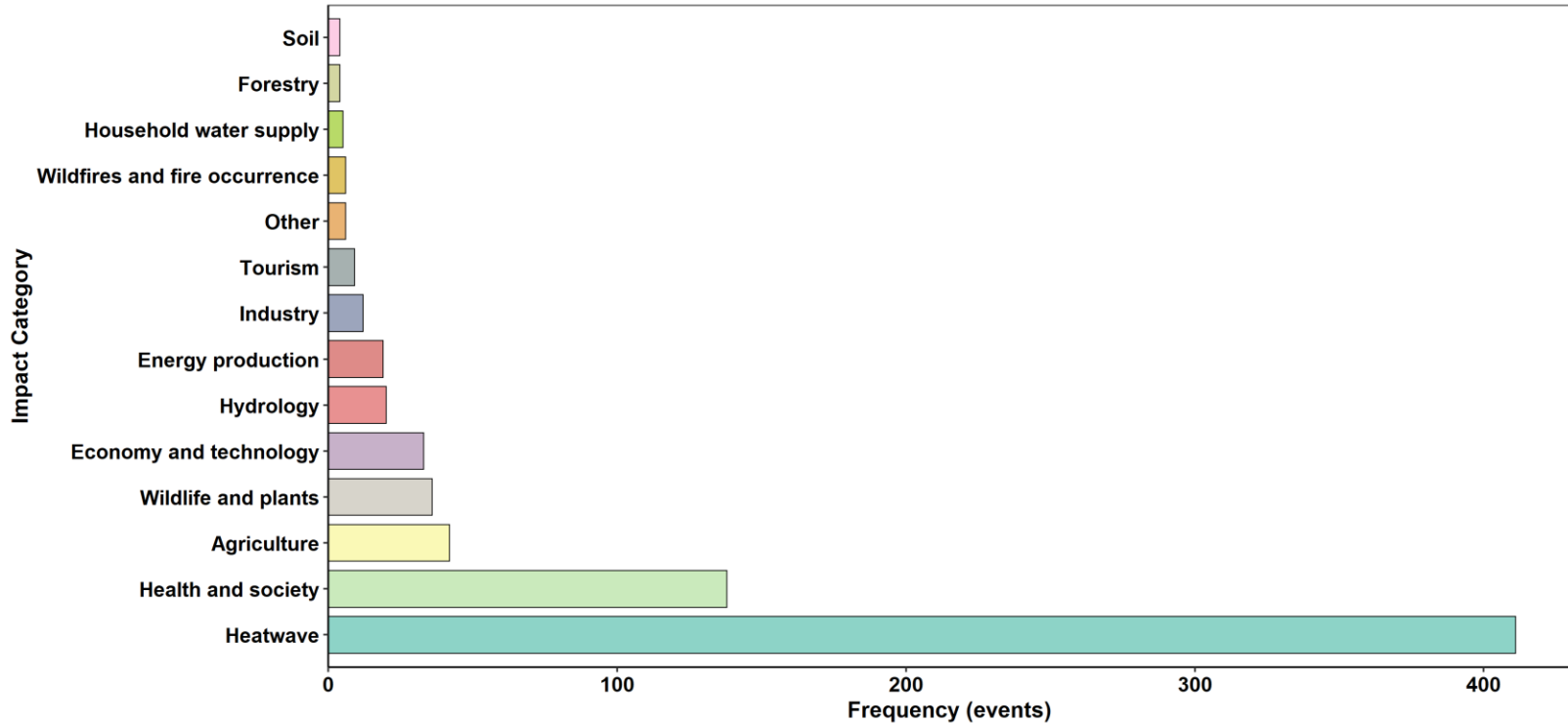


# Societal responses - drought



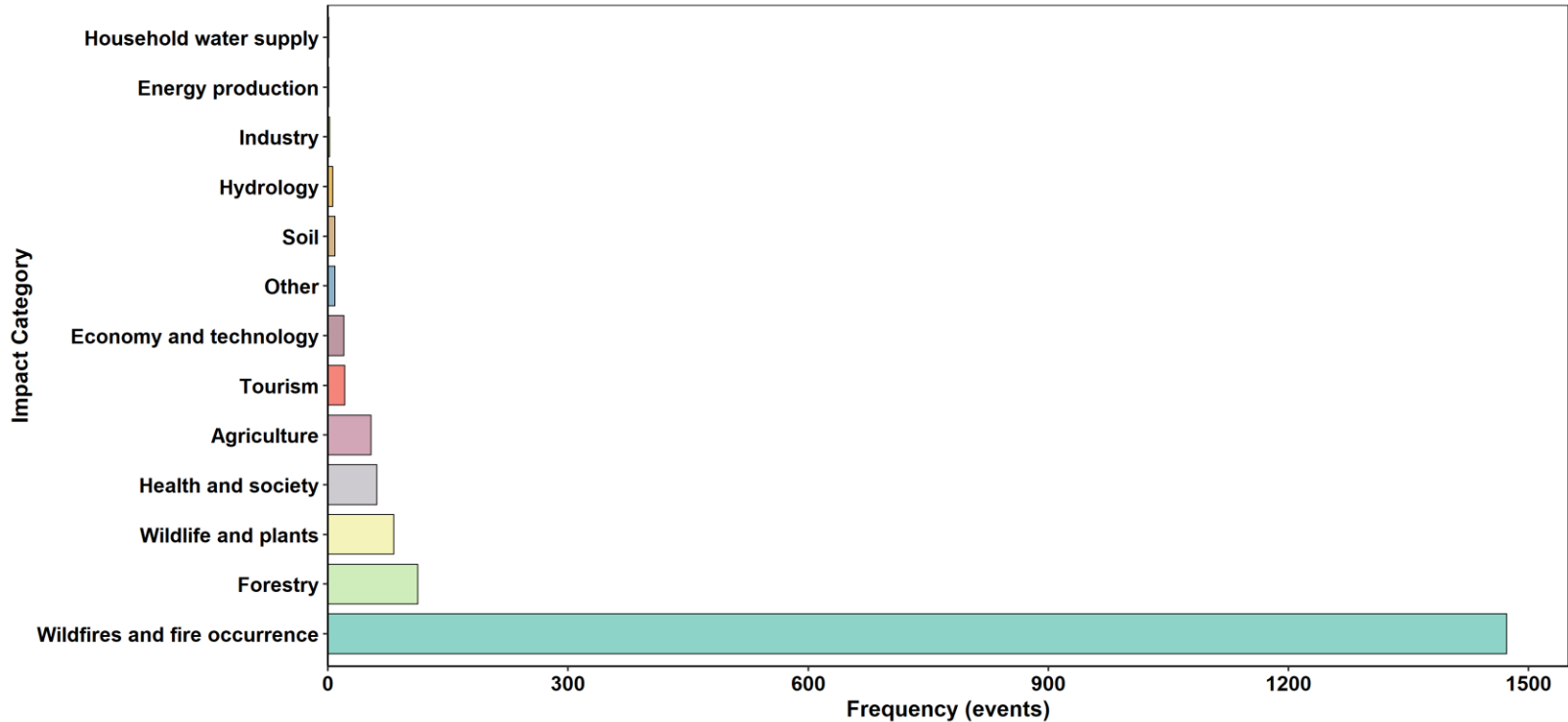
# CRITICAL EVALUATION OF PAST EXTREME EVENTS

## Impact categories - heatwaves



# CRITICAL EVALUATION OF PAST EXTREME EVENTS

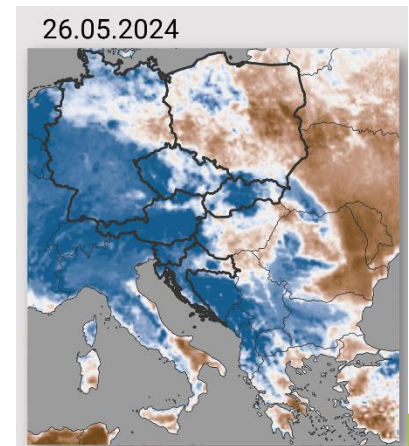
## Impact categories - wildfires



# CRITICAL EVALUATION OF PAST EXTREME EVENTS AND MONITORING/FORECASTING CURRENT ONES

**DHF tool box** - <https://clim4cast.czechglobe.cz/#home>

- Clim4Cast has developed concise DHF analysis for the entire Clim4Cast domain in daily time step
- Resolution 9 km based on ERA5Land and linked to IFS ECMWF model for forecast;
- 1980-present daily archive includes:
  - Daily soil moisture status/anomaly,
  - Fuel moisture and wildfire spread indicators
  - Heat stress indicators



# JOINT DHF EVENT FORECASTING TOOL...



<https://clim4cast.czechglobe.cz/#home>

# DROUGHT FORECAST...





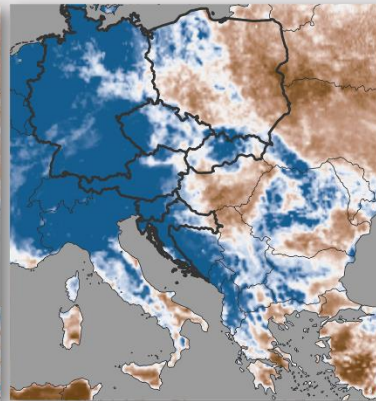
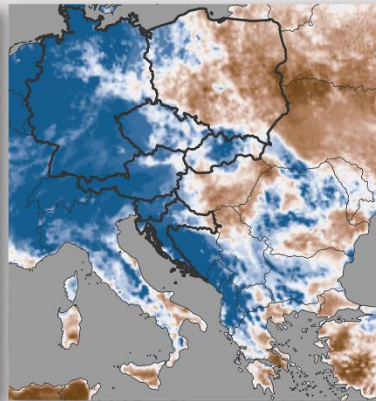
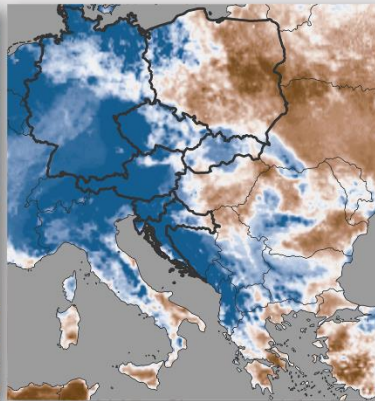
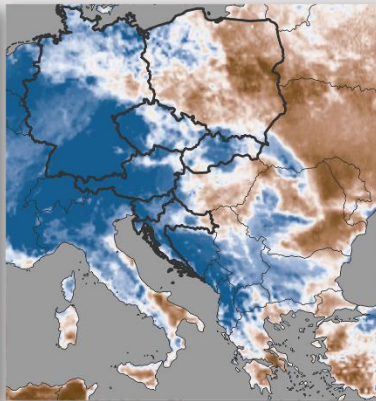
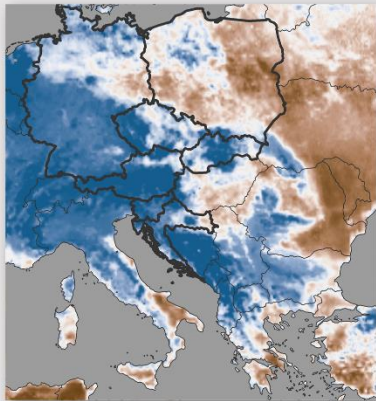
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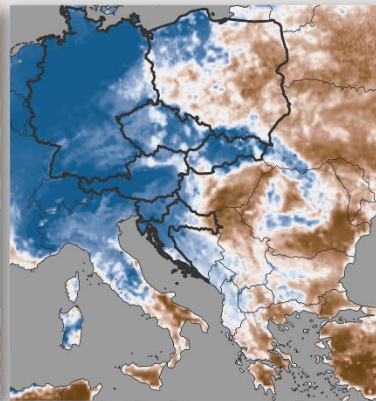
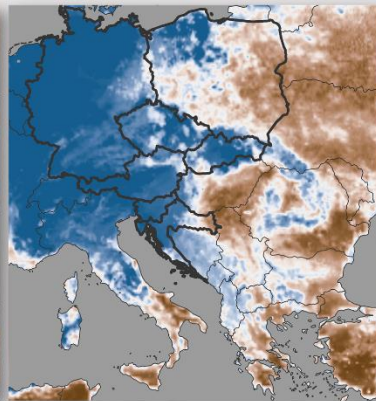
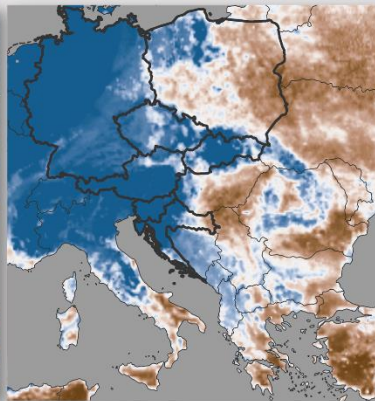
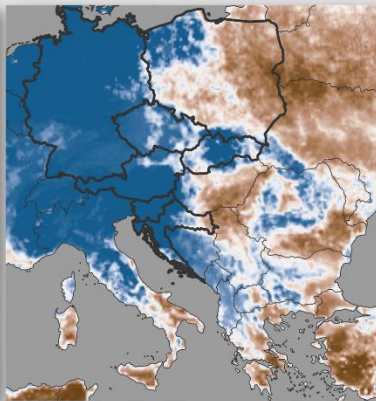
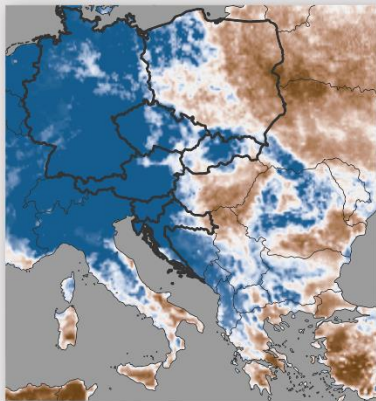
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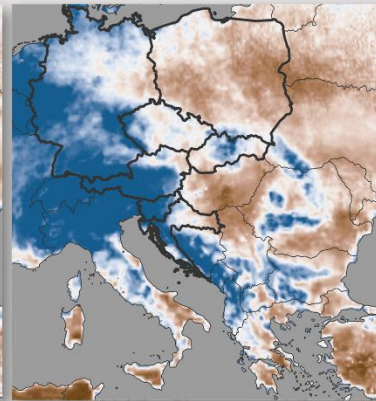
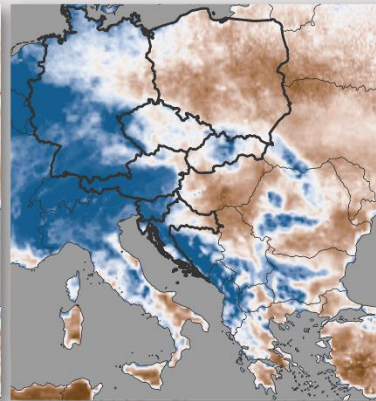
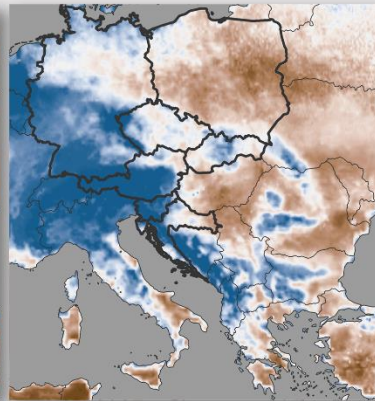
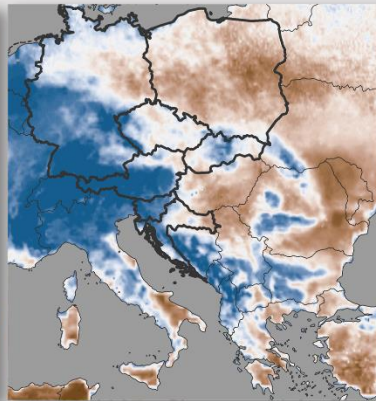
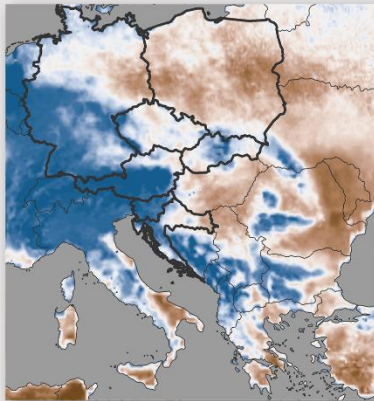
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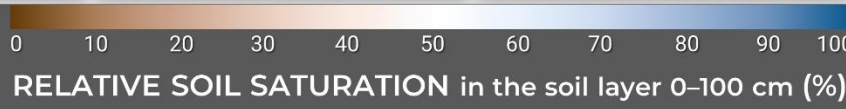
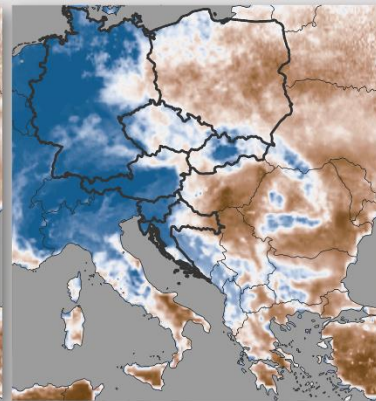
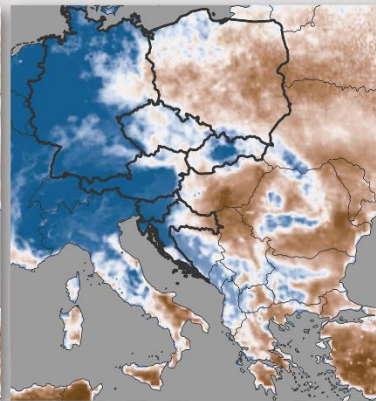
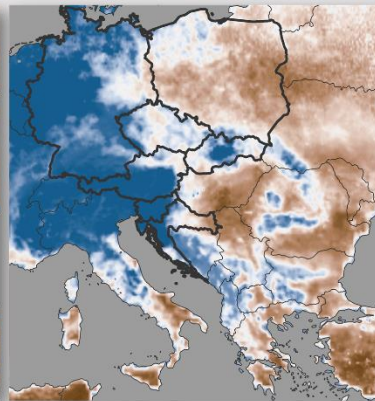
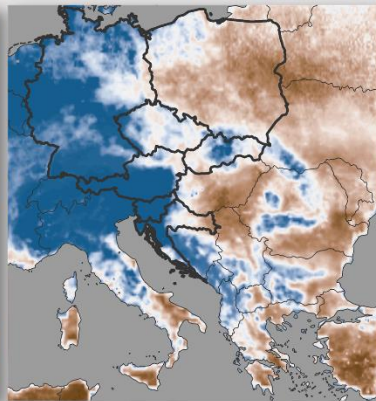
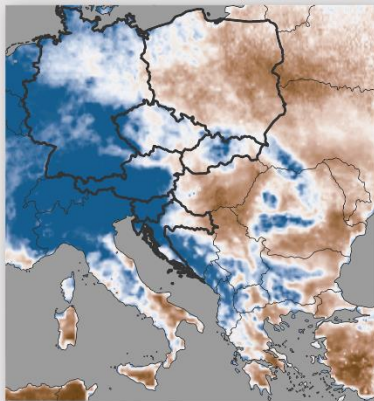
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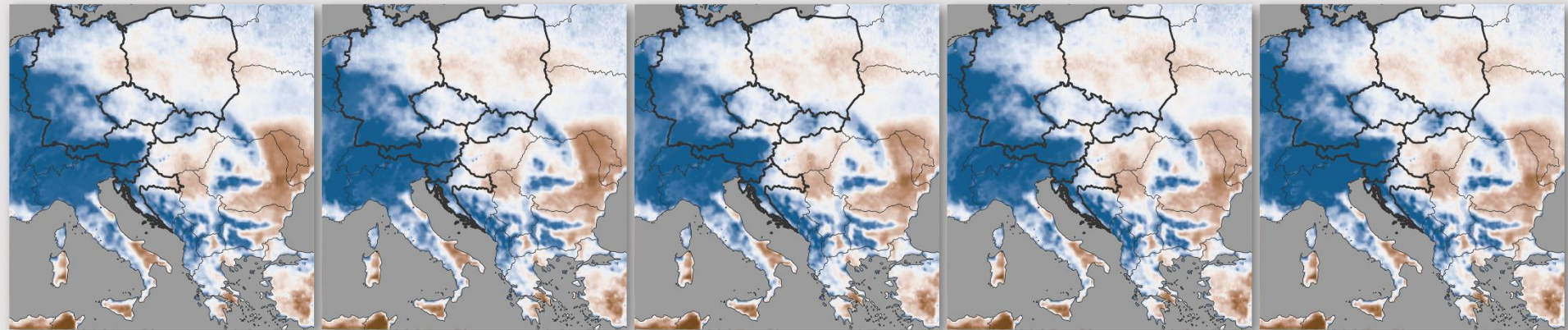
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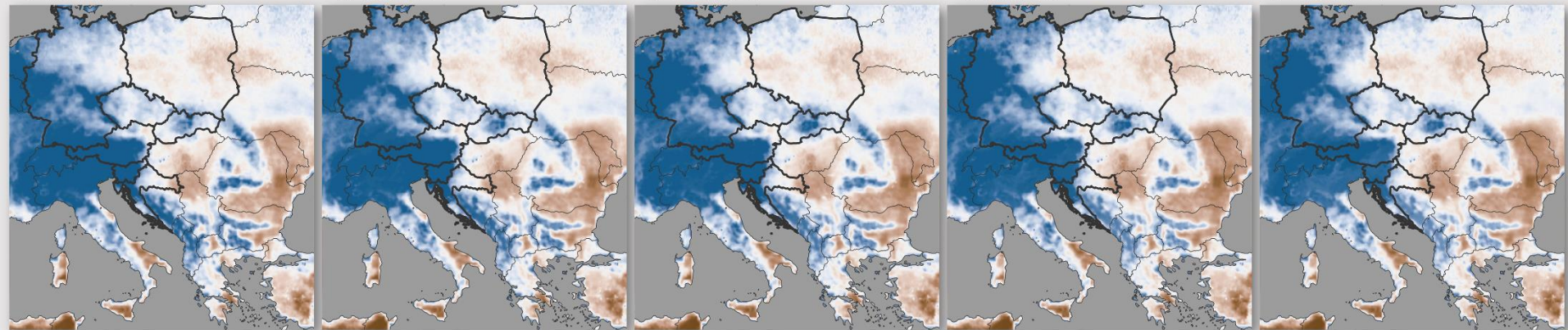
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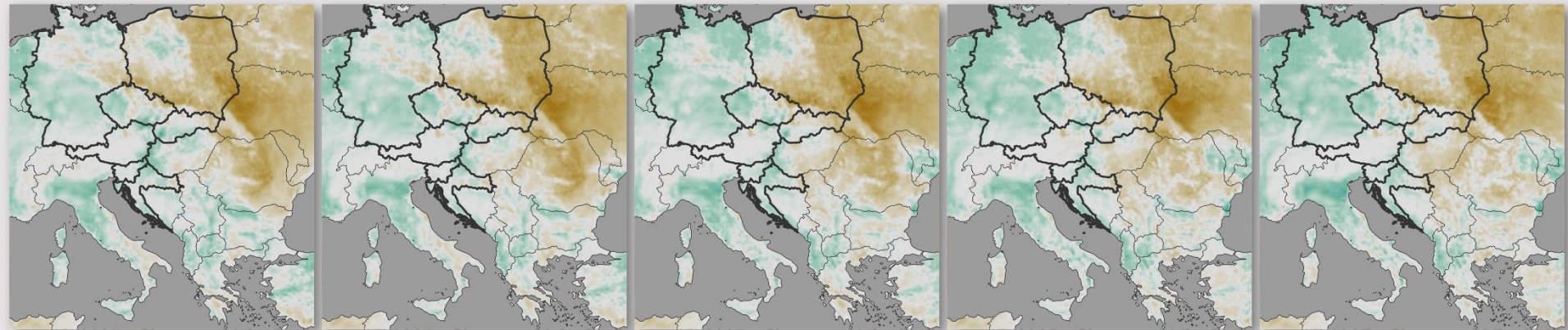
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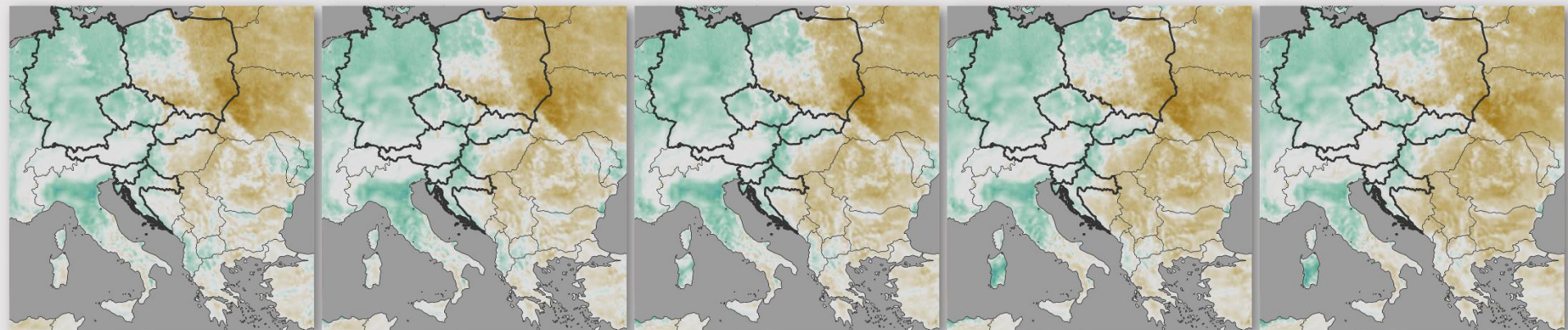
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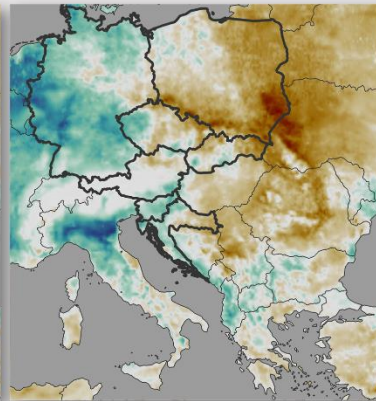
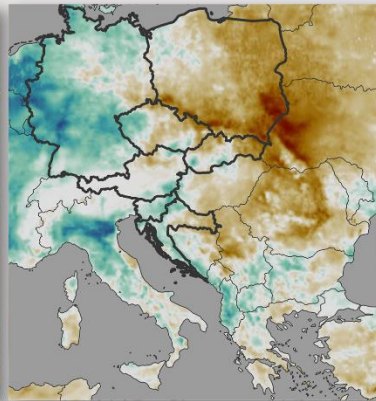
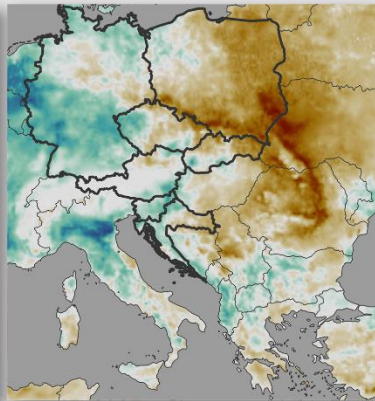
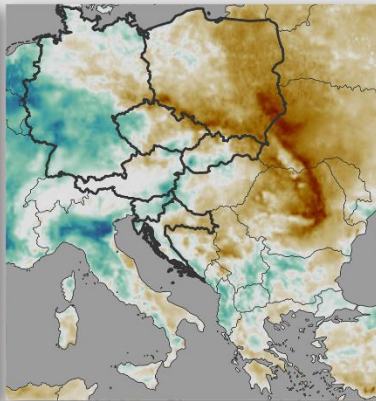
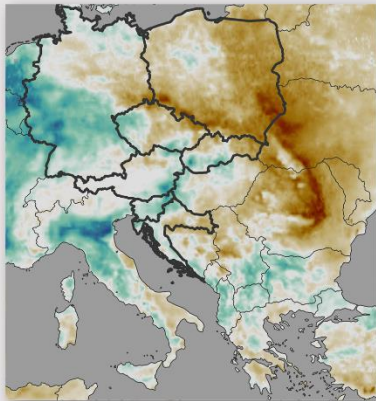
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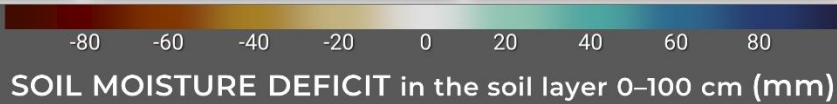
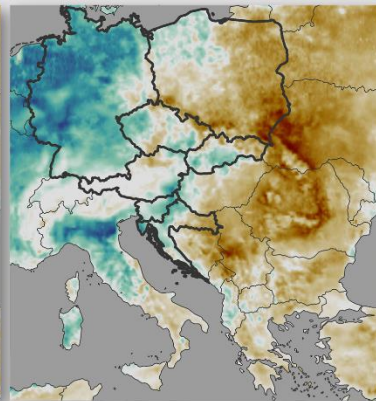
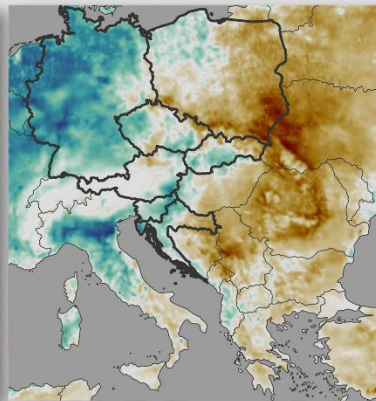
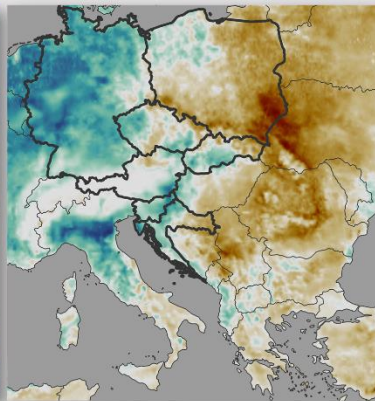
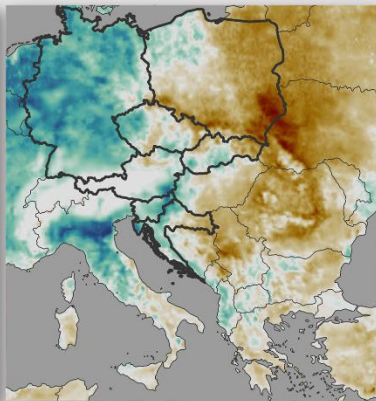
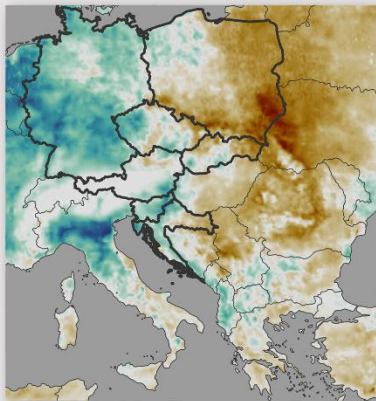
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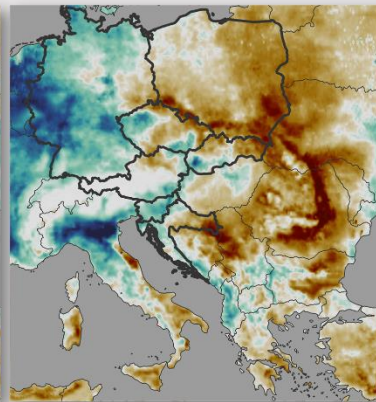
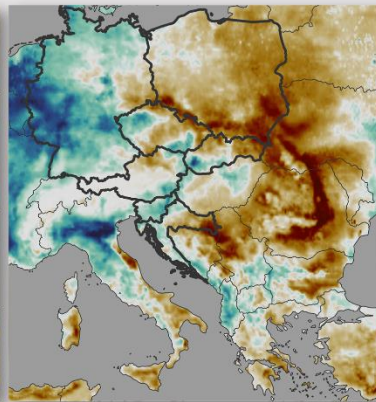
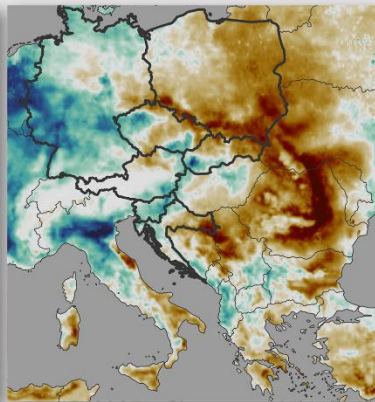
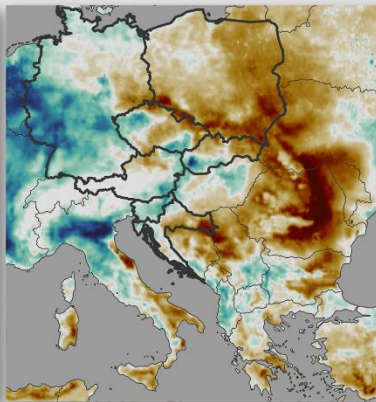
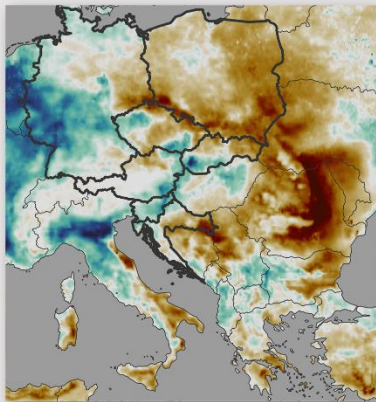
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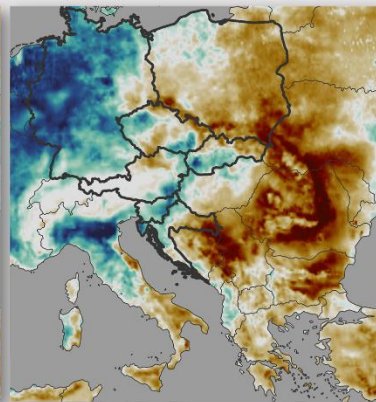
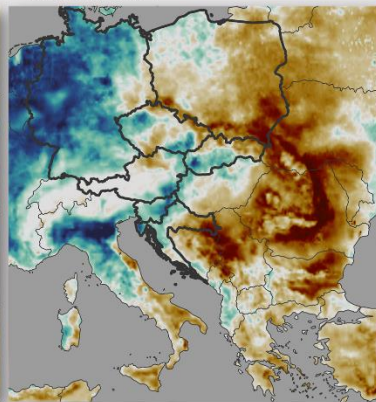
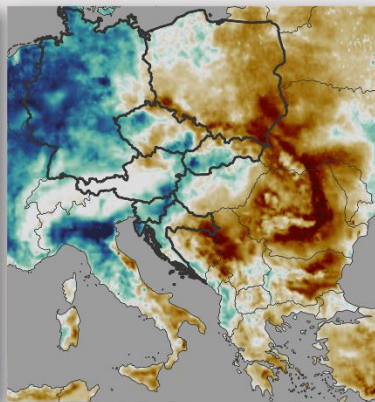
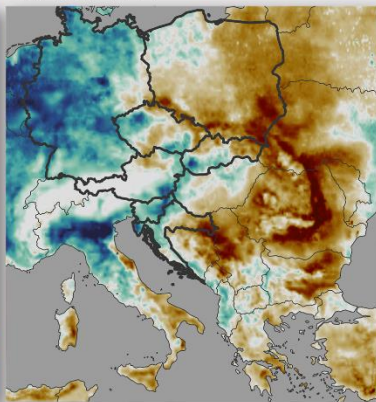
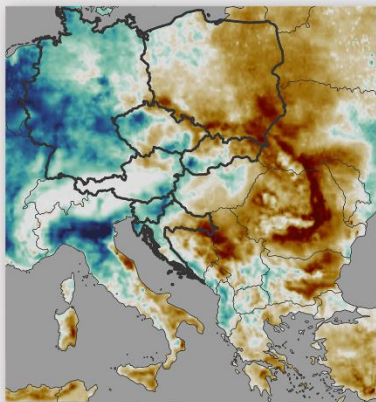
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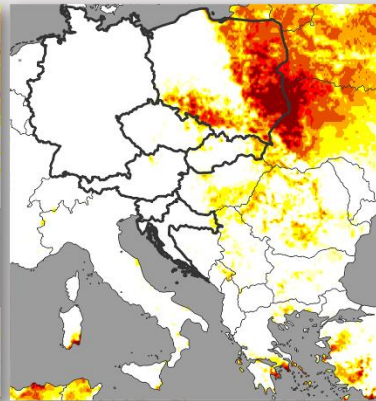
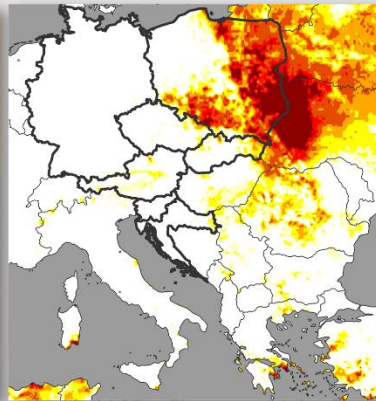
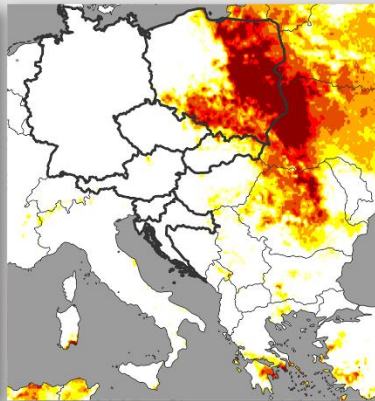
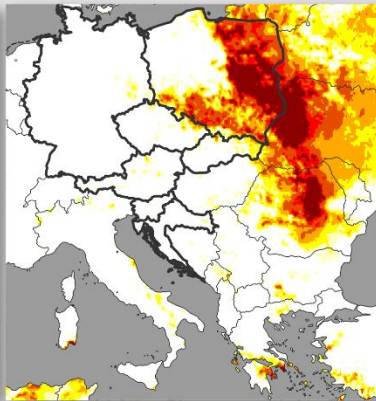
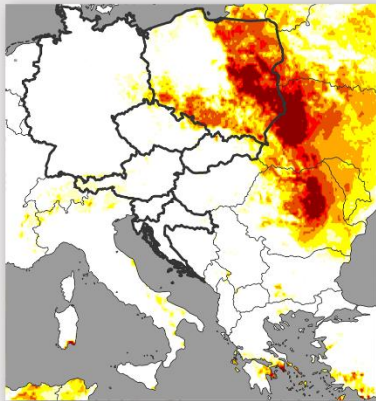
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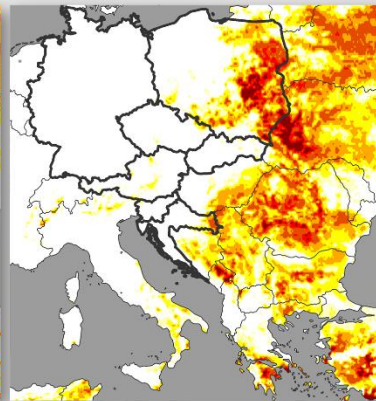
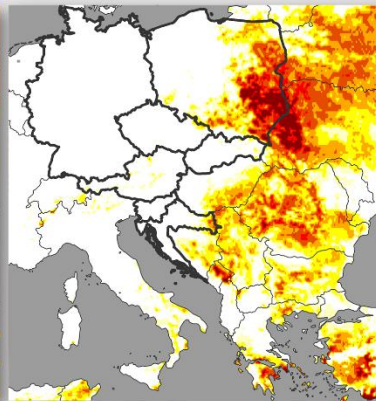
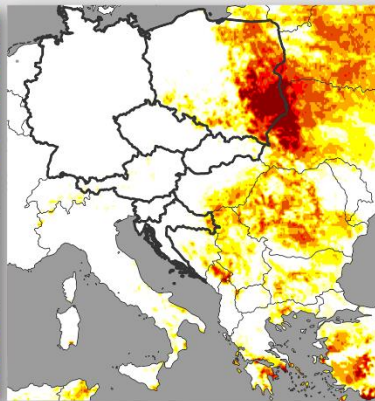
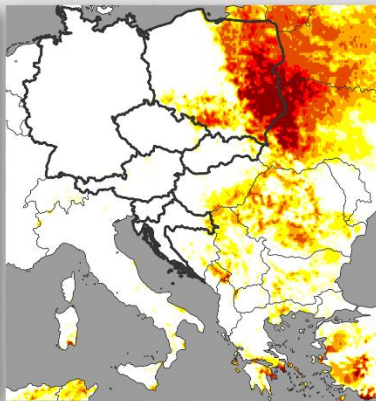
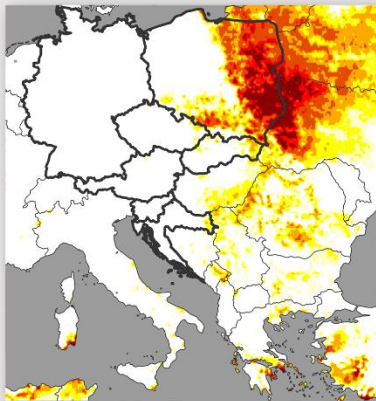
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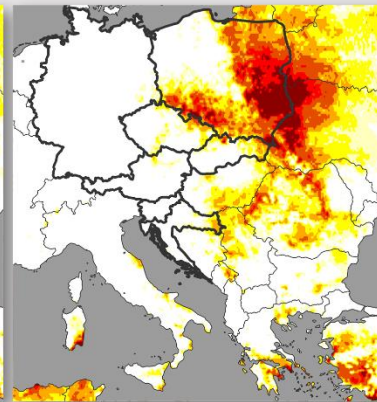
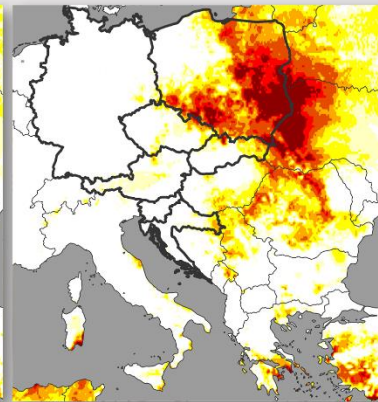
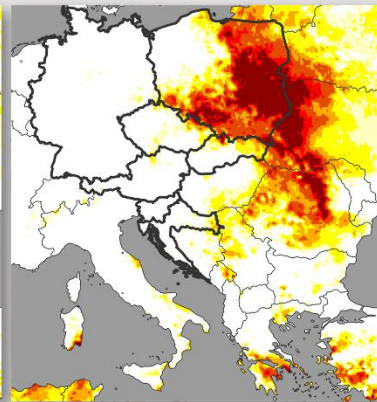
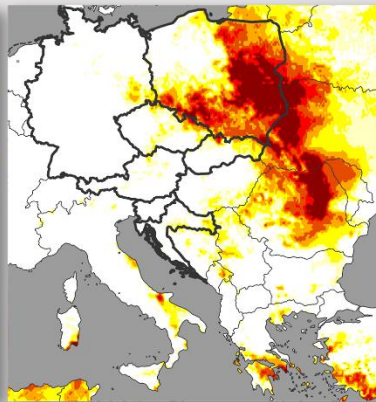
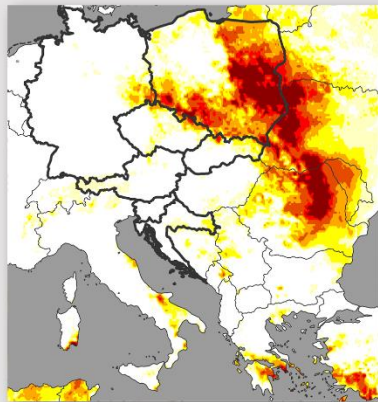
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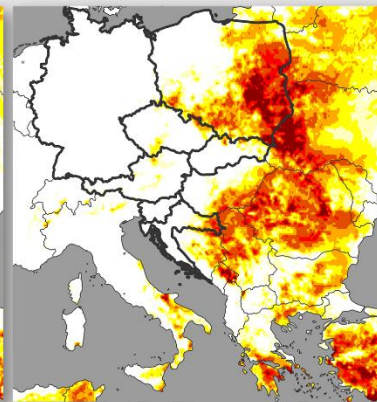
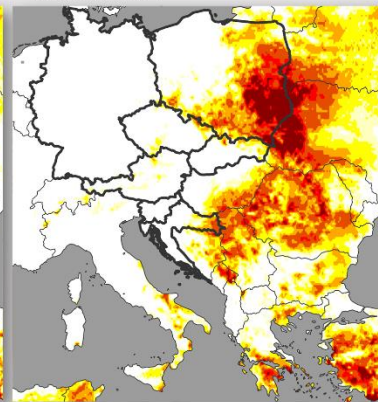
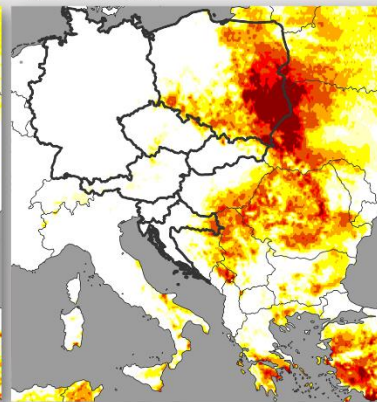
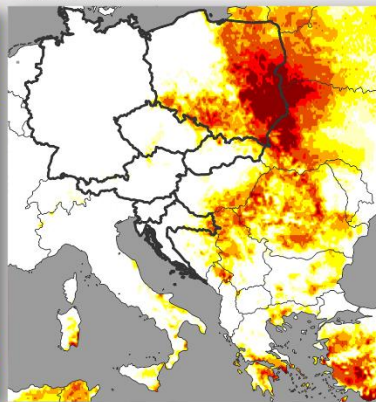
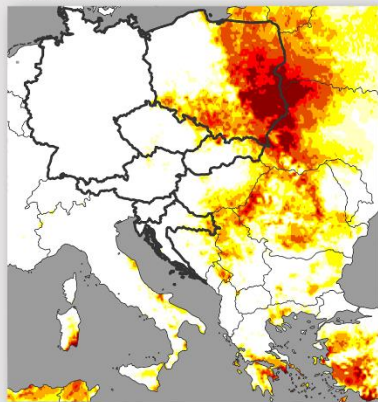
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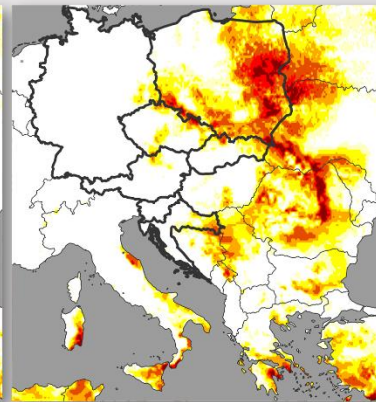
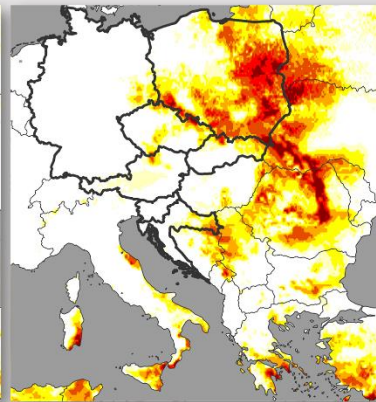
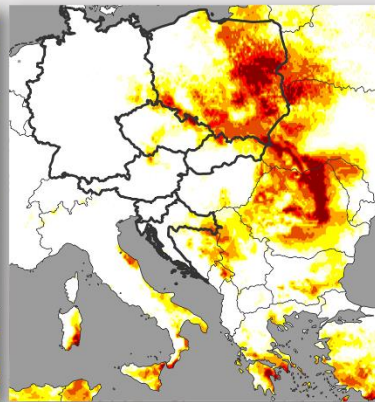
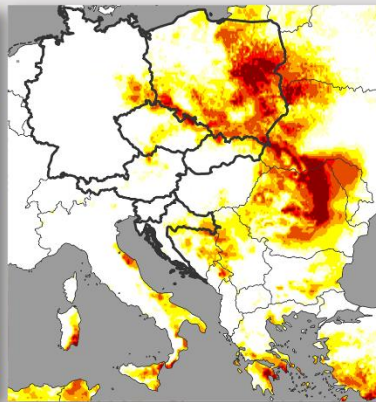
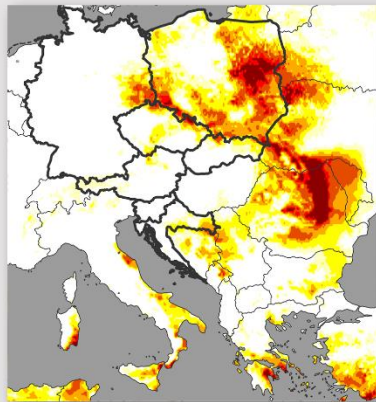
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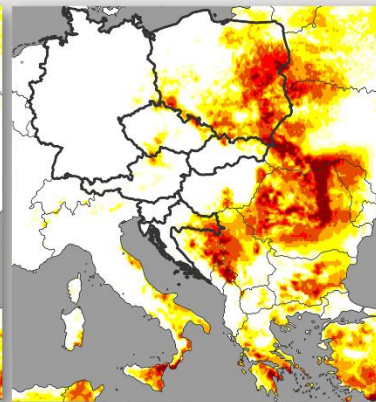
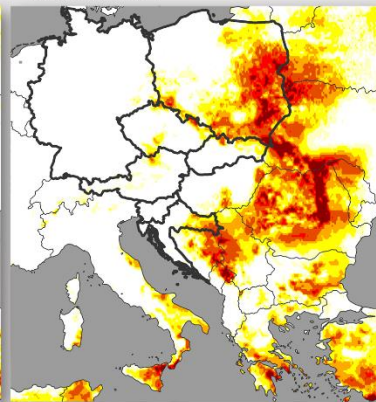
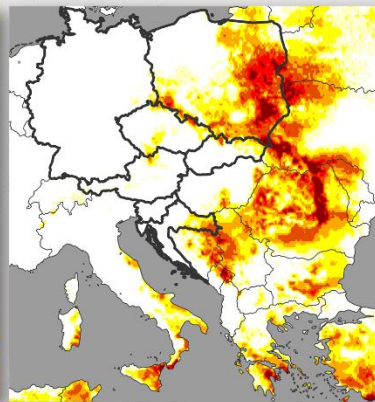
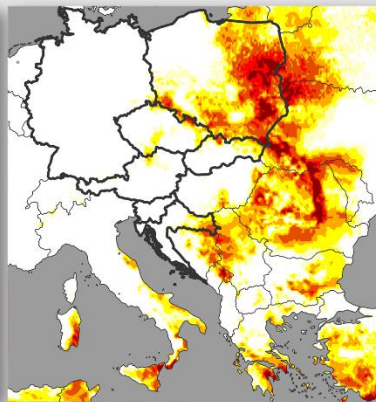
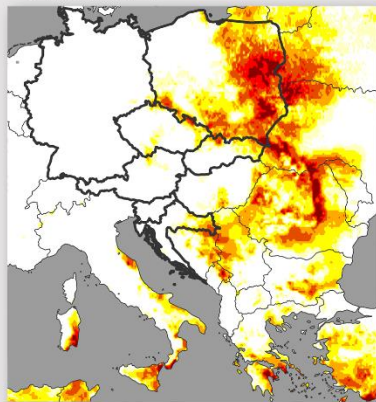
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# WILDFIRE HAZARD...





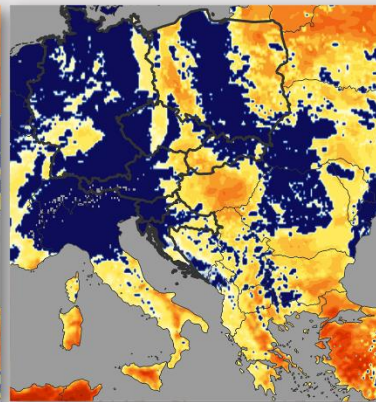
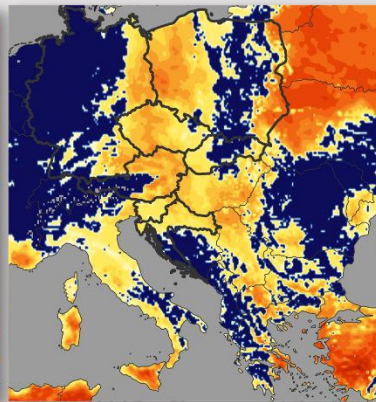
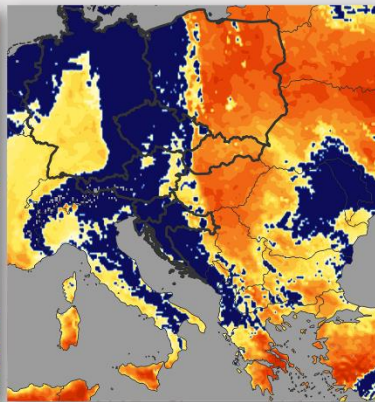
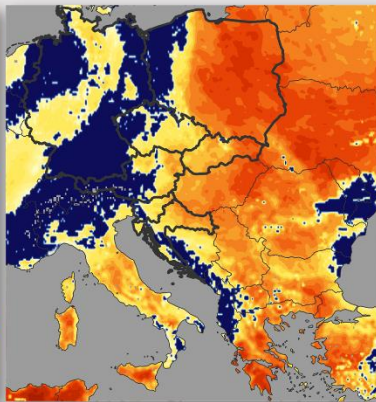
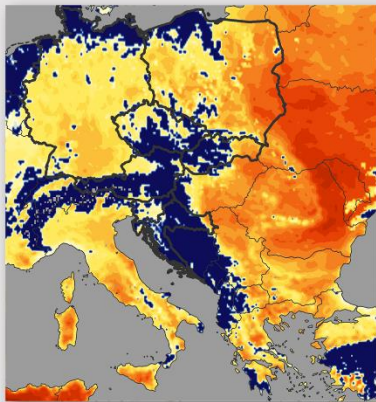
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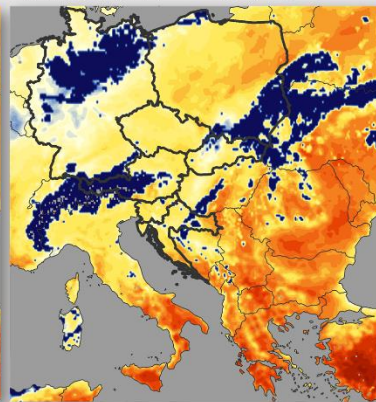
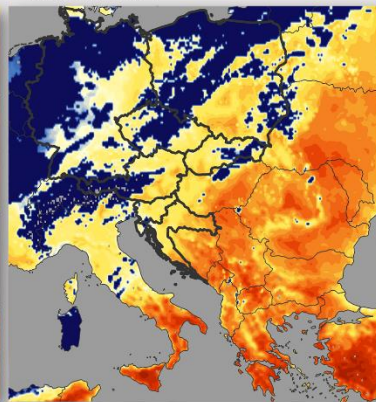
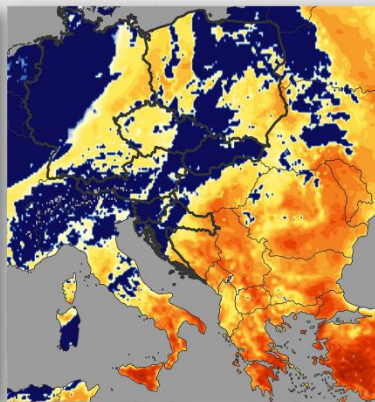
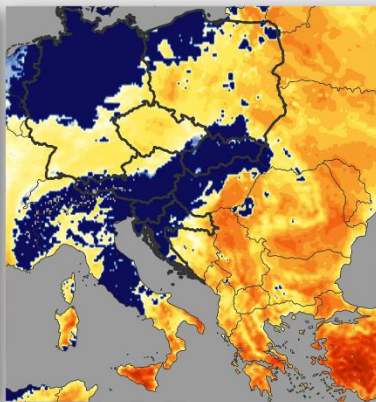
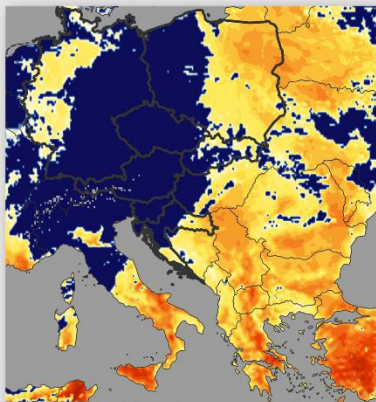
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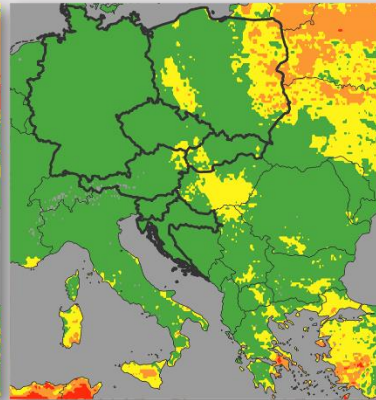
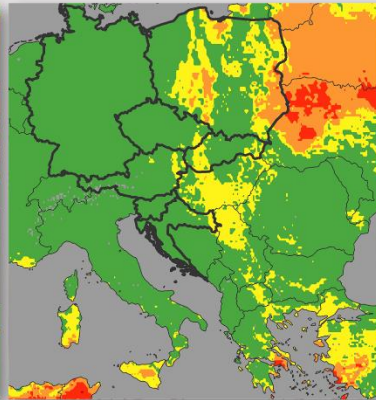
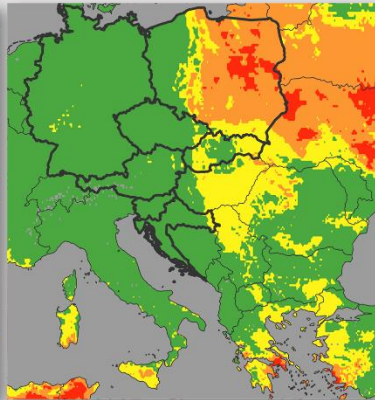
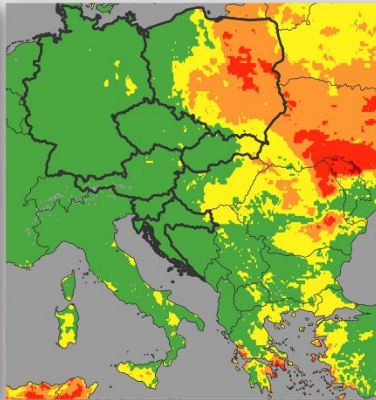
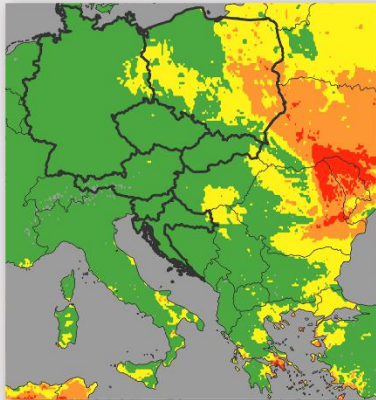
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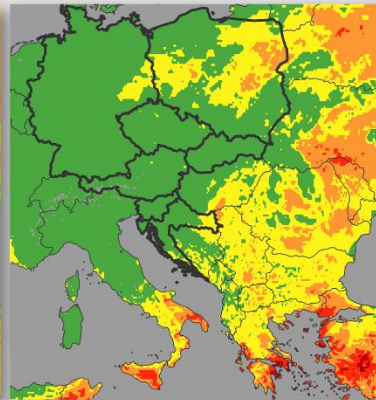
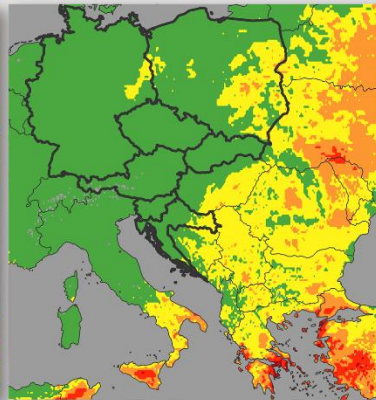
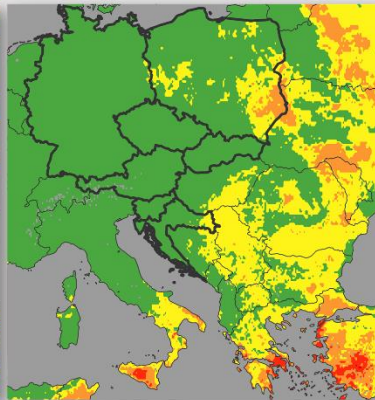
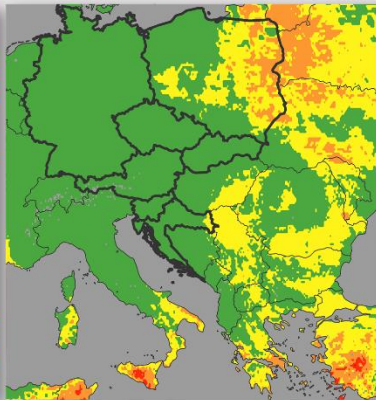
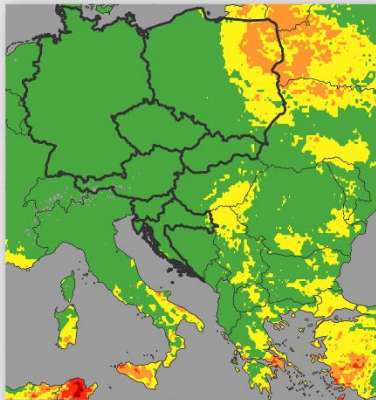
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# HEAT STRESS...





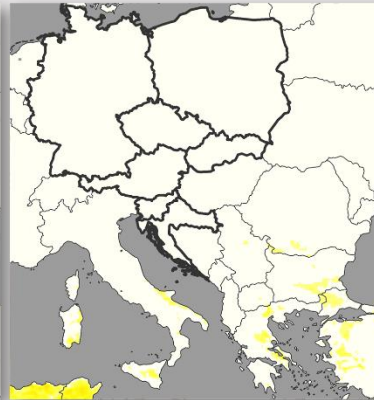
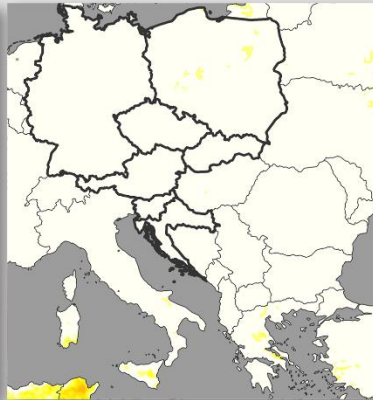
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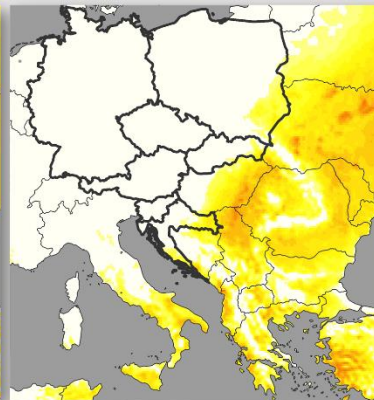
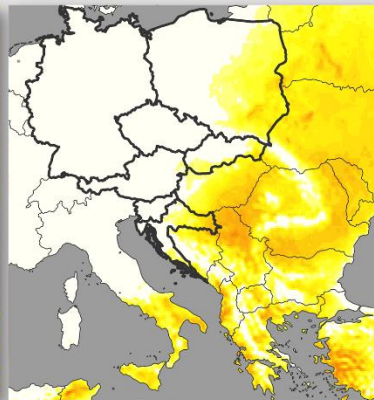
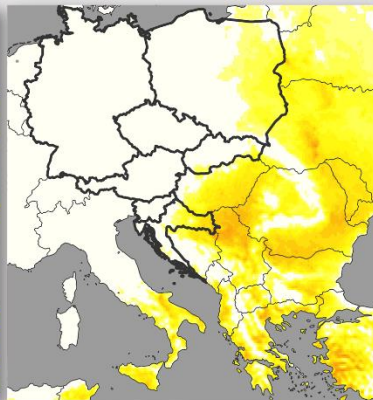
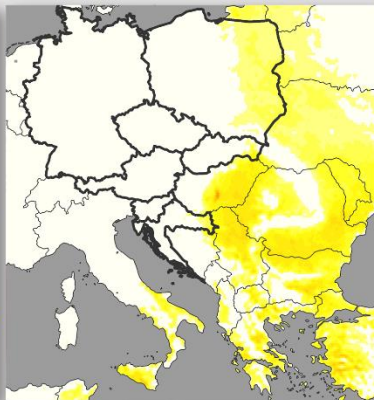
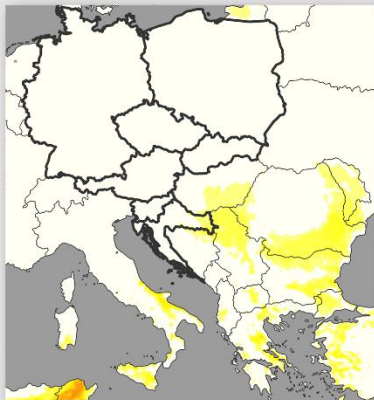
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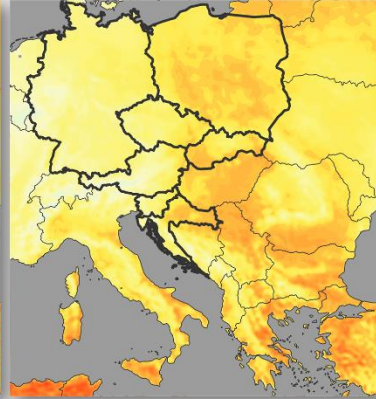
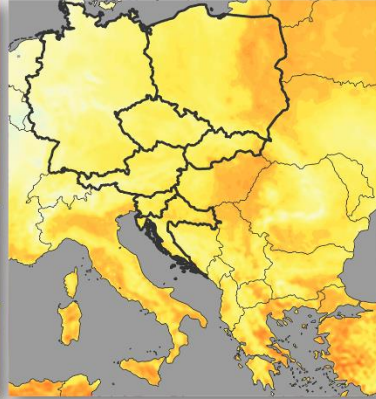
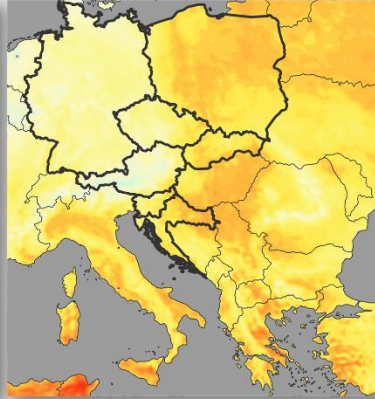
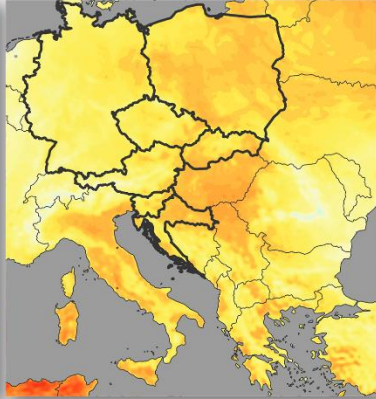
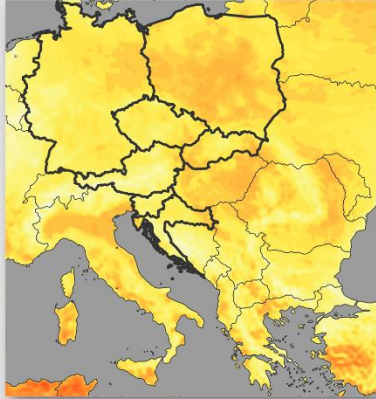
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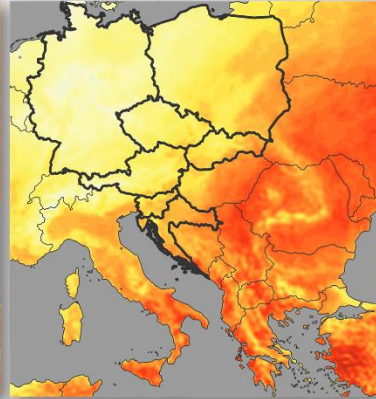
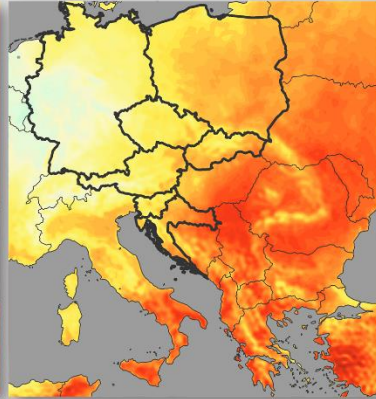
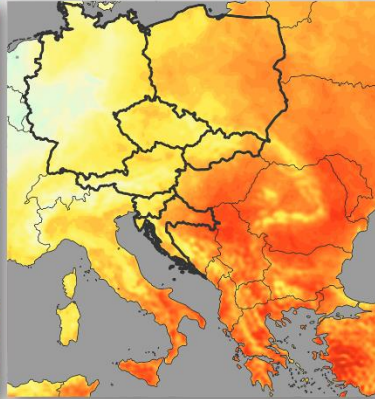
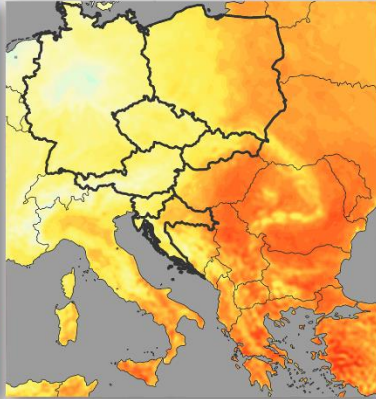
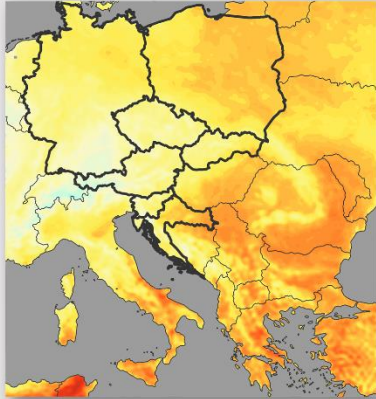
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## Attribution analysis

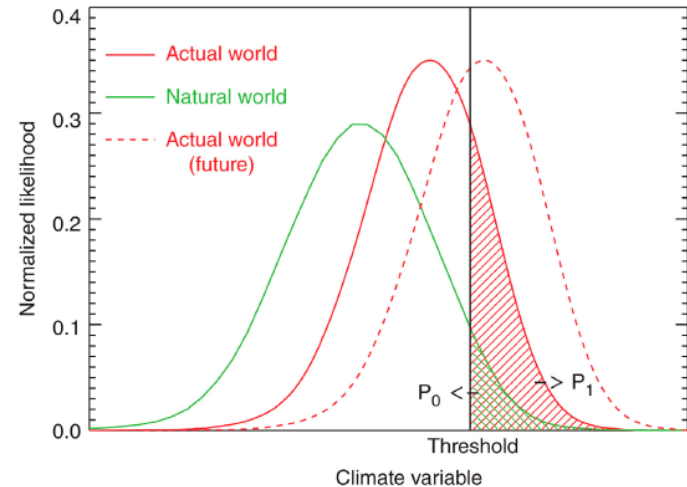
- The goal is to relate given event to the CC
- Both for „communication“ but also for Loss&Damage discussions
- Inspired by global WWA team work





# WHAT WILL BE DONE

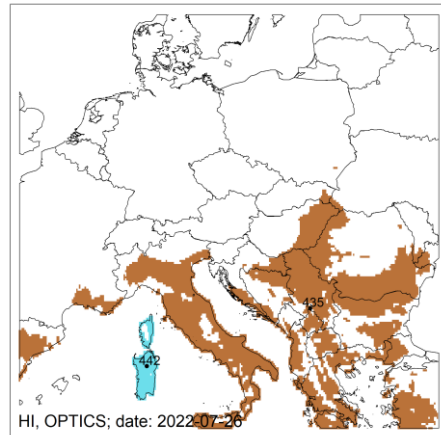
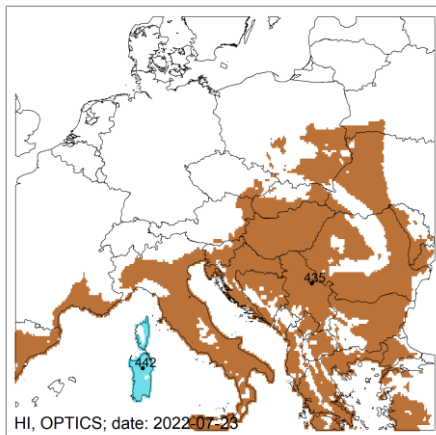
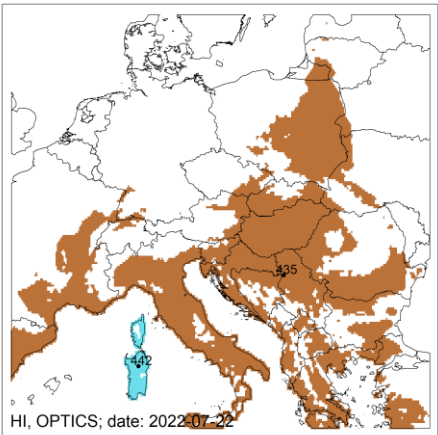
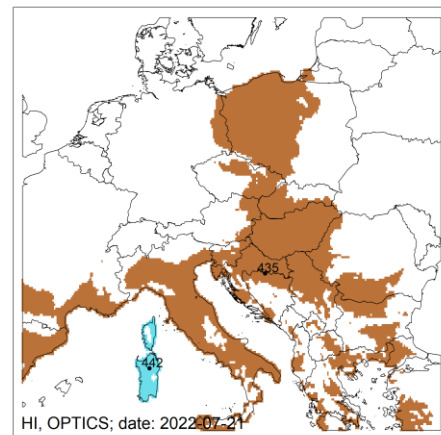
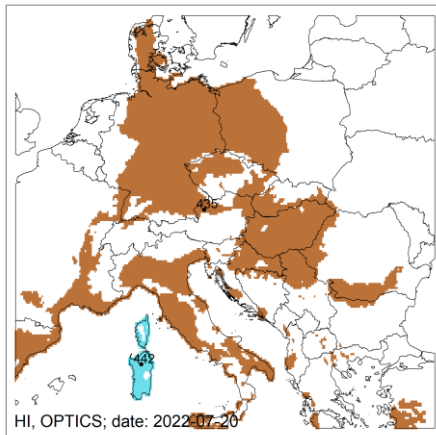
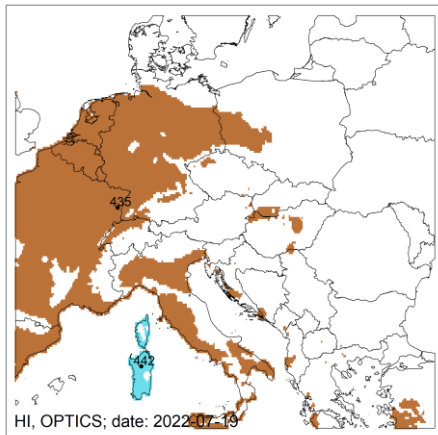
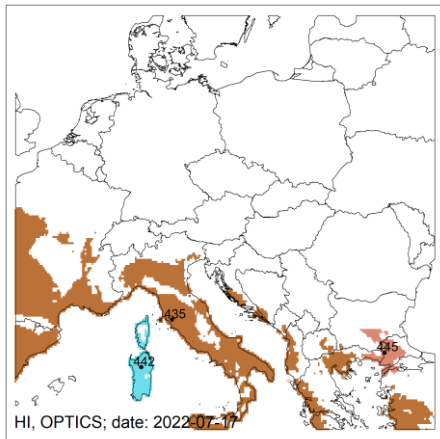
- The basic principle is to establish likelihood of the event during „Natural“, „Actual“ and „Future“ periods and compare probability of the event with particular magnitude.
- **The definition of the events will be developed based on the impact database**
- **The analysis based on the DHF toolbox**



**Figure 1** | Extreme event attribution in practice, from Stott et al., 2016. The two curves represent a climate variable, such as daily temperature. Average temperatures are the most likely (the peak of the curve), while extreme temperatures (hot and cold, at the edges) are the least likely. The green curve represents how likely those temperatures were in the pre-industrial world that was not warmed by human influence, red is the modern world. The threshold line is what we select when an extreme event (in this example a very hot day) occurs. Then, the relative size of the shaded areas shows how much more likely an event has become in the modern world. The dashed line shows how weather may change again in the future — in this case suggesting that the very hot day in the current climate could become a relatively cool day in the future climate.

# WE ARE ON THE WAY TO HAVE IT BY 2025 SEASON

EXAMPLE OF HEAT  
EVENT. JULY 2022



# DEVELOPMENT OF A METHODOLOGY FOR ATTRIBUTION OF THE OCCURRENCE OF EXTREME EVENTS TO CLIMATE CHANGE

## STEPS OF THE ANALYSIS

1. Attribute the trends in heat waves and drought through standard methods across the Clim4Cast region  
- Study lead by JM and RB; - by February 2025
2. Select the „worst“ drought and heat events (from hazard perspective) and attribute those to CC through WWA methodology - by March 2025
3. Impacts and „vulnerability“ analysis to events attributed to CC - by May 2025
4. Establish database that will allow QUICK attribution of future droughts and heat events by March 2025  
- Rapid response of Clim4Cast team;
5. Combine the 1-4 with Drought and Heat event. Action plans - have the draft of the plans and ACTION SHEETS in national languages before 2025 season
6. Wildfire work will start in April 2025

# ROLE OF ASSOCIATED PARTNERS AND DMCSEE...

- Co-creative approach in development of DHF tools - feedback and consultation with the AP - already ongoing;
- Joint evaluation of the selected DHF cross-border events
  - Sample of most severe DHF events in past 10 years;
  - Evaluation of the DHF response by individual AP + exchange of knowledge;
  - Joint work coping strategy for future DHF events
- Testing DHF forecasting tools in collaboration with national partners;
- Discussing most efficient communication of the HAZARD;
- Collaborating on the VULNERABILITY reduction through action plan development.

# THANK YOU FOR YOUR ATTENTION

...WE HAVE A RESPONSIBILITY TO REDUCE PREVENTABLE IMPACTS



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[podebradska.m@czechglobe.cz](mailto:podebradska.m@czechglobe.cz)



[trnka.m@czechglobe.cz](mailto:trnka.m@czechglobe.cz)

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