Press Release [EMBARGO: 09-01-2024, 13.00CET]

Media briefing: January 9th 2024, 14.00-15.00 CET

XAIDA, a consortium of leading European climate institutes, will hold an online media briefing on January 9 from 14.00-15.00 CET to discuss key findings on weather extremes in 2023 as outlined in the press release below. You can join the briefing here:
https://cnrs.zoom.us/j/95595000147?pwd=c3QvQWo2ZlpubUZ6dVlrVEtIc3JCUT09
Meeting ID: 955 9500 0147
Passcode: b9WfUv
YouTube lifestream: rtmp://a.rtmp.youtube.com/live2

MANY DEVASTATING EXTREMES IN 2023 WERE AMPLIFIED BY GLOBAL WARMING

In 2023, the world reached new record temperatures, with an unprecedented global mean temperature of 1.48°C above pre-industrial levels. These record temperatures strongly increased the intensity of heatwaves, droughts and extreme rainfall associated with storms like Otis and Daniel.

2023 was an extraordinary year for climate: each month from June onward was warmer than the corresponding month in any previous year. In this last half year temperatures exceeded 1.5°C above pre-industrial levels (1850-1900) with some days even exceeding 2.0°C. While the development of El Niño contributed additional heat, the main driver of the record-breaking temperatures were fossil fuel emissions. As reported by the EU's Copernicus Climate Change Services (C3S), annual global temperatures reached +1.48°C above pre-industrial levels, breaking the previous record year (2016) by an unprecedented 0.17°C. Throughout the year, extreme weather hit nations around the world including heatwaves, droughts, floods and wildfires. In the aftermath of those events, many people asked how those extremes related to the record warmth?

Studies from XAIDA ('eXtreme events: Artificial Intelligence for Detection and Attribution) researchers provided a range of insights to this question in 2023. XAIDA unites 16 leading institutes in Europe working on extreme weather. Dim Coumou, XAIDA coordinator and Professor in Climate Extremes and Societal Risk at VU Amsterdam, says new Artificial Intelligence (AI) methods, together with massive climate datasets, are enabling scientists to study the relationship between climate change and extreme weather in novel ways. "For more than ten years, attribution studies have shown that climate change is making several types of extreme weather events more intense. Now, with these new tools, we can study the underlying processes as well as the societal impacts in new ways."

Storms Otis and Daniel

In October 2023, Hurricane Otis made landfall in Acapulco, Mexico, killing more than 50 people and causing more than $US10 billion in damages, making it one of the costliest tropical cyclones ever recorded in Mexico. "We find a clear climate change signal in increasing rainfall associated with Hurricane Otis", reports Davide Faranda, Directeur de Recherche at CNRS in Paris, who leads research on tropical cyclones within XAIDA. A warmer atmosphere can hold more water vapor, leading to

heavier downpours. In addition, climate change can affect the dynamical processes within storm systems, which can further increase the amount of rainfall. "Our study highlights that Hurricane Otis is a unique event in the observational data, and that it emerges as a product of human-driven climate change. This finding underscores the urgency of extending attribution studies to regions that are vulnerable to such storm systems," says Faranda (ClimaMeter, 2023a). "Similarly, in the case of Storm Daniel, a so-called Medicane, the elevated temperatures in 2023 fueled the storm with extra moisture, producing more extreme rainfall," adds Faranda (ClimaMeter, 2023b). In September, storm Daniel struck Libya, bringing extreme rainfall that led to the collapse of three dams and the deaths of more than 3400 people. A study by World Weather Attribution found that climate change made the rainfall up to 50% more intense (WWA 2023a). “Throughout 2023, extreme weather events demonstrated how poorly prepared the world is for the growing risks of climate change,” says Friederike Otto, co-founder of World Weather Attribution and Senior Lecturer in Climate Science at the Grantham Institute, Imperial College London.

Heatwaves around the globe

In July 2023, heatwaves hit the United States, southern Europe and China, with temperatures in the US and China exceeding 50°C. Such heatwaves can be deadly. “Temperatures exceeding 50°C are also possible in Europe”, adds Erich Fischer, Professor at ETH Zurich who studies very extreme heat waves within XAIDA. Fischer and colleagues studied heatwaves over France in thousands of climate model realizations and found that heat waves much warmer than presently observed are possible (Fischer *et al* 2023). “Heat stress associated with such worst-case heat waves present risks for large public events in cities, like the upcoming 2024 Olympic Games in Paris which are organized at the height of the summer season” says Pascal Yiou, vice-coordinator of XAIDA and Senior Researcher at CNRS in Paris (Yiou *et al* 2023). XAIDA studies have shown that heat waves over Europe are increasing faster than elsewhere due to dynamical changes in the jet stream (Singh *et al* 2023, Vautard *et al* 2023). It is currently unclear why state-of-the-art climate models (CMIP6) fail to accurately capture this trend, raising concerns about future projections of heat waves over Europe.

Drought, crop losses and wildfire

A recent XAIDA study shows that crop losses due to heatwaves and droughts have been increasing since 1982 throughout important food-producing breadbasket regions in the Northern Hemisphere (Li *et al* 2023). Where forests are typically more resilient to these hot-and-dry extremes, croplands can suffer large productivity losses which can drive up food prices. “It is worrying that we can already see in observations of the last 40 years that crop losses due to hydroclimatic extremes are getting more severe” says Jakob Zscheischler, Professor for Data Analytics in Hydro Sciences at the Helmholtz Centre for Environmental Research (UFZ) in Leipzig.

Agricultural drought, which is the combined effect of periods with low rainfall and heat, also intensifies with climate change as warmer air dries the soils more rapidly via evapotranspiration. The long-lasting agricultural drought (2020-2023) in West Asia was the second worst on record, but in the current climate it is now a relatively common event expected to occur about once every decade. Climate

change made the drought about 25 times more likely in Syria and Iraq, and about 16 times more likely in Iran (WWA 2023b). Friederike Otto says heat was the primary driver of the drought. “While the low rainfall did not show clear signs of being influenced by climate change, the extreme heat, driven by climate change, increased evaporation from soil and plants, making the drought much more intense.” With a large part of the population in the Middle East dependent on rain-fed agriculture, and a vulnerable population due to, among others, war and post-war transition, the long-lasting drought created a humanitarian crisis with more than 12 million people facing food insecurity in Syria alone.

Warming also increases the risk of hot and dry conditions that fuels wildfire. In 2023, Canada experienced its most severe wildfire season on record with 18.4 million hectares burned. Climate change made the hot, dry and windy conditions that drove wildfires in Québec, Canada at least two times more likely (WWA 2023c). Devastating wildfires also raged in the Mediterranean and Siberia, Russia in 2023.

Loss & Damage

The large number of devastating extremes in 2023, and the strong role of human-caused climate change on many of those - as reported by XAIDA scientists and others - stresses the need for adaptation of societies around the world. In vulnerable developing countries, climate extremes can result in human catastrophes. In 2023, at COP28, important steps were made on the establishment of a fund to support vulnerable developing countries in dealing with loss and damage arising from extremes and other climate impacts. The devastating extremes in 2023 highlight the importance of a prompt operation of this Loss & Damage fund.

Press conference details

Topic: XAIDA Press Conference, Jan 9, 2024 02:00 PM Paris
https://cnrs.zoom.us/j/95595000147?pwd=c3QvQWo2ZlpubUZ6dVlrVEtIc3JCUT09
Meeting ID: 955 9500 0147
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XAIDA is funded via the European Commission's Horizon2020 program under Grant Agreement n°101003469 and unites the following research institutes within Europe:

INSTITUTE	Principal Scientist
1. Institut Pierre-Simon Laplace - Centre National pour la Recherche Scientifique (CNRS)	Pascal Yiou
2. Vrije Universiteit Amsterdam (VU)	Dim Coumou
3. University of Oxford (UOxF)	Scott Osprey
4. Koninklijk Nederlands Meteorologisch Instituut (KNMI)	Sjoukje Philip
5. Met Office (MOHC)	Peter Stott
6. Max-Planck-Gesellschaft zur Förderung der Wissenschaften ev (MPG)	Marcus Reichstein
7. Universitat de Valencia (UVEG)	Gustau Camps-Valls
8. Universität Leipzig (UL)	Miguel Mahecha
9. Deutsches Zentrum für Luft- und Raumfahrt (DLR)	Jakob Runge
10. Eidgenössische Technische Hochschule Zürich (ETH)	Sonia Seneviratne & Erich Fischer
11. Helmholtz-zentrum fur Umwelforschung GMBH (UFZ)	Jakob Zscheischler
12. University of Reading (UR)	Ted Shepherd
13. International Centre for Theoretical Physics (ICTP)	Erika Coppola
14. Office for Climate Education (OCE)	Simon Klein
15. Climate Centre on Climate Change and Disaster Preparedness - RCRC	Roop Singh
16. Grantham Institute – Imperial College London (ICL)	Friederike Otto

You can find the institutions, logos and website links of the XAIDA Consortium on https://xaida.eu/partnership/

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Relevant XAIDA papers from 2023

ClimaMeter 2023a, Heavy rain in Hurricane Otis mostly strengthened by human-driven climate change (link)

ClimaMeter 2023b, Heavy precipitation in Medicane Daniel mostly strengthened by human-driven climate change (link)

Faranda D, Ginesta M, Alberti T, Coppola E and Anzidei M 2023 Attributing Venice Acqua Alta events to a changing climate and evaluating the efficacy of MoSE adaptation strategy npj Clim. Atmos. Sci. 6

Fischer E M, Beyerle U, Gessner C, Humphrey V, Lehner F, Pendergrass A G, Sippel S, Zeder J and Knutti R 2023 Storylines for unprecedented heatwaves based on ensemble boosting 1–11

Li J, Bevacqua E, Jain A K, Goll D, Wang Z, Sitch S, Arora V, Arneth A, Tian H and Zscheischler J 2023 Hydroclimatic extremes contribute to asymmetric trends in ecosystem productivity loss 1–10

Singh J, Sippel S and Fischer E M 2023 Circulation dampened heat extremes intensification over the Midwest USA and amplified over Western Europe *Commun. Earth Environ.* **4** 1–9

Vautard R, Cattiaux J, Happé T, Singh J, Bonnet R, Cassou C, Coumou D, Andrea F D, Faranda D, Fischer E, Ribes A, Sippel S and Yiou P 2023 Heat extremes in Western Europe increasing faster than simulated due to atmospheric circulation trends 1–9

Yiou P, Cadiou C, Faranda D, Robin Y and Vrac M 2023 Ensembles of climate simulations to anticipate worst case heatwaves during the Paris 2024 Olympics *npj Clim. Atmos. Sci.* 1–8

WWA, 2023a, HumInterplay of climate change-exacerbated rainfall, exposure and vulnerability led to widespread impacts in the Mediterranean region (link)

WWA, 2023b, Human-induced climate change compounded by socio-economic water stressors increased severity of drought in Syria, Iraq and Iran (link)

WWA, 2023c, Climate change more than doubled the likelihood of extreme fire weather conditions in Eastern Canada (link)

The information in this press release is embargoed until 09-01-2024, 13.00CET.