CASE STUDY: Developing world-leading capability that is delivering significant global impact and value

Executive Summary: The Climate Science for Service Partnership (CSSP) China project has supported the development of the Met Office's world-leading Event Attribution system, which has transformed understanding of how human-induced climate change influences extreme weather, providing critical evidence that supports climate policy, adaptation planning, and disaster risk management worldwide. Through international partnerships, research collaborations, and capacity-building workshops, CSSP China and CSSP Brazil have developed global expertise in attribution science, strengthened scientific capabilities in China, Brazil and the UK, and enabled faster, evidence-based decision-making to help protect lives, livelihoods, and infrastructure from climate-related risks.

The Challenge: Extreme weather and climate events impact all levels of society and have devastating short and long-term impacts on lives and livelihoods. Uncertainty remains on how weather extremes will change in the future, and the ability to better characterise these is crucial for developing effective strategies to reduce future climate risks and impacts. The science of event attribution aims at establishing whether extreme weather and climate events are linked to climate change driven by human activity. These studies provide an important climate service that contributes to monitoring the effects of climate change and improving our understanding of current and future weather and climate extremes. The continued rise in incidence of extreme weather events across the globe, resulting in severe flooding, landslides, droughts and wildfires that significantly impact multiple sectors across society, demonstrates the urgent need for event attribution studies to place these events in context and inform decision makers on current and future risks of such events. This will help inform better adaptation planning in different sectors to build resilience to future weather and climate variability and change, as well as support decision making around the mitigation of human-induced greenhouse gas emissions.



Top: Rescue services responding to the aftermath of an extreme flooding event. Bottom: Intense wildfire July 2025 in Riba de Saelices, Guadalajara province, Central-Eastern Spain

Meeting the Challenge: Under CSSP China, the Met Office have developed and maintained a world-leading Event Attribution system (HadGEM3-GA6-N216), based on the Hadley Centre Global Environment Model version 3 with the Global Atmosphere version 6.0 atmospheric science configuration and physics package and with a horizontal model grid resolution of ~60 km at mid-latitudes. For over a decade, this attribution system has provided the global climate science community with large datasets from a world-leading modelling system tailored for the attribution of extreme weather and climate events. The research that it has enabled is providing critical information regarding our understanding of the relationship between weather hazard, vulnerability and exposure as societies plan for mitigating and adapting to climate change.

FitzRoy Road, Exeter, Devon, EX1 3PB United Kingdom

enquiries@metoffice.gov.uk
www.metoffice.gov.uk

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Pathway to Impact: This key modelling capability has underpinned the development and delivery of research and services across a range of projects and programmes, both within the Met Office and internationally. It has enabled cutting-edge collaborative research, supporting over 100 studies published in peer-reviewed literature to date. For example, collaborative research under the CSSP China and CSSP Brazil projects is providing new understanding at the frontier of weather and climate science that is supporting climate mitigation and adaptation policy decision-making in the UK, China, Brazil and around the world.

Chao Qingchen, past Director-General of the National Climate Centre, China Meteorological Administration, commented: *"During the past decade we have carried out in depth collaborative research and development in the front areas of climate science and its translation into climate services. I have also witnessed that the outcomes supported the national policy making and benefitted social and economic development."*

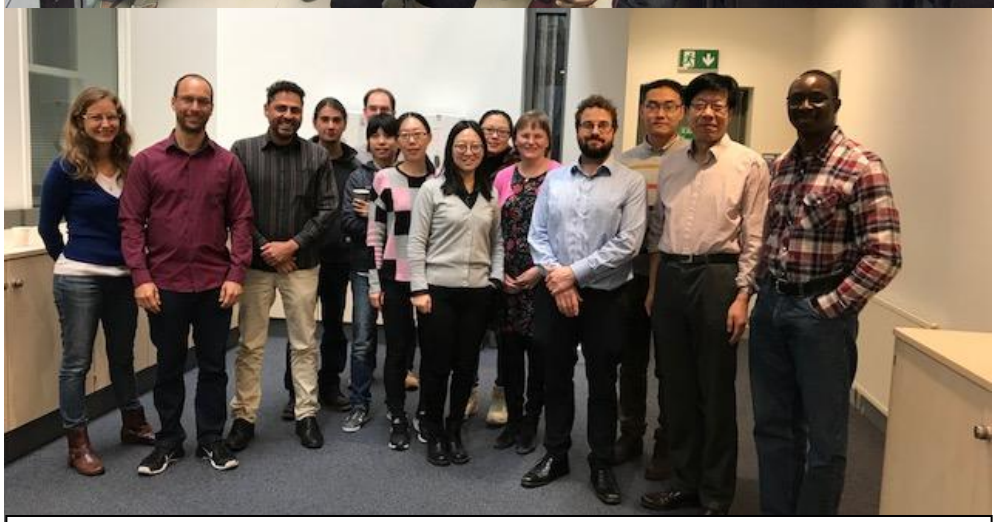
This collaborative effort has delivered substantial capacity-building for partners through extreme event attribution workshops, designed to not only utilise the Event Attribution system for generating novel research but also equip participants with attribution skills, techniques and tools. This has established new expertise that has expanded the knowledge base contributing towards international initiatives such as the Intergovernmental Panel on Climate Change (IPCC). The delivery of these services is strengthening international partnerships and collaborations as well as partners reputation for excellence in science, technology, research and innovation. For example, prior to the CSSP China project, the IPCC Assessment Reports included no event attribution contributions from Chinese authors. This has now markedly changed with over 100 papers on extreme event attribution featuring in IPCC reprorts, helping strengthen China's global standing and thought leadesrhip in climate policy and diplomacy and increase the global knowledge base to support global climate mitigation and adaptation policy making.

Prof. Zhou Tianjun, Deputy Director-General of the Institute of Atmospheric Physics (IAP) - Chinese Academy of Sciences, commented: "*The project has significantly helped China to develop and advance its capabilities in the field of attribution science; for example, IAP are now able to conduct rapid attribution within 8 days of an extreme weather event, to assess what proportion of it was due to human activity. This research has enabled over 100 peer-reviewed publications to contribute to the IPCC process and supporting global climate change policy* making"

Sarah Sparrow, Associate Professor in Environmental Impacts at the University of Oxford commented: *"The workshops were especially rewarding as the attendees will be actively applying the new skills that they have learnt in their future research, to better inform decision making around weather and climate extremes to help protect lives and livelihoods."*

Within the Met Office, the Event Attribution system plays a critical role in supporting research conducted under the Met Office Hadley Centre Climate Programme (MOHCCP). This provides crucial scientific evidence to the UK government and aiding in understanding and addressing climate change challenges. For example, recent work has assessed the rapidly increasing chance of record UK summer temperatures. Dr Gillian Kay, Senior Scientist at the MOHC, said: *"The chance of exceeding 40°C has been rapidly increasing, and it is now over 20 times more likely than it was in the 1960s. This key result illustrates how the Event Attribution system can provide robust insights into the likelihood and nature of future high-impact events, supporting a range of applications that inform policymakers in managing climate-related risks and helping the public to understand and prepare for the impacts of climate change across the globe."*





Top: Delegates of the Extreme Event Attribution workshop held in 2025 under CSSP Brazil hosted by INPA, Brazil. Bottom: Delegates of a joint CSSP China and CSSP Brazil extreme event attribution workshop held in 2018 hosted by the University of Edinburgh.

The pioneering Met Office event attribution research has played a crucial role in supporting the work of the Met Office Extremes Team. Consisting of a diverse range of experts from across the organisation, it was aimed at synthesising knowledge and understanding on the links between climate change and weather extremes to better inform the public, industry, business, and local and national government for dealing with extreme weather and help them remain safe and resilient in a changing climate.



Met Office Chief Executive Penny Endersby giving evidence at the Public Accounts Committee on Government Resilience to Extreme Weather

FitzRoy Road, Exeter, Devon, EX1 3PB United Kingdom

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enquiries@metoffice.gov.uk
www.metoffice.gov.uk

One key outcome of their work was the development of 'Climate Context' resources, which informs public communications about major weather events, such as National Severe Weather Warnings. These documents are used daily within the Met Office and one notable example is supporting the Met Office Chief Executive Penny Endersby for her appearance before the Public Accounts Committee on Government Resilience to Extreme Weather. This ensured the very latest event attribution research findings were communicated into the decision-making process around improving central government's management of civil contingency risks within the UK.

Dr Emily Wallace, Met Office Fellow in Weather and Climate Extremes and Impacts, commented: "*The attribution system has been a vital component of world-leading research that guided the Met Office Extremes Team. We were delighted that this work was selected at the 2024 Royal Meteorological Society annual awards with a prize for services to public understanding of climate change. The power of rapid attribution to provide real-world understanding of climate change was deservedly celebrated.*"

The system has delivered substantial value to external organisations and research institutes. It formed a key modelling capability within significant EU-funded projects, including EUCLEIA that studied the attribution of weather and climate risks in Europe, and EUPHEME which advanced scientific capabilities in enhancing societal resilience to weather and climate risks. The World Weather Attribution (WWA) initiative also utilises the Met Office Event Attribution System, along with those from other research centres, to provide rapid attribution statements on the human influence on extreme weather and climate events in their immediate aftermath. The Met Office Event Attribution system underpinned significant analysis featured in the 2023-24 State of Wildfires Report and also contributed to the UK Climate Resilience Programme where it supported novel research that improved techniques for hazard quantification for use in climate-risk estimation, with a focus on the impact of climate change on flooding in the UK through heavy rainfall events. These are just a few examples that illustrate the system's extensive and enduring impact in building foundational climate science knowledge and capabilities across the UK, Europe and the globe.

Next steps: The growing influence of climate change on the frequency and intensity of extreme weather events demands a growth in the capacity of this event attribution capability. In response to the need for immediate information during ongoing extreme weather and climate events, we are working on increasing access to existing data by sharing it on the UK's Centre for Environmental Data Analysis (CEDA) data sharing platform. Current activities are focusing on upgrading the attribution system to use the latest version of the Met Office climate model and weather observations system, which will enable faster studies to be produced in response to the latest extreme weather and climate events. This will ensure the delivery of further impact and value to help people make better decisions to stay safe and thrive in a radically changing world.