CASE STUDY: Building global climate resilience through scientific excellence, international partnerships and capacity development

Executive Summary: The Weather and Climate Science for Service Partnership (WCSSP) programme has strengthened global resilience to climate change by building international scientific partnerships, developing climate research expertise, and improving countries' ability to assess and respond to changing weather extremes. Through training, collaborative research, and stakeholder engagement, the programme has increased scientific capability, informed climate adaptation and disaster risk management, and created a lasting network of experts equipped to support evidence-based decision-making.

Delivering impact and value

A major achievement of the Weather and Climate Science for Service Partnership (WCSSP) has been its success in building an international network of weather and climate scientists while strengthening global resilience to extreme weather and climate change. Beyond delivering high-quality scientific research, the programme has made a substantial contribution to developing the next generation of researchers critical in helping to tackle the shared global challenges posed by extreme weather and climate change. It is creating lasting partnerships between the UK and international institutions and enhancing the capability of countries to understand and respond to weather and climate-related risks.

One of the most significant areas of progress has been in extreme event attribution science, which investigates how human-induced climate change affects the likelihood and intensity of extreme weather events, delivering vital knowledge to support mitigation and adaptation decision-making. Through collaborations under CSSP China and CSSP Brazil, UK and international partners have worked together to advance scientific understanding while simultaneously building local expertise. Workshops and collaborative research activities have equipped early career researchers with the skills, tools and methodologies needed to undertake attribution studies independently. This investment in people has expanded global research capacity and generated critical evidence on climate change impacts that has contributed to major international assessments, including those of the United Nations Intergovernmental Panel on Climate Change (IPCC). These activities have also strengthened the UK and international partners global standing in climate policy and diplomacy and strengthened their reputation for scientific excellence as well as reinforcing international research partnerships.

The approach

A key milestone was the **LOTUS (LOng Term Undulations versus Secular Change in Chinese Climate)** project under CSSP China. Running from 2016 to 2018 and led by the University of Edinburgh, LOTUS explored the drivers of climate change in China and associated risks such as drought. It pioneered a collaborative workshop style learning model, where delegates co-develop analysis of extreme weather events alongside UK experts in attribution science, allowing the exchange of knowledge, expertise and skills needed for delegates to then conduct future attribution studies independently and to act as trainers at future workshops. This approach proved very successful with several workshops held, demonstrating the

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effectiveness of a practical, collaborative learning model and generating several peer-reviewed publications. Importantly, it helped establish a cohort of scientists with expertise in a highly specialised and societally relevant area of climate science. A landmark workshop hosted at the University of Oxford in 2018 collaborated with CSSP Brazil, bringing together early career researchers from China, Brazil and the UK to analyse extreme climate events and assess the role of climate change in their occurrence. Building on this success, a series of follow-on projects under CSSP Brazil, co-led by the University of Oxford and in-country partner CEMADEN (National Center for Monitoring and Alerts for Natural Disasters), further expanded scientific capability and knowledge exchange. The programme successfully transferred the approaches developed under the LOTUS project to a Brazilian context, demonstrating that the workshop template could be applied within wider international projects and enhanced via the addition of communications training to improve dissemination of the scientific findings to stakeholders to inform decision making.



Top: Delegates of the first extreme event attribution workshop held in 2016 at the University of Edinburgh Bottom: Delegates of a joint CSSP China and CSSP Brazil extreme event attribution workshop held at the University of Edinburgh in 2017.

The **AFLAME (Attributing Amazon Forest Fires from Land-use Alteration and Meteorological Extremes)** project represented a major innovation by linking climate attribution research directly with real-world impacts. For the first time, the work combined analysis of extreme weather events with assessments of societal consequences, enabling estimates of climate-attributable losses. Through a "learning by doing" approach during



Delegates of online extreme event attribution workshop under AFLAME project

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several workshops, researchers from Brazil and the UK developed strong collaborative teams and gained hands-on experience in advanced attribution methods. Participants were also trained to communicate findings beyond academia through policy materials, press releases and stakeholder-focused communications. Feedback demonstrated significant improvements in participants' skills and confidence, with knowledge expected to be applied in future research and professional practice. The project additionally created new research opportunities, including doctoral studies focused on improving the resilience of energy systems to wildfire risks in South America.



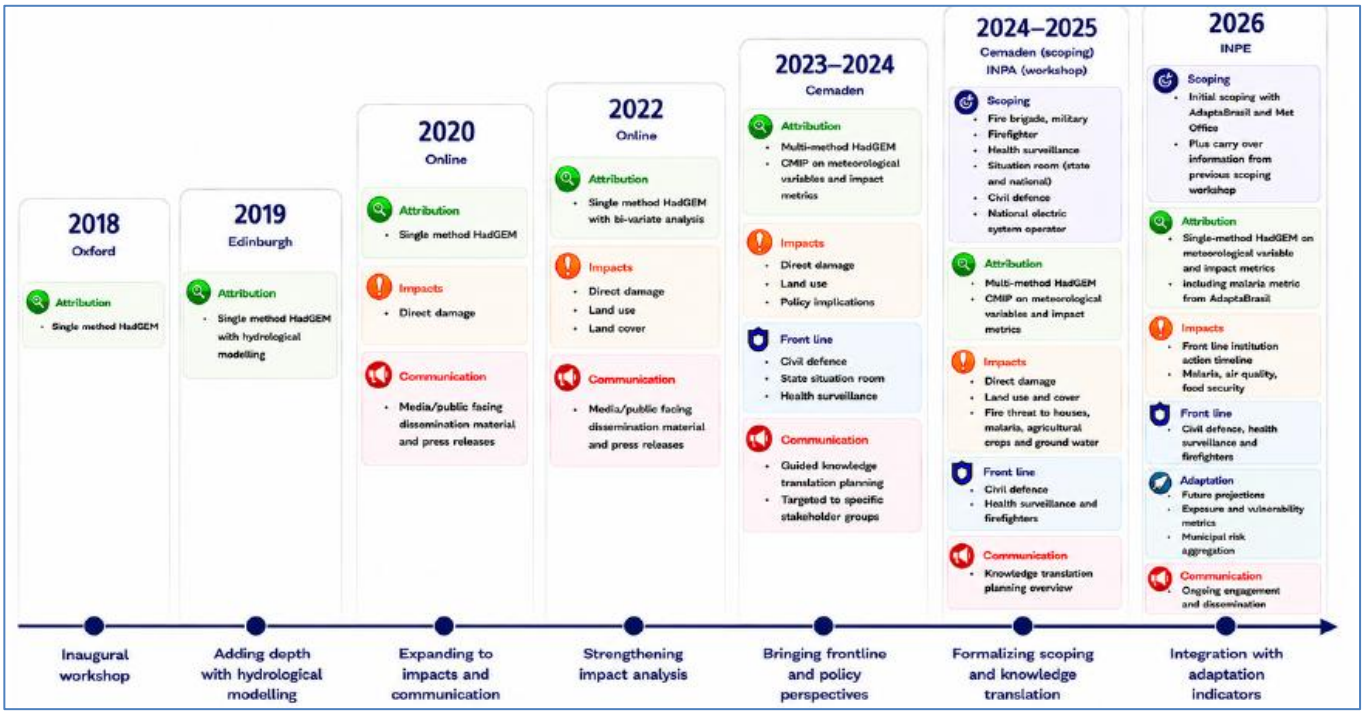
Delegates of an extreme event attribution workshop under the ASLIP project, hosted by INPA, Brazil

The **ASLIP (Attribution and Synopsis of Landslide Impacts from Precipitation)** project built on AFLAME's achievements and further enhanced Brazilian capacity in climate impact assessment. A particularly innovative feature was the direct involvement of local stakeholders in the workshop's analytical activities. Their participation helped identify important gaps in impact data collection, emergency response procedures and policy frameworks related to extreme weather events. The project also supported the co-development of practical communication products, including policy briefs and stakeholder information materials. This collaborative model highlighted the value of integrating researchers, policymakers and practitioners to improve both scientific understanding and decision-making. Another notable outcome was the design of a citizen science landslide reporting platform, which will strengthen future data collection and support improved analysis of landslide risks across Brazil.

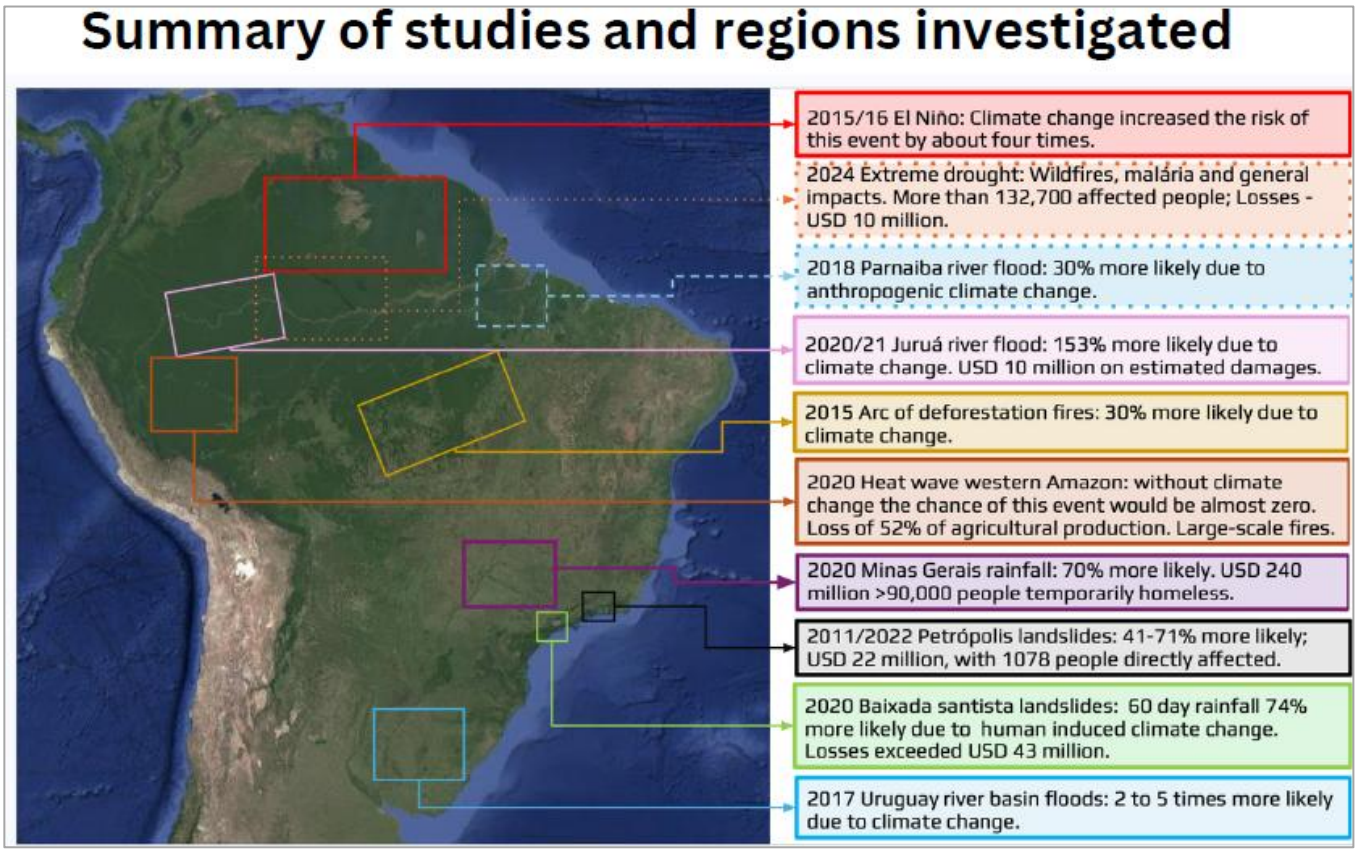


Delegates of an extreme event attribution workshop under the AIIM project, hosted by INPA, Brazil

The ongoing **AIIM (Assessment and Attribution of Impacts from Multi-Hazards)** project is now doing pioneering research to move climate attribution science towards an operational service for decisionmakers in Brazil. The project is developing routine approaches to assessing the influence of climate change on extreme weather while integrating stakeholder needs throughout the process. The collaboration workshops have significantly helped advance scientific capability through innovative methods that combine climate modelling, impact assessments, epidemiological analysis and machine learning techniques, particularly for improved landslide prediction. Collaboration with national institutions, including the National Institute for Space Research (INPE) and the AdaptaBrazil platform, (led by the Brazilian Ministry of Science, Technology, and Innovation - MCTI), is



Timeline evolution of the Extreme Event Attribution workshops under CSSP Brazil and CSSP China from 2018 - 2026



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ensuring that scientific findings are translated into practical tools for climate adaptation and disaster risk management. The research has generated new evidence on changing climate risks in Brazil and is directly supporting policymakers and local authorities in developing adaptation strategies.

Further progress under CSSP China: Knowledge and experience from these CSSP Brazil projects have been shared within CSSP China, with in-country partners attribution science expertise continuing to mature. A recent workshop involving Chinese and UK scientists produced multiple peer-reviewed studies and strengthened collaboration between institutions. The long-term impact of these efforts is reflected in China's rapidly growing attribution capability. According to senior leadership at the Chinese Academy of Sciences (CAS), Institute of Atmospheric Physics (IAP), Chinese researchers can now conduct rapid attribution studies within eight days of an extreme weather event and have produced more than 100 peer-reviewed publications that have contributed substantially to IPCC assessments.



Extreme event attribution workshop under CSSP China hosted by the Zhuhai campus of Sun Yet-Sen University, China

New work under WCSSP South Africa is aimed at providing underpinning science, tools, and training to support impact-based attribution in South Africa, enabling in-country partners to respond to questions on the influence of human-induced climate change in relation to specific impactful events. The work is drawing on the knowledge and experiences from previous WCSSP work on this topic and involves collaborative in-country workshops aimed at training early-career scientists from a variety of different backgrounds in impact-based attribution analysis, with the first of these taking place in February 2027. This work is being further supported through leveraging knowledge and expertise from wider Met Office programmes/projects to improve the uptake of latest advances in attribution science, helping realise its full utilisation in climate change policy, including mitigation, disaster risk management, climate adaptation, Loss and Damage, and climate litigation.

A lasting legacy

Overall, WCSSP is delivering value far beyond scientific research and publications alone. It has created vibrant sustainable international partnerships, developed highly skilled early career researchers, accelerated knowledge exchange, strengthened institutional capability and generated evidence that highlights the need for climate mitigation and supports climate adaptation and disaster risk reduction. By combining cutting-edge science with practical stakeholder engagement and capacity building, the programme is helping countries better understand climate risks and equipping them with the expertise needed to respond to the growing challenges posed by extreme weather and climate change. Ongoing work under WCSSP will continue to build on these foundations to deliver further impact and value to help people make better decisions to stay safe and thrive.

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