

ASSESSING THE CHANGING LIKELIHOOD OF EXTREME EVENTS IN BRAZIL



CSSP BRAZIL



ASSESSING THE CHANGING LIKELIHOOD OF EXTREME EVENTS IN BRAZIL

Typically, people discuss our changing climate in terms of long-term trends in temperature and rainfall. However, we most directly experience the effects of our climate, and changes to it, through extreme weather and climate events such as heatwaves, droughts and rainstorms.

Indeed, a question often asked about climate change is whether the changes we are seeing in the Earth's climate are due to human influence e.g. greenhouse gas emissions, or if they can be explained by natural causes such as the sun or volcanic eruptions. The research that looks at this question is known as 'attribution' science and the Climate Science for Service (CSSP) Brazil project is investigating the role of climate change in recent extreme weather and climate events in Brazil.

How can attribution studies help support decision makers?

Attribution studies provide decision makers with guidance on the potential urgency and scale of measures needed to help them adapt to the impacts of a changing climate. In addition, research showing that human activities increase the likelihood of a particular extreme weather or climate event supports policies to mitigate greenhouse gas emissions.

What CSSP Brazil is doing

Many extreme weather and climate events in Brazil are water related such as floods and droughts. From direct impacts on lives and livelihoods to impacts on agriculture and energy, there is an increasing need to be able to predict and warn of hydrological extremes, and to understand what has caused past events and how their likelihood is changing both now and into the future. Building this evidence base will help enhance Brazil's capabilities in Disaster Risk Reduction and protect the economy, infrastructure and human well-being.

The CSSP Brazil project has provided a platform for scientists in the UK and Brazil to analyse recent extreme weather and climate events in Brazil and investigate whether they have become more likely due to our changing climate. As part of this, the Universities of Edinburgh and Oxford have delivered several workshops to train and build the capacity of early career Brazilian scientists to carry out attribution studies. These productive workshops have produced several papers focussing on specific extreme events in Brazil, including publications in the annual Bulletin of the American Meteorological Society (BAMS) Special Supplement 'Explaining Extreme Events from a Climate Perspective'.



Participants of the Event Attribution workshop held at the University of Edinburgh's Centre for Carbon Innovation - January 2019

One such paper¹ focusses on the extensive flooding event in June 2017 along the Uruguay River, which is of great economic importance to South America. During this event parts of the river reached more than eight metres above its normal level after intensive rain in April and May 2017. The flooding led to significant impacts such as direct economic loss in Brazil of 102 million U.S. dollars² and displacement of more than 3,500 people in Uruguay³.

The paper concludes that human influence on the climate has made such extreme rainfall in the river basin about five times more likely in the present day compared to in the pre-industrial period. This result can help inform adaptation planning decisions along the river and help protect society against the risk of future flooding.

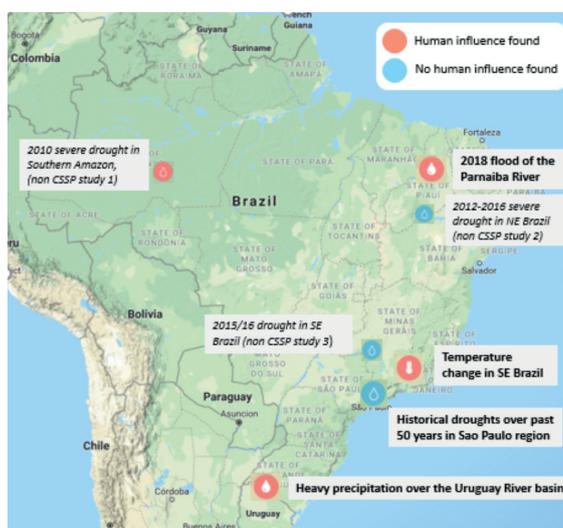
Conrado Rudorff, at CEMADEN, commented 'the event attribution workshops have initiated twelve Brazilian scientists, including myself, into detection and attribution and have been instrumental in increasing the coverage of assessments over Brazil'. Conrado is now working on the detection and attribution of hydrological impacts and flood risk analysis for Brazil in the IPCC 6th Assessment Report as Contributing Author for chapter 4 (Water) of Working Group 2.

¹Abreu et al (2018), Contribution of anthropogenic climate change to April-May 2017 heavy precipitation over the Uruguay River basin, Bulletin of the American Meteorological Society (BAMS) Special Supplement 'Explaining Extreme Events of 2017 from a Climate Perspective'. DOI:10.1175/BAMS-D-18-0102.1

²FAMURS, 2017: Sobe para R\$ 339 milhões o valor dos prejuízos com o temporal no RS. Federação das Associações dos Municípios do Rio Grande do Sul, accessed 12 January 2018, www.famurs.com.br/noticias/sobe-para-r-339-milhoes-o-valor-dos-prejuizos-com-o-temporal-no-rs/

³BBC, 2017: Uruguay floods displace thousands. British Broadcasting Corporation, www.bbc.com/news/world-latin-america-40171998.

Another CSSP Brazil study⁴ investigated the April 2018 flooding in the Parnaíba River, Northeast Brazil which resulted in 5000 homeless or temporarily displaced people across four towns. Research shows that human influence on the climate has increased the likelihood of this flooding by about 70%. CSSP Brazil has also investigated the long-term warming trend over Southeast Brazil and found that human influence on the climate, primarily through increases in greenhouse gas concentrations, are the main cause of the warming⁵.



Map showing attribution studies carried out over Brazil so far, with CSSP Brazil studies highlighted in bold. The symbol indicates the type of extreme event e.g. rainfall, drought or temperature related. Red symbols depict events which are now more likely due to human influence on the climate and blue symbols show extreme events.

What's next?

CSSP Brazil will continue to build the capacity of early career researchers in Brazil and the UK in attribution science to support Brazil in understanding its changing risk and exposure to extreme weather events. The building of this evidence base will help inform policies that support mitigation and adaptation to a changing climate.

⁴Guedes M. R. G. et al, (2019), Attribution of the 2018 Parnaíba River flood in Northeast Brazil. (Submitted to BAMS)

⁵Abreu, R. C., et al, (2019), Attribution of detected temperature trends in southeast Brazil. (Submitted to Geophysical Research Letters)

CSSP Brazil is building strong science partnerships

CSSP Brazil is a research project that supports collaboration between the UK and Brazil. It aims to develop capability to inform decision makers in climate mitigation and adaptation strategy and to underpin services to support climate and weather resilient economic development and social welfare.

CSSP Brazil is building strong, sustainable partnerships between Brazil's National Institute for Space Research (INPE), National Institute for Amazonian Research (INPA), National Centre for Monitoring and Early Warning of Natural Disasters (CEMADEN) and the Met Office, the UK's national meteorological service, and other key UK and Brazilian scientific institutes.

The Weather and Climate Science for Service Partnership Programme – of which CSSP Brazil is a part – is funded by the UK Government's Newton Fund.

For further information visit the Newton Fund website (www.newtonfund.ac.uk) and follow via Twitter: @NewtonFund

For more information on CSSP Brazil visit the Met Office website <https://www.metoffice.gov.uk/research/collaboration/newton/cssp-brazil/index>

Met Office

The Met Office is the UK's national weather service working at the forefront of weather and climate science for protection, prosperity and well-being. The Met Office Hadley Centre, formed in 1990, is one of the UK's foremost climate change research centres.

National Institute for Space Research (INPE)

The National Institute for Space Research (INPE) is responsible for fostering Earth and space science and technology to offer products and services in benefit of the Brazilian nation.

National Institute for Amazonian Research (INPA)

The National Institute of Amazonian Research (INPA) is a public research and educational institution and world reference in tropical biology, headquartered in Manaus, Brazil. INPA was founded in 1952, with the purpose of furthering scientific knowledge of the Brazilian Amazon Region through scientific studies of the physical environment and living conditions to promote human well-being and socio-economic development.

National Centre for Monitoring and Alerts of Natural Disasters (CEMADEN)

The National Center for Monitoring and Alerts of Natural Disasters (Cemaden) is linked to the Brazilian Ministry of Science, Technology and Innovation (MCTI). Cemaden was formed in July 2011 with its main objective being to monitor and issue natural disaster alerts that help safeguard lives and reduce social, environmental and economic vulnerability resulting from these events.

