CASE STUDY: Providing improved information to decision makers in India around flood risks and impacts

Executive Summary: The Weather and Climate Science for Service (WCSSP) India project has helped improve flood risk management in India by co-developing an innovative Flood Hazard Impact Model with Indian partners, enabling more accurate impact-based flood forecasting, earlier warnings, and better-informed emergency response. The programme has strengthened scientific capability and operational forecasting in India, helping to reduce the impacts of flooding on communities, infrastructure, and the economy while creating a sustainable platform for future resilience and disaster risk reduction.

The Challenge: India is highly vulnerable to a range of weather hazards that affect its economic development and social welfare, and impact vulnerable communities. The Indian Meteorological Department (IMD) and National Centre for Medium Range Weather Forecasting (NCMRWF) are keen to adopt an impact-based forecasting approach, aligning with World Meteorological Organization best practice. This will improve the effectiveness of early warning of high-impact weather events and allow for better preparedness by disaster management. Some work in this area has already been undertaken in India, however, there is a need to advance the science behind impact-forecasting and building the capacity to allow IMD and NCMRWF to transition towards delivery of impact-based forecasting and warning in the future. New tools and methods will provide partners with the ability to extend and enhance their impact-based forecasting approaches and pull through these developments for improved warnings and communication to users.



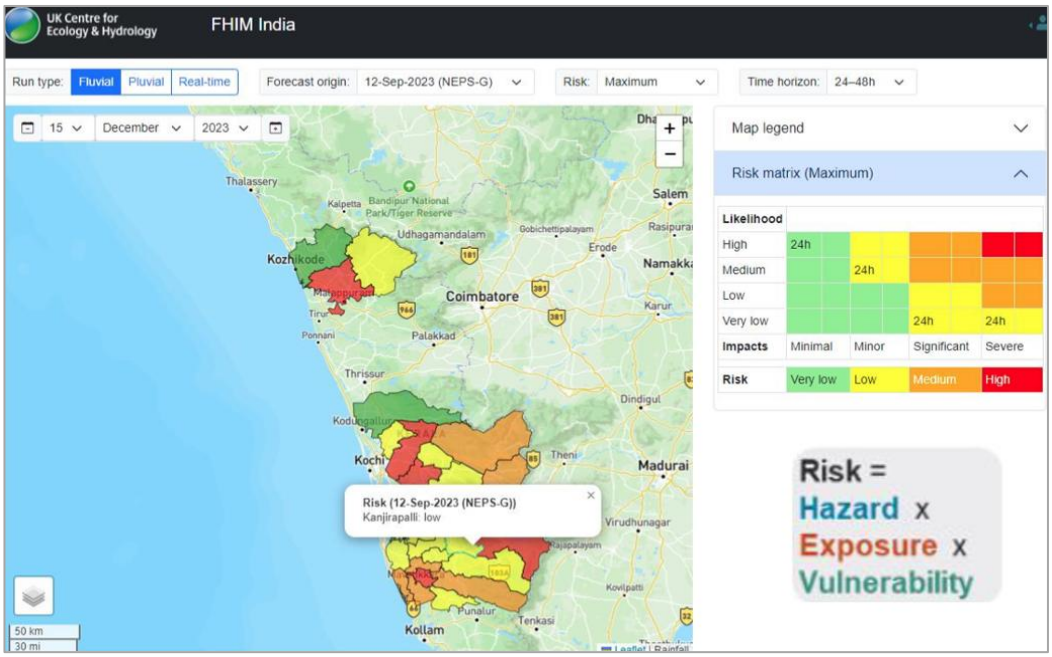
Flooding in New Delhi, India July 2023 after Yamuna River started overflowing after crossing the 208m danger mark.

The Approach: Considerable progress has been made under WCSSP India, including a project led by the UK Centre for Ecology and Hydrology (UKCEH) which co-developed with NCMRWF a prototype Flood Hazard Impact Model (FHIM) for India. This tool provides improved forecasting of flood hazard and impact to target and implement impact mitigation measures, such as flood guidance and warning control actions, evacuation, and coordination of emergency services. The prototype FHIM was successfully demonstrated offline during the recent flooding in the Kerala region. It has also been successfully incorporated into an end-to-end FHIM-India system, connecting the various model and data components into a single user interface for real-time forecasting of flood hazard impacts.

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Visual taken from the FHIM-India Web portal.



UK FHIM lead Steven Cole (UKCEH) with India Meteorological Department collaborators during an engagement visit to Meteorology Centre Thiruvananthapuram, Kerala, India

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Pathway to Impact: Building on the close relationships developed with partners NCMRWF and IMD, ongoing work is now directly targeted at supporting them implement the co-developed FHIM system for operationalisation and real-time forecasting and warning. Training existing modelling framework, including supporting catalogues and datasets. This includes technical work to assist with porting the FHIM-India model framework onto partner supercomputer systems, to support knowledge exchange and training as relevant. Work is also being undertaken to upscale the FHIM to other regions within India that are prone to flooding events. This final stage of the work will enable a very strong legacy and impact of the investment for improving early warning and communication of the risks associated with flooding. It will help target impact mitigation actions, resulting in reduced damage costs and less societal disruption and suffering at times of flooding.

The delivery of this cutting-edge tool is strengthening the quality of UK science, technology, research and innovation and the methodology and experience of co-developing prototype climate services can be applied to the UK. Improved early warnings of high impact weather allowing for better preparedness and reduced impacts will contribute towards the foundations of a stable economy, a key milestone in the UK Governments Plan for Change and is vital to ensuring the United Kingdom remains resilient and responsive in the face of potential future shocks.

Dr, Raghavendra Ashrit, Scientist at NCMRWF said *"The flood hazard impact modelling project is critical for improved understanding and forecasting of flood risk in India. As demonstrated in the test case study of 2018 monsoon floods over Kerala, the flood hazard impact model project has immense potential for impact-based forecasting."*

FHIM project Principal Investigator, Prof. Steven Cole (UK Centre for Ecology and Hydrology) said *"To help better prepare for the monsoon season a flood impact model has been developed for forecasting potential impacts over the next few days over the Kerala region of India."*

Seshagirirao Kolusu, Science Manager in the Met Office Earth System Data Sciences team said *"The comprehensive evaluation of the FHIM-India flood forecasting model has provided valuable insights, highlighted future challenges, and emphasised the need for developing multi-hazard impact-based forecasting models and approaches in India."*

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