Assess the sensitivities and utility of FHIM over the Kerala Domain

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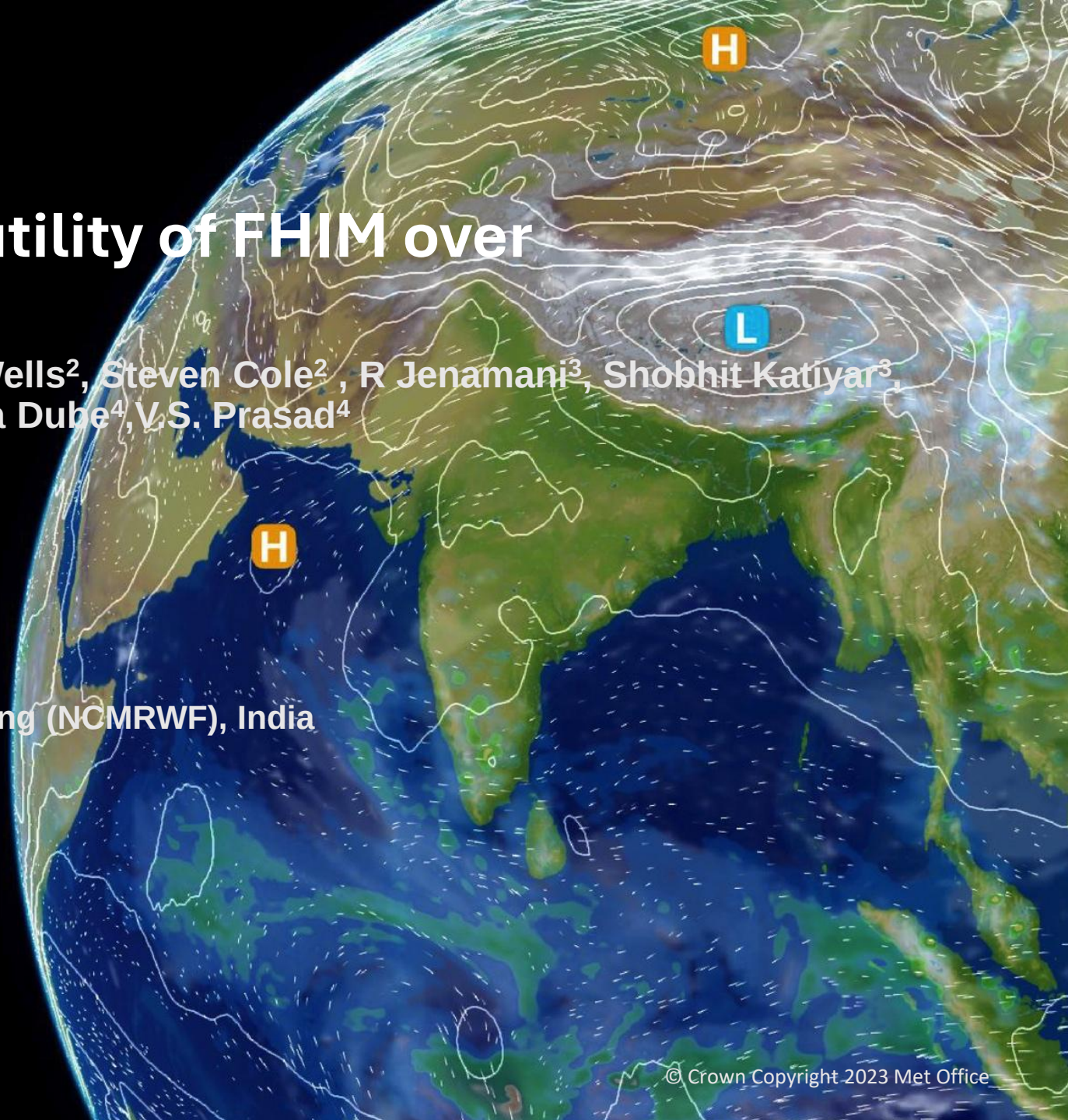

Overview of the talk

- Motivation of the study
- FHIM-Modelling components
- Introduction of Flood Hazard Impact Model (FHIM-India) Framework
- Flood Hazard Impact Model Coverage in Kerala
- Case studies results
- Conclusions and future work

FHIM-India modelling framework (The WCSSP-India project): Motivation

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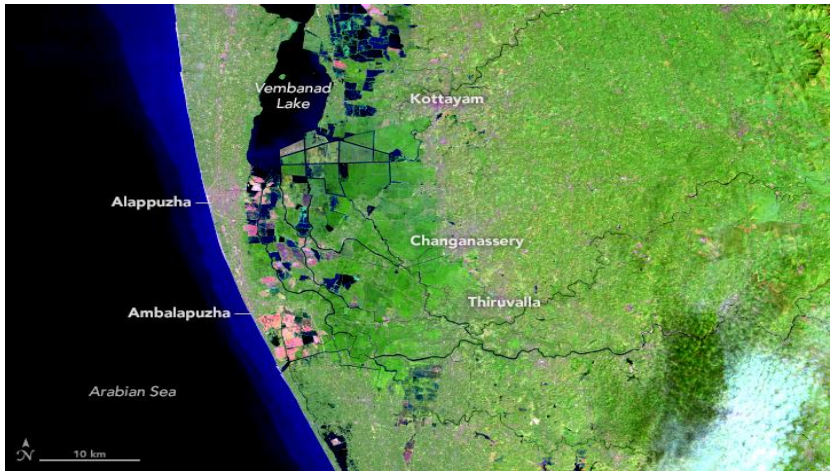
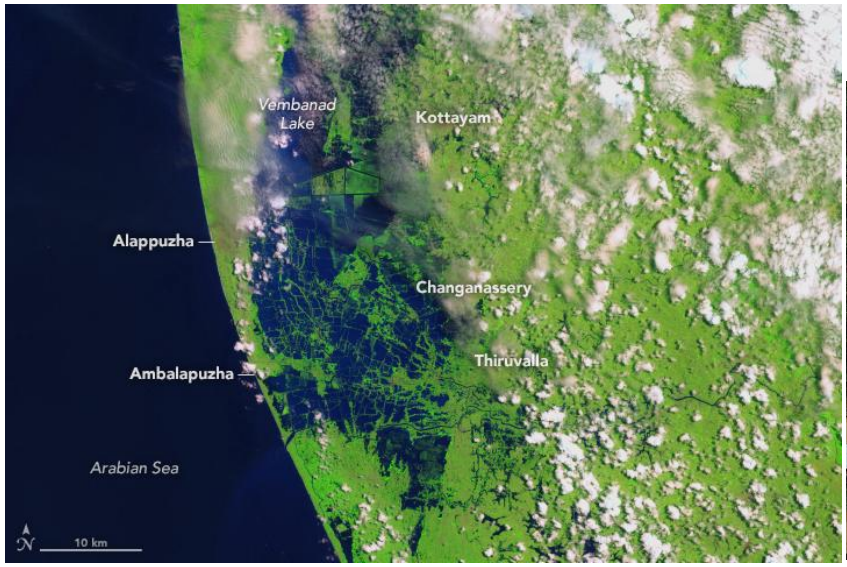
- Frequency of extreme events in India increasing 3 fold during the 1950-2015 and rainfall totals increasing too[1]
- Flooding causes major socio-economic impacts across India[2]
- According to a report by the **Central Water Commission (CWC)**, between 1953 and 2020, floods impacted around **33 million people per year**, causing significant economic and infrastructural damage.
- FHIM-India has developed **flood and impact forecasting methods** using FHIM
- Quantifying the sensitivity of FHIM risk profiles with different NWP ensemble forecast impacts on flood assessment is important for flood forecast management

Before Kerala flood Feb 2018



After Kerala flood 22 August 2018



Dark blue :Flooded water. Bright green: Vegetation.

@https://earthobservatory.nasa.gov/images/92669/before-and-after-the-kerala-floods

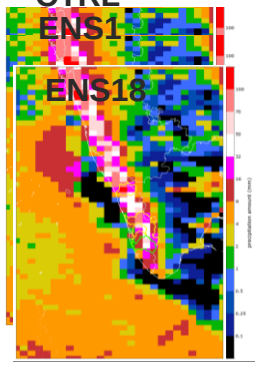
https://www.bbc.co.uk/news/world-asia-india-45232327

[1]Roxy *et al.* (2017), Nature Communications, [2]Mohanty et al. (2020), Int. J. Disast. Risk Reduction

Flow chart of Flood Hazard Impact Model Framework (FHIM-India)

India

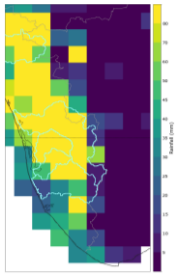
Component 1



MOGREPS-G

NEPS-G

NEPS-R

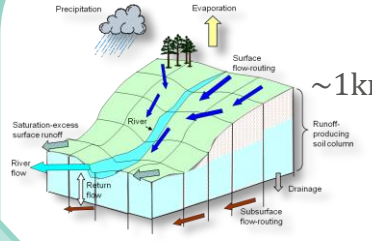


Observations
IMD

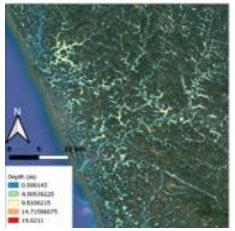
Driving ensemble forecasts

FHIM-India Workflows are run on JASMIN HPC

Component 2



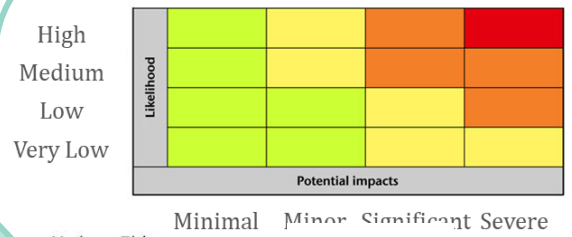
G2G
~1km flood modelling
developed by
UKCEH

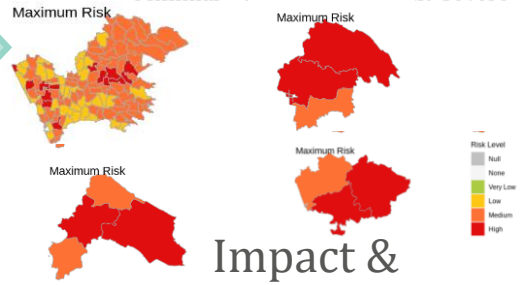


HiPIMS
~30m flood modelling
supported by
Loughborough/ Birmingham

Risk modelling

Component 3



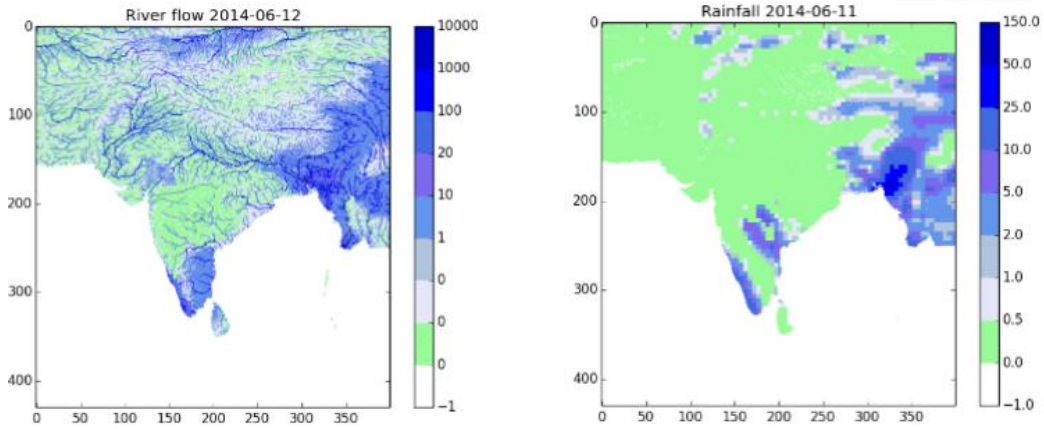


Impact &
Risk supported by
HSE

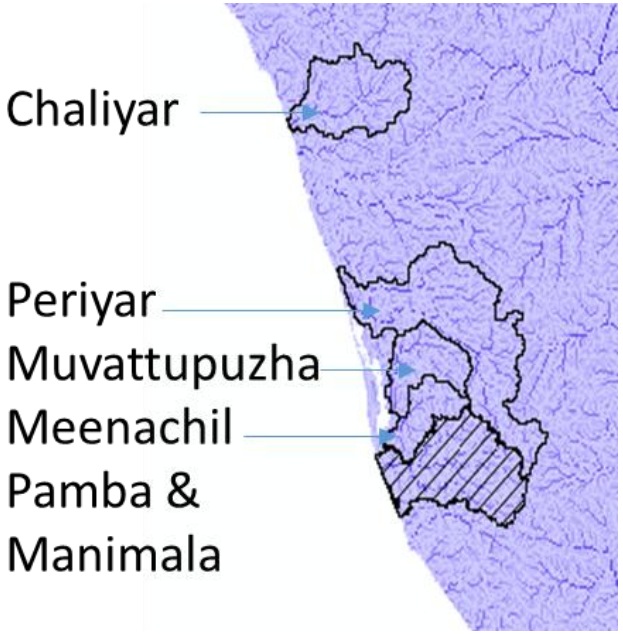
- Developed **automated Flood Hazard Impact Model** workflows for India
- Risk Matrix approach that combines uncertainty ***and*** impacts ⇨ ENSEMBLES

Flood Hazard Impact Model Coverage

- G2G Hydrological Model used across Britain at 1km for national flood forecasting
- Configured across southern India at ~1km

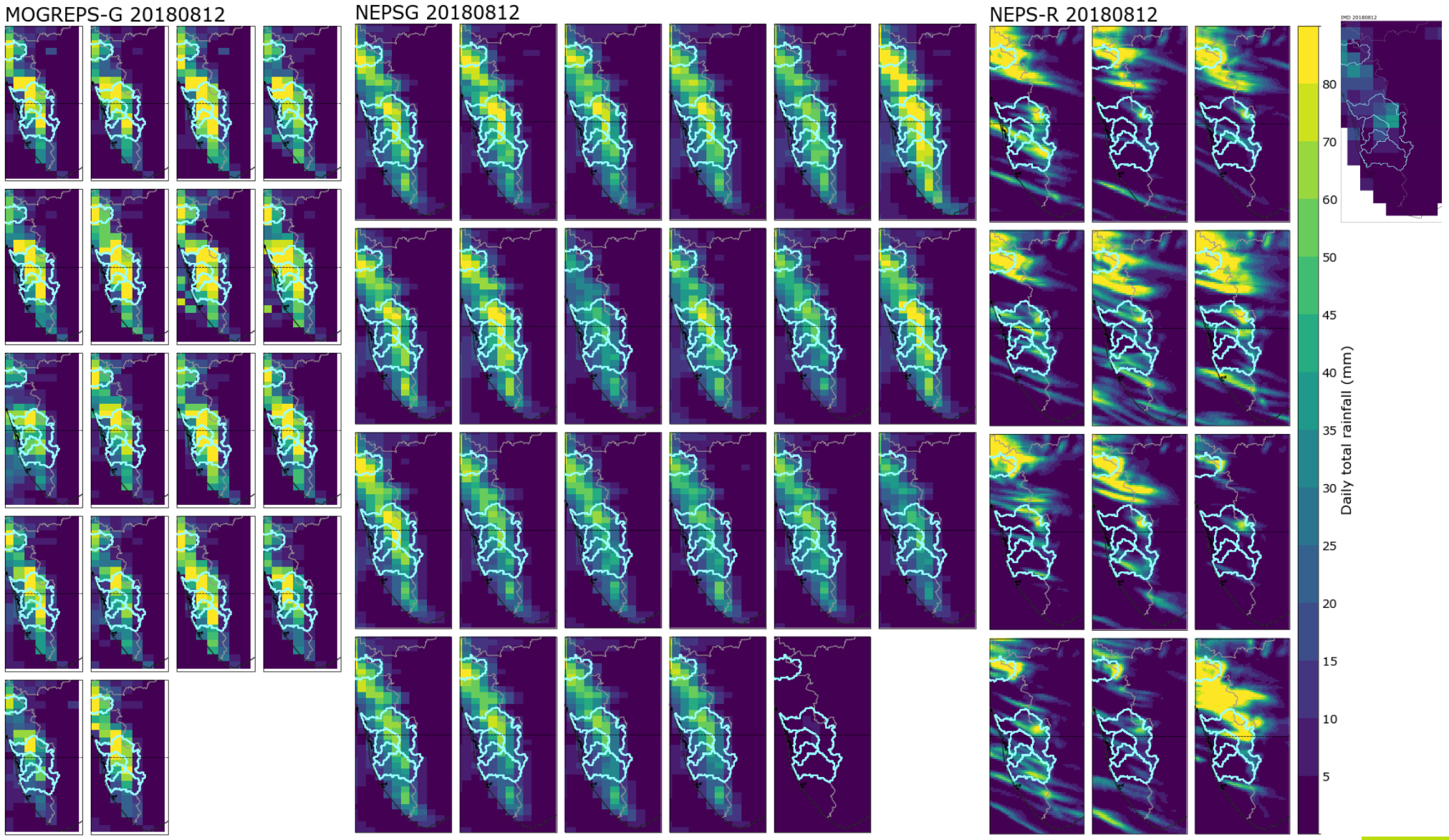


Example G2G daily output at ~10km

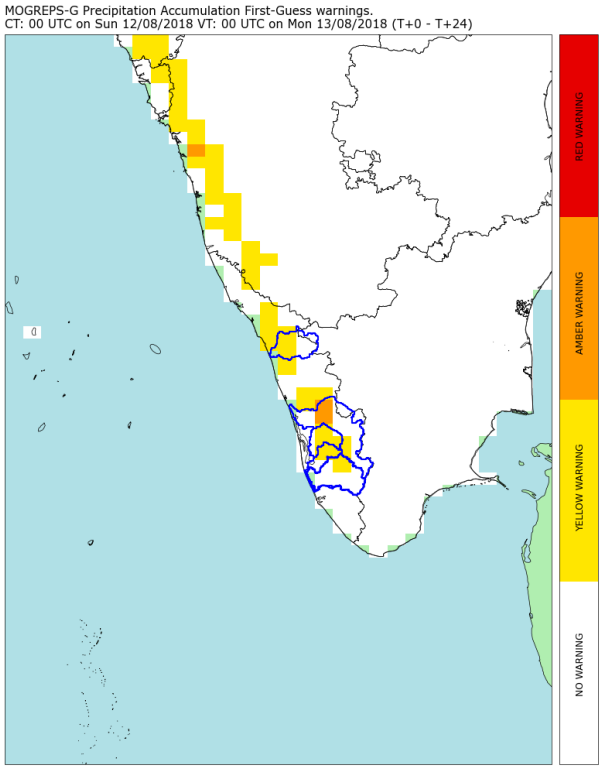


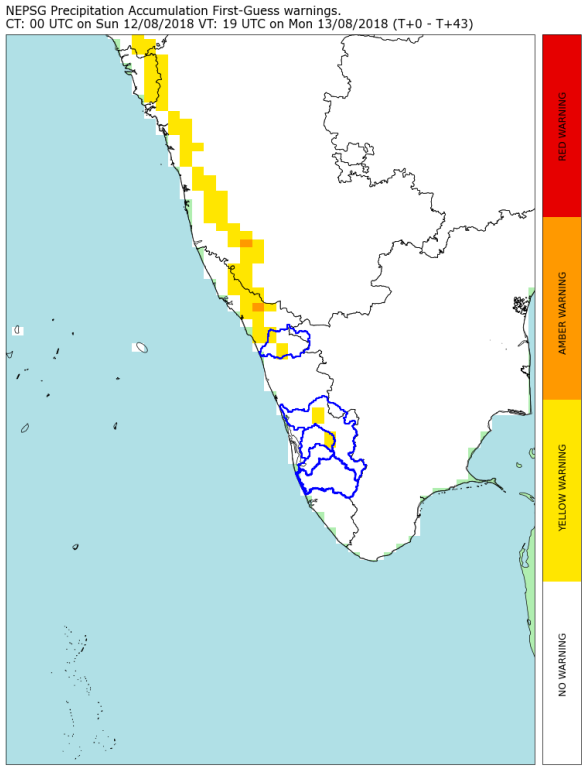
- Detailed Impact Modelling currently available for 6 regions of Kerala
- Extended to Karnataka state

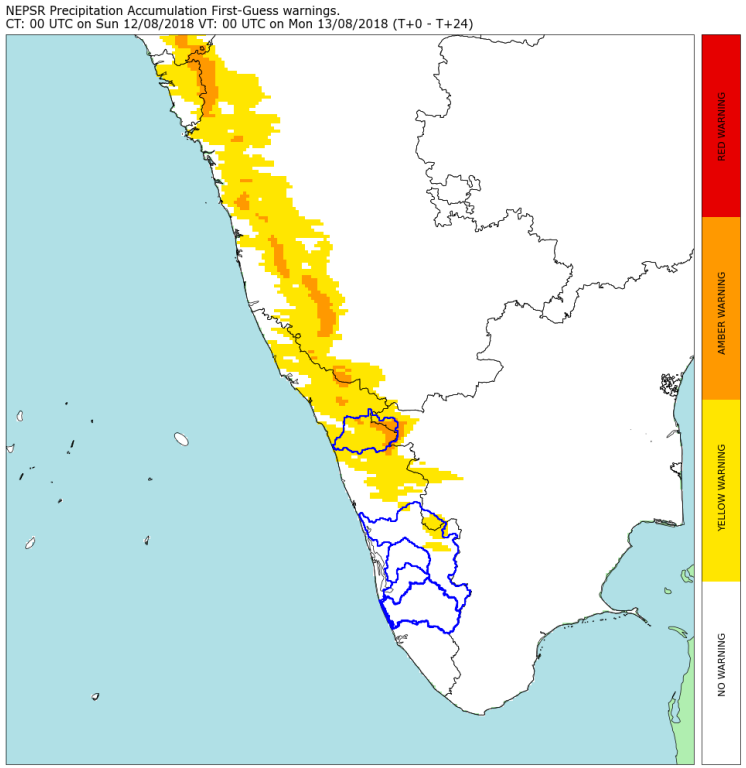
Case study of 12th August 2018 (day 0): Variability in the model ensembles rainfall patterns

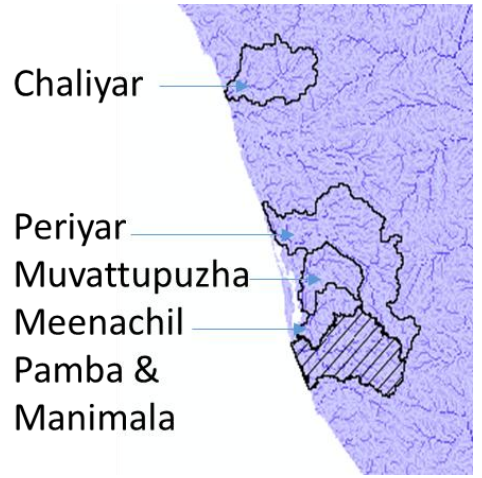


Case study of 12th August 2018 (day 0): Hazard identification in the models







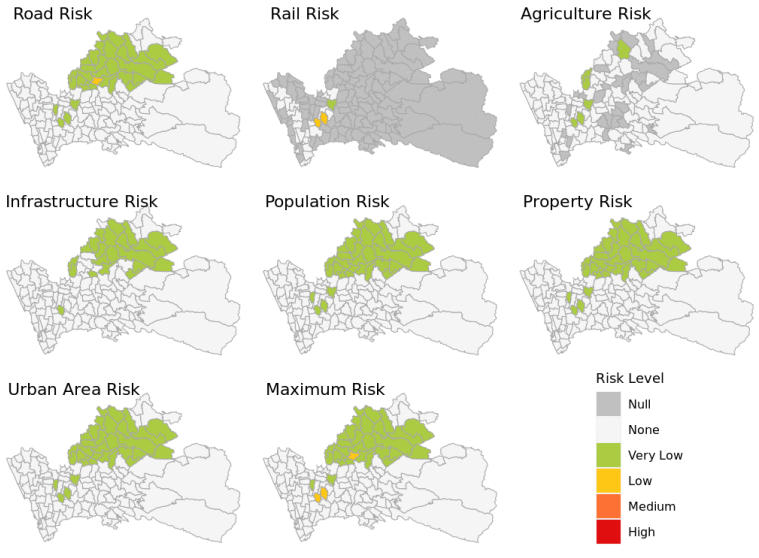


Level	Thresholds
Low Impact (Heavy)	64.4mm per day
Medium Impact (Very Heavy)	115.5mm per day
High Impact (Extremely Heavy)	204. mm per day

Case study of 12th August 2018:Pluvial risk forecasts for Pumba catchments

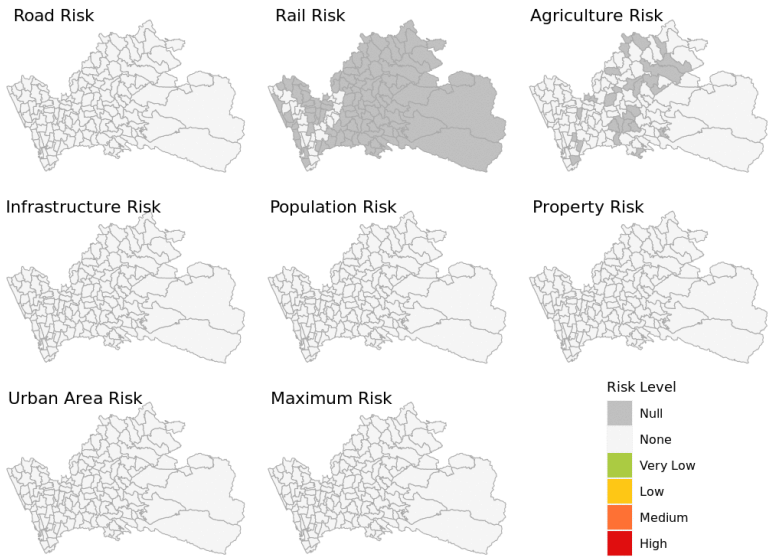
MOGREPS-G

Pluvial flooding by Village: Risk Maps 201808120000, 1h duration, Time period:T.1h_T.24h



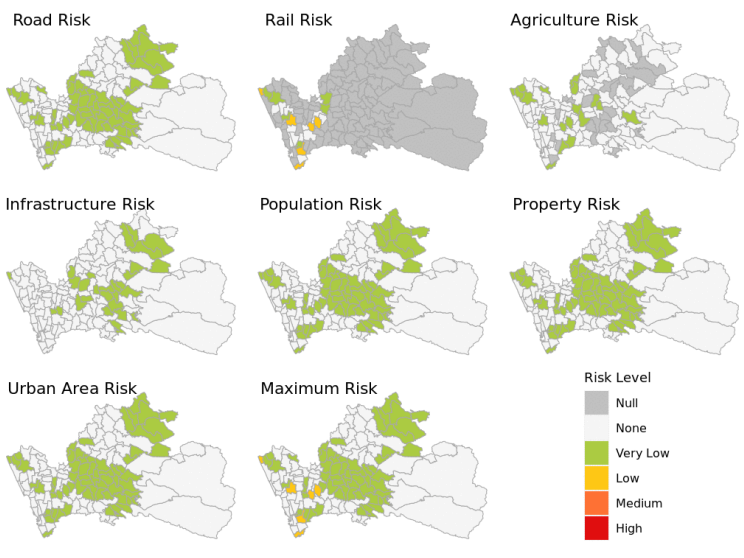
NEPS-G

Pluvial flooding by Village: Risk Maps 201808120000, 1h duration, Time period:T.1h_T.24h



NEPS-R

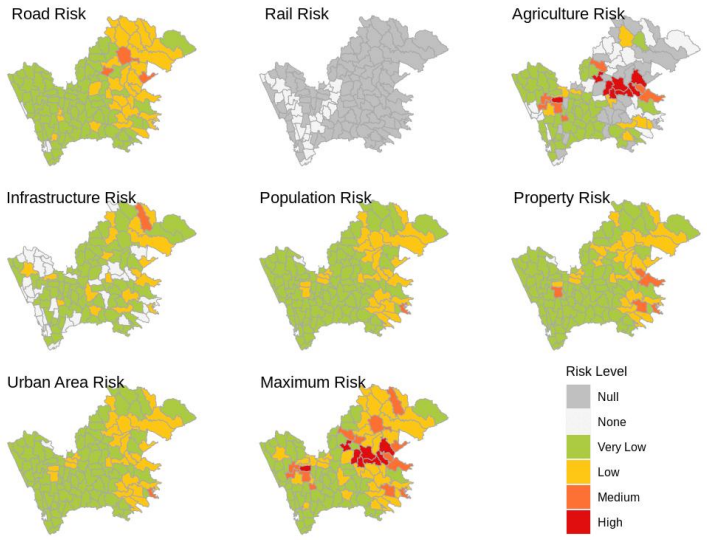
Pluvial flooding by Village: Risk Maps 201808120000, 1h duration, Time period:T.1h_T.24h



Case study of 12th August 2018: Fluvial risk forecasts for Pumba catchments

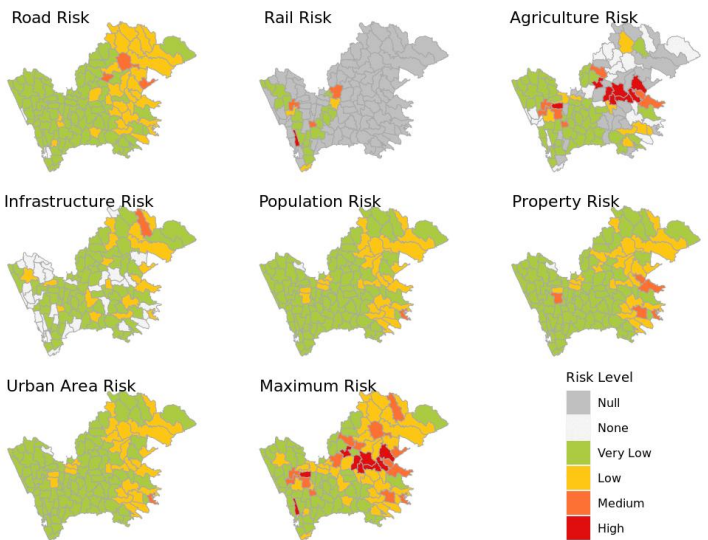
MOGREPS-G

Fluvial flooding by Village: Risk Maps 201808120000, 24h duration, Time period:T.1h_T.24h



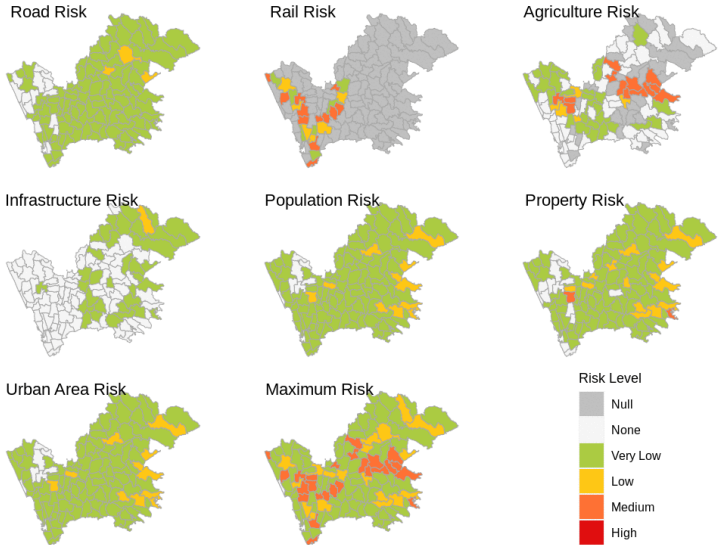
NEPS-G

Fluvial flooding by Village: Risk Maps 201808120000, 24h duration, Time period:T.1h_T.24h



NEPS-R

Fluvial flooding by Village: Risk Maps 201808120000, 24h duration, Time period:T.1h_T.24h



Sensitivities and utility of Flood Hazard Impact model (FHIM-India) over Kerala

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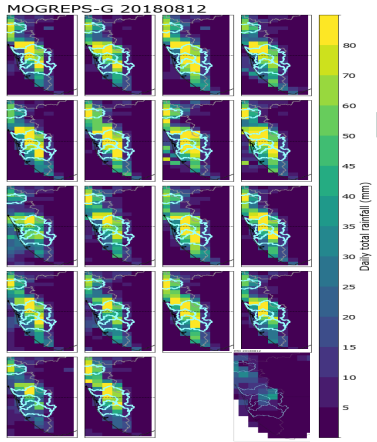
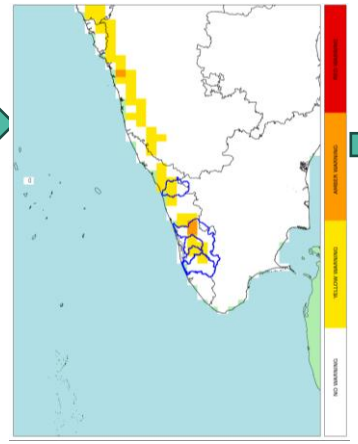
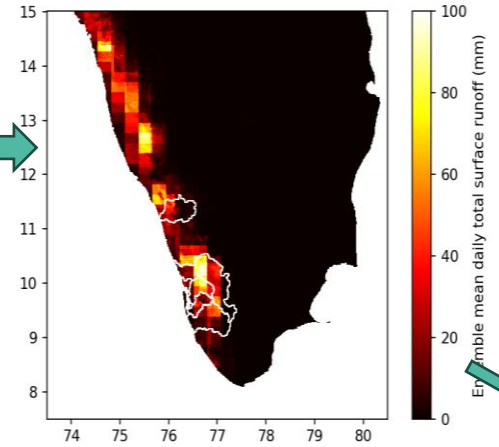
End-to-end testing of FHIM-India model

EPS-W MOGREPS-G

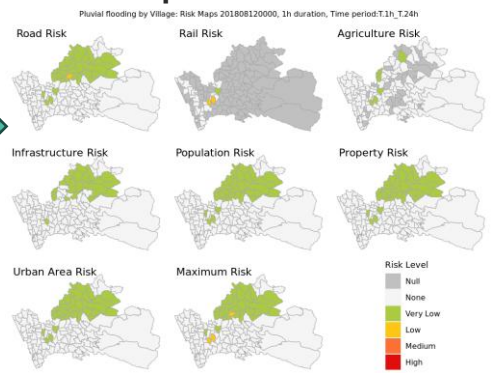




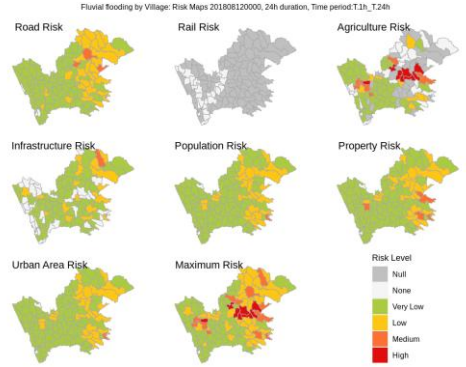
G2-G runoff driven with MOGREPS-G

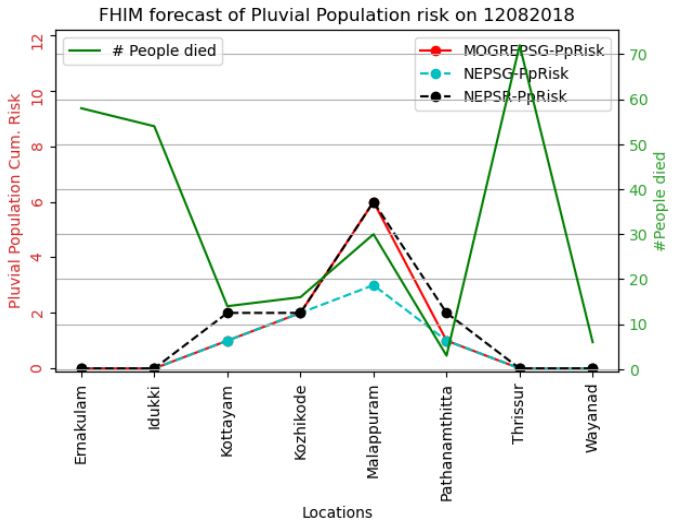


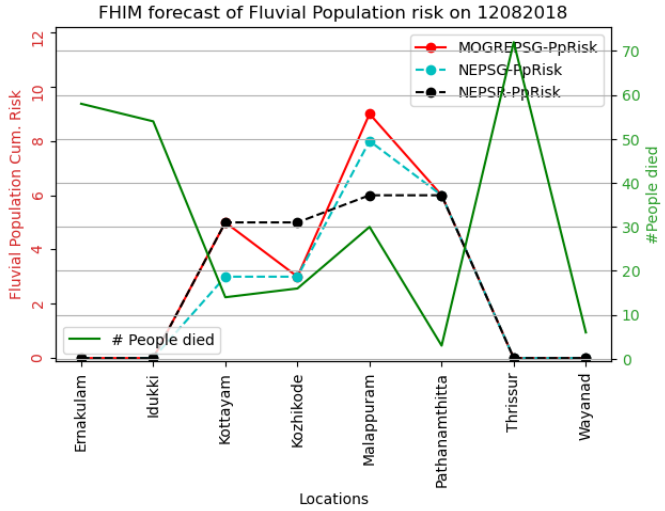
MOGREPS-G pluvial flood risk



MOGREPS-G fluvial flood risk



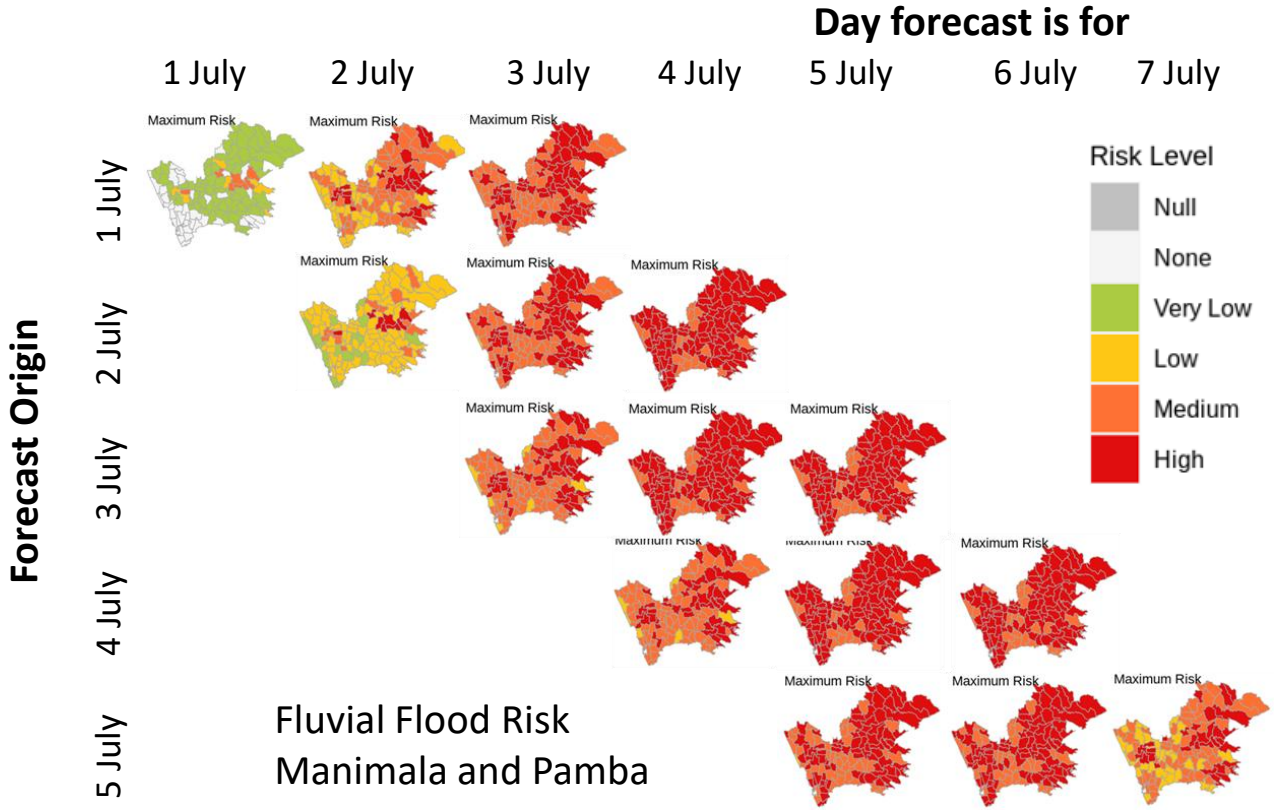




Case Study Success Story : Effective Flood forecast Example

Flood Hazard Impact Model
1-5 July 2023 Forecasts

- **Sequence of three-day fluvial flood risk forecasts for forecasts beginning 1-5 July**
- **Can see strong signals for 3-6 July with three-day lead-time**



Further extension of the FHIM-India domain

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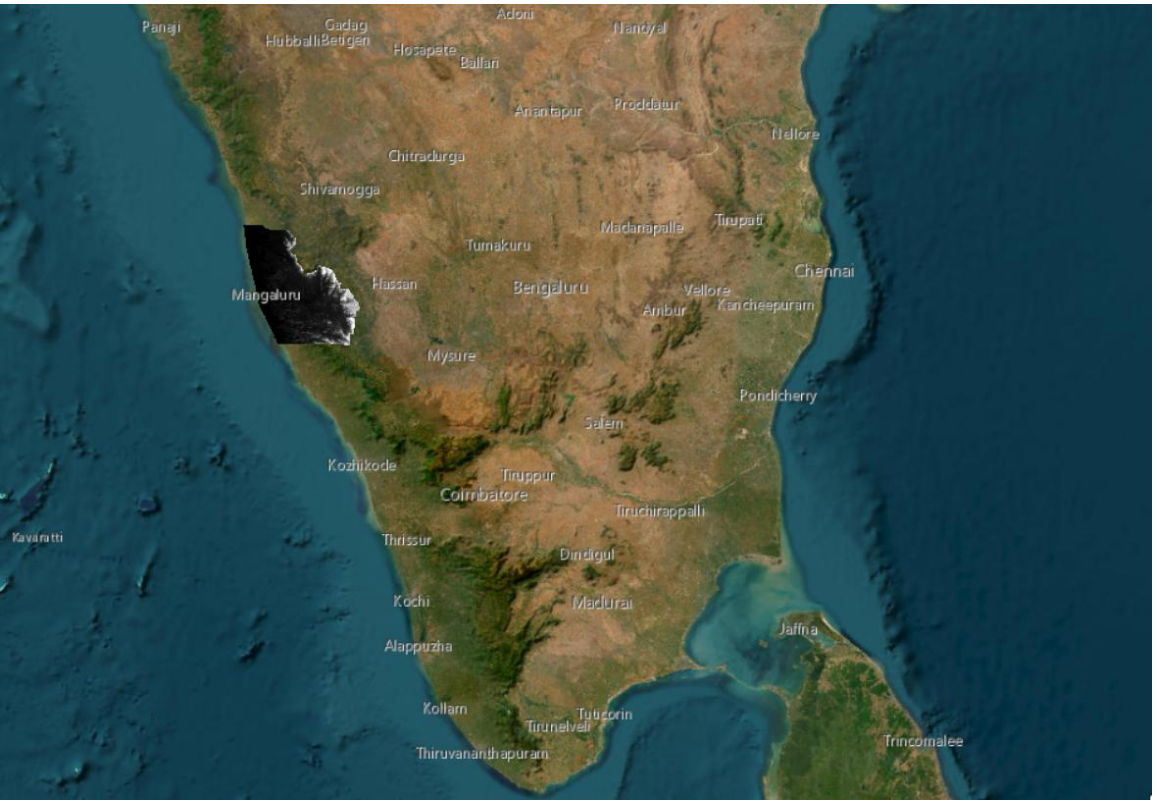

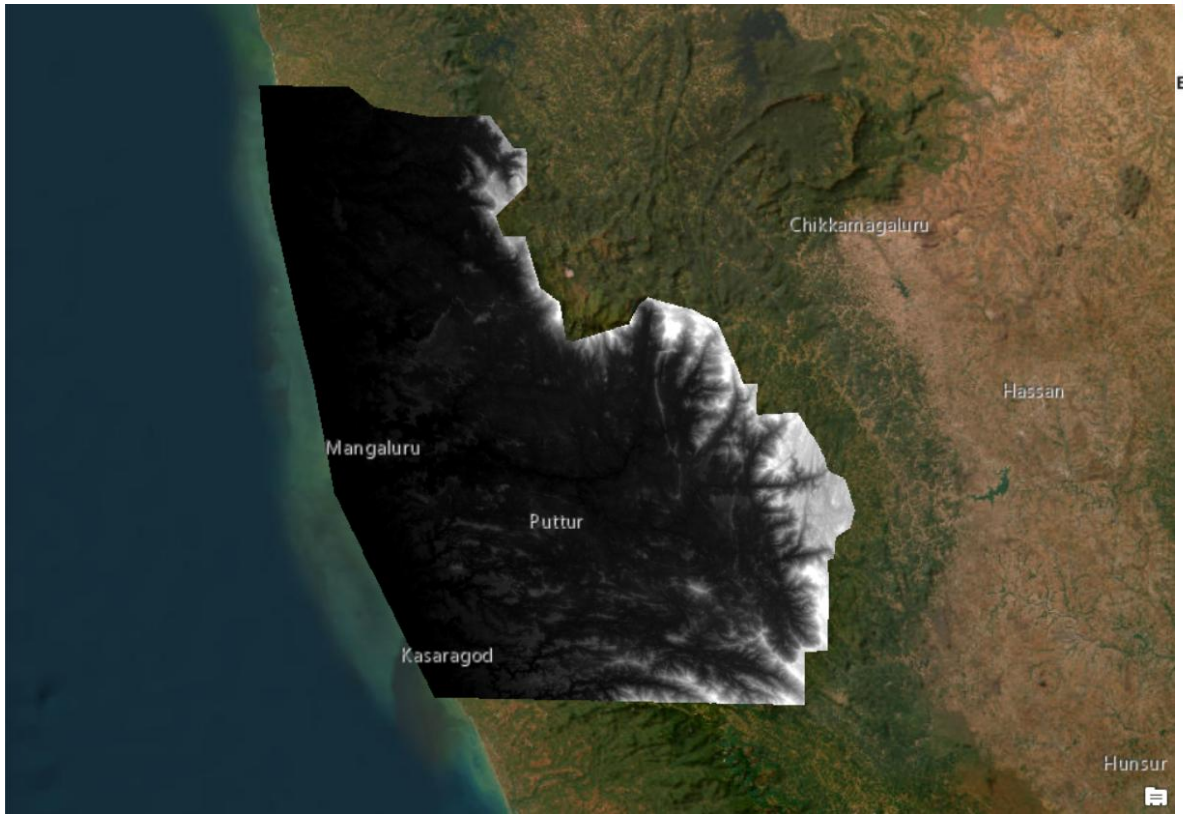

Bridging the Gap: Ensuring Forecasts Reach End Users for Disaster Resilience

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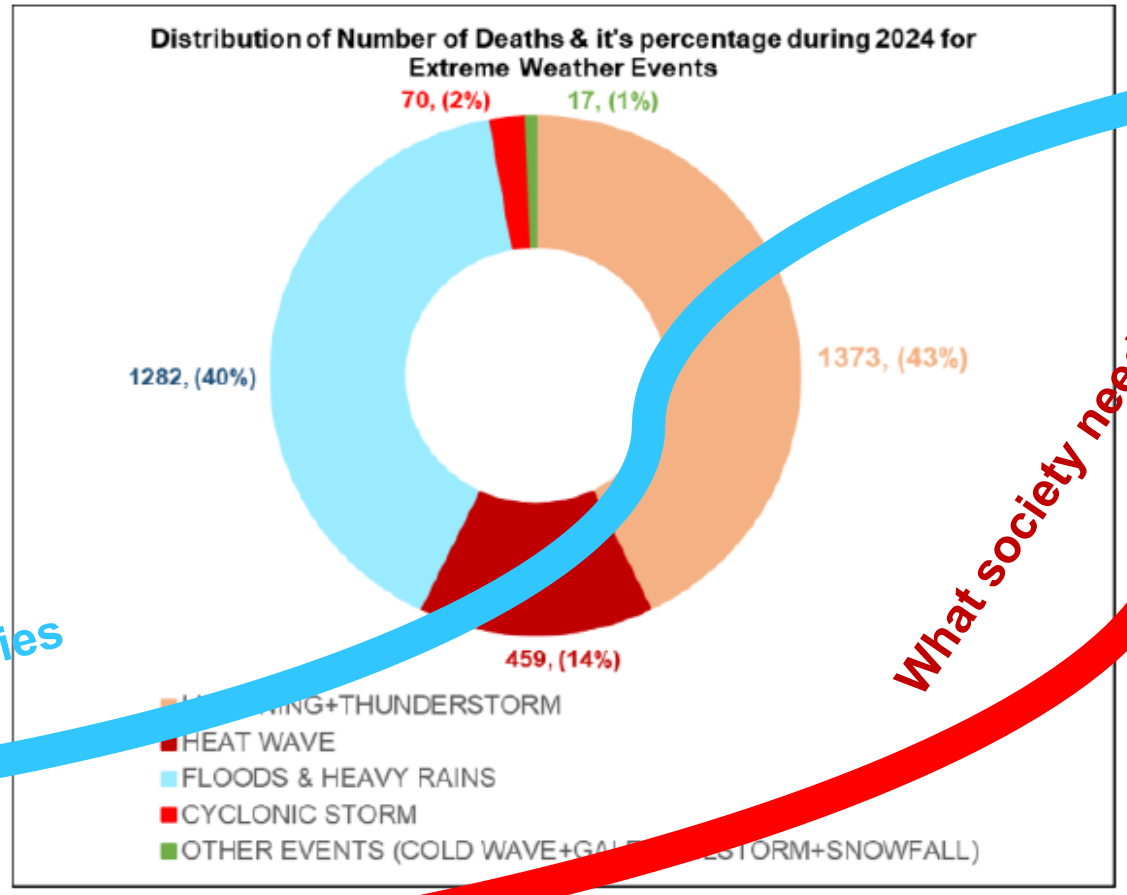

Forecast trajectories

What society needs

चित्र २२: प्रभावित चरम मौ ं घटनाओं के कारण २०२४ के दौरान मौतों की संख्या और इसके प्रतिशत का वितरण

Fig. 22: Distribution of the Number of Deaths and its percentage during 2024 for Impacted Extreme Weather Events

Conclusion & Future Work

- The FHIM-India model demonstrated potential for flood risk management.
- Uncertainties in observational/Impact data remain a challenge.
- Future work includes incorporating satellite data and validate with other impacts data (e.g. local data).
- Expanding FHIM-India to a Pan-India domain will enhance its utility.
- There is significant potential to integrate AI and ML approaches into impact data collection and early warning systems.

Thanks for your attention and questions

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