MOUNTAIN RESEARCH INITIATIVE

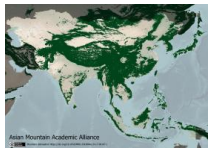
University of Reading

Professor Maria Shahgedanova
Dr Gavkhar Mamadjanova
Ms Qiao Li
Dr Jacob Steiner
on behalf of the MRI network

Improving monitoring and forecast for early warning in Central and High Mountain Asia

The Mountain Research Initiative

MRI activities in TPRCC region



- **Facilitation of long-term multi-disciplinary monitoring and data acquisition and provision**
- **Strengthening mountain resilience and adaptive capacity through the reduction of risks and improved mountain governance**
- **Capacity building and education**

Extreme events and risk assessments in TPRCC region: Projects funded by MRI

- Curation of Risk Data for High Mountain Asia (HiRISK)
- Central Asia Mountain Observatory Network (CAMON): Provision of data on GLOF and pluvial debris flows in Central Asia
- Monitoring of glaciers in the Karakoram with special emphasis on water demand and management (STREAM)
- Risk assessment for hydropower projects from rock and/or ice avalanches in High Mountain Asia (REACH)
- Long-term monitoring of snow accumulation and related climate variables at a high-altitude cryospheric research site in Bhutan

Development of an online platform cataloguing and assessing natural disasters and hazardous events in the TPRCC region

Development of new very-high resolution glacier lake inventory for Central Asia

Using post-processed ecPoint rainfall forecasts for early warnings of precipitation-induced hazards in Central and High Mountain Asia

Risk Data for High Mountain Asia: May – October 2025

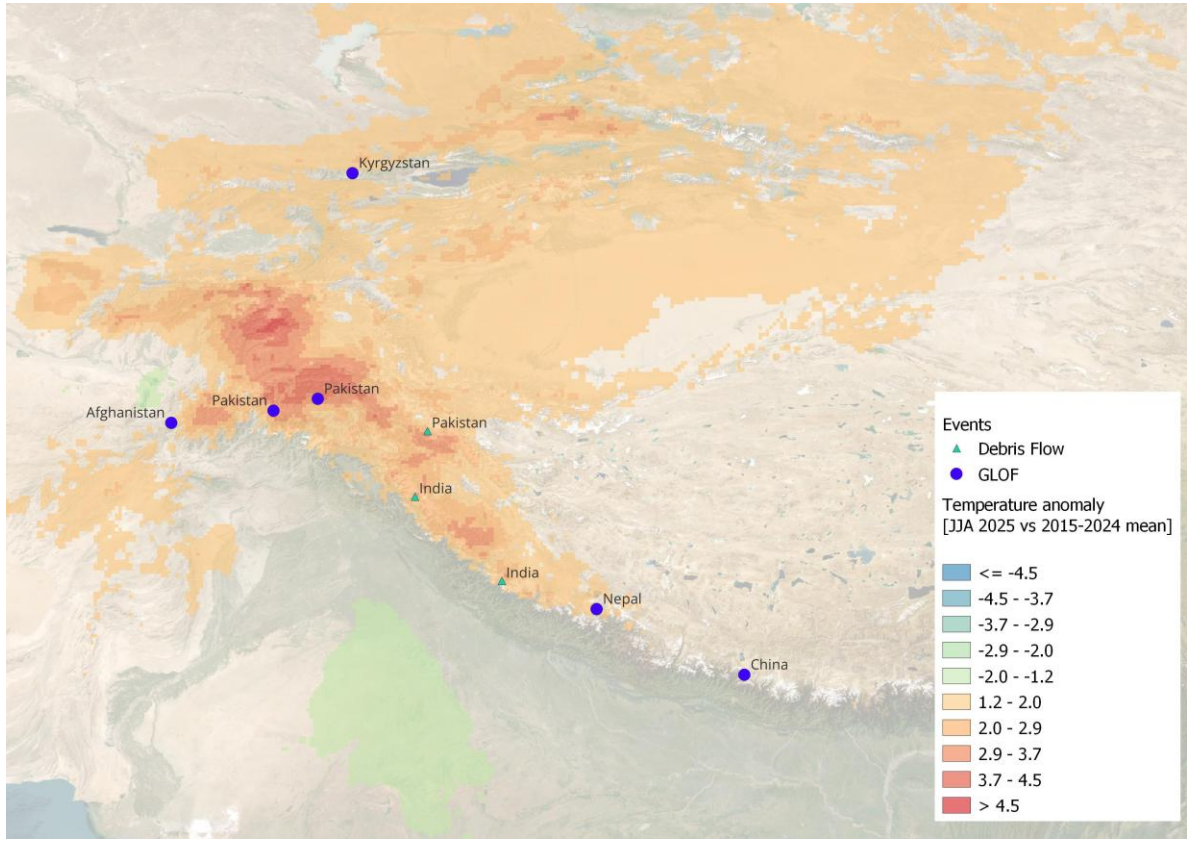
HiRISK @ https://hirisk.org/

Event	Year / Month	Language	Country	Type	Report
PK4	2025/06	Khowar, English	Pakistan	GLOF	Luspur GLOF, Pakistan, June 2025
CN1	2025/07	Chinese, Nepali, English	China/Nepal	GLOF	Purepu GLOF, China, July 2025
NP2	2025/07	Nepali, English	Nepal	GLOF	Chumjung GLOF, Nepal, July 2025
PK5	2025/07	English	Pakistan	Debris flow	Kondus debris flow, Pakistan, July 2025
PK6	2025/08	English	Pakistan	Glacier tongue collapse	Shisper Glacier tongue collapse, Pakistan, July August 2025
PK7	2025/08	Urdu, English	Pakistan	GLOF	Rawoshan/Gupis GLOF, Pakistan, August 2025
IN2	2025/08	English	India	Debris flow	Debris flow Dharali/Harsil, India, August 2025
TJ1	2025/10	Tajik, English	Tajikistan	Glacier collapse	Glacier collapse Didal/Safedob, Tajikistan, October 2025

Subscribe for reports: https://hirisk.org/risk-assessments/

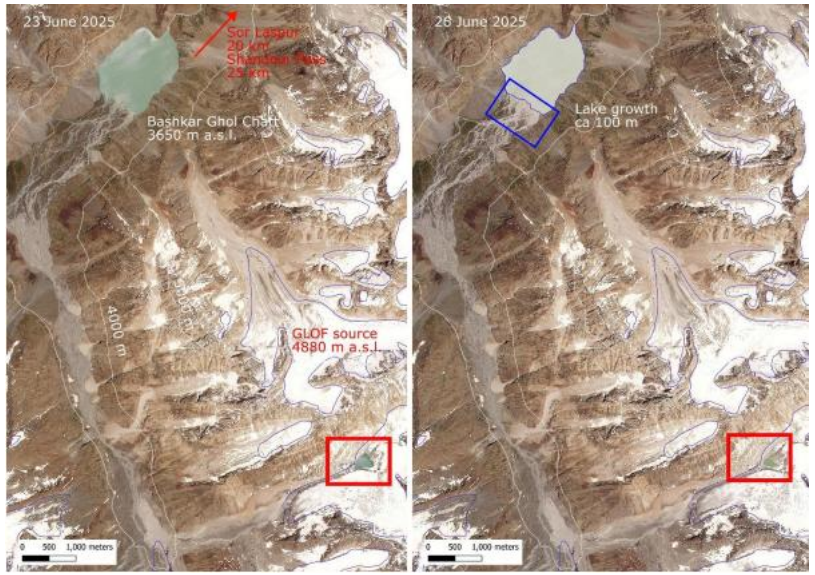
Contact: Dr Jacob Steiner, AMAA
(jakob.steiner@uni-graz.at)

GLOF and JJA 2025 air temperature anomalies relative to 2015-2024 mean



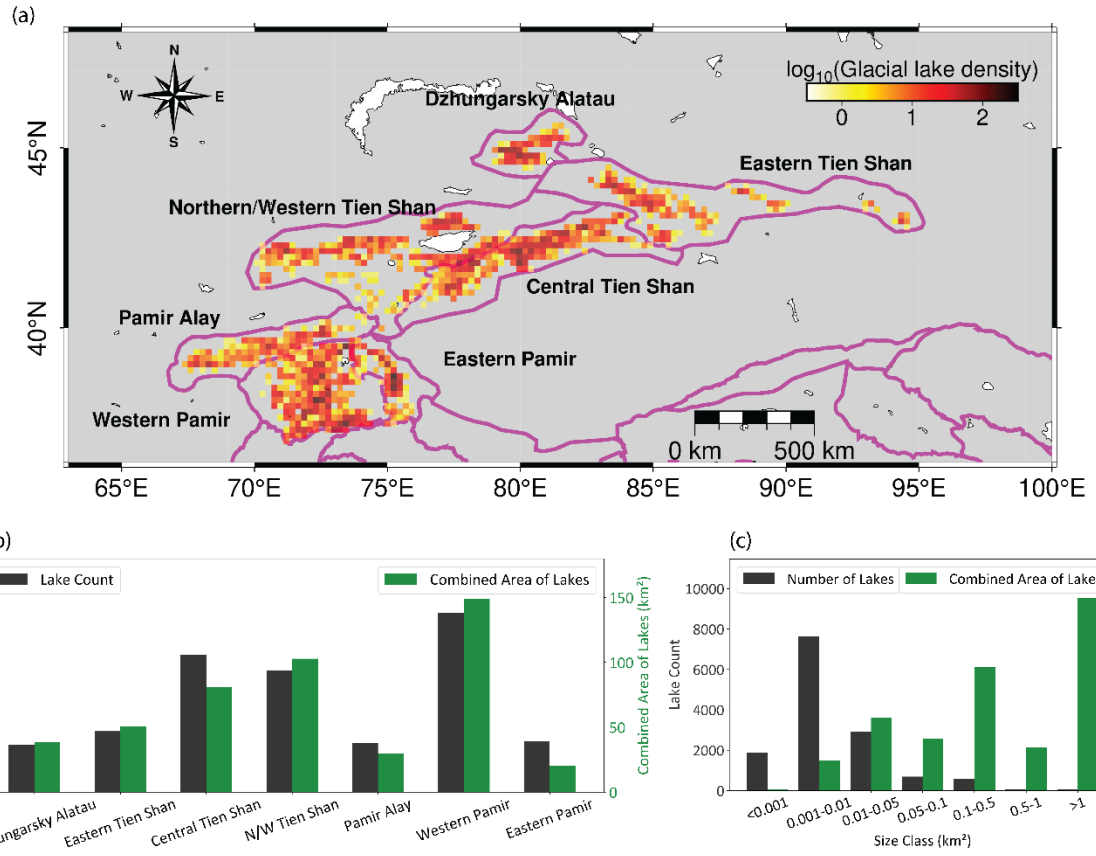
- Occurrence of GLOF (especially in Pakistan) was linked to a strong positive temperature anomaly
- Similar response to high-elevation heatwaves was reported earlier for Central Asia (Shahgedanova et al., 2024; https://doi.org/10.1038/s44304-024-00050-7)

Luspur GLOF, Pakistan: 23-24 June 2025 (35.84726°N, 72.38435°E)



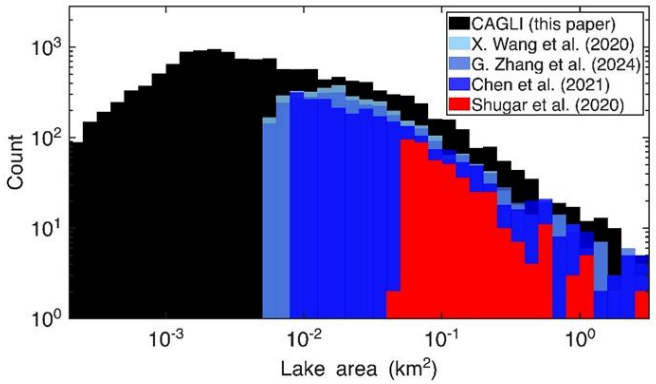
A system consisting of three proglacial lakes drained in June 2025. No previous GLOF history but formation of the lakes in 2023 and rapid growth afterwards. The location is still mapped as glacier (RGI2000-v7.0-G-14-03707) in RGI.

New high-resolution Central Asia Glacier Lake Inventory (CAGLI)



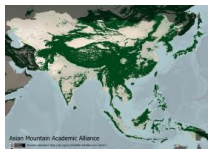
(a) Lake density mapped on a 25 × 25 km grid (logarithmic scale). (b) Total number and cumulative area of lakes by subregion (Fig. 1). (c) Total number and cumulative area of lakes by size class.

- A new glacier lake inventory for the Tien Shan and Pamir (August and September 2023)
- Very-high resolution (3 m) imagery from the Planet Scope constellation with ~1 day return period was used
- Extensive methodological improvements enabling more accurate mapping of glacial lakes
- 13858 glacial lakes and ponds (>200 m^2) with a combined area of 460.20 ± 0.23 km^2
- 4319 glacial lakes (>0.01 km^2) with a combined area of 431.59 ± 0.40 km^2
- Particularly important: provision of data for the Pamir



Credit: Qiao Li, University of Reading. Submitted to JGR Solid Earth.

Improving flash flood and debris flow early warning using ecPoint Precipitation product



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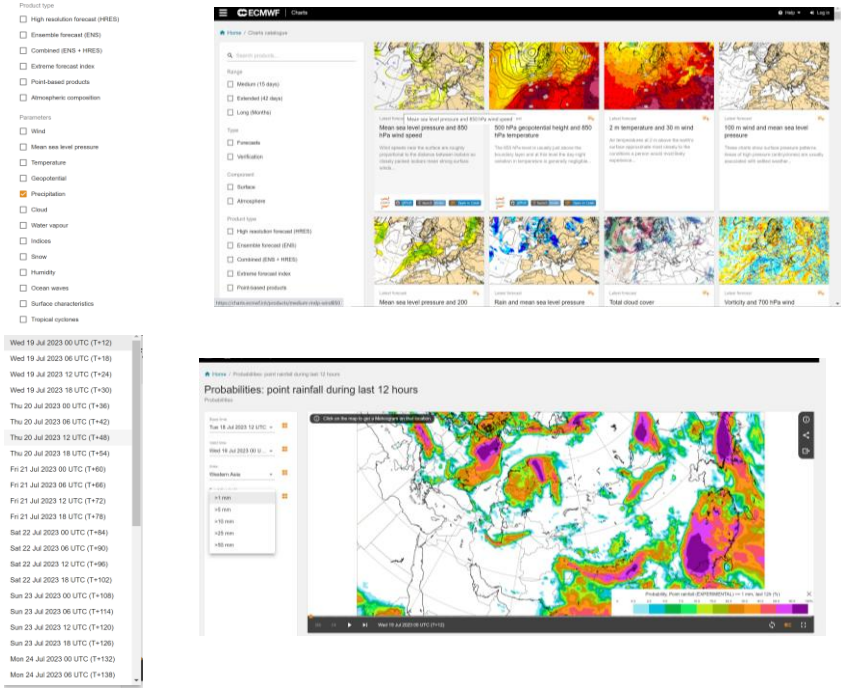
ECMWF charts & eccharts



ecPoint - ECMWF Point Rainfall Forecasts:

- Decision-tree based post-processing of ECMWF ENS forecasts
- Converts grid-scale ENS rainfall into point-scale values characterizing sub-grid variability
- Generates **100 point** estimates per ENS member (**51 members**) → **5100 values** → probabilistic percentiles
- **'Ensemble of ensembles'**
- Currently provides 12-hourly global rainfall forecasts up to 10 days

A low-cost post-processing technique improves weather forecasts around the world

Timothy David Hewson & Fatima Maria Pillosu

Communications Earth & Environment **2**, Article number: 132 (2021) | Cite this article

2014
Concept of postprocessing after extreme rainfall in Copenhagen

2015
Nominated for the Harry Otten Prize for the Innovation in Meteorology

2016
ecPoint development & testing

2019
Launching ecPoint into the operational system on experimental mode (ecCharts)

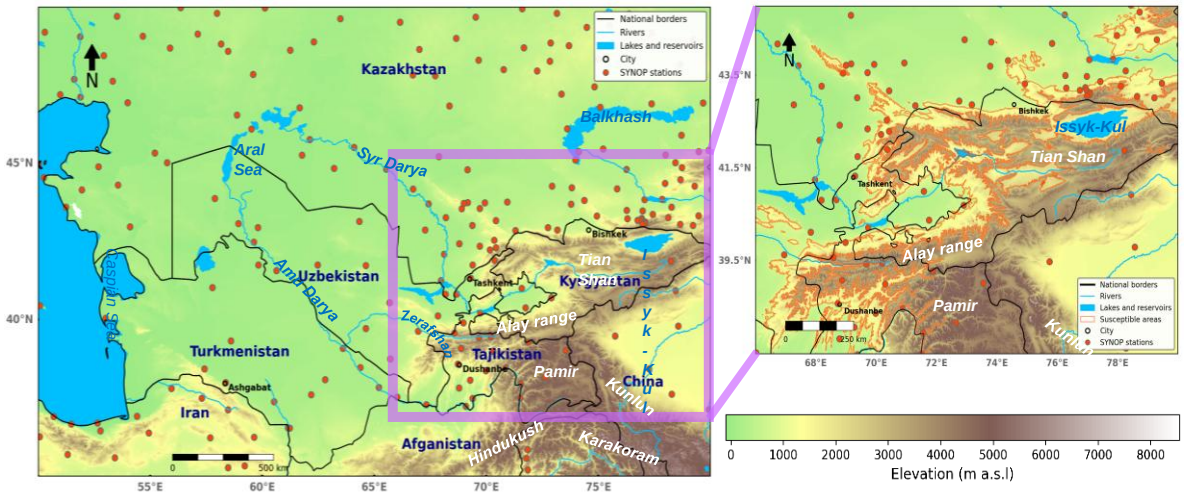
2025
RMS Robert Mill Award for Precipitation Research (Tim Hewson& Fatima Pillosu)

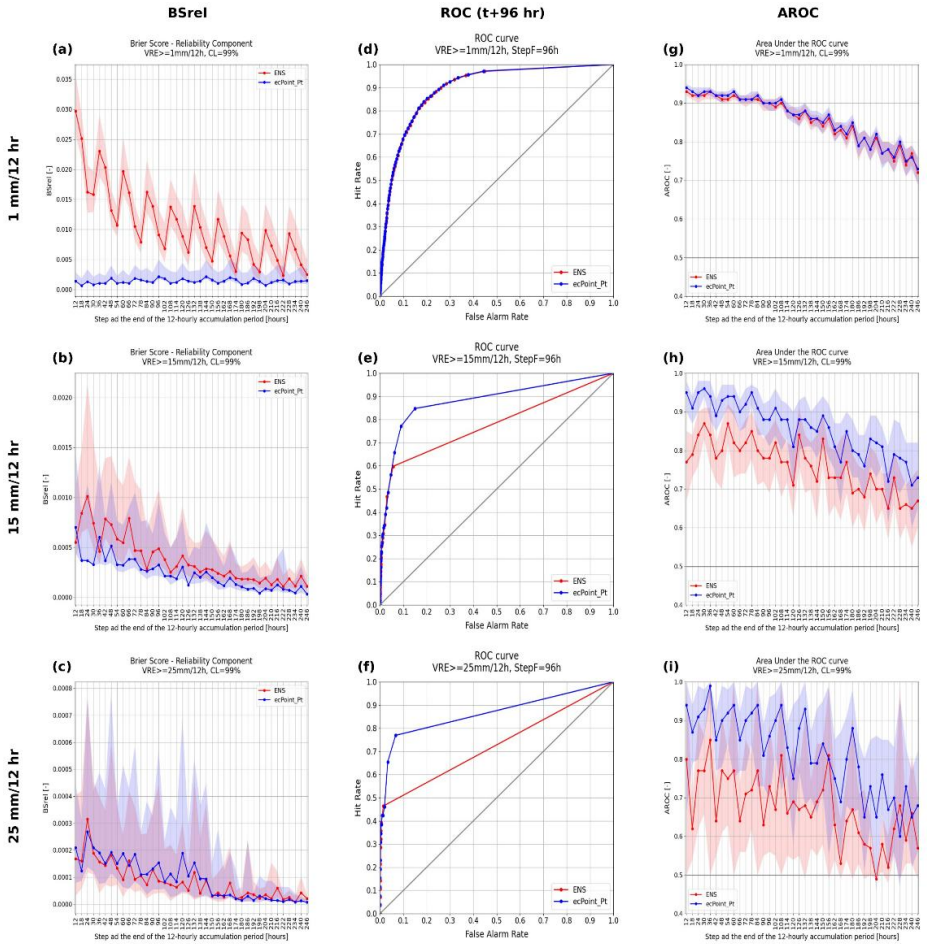
2026
Fully in operational run in 6, 12 hourly steps medium-range forecasts

2023: A workshop introducing ecPoint product to NHMS and researchers from Uzbekistan and Kazakhstan

Availabile to non-ECMWF countries

Improvement in the precipitation forecast skill using ecPoint Precipitation: Central Asia, spring 2022





Breir Score Reliability Component:

- 1mm/12 hr ecPoint outperforms raw ENS
- 15 mm/12 hr ecPoint shows improved skill

Relative Operating Characteristics (ROC):

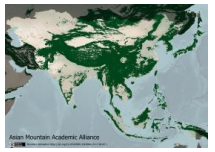
- ecPoint shows improved skill at higher thresholds
- Similar skill at low threshold (1 mm)

Area under ROC curve (AROC):

- Strong skill at >1 mm for both ENS and ecPoint,
- ecPoint outperforms ENS at 15mm

Credit: Dr G. Mamadjanova, University of Reading (Contact: gavkhar.mamadjanova@reading.ac.uk), Dr. F. Pillosu and Dr. T. Hewson (ECMWF)

Case study: Extreme precipitation and landslides in Bhutan 5/10/2025



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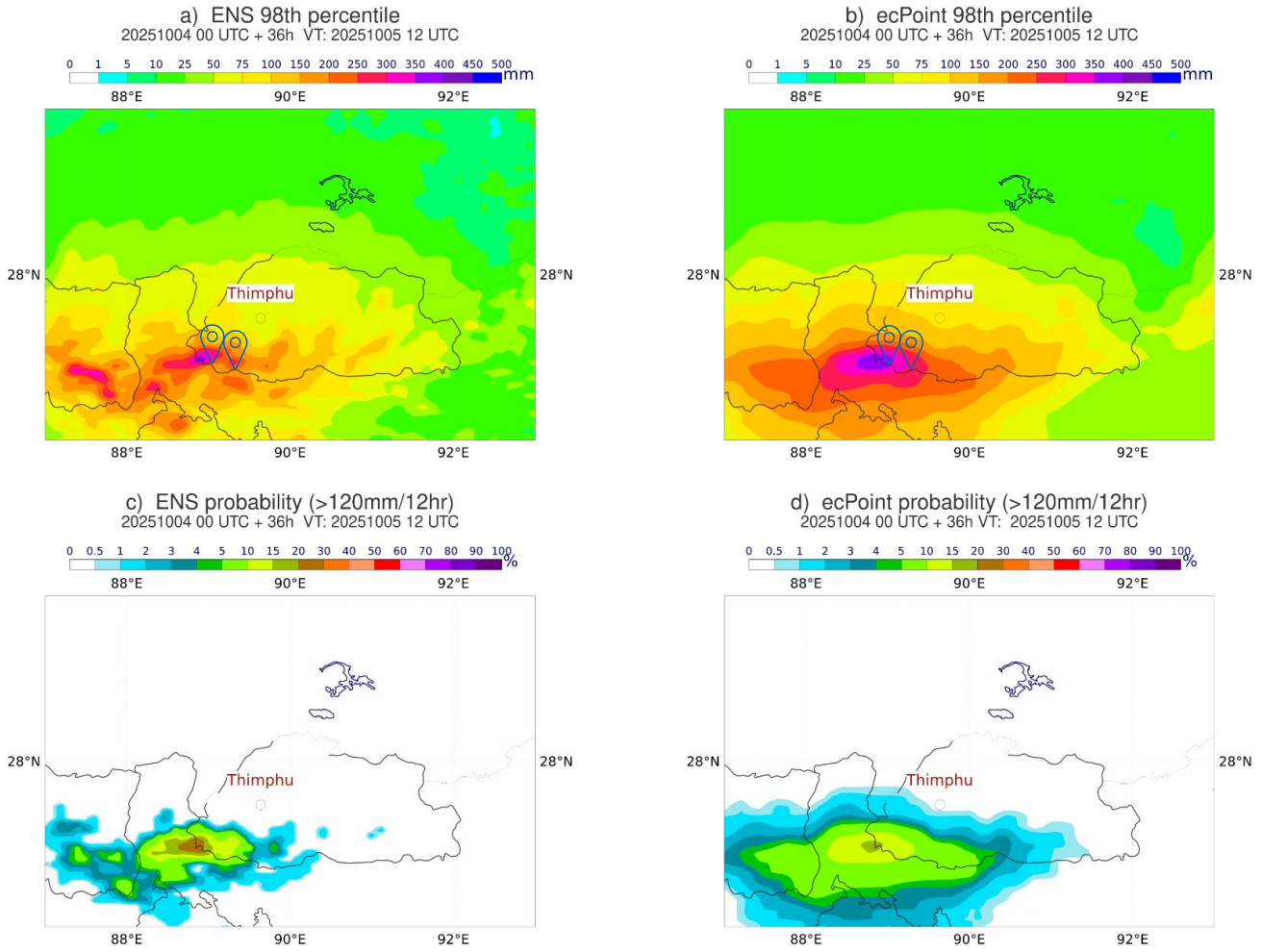
Severe Storm & Impacts

- Low-pressure system from Nepal caused **intense rainfall, flooding, and landslides**
- Rapid storm intensification from **Bay of Bengal** moisture
- **Samtse - 302 mm, Phuentsholing - 285 mm**
- Hydropower network **shut down** due to continuous rain and flash floods.

Forecast Performance

- ENS & ecPoint (98th percentile) **identified high-risk zones**.
- **ecPoint:** Higher magnitudes & stronger hazard probabilities, matching observed rainfall.
- **ENS:** Slight underestimation.
  ecPoint's skill improvement: **Weather type dependent post-processing** correcting biase and adding realistic sub-grid rainfall variability.



➢ **Consider wider use of ecPoint Rainfall in forecasting extreme events and hazards**

Thank you

Recent high-profile MRI publication

Peppin et al. Elevation-dependent climate change in mountain environments

November 2025, Nature Reviews Earth & Environment 6(12)

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