ATMOSPHERIC RIVERS AS TRIGGERS OF SLOPE INSTABILITY AND LANDSLIDES IN THE HIMALAYAS

Basit Ahad Raina & Munir Ahmad Nayak
Department of Civil Engineering, National Institute of Technology Srinagar, Kashmir, India
basit.raina121@gmail.com, munir.nayak@nitsri.ac.in

INTRODUCTION

- The Himalayas are highly prone to landslides due to steep slopes and intense rainfall.
- Atmospheric River events transport large amounts of moisture and produce intense, prolonged precipitation.
- This study evaluates the impact of Atmospheric River–induced rainfall on slope stability.

DATA

DATA	PURPOSE
NASA GLC (2007–2020)	Landslide inventory
Copernicus DEM	Slope and elevation
SoilGrids	Soil properties
ERA5	ARs and soil moisture

METHODOLOGY

METHOD	APPLICATION
IVT Analysis	AR detection
Terrain Analysis	Slope extraction
Infinite Slope Model	FoS estimation
Spatial Analysis	AR–landslide linkage

RESULTS

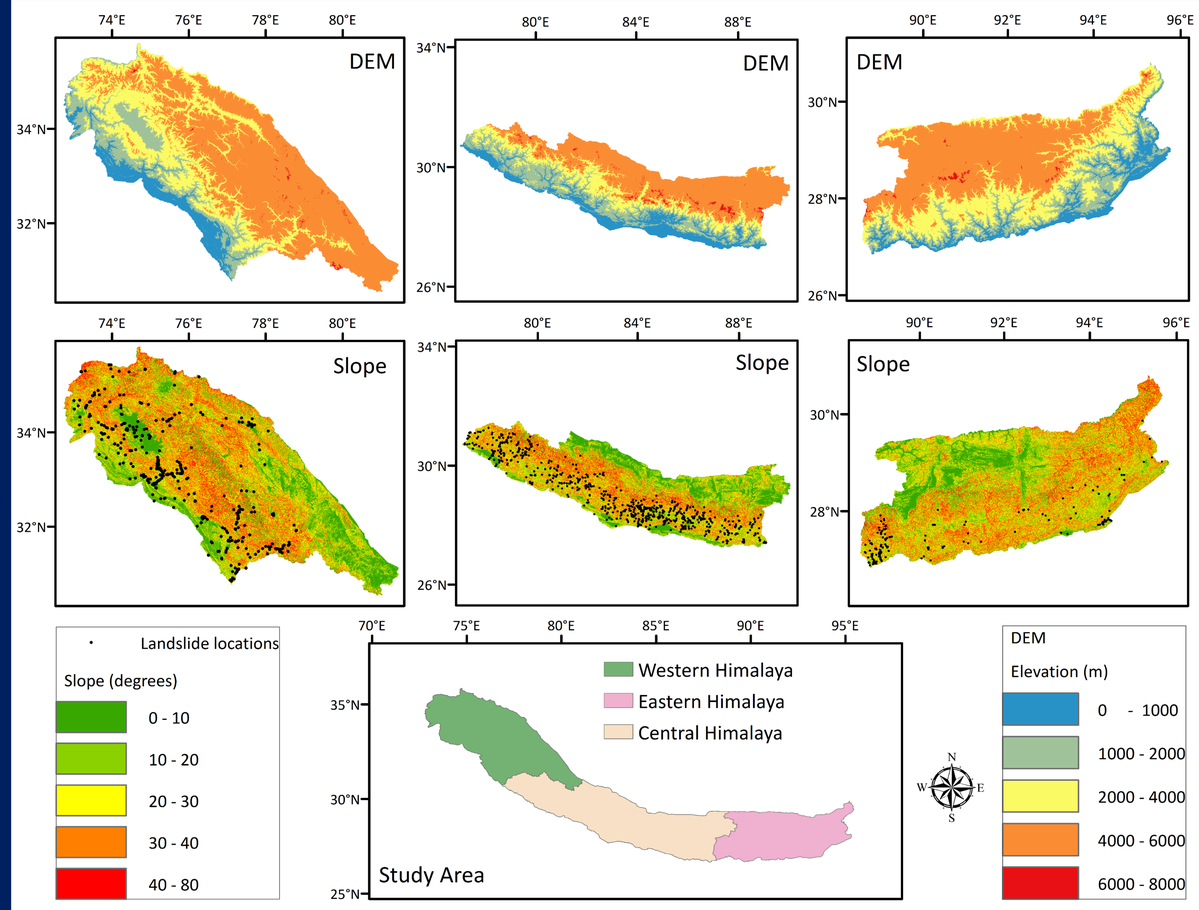

Figure 1. DEM, slope distribution, and landslide locations across the Himalayas.

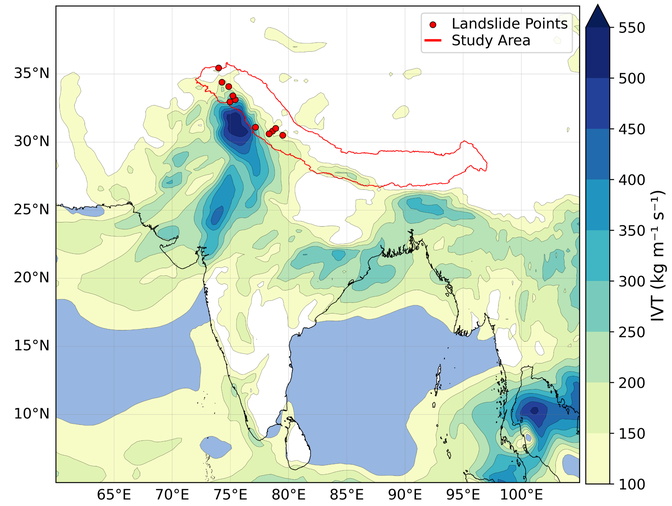

Figure 2. ERA5-derived Integrated Vapor Transport (IVT) during the 05 April 2017 AR event over the Himalayas.

CONCLUSIONS

- Atmospheric Rivers significantly enhance landslide susceptibility in the Himalayas.
- FoS during AR shows substantial stability reduction during AR events.
- AR-driven moisture transport correlates with observed landslide occurrence.
- Integrated AR–Landslide analysis improves regional landslide hazard assessment.

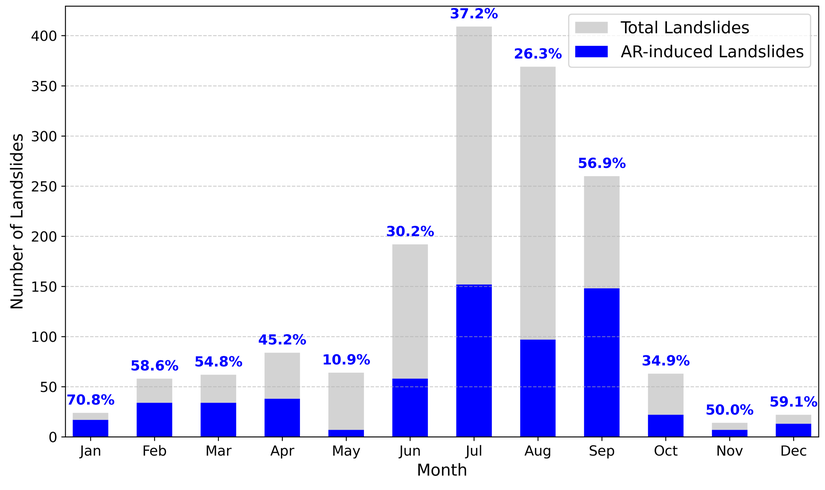

Figure 3. Monthly distribution of total and AR-induced landslides in the Himalayan region.

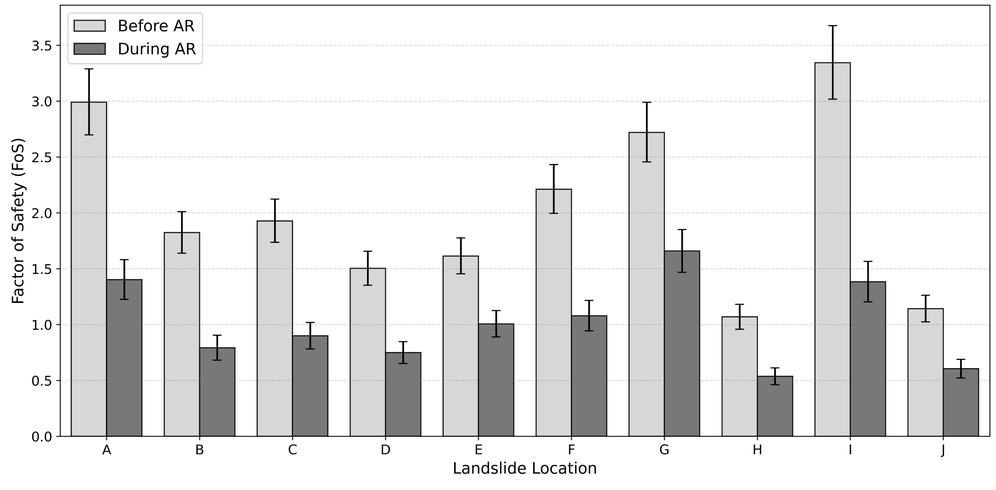

Figure 4. Comparison of before and during AR (FoS) for selected landslide locations.