

# Supplementary material:

**Glacier mass balance and its climatic and non-climatic drivers in the Ladakh region during 2000-2021 from remote sensing data**

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<https://meetingorganizer.copernicus.org/EGU23/EGU23-6319.html>

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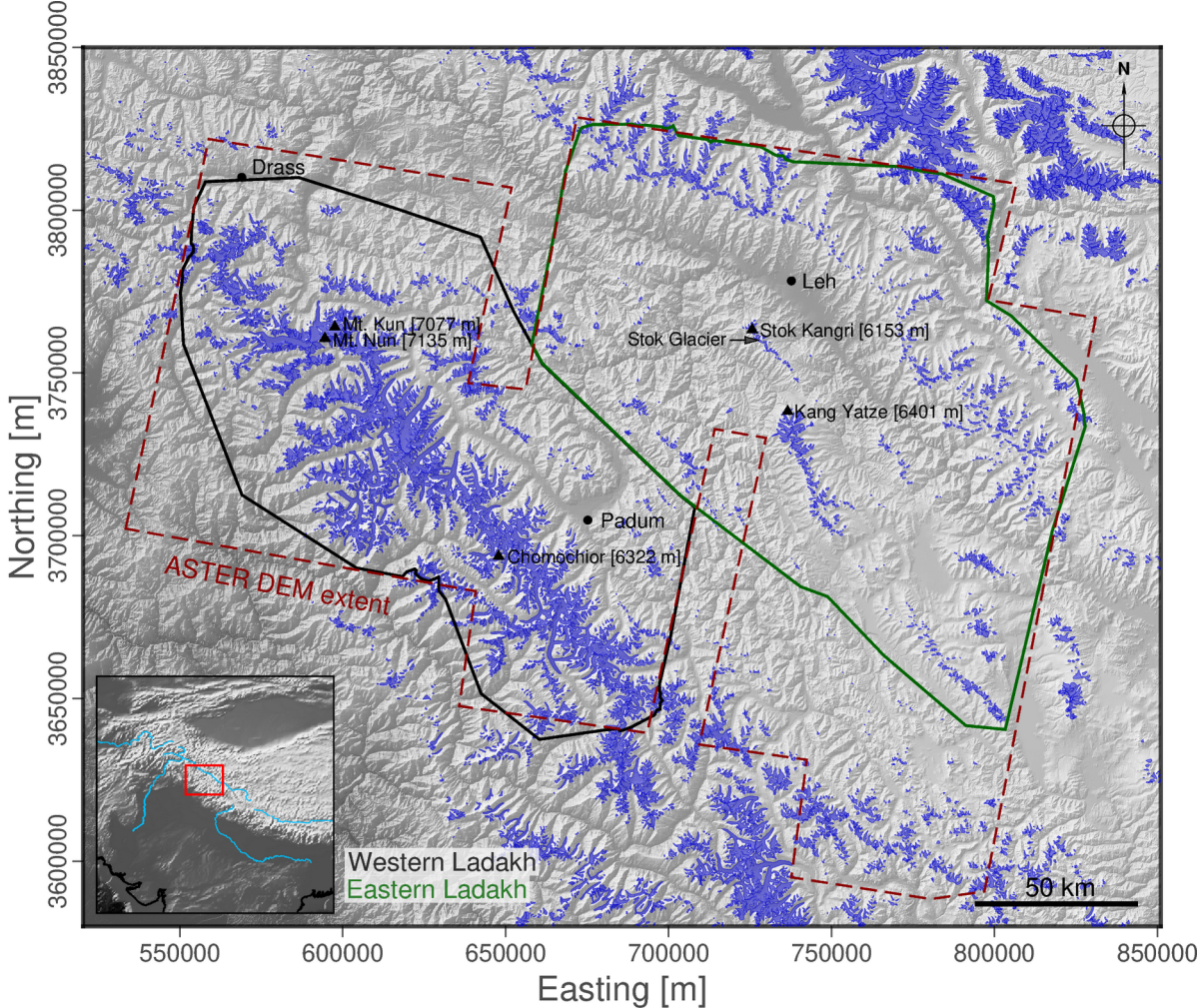
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# Ladakh Region (Western Himalaya, RGI 14. South Asia West)

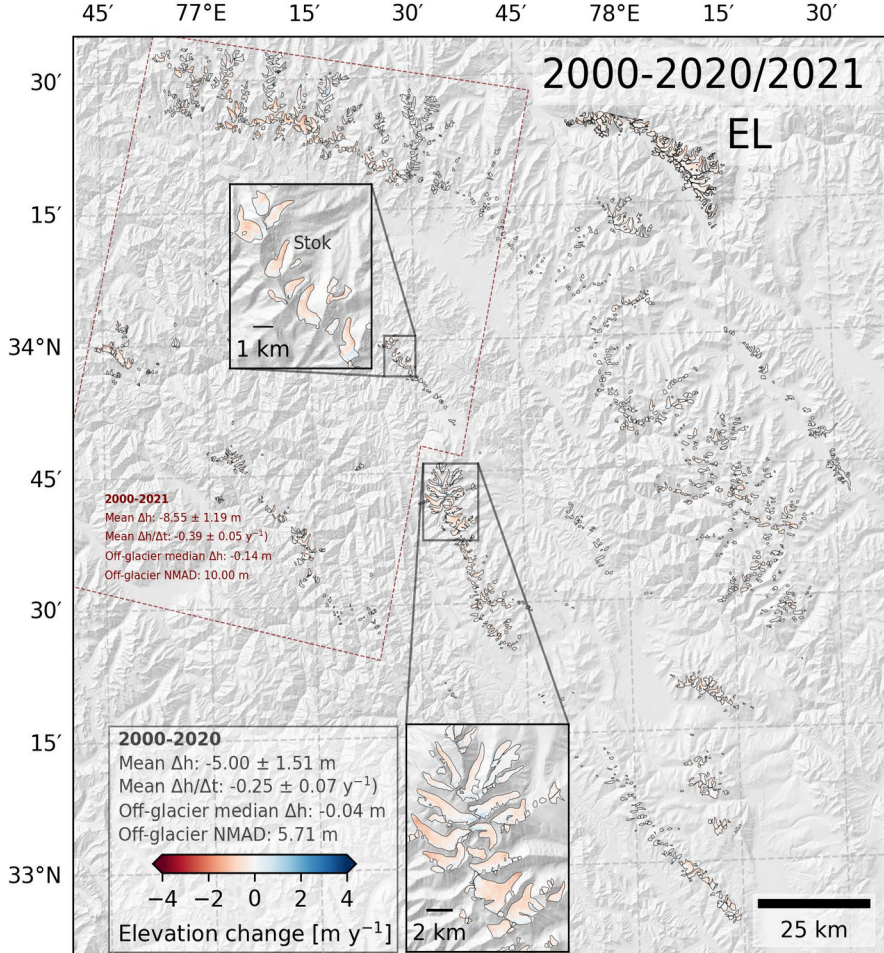
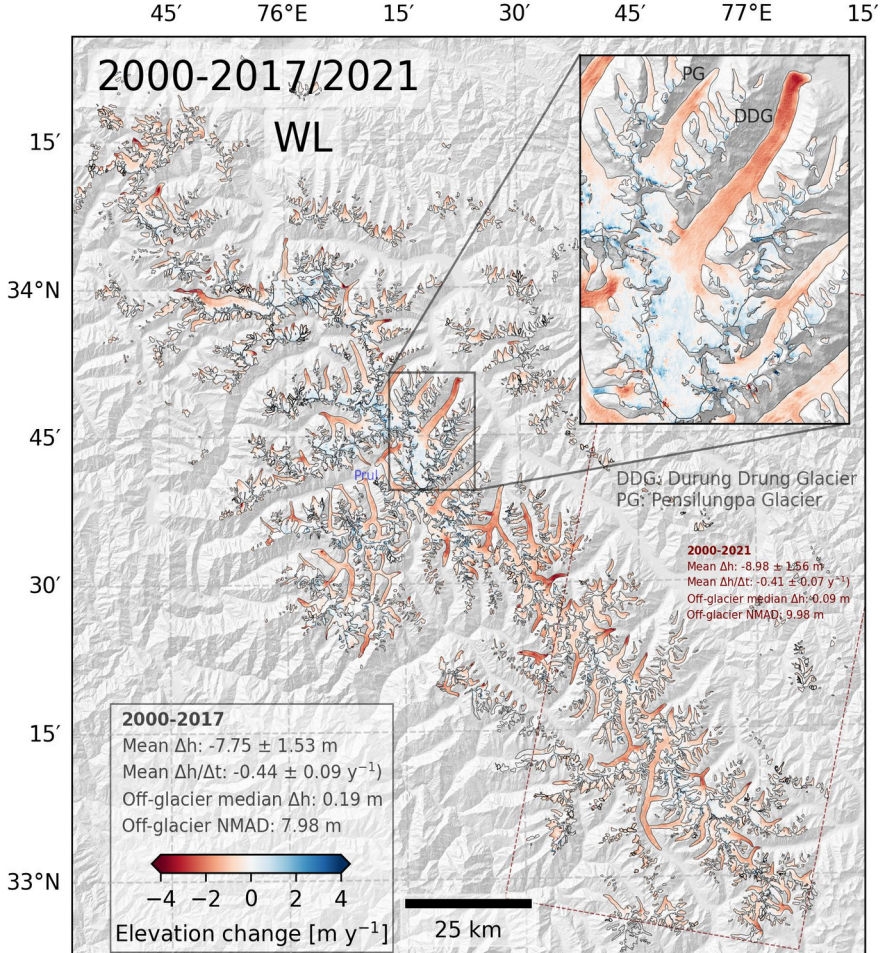


## Ladakh Region and other details

Region/Parameter	Western Ladakh (WL)	Eastern Ladakh (EL)
<b>Physiography and glacier numbers</b>		
Regional details	Western Himalaya	Western Himalaya (a small part of the Eastern Karakoram)
River basin covers	Major: Zaskar and Suru Minor: Drass and Shingo	Major: Leh, Tsokar and Tsomoriri Minor: Pangong and Shayok
Number of glaciers	2311 (n = 428 > 1 km <sup>2</sup> )	1468 (n = 179 > 1 km <sup>2</sup> )
Glacierised area (all glaciers)	2739 km <sup>2</sup>	759 km <sup>2</sup>
Glacierised area (glaciers > 1 km <sup>2</sup> )	2173 km <sup>2</sup>	366 km <sup>2</sup>
Debris area (% of total area)	646 km <sup>2</sup> (24%)	124 km <sup>2</sup> (16%)
Glacier elevation range	3115 – 7065 m a.s.l.	4865 – 6640 m a.s.l.
Median glacier elevation	5060 m a.s.l.	5680 m a.s.l.
<b>Climatology</b>		
Temperature (annual / range)	6 °C / -20 to 24 °C	6 °C / -30 to 25 °C
Precipitation (annual / summer)	~800 mm / ~125 mm	~115 mm / ~20 mm



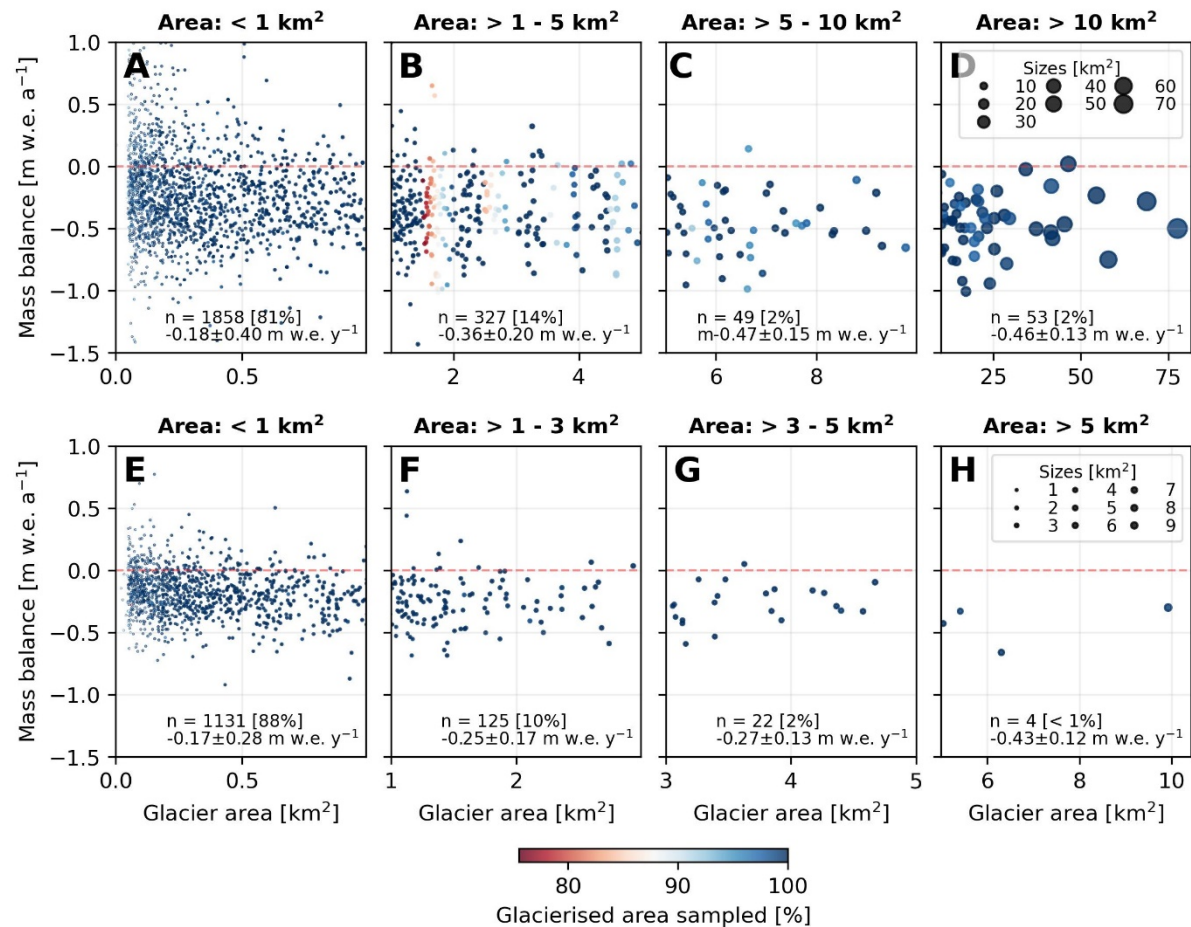
# Elevation changes (DEM differencing)





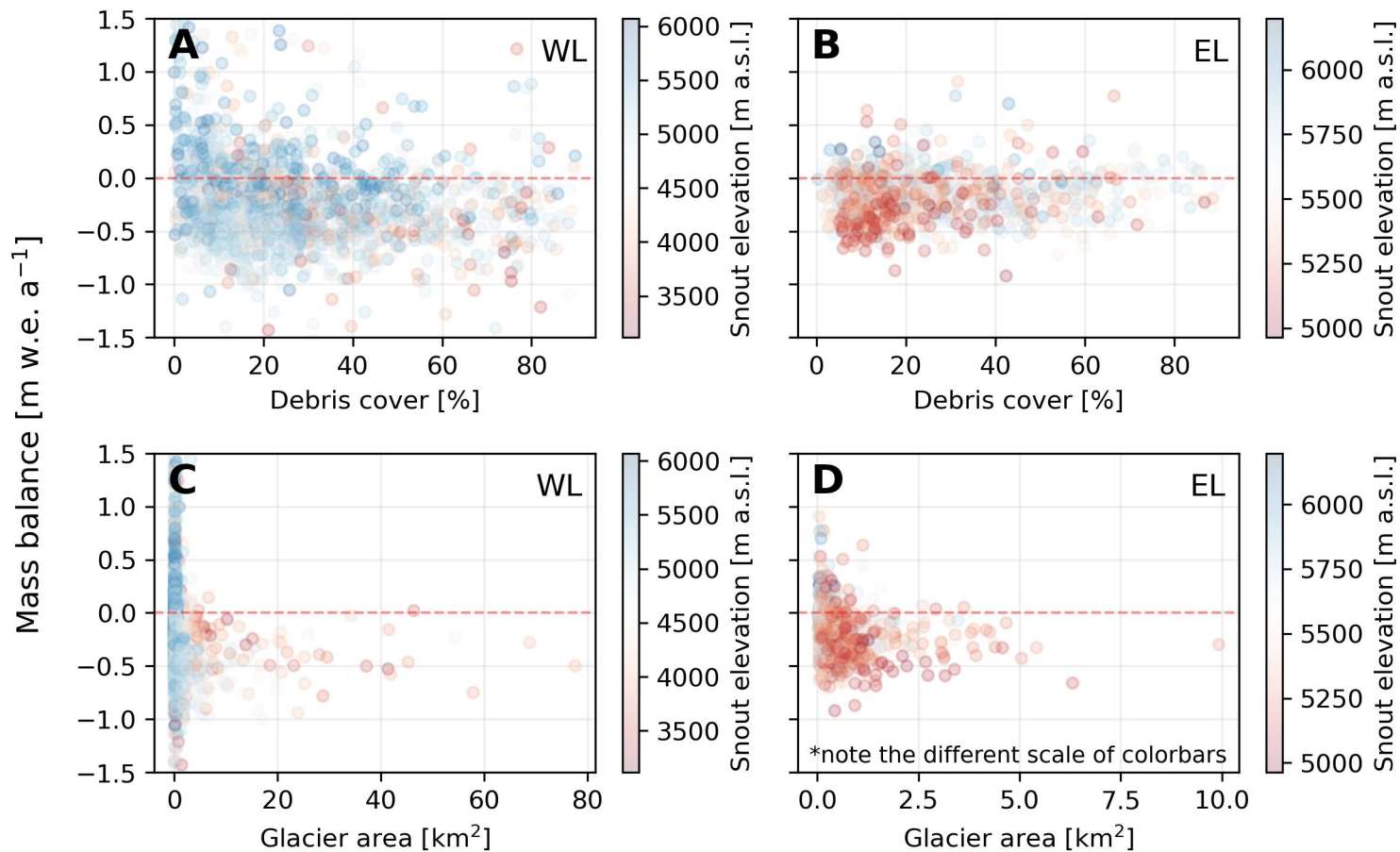
# Glacier mass balances (for different size/area categories)

Top: Western Ladakh [2000-2017/2021]  
Bottom: Eastern Ladakh [2000-2020/2021]



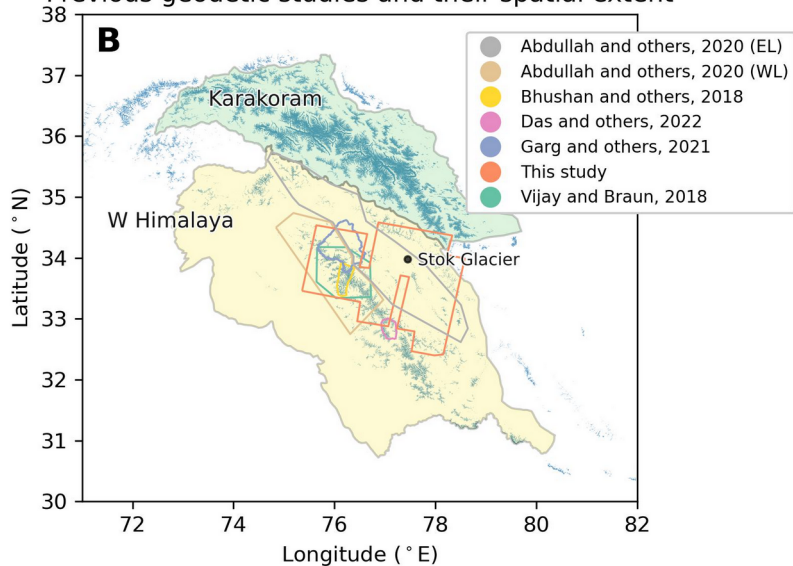
# Mass balances and debris cover relationship

Mass balance, debris cover, area and snout elevation

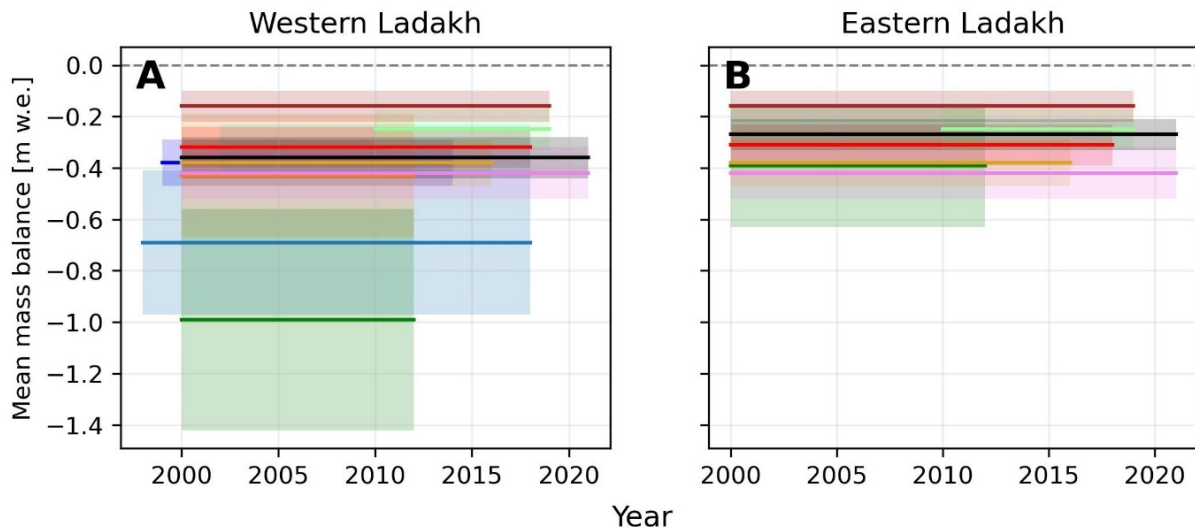


# Comparison to other regional work

Previous geodetic studies and their spatial extent



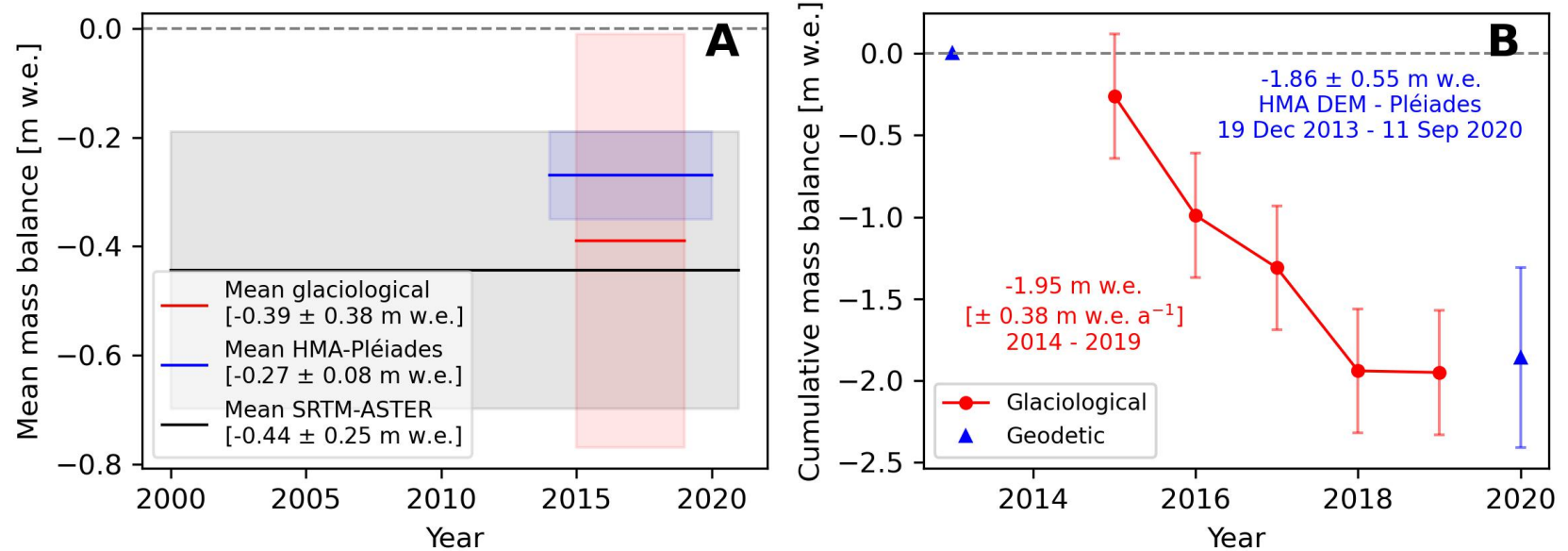
- Das and others, 2022 [ASTER; Jankar Chhu sub-basin]
- Garg and others, 2021 [ASTER - SRTM/ELA method; Suru sub-basin]
- Bhushan and others, 2018 [Cartosat-1 - SRTM; 10 glaciers in Zaskar]
- Vijay and Braun, 2018 [TanDEM-X - SRTM; entire Zaskar]
- Abdullah and others, 2020 [TanDEM-X - SRTM; entire Zaskar]
- Brun and others, 2017 [ASTER; W Himalaya]
- Shean and others, 2020 [ASTER/WV/GE; W Himalaya]
- Jakob and others, 2021 [CryoSat-2 altimetry; W Himalaya]
- Hugonnet and others, 2021 [ASTER; South Asia West]
- Fan and others, 2022 [ICESat-2-NASADEM; W Himalaya]
- This study [ASTER - SRTM]





# Geodetic MB comparison to glaciological record

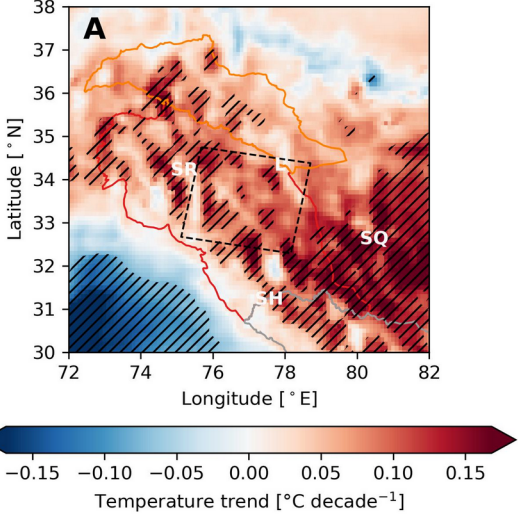
## Geodetic vs. Glaciological mass balance Stok Glacier [Eastern Ladakh]



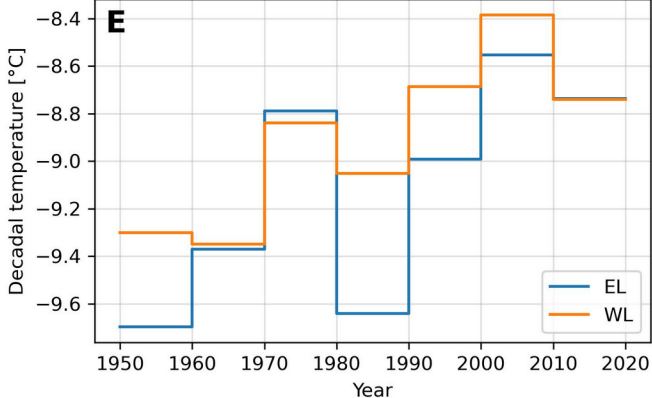
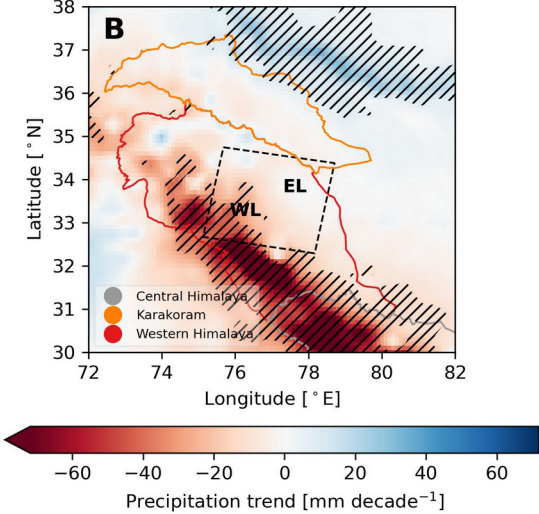
Thanks to Pléiades Glacier Observatory (PGO, CNES) for Pléiades, NSIDC for HMA 8-m DEM and NASA for ASTER L1A DEMs.

# Climate changes around the region (ERA5-Land, evaluated by GHCN-M)

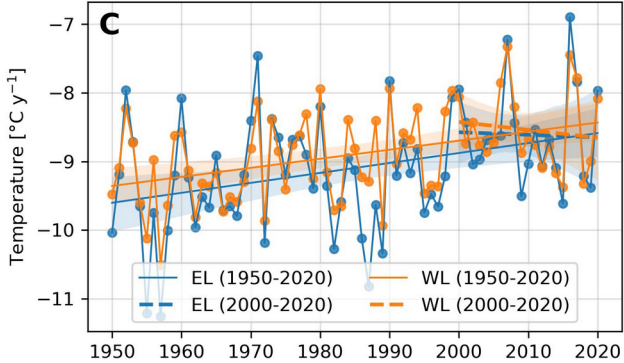
Temperature trend for 1950-2021



Precipitation trend for 1950-2021



Temperature time series



Precipitation time series

