

EXPLORING THE CAUSES OF ICE VELOCITY ANOMALIES IN HIGH MOUNTAIN ASIA

ANALYSIS FROM THE KARAKORAM, SPITI LAHAUL
AND EASTERN HIMALAYA

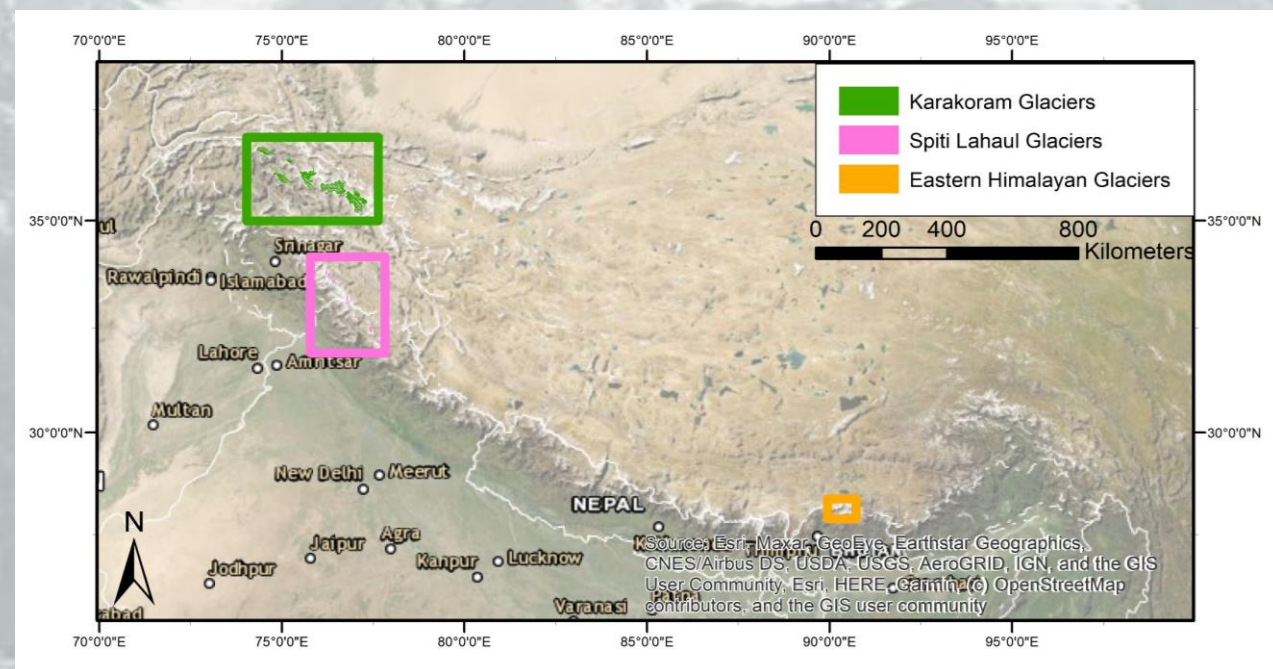
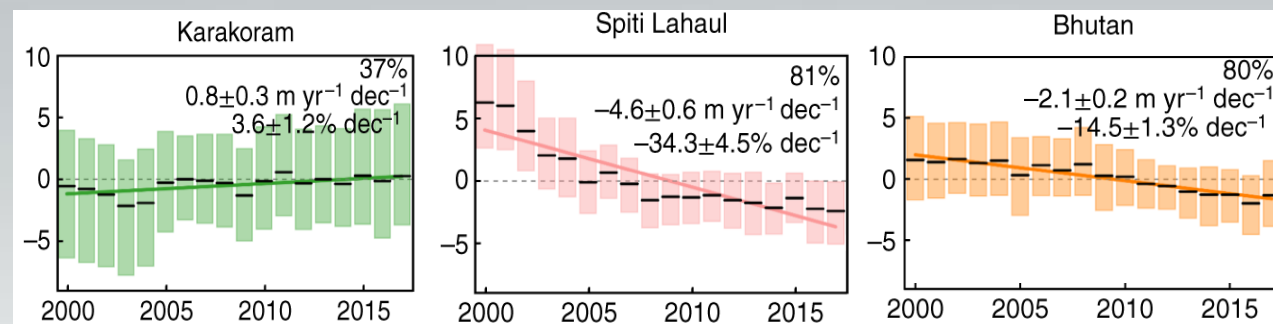
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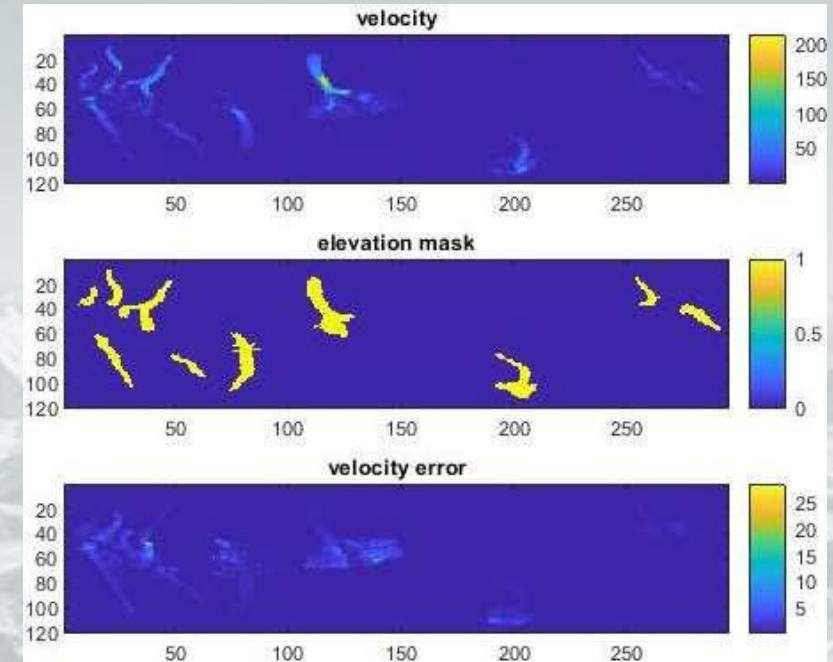
OVERVIEW

- Dehecq et al. (2019) presented observations of changes in ice flow for all glaciers across High Mountain Asia (HMA) over the period 2000–2017
 - Contemporary glacier change across HMA is **regionally contrasted**
- The **causes** of ice velocity anomalies are poorly constrained, especially on **intra-regional scales**
 - Morphometric controls
 - Autocorrelations
- This is particularly important for **water resource management** and potential **hazard mitigation strategies**

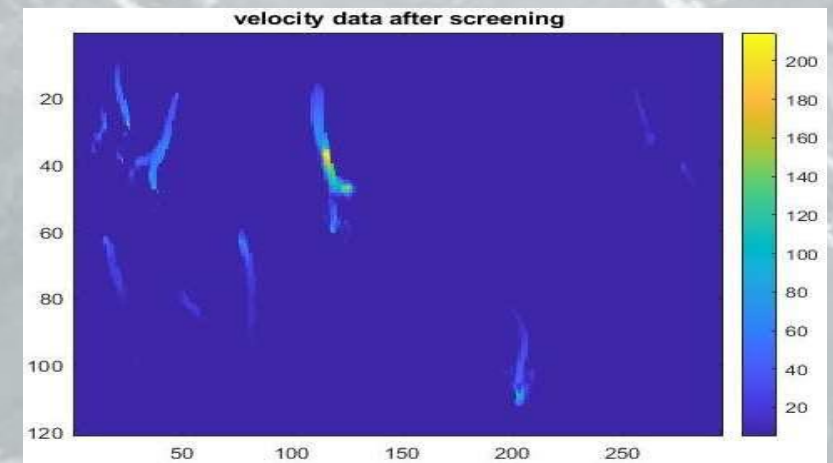


APPROACH

- Bespoke MATLAB script used to extract **glacier-specific** velocity data from NASA MEaSUREs ITS_LIVE
- Velocity analysis occurred where pixels **met specific selection certain criteria**:
 - **Velocity** > 5 m yr⁻¹
 - **Uncertainty** < 5 m yr⁻¹
 - Glacial **ablation** zone
- Velocity change calculated following established methods (Dehecq et al., 2019)
- Investigated how various **morphometric properties** and **climatological records** associated with ice velocity anomalies



MATLAB inputs:
Velocity, elevation
mask and velocity
error for EHR in
2000



Velocity data after
MATLAB screening,
with pixels meeting
all selection criteria
visualised for EHR
for the year 2000

RESULTS KARAKORAM

- North Western Karakoram

- **Slowdown** experienced between 2000–2016

- $-0.86 \pm 5.69 \text{ m yr}^{-1}$ per year (2000–2012) and $-3.23 \pm 2.53 \text{ m yr}^{-1}$ per year (2013–2016)

- Data **artefact** (2013–2016) to **undergo correction**

- South Eastern Karakoram

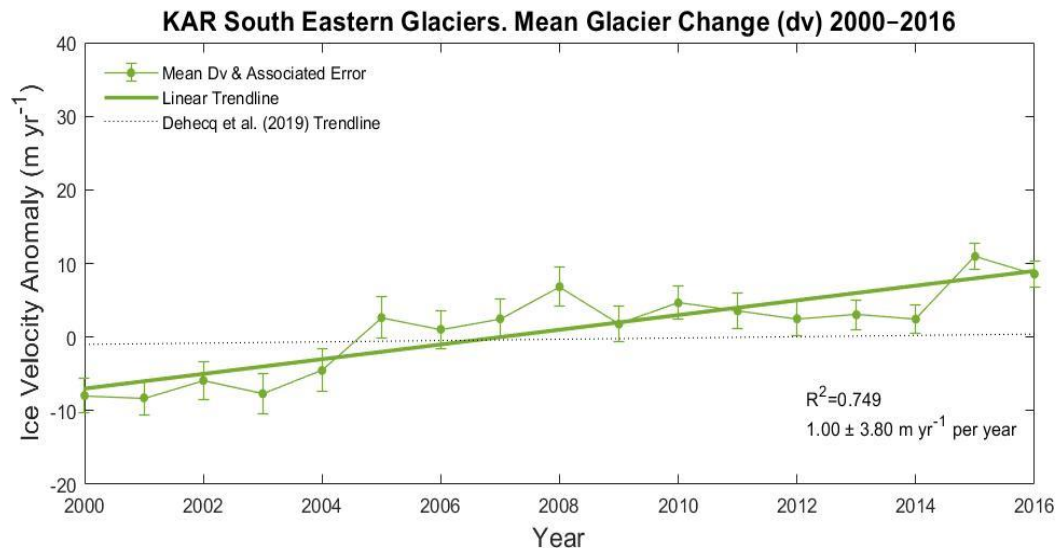
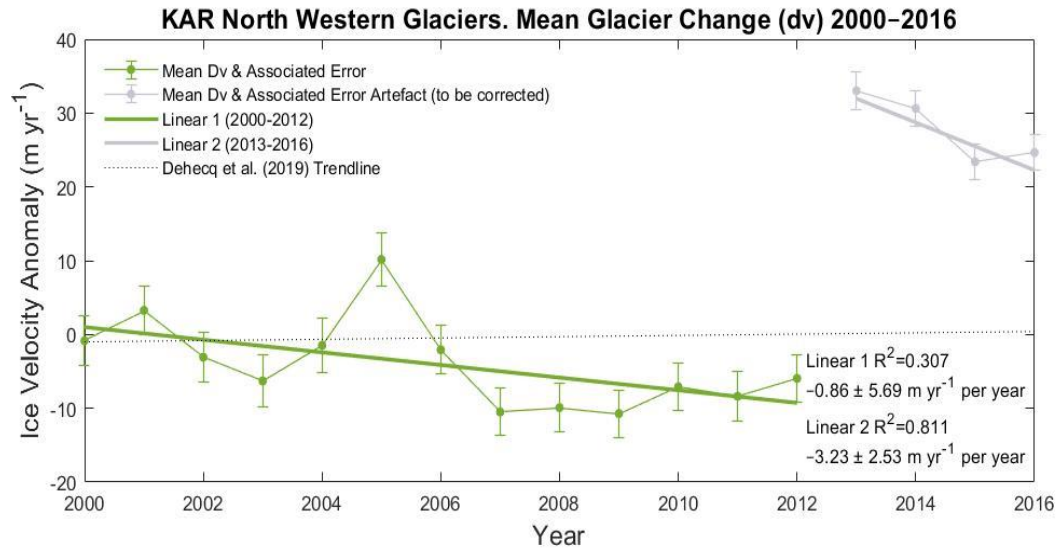
- **Speedup** experienced between 2000–2016

- $1.00 \pm 3.80 \text{ m yr}^{-1}$ per year

- Morphometric Control? Autocorrelations?

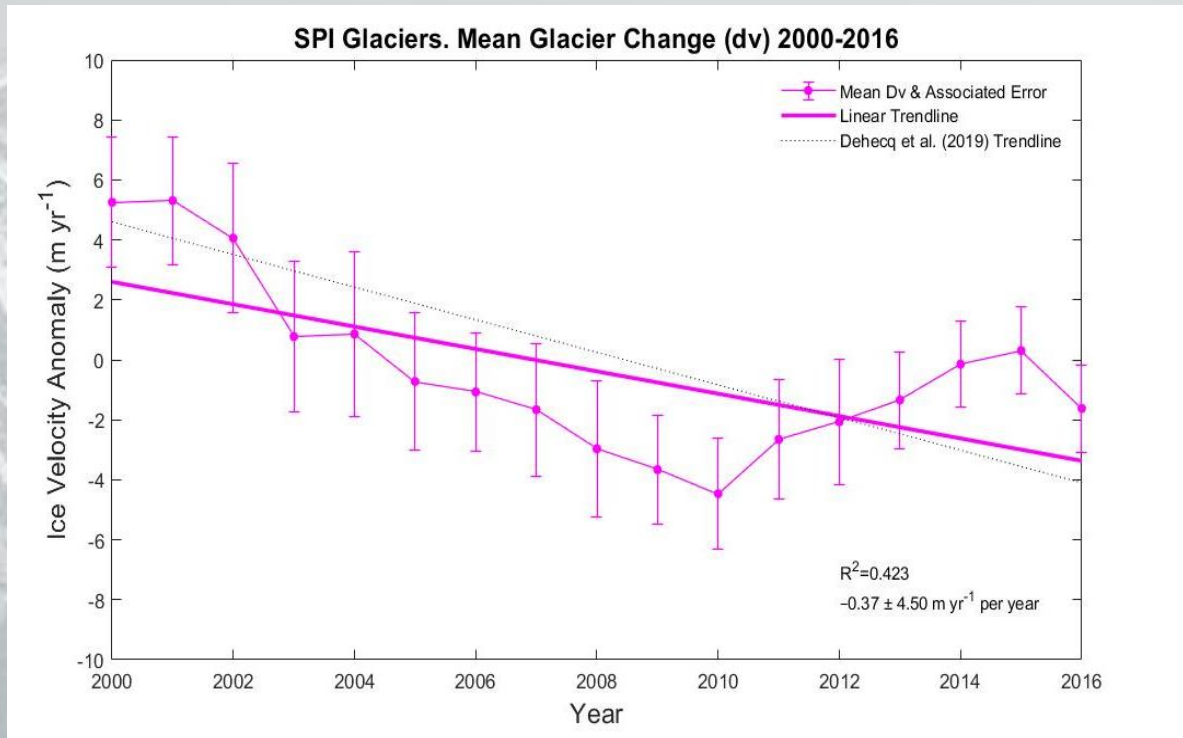
- **Minimum elevation** ($Z_{\min}$) (-) and **hypsometric integral** (+)

- **Autocorrelations** between glacier size, ablation area and flow line length, $Z_{\min}$ and percentage debris cover, $Z_{\min}$ and hypsometric integral, flow line length and debris area



RESULTS

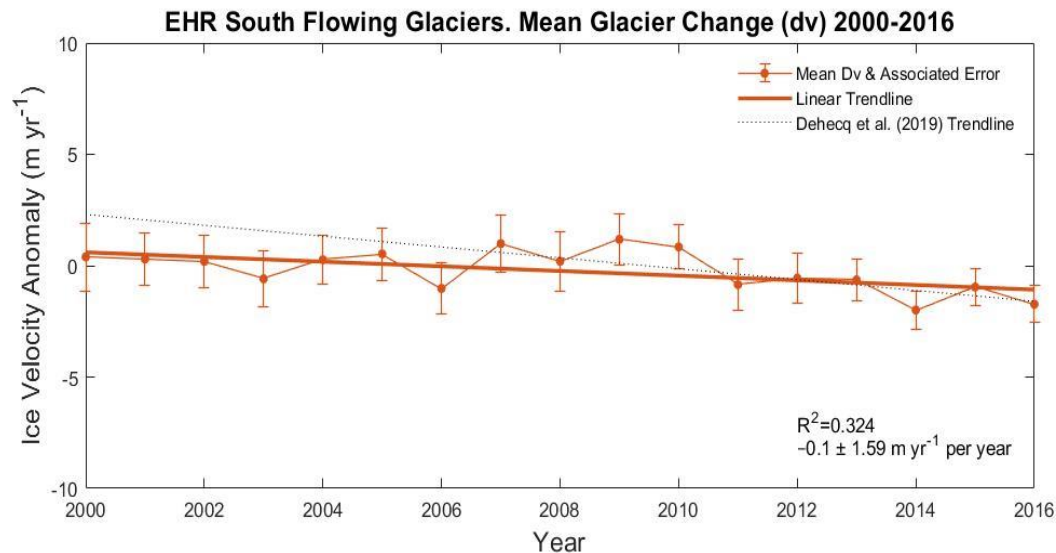
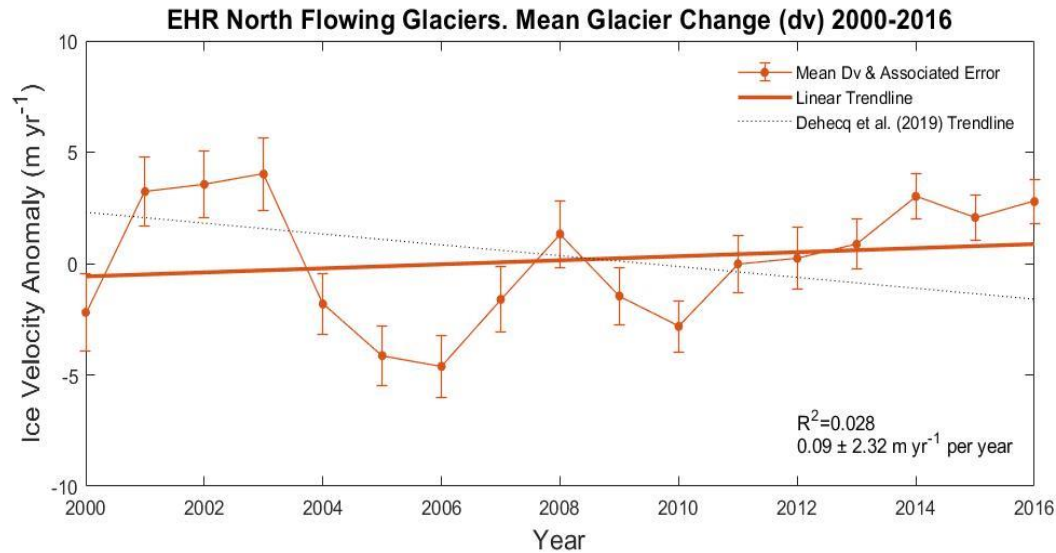
SPITI LAHAUL



- Spiti Lahaul
 - **Slowdown** experienced between 2000–2016
 - $-0.37 \pm 4.50 \text{ m yr}^{-1} \text{ per year}$
 - **Good agreeance** with that presented by Dehecq et al. (2019), with both linear regressions following similar paths of change
 - Morphometric Control? Autocorrelations?
 - **No morphometric controls identified**
 - **Autocorrelations** between glacier area and ablation area and flow line length, $Z_{\min}$ and percentage debris cover
 - Ladakh **flooding** event on 6th August 2010

RESULTS

EASTERN HIMALAYA



- Eastern Himalaya: North flowing glaciers
 - **Speedup** experienced between 2000–2016
 - $0.09 \pm 2.32 \text{ m yr}^{-1} \text{ per year}$
- Eastern Himalaya: South flowing glaciers
 - **Slowdown** experienced between 2000–2016
 - $-0.1 \pm 1.59 \text{ m yr}^{-1} \text{ per year}$
 - Influence of the **Indian Summer Monsoon**
- Morphometric Control? Autocorrelations?
 - **Glacier size (+), ablation zone area (+) and hypsometric integral (+)**
 - **Autocorrelations** between $Z_{\min}$ and percentage debris cover, ablation area and flow line length