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Unraveling glacier change signals in high-mountain region

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A key challenge for the climatological and glaciological communities is the detection and attribution of climate change, which is the effort to decompose environmental signals into an anthropogenic component and a component due to internal modes of atmospheric variability, such as climate oscillations. This challenge is especially great in high-mountain regions, where observational data are sparse but environmental changes such as glacier retreat have the potential to strongly impact human populations.

Using a case study of Kilimanjaro in East Africa, we employ an interdisciplinary approach to unraveling recent climate and glacier-change signals, combining sub-kilometer resolution atmospheric simulations, in situ measurements, and physically based glacier mass balance modelling over a decadal period. We use these datasets to assess the impact of the El Niño Southern Oscillation and the Indian Ocean Zonal Mode, as well as interactions between them, on large- and local-glacier-scale atmospheric conditions and therefore drivers of glacier change. Elucidating the present-day impact of internal climate variability at high altitudes is key for understanding local phenomena and will permit more accurate assessments of external forcing factors, including future projections.