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Everest-region glacier recession measured by satellite radar interferometry and feature tracking

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Local atmospheric warming reflecting climatic adjustment in high-Himalayan areas (e.g. Nepal) is believed to be responsible for variations in winter precipitation and, consequently, decreased glacier flow. Many glacier snouts in the region are reported to be approaching stagnation and there has been a coincident increase in glacier hazard development, in particular the formation of glacial lakes impounded either by the terminal moraine or by the remnant glacier snout. This has important implications for human welfare as well as for water resources, with large parts of Asia being dependent on Himalayan fed rivers for drinking and sanitation needs. In this study, we use interferometry and feature tracking techniques to measure flow rates in twenty Everest-region glaciers over the period 1992-2002 to assess how recent climatic changes have affected glacier dynamics in this well known but understudied area.

The most striking result is that the vast majority of the measured debris covered snouts in the region are now approaching total stagnation, exhibiting annual displacements of less than 10m, even in their upper reaches. Only one glacier of those studied maintains flow across the entire debris-covered surface. Where glacier flow is measurable there is little evidence of any coherent spatial trend, with the most likely explanation for differences in the magnitude of displacement being only the height and size of the contributory accumulation areas and, in places, preferential monsoonal sustenance. There is some indication of a seasonal variability in flow, with the greatest extent and magnitude of flow being detected during warm and wet months, perhaps as a result of

increased precipitation and associated rises in basal meltwater volumes. Concave surface profiles extracted from an SRTM DEM indicate that downwasting is the prevalent ablation mechanism in the study area, the implication of which is for increased lake development in the surrounding region and an associated increase in glacial hazard events on a time scale of the order of decades.