Title:	Factors governing the pattern of glacier advances since the Last Glacial Maxima in the transitional climate zone of the Southern Zanskar Ranges, NW Himalaya
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Abstract:	The present study investigates the relics of glacier advances and retreats in the transitional climatic zone of the Southern Zanskar Range, NW Himalaya in response to the temporal changes in the Indian Summer Monsoon (ISM) and mid-latitude westerlies. The study identifies four glacier advances which are named from the oldest to youngest as the Southern Zanskar Glacier Stage-4 (SZS-4) to SZS-1. The SZS-4 remains undated, however based on the existing chronology of the stratigraphically equivalent moraines/trimlines in the region; it is conjectured to the Marine Isotope Stage-4 (MIS-4). The optical chronology obtained during the present study dates the SZS-3 to 22.8 ± 1.9–19.1 ± 1.9 ka which corresponds to the Last Glacial Maxima (LGM). The SZS-2 is dated to 15.7 ± 1.3–14.3 ± 1.3 ka (late Glacial period) whereas, based on the chronology of the recessional moraines (4.9 ± 0.4–4.5 ± 0.3 ka) the youngest SZS-1 is assigned to ~6 ka (mid-Holocene). The snout proximal moraines are attributed to the Little Ice Age (LIA)/historical times. The pulsating deglaciation associated with each advance since the LGM is represented by the recessional moraines and outwash gravel terraces. The older gravel terrace is dated between 10.8 ± 0.9 and 6.5 ± 0.5 ka and is attributed to SZS-2 deglaciation which is also manifested by the deposition of sandy facies in a relict lake sequence (6.7 ± 0.6 ka) and development of palaeosol (5.6 ± 0.5 ka). We propose that the glacial advances were triggered by the millennial scale cooling events during the periods of strengthened westerlies and thus, suggest a synoptic scale coupling with the Northern Atlantic. The deglaciation is suggested to occur during the warmer ISM dominated phases. The late Holocene climatic instability that followed the recession of SZS-1 is manifested by the development of rhythmites (3.8 ± 0.5 ka), loess (2.5 ± 0.2 ka), and palaeosol (2189 ± 296 cal yr BP).
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