SATELLITE OBSERVATIONS OF GLACIER ADVANCES AND RETREAT IN THE WESTERN KARAKORAM

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ABSTRACT
Debris-covered alpine glaciers around the world have been retreating and downwasting. This suggests glacier response to atmospheric warming. Recent studies in the eastern Himalaya have shown systematic retreat for many glaciers. In the western Himalaya, however, systematic and quantitative data are not yet available to determine glacier sensitivity and mass balance trend. Given the paucity of bench-mark glaciers in the Himalaya, remote-sensing-based studies are required to obtain baseline information and produce estimates of advance and retreat rates. Consequently, our objective was to assess glacier fluctuations in the western Karakoram as a part of the Global Land Ice Measurements from Space (GLIMS) project. Specifically, we used multi-temporal satellite data (ASTER 06/17/1979, 06/28/1980, 07/19/1979, 06/22/1980) to quantitatively assess terminus fluctuations. Results indicate that 45% of the sampled glaciers are advancing, and/or exhibit similar terminus positions to past positions. For example, Momhil Glacier is advancing at the rate of 10 m/yr. On the other hand, most of the small to medium sized glaciers such as Siling Glacier are retreating (4 m/yr). Some of these glaciers have also shown strong downwasting characteristics in the form of increased frequency and size of supraglacial lakes. Collectively, our results indicate that these glaciers may be responding differently to the current climatic conditions than in the eastern Himalaya (east of the Karakoram) and Wakhan Panmah region (northwest of the Karakoram). These quantitative results from remote-sensing studies also indicate that glacier fluctuations in this region are spatially and temporally complex. These complexities may be governed by multi-scaled topographic effects, as well as by variations in winter precipitation and decreases in summer temperature from increased cloudiness, as suggested by others.

STUDY AREA

Batura and Hispar Mustagh Region

Baltoro, Biafo and Panmah Mustagh Region

CONCLUSION
Retreat and downsizing of alpine glaciers are reported in many mountain environments, although our results document a relatively high percentage of advancing/surging glaciers in the Karakoram Himalaya. We have also identified retreating glaciers which exhibit lower retreat rates than those observed in the eastern Himalaya or the Hindu Kush region of Afghanistan (Haritashya et al., 2007).

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REFERENCES

Three-dimensional perspective of Bualtar Glacier in the Hunza Karakoram. Satellite imagery draped over a digital elevation model clearly depicts different phases of surged supraglacial lakes. It also shows debris cover patterns in the lower ablation region and terminus area. (Courtesy: Google Earth)