



## **Glacier distribution and glacier area changes 1960s-2000 in the Brahmaputra river basin**

**A. Kääb**, R. Frauenfelder and J.A. Frauenfelder Kääb

Department of Geosciences, University of Oslo

Glacier distribution, glacier changes and permafrost occurrence are investigated for the area of the Upper Brahmaputra River Basin in order to determine the influence of melting glaciers and degrading permafrost on the long-term runoff of the Brahmaputra River. The work is embedded in the EU-project BrahmaTWinn which aims at quantifying climate change impacts on the Brahmaputra (Himalaya) and Inn (European Alps) river basins, and at investigating and comparing related water resources management strategies and policies.

In this contribution we derive glacier inventories for two test areas in the Upper Brahmaputra River Basin based on semi-automatic classification of Landsat data of 2000 and supplementary ASTER data. The resulting glacier outlines are intersected with the glacier outlines of the Chinese Glacier Inventory from about the 1960s. The obtained changes in glacier area show a large scatter in all size classes, only slightly decreasing towards the larger glaciers. In total, an area loss of about 18% was observed over the period investigated. We estimate the according ice volume loss to be on the order of 20%, or -0.2 m water equivalent per year. This number perfectly coincides with the directly measured mass balance of the Urumqihe S, No 1 glacier in the Tien Shan at the northern margin of the Tibetan plateau, ca. 1500 km north of the study area.

Using the Chinese Glacier Inventory and our inventory results we upscale the above glacier change to the entire Upper Brahmaputra River Basin and estimate it to be on the order of 10% area loss per decade since the 1960s, and 4.5 cubic kilometres water equivalent per year (0.01 mm/yr sea level equivalent).