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Glacier elevation changes on the Tibetan Plateau derived by ICESat

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Glaciers are a sensitive indicator for climate change in high mountain regions where climate stations are rare or non-existent. In addition, glacier changes have a significant impact on the hydrological cycle of the vulnerable region of the Tibetan Plateau. Therefore a continuous monitoring of glaciers is necessary. In-situ measurements are essential but can only be conducted at a very limited number of glaciers in this large and remote region due to enormous logistical efforts and high costs. Remote sensing techniques are suitable to complement these in-situ measurements and address a large area simultaneously. Traditionally, mountain glaciers are monitored in terms of area changes from aerial or satellite image data. However, these changes show, in contrast to volume changes, a delayed signal to climate only. In order to estimate volume changes of glaciers on the Tibetan Plateau data from the Geoscience Laser Altimeter System (GLAS) carried on-board the Ice Cloud and Elevation Satellite (ICESat) was used for extraction of elevation changes for the period 2003 to 2009. GLAS shots over glaciers were selected using the Global Land Ice Measurements from Space (GLIMS) dataset with support of recent cloud free Landsat scenes obtained from USGS. ICESat repeat-tracks are spatially close but do not match exactly. They can be horizontally separated by up to 3000 m. Therefore, an independent reference surface is used for a multi-temporal comparison of GLAS shots. For this purpose we use a Digital Elevation Model (DEM) acquired in February 2000 by the Shuttle Radar Topography Mission (SRTM). Glaciers with an adequate ICESat data coverage (approximately 12% of the glaciers captured in the GLIMS database) were grouped according to the mountain chains in certain compact geographic regions. Mean trends in glacier elevation changes were estimated for these regions for the seven years of ICESat's lifetime. Preliminary results suggest a heterogeneous wastage of glaciers across the Tibetan Plateau with higher melting rates in the East, (e.g. Nyainqentanglha Mountains) and lower ones in the West (e.g. Kunlun Shan).