

## A glacier inventory covering the entire Karakoram and Pamir mountain ranges with separately mapped debris cover to facilitate large-scale glacier modelling

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Modelling past and future glacier development from regional to large scales strongly depends on the availability of high quality input data. This includes accurate glacier outlines, precise geolocation, and correct glacier flow divides. As extensive debris coverage can have a strong effect on long-term glacier evolution, it would be highly beneficial to include the area (in  $\text{km}^2$ ) and location (shapefile) of debris-covered glacier parts in large-scale glacier inventories.

As a contribution to the Randolph Glacier Inventory (RGI) and the GLIMS glacier database, we have produced a homogeneous inventory of the Pamir and the Karakoram mountain ranges using 28 Landsat TM and ETM+ scenes acquired around the year 2000. We applied a standardized way of automated digital mapping of glacier extent and manual correction of glacier outlines using coherence images from ALOS PALSAR. Glacier complexes are separated into individual glaciers using drainage divides derived by watershed analysis from the ASTER GDEM2, and debris-covered areas were mapped by subtracting the corrected from the raw outlines. In total, we mapped 27'437 glaciers  $>0.02 \text{ km}^2$  covering an area of 35'287  $\text{km}^2$  ( $\pm 1209 \text{ km}^2$ ) with an elevation range from 2260 m to 8600 m with regional median elevations varying from 4150 m to almost 5400 m, likely due to large climatic differences. The coverage of glaciers by debris is  $\sim 5 \%$ , and especially for larger glaciers ( $>10 \%$  for glaciers larger  $5 \text{ km}^2$ ) an important factor to be considered in subsequent applications.

Regarding the inventories now being available for the region, one has to note that the interpretation of glacier extents is not yet consistent, in particular for the highest parts (perennial snow and firn) and the debris-covered regions. In the future, the now available higher resolution sensors such as Sentinel 2 will be very helpful to get at least the lower glacier parts more precisely mapped. Additionally, a future goal is to develop a reduced complexity glacier model to assess the influence of debris cover on projected glacier development.