6.9 Central Asia

The main mountain range of Central Asia is the Himalaya and its adjacent mountain ranges such as Karakoram, Tien Shan, Kunlun Shan and Pamir. The sum of its glacierised area corresponds to about one sixth of the global ice cover of glaciers and ice caps. The available observations are distributed well over the region but continuous long-term fluctuations series are sparse.

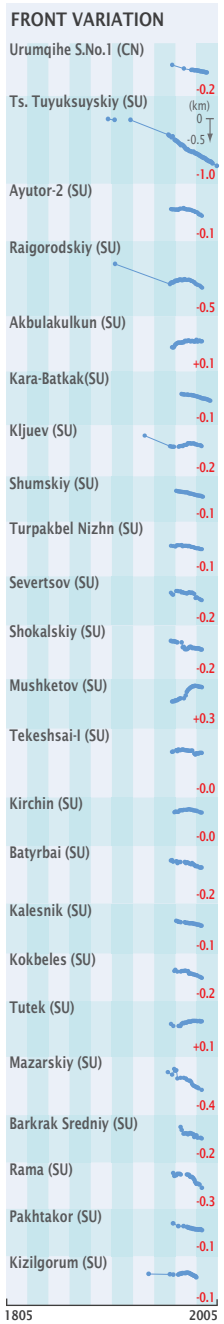
Ice covered area (km²): 114 800

Front variation

number of series:	310
average number of observations:	5
average time length (years):	22

Mass balance

number of series:	35
average number of observations:	13



Central Asia with an estimated total ice cover of 114 800 km² has as its dominant mountain range the Himalaya, where most of the glaciers occur (33 050 km²) and its adjacent mountain ranges (with corresponding ice areas): Karakoram (16 600 km²), Tien Shan (15 417 km²), Kunlun Shan (12 260 km²) and Pamir (12 260 km²) mountains (Dyurgerov and Meier 2005). The Himalaya is the highest mountain range of the world and extends from the Nanga Parbat (8 126 m asl) in the NW over 2 500 km to the Namcha Barwa (7 782 m asl) in the SE with a north-south extent of 180 km (Burga et al. 2004). The climate, and the precipitation in particular, is characterised by the influence of the South Asian monsoon in summer and the mid-latitude westerlies in winter. In Central Asia, glacier degradation is accompanied by increasing debris cover on many glacier termini and the formation of glacier lakes (Ageta et al. 2000). Such lakes, sometimes also dammed due to glacier surges (Kotlyakov et al. 2008), have the potential to threaten downstream areas with outburst floods (Wessels et al. 2002). The mountain ranges of Central Asia function as water towers for millions of people. Glacier runoff thereby is an important freshwater resource in arid regions as well as during the dry seasons in monsoonal affected regions (Barnett et al. 2005).


Fig. 6.9.1 Ts. Tuyuksuyskiy Glacier

The LIA is considered to have lasted until the mid or late 19th century in most regions (Grove 2004) with glacier maximum extents occurring between the 17th and mid 19th century (Solomina 1996, Su and Shi 2002, Kutuzov 2005). The available 310 front variation series are distributed over most of the region, and the first observations started early in the 20th century. About 10 per cent of the series extend back to the first half of the 20th century but only 24 data series, located in Pamir and Tien Shan, consist of more than 15 observation series. Unfortunately, 90 per cent of the observations series were discontinued before 1991 and only about a dozen series have reported information in the 21st century. The distribution of mass balance series in space and time shows a similar pattern. Just six (out of 35) series consist of more than 15 observation years and only two of them, Ts. Tuyuksuyskiy (Kazakh Tien Shan) and Urumqihe South No.1 (Chinese Tien Shan) are still surveyed every year. As in Northern Asia, the breakdown of the Soviet System in 1989 might partly explain the breakdown of the observation network in the 1990s. Within Central Asia, the Himalaya is strongly underrepresented in terms of front variation and mass balance observations, and most series are comparably short.

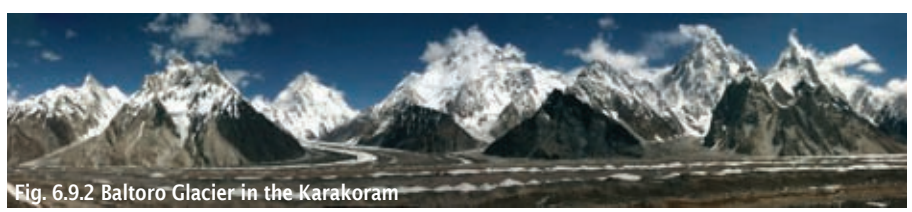


Fig. 6.9.2 Baltoro Glacier in the Karakoram

Fig. 6.9.1 Tsentralniy Tuyuksuyskiy, Kazakh Tien Shan, in September 2003. Source: V.P. Blagoveshchenskiy.

Fig. 6.9.2 Panoramic view with direction NNE to the confluence of the Godwin Austen Glacier, flowing south from K2 (8 611 m asl), with the Baltoro Glacier in the Karakoram. Source: C. Mayer, *Commission for Glaciology of the Bavarian Academy of Sciences.*

Regional studies based on remote sensing data help to provide a better overview on the recent changes in the Central Asian ice cover. Glacier retreat was dominant in the 20th century, except for a decade or two around 1970, when some glaciers gained mass and even reacted with re-advances of a few hundred metres. After 1980 ice loss and glacier retreat was dominant again. In Bhutan, Eastern Himalaya, an eight per cent glacier area loss was observed between 1963 and 1993 (Karma et al. 2003). Berthier et al. (2007) used remote sensing data to investigate glacier thickness changes in the Himachal Pradesh, Western Himalaya. They found an annual ice thickness loss of about 0.8 m w.e. per year between 1999 and 2004 – about twice the long-term rate of the period 1977–1999. In China, the overall glacier area loss is estimated at about 20 per cent since the maximum extent in the 17th century (Su and Shi 2002). The area loss since the 1960s is estimated to about 6 per cent, and is more pronounced in the Chinese Himalaya, Qilian Mountains and Tien Shan, but with rather small recessions in the hinterland of the Tibetan plateau (Li et al. in press). Over the 20th century, glacier area is estimated to have decreased by 25–35 per cent in the Tien Shan (Podrezov et al. 2002, Kutuzov 2005, Narama et al. 2006, Bolch 2007), by 30–35 per cent in the Pamirs (Yablokov 2006), and by more than 50 per cent in northern Afghanistan (Yablokov 2006).

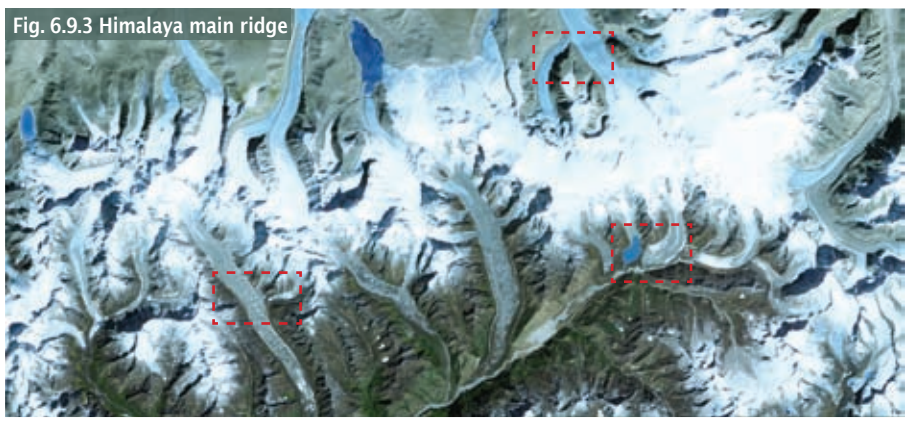


Fig. 6.9.3 Himalaya main ridge

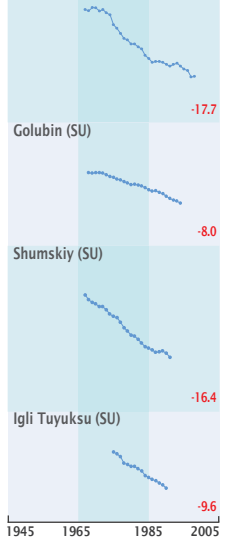


Fig. 6.9.3 Himalaya main ridge between Bhutan and Tibet. Source: ASTER satellite image (56 x 32 km) and close-ups, 20 January 2001.


Fig. 6.9.3a

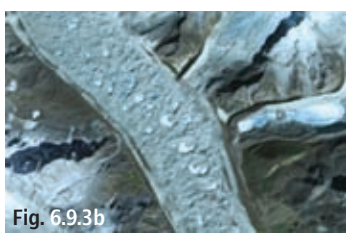


Fig. 6.9.3b

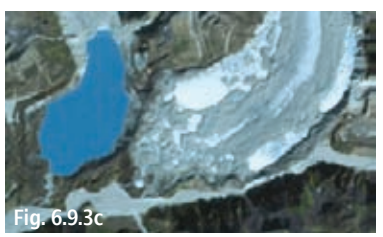


Fig. 6.9.3c