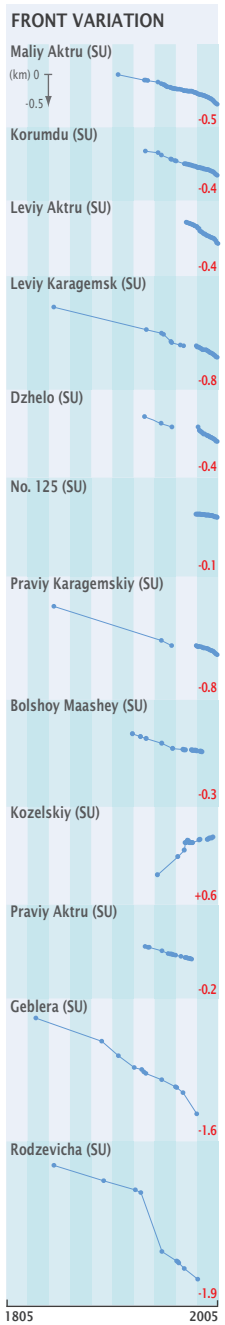
6.7 Northern Asia

The majority of land surface ice in Northern Asia is located on the East Arctic Islands such as Novaya Zemlya, Severnaya Zemlya and Franz Josef Land, as well as distributed in the mountain ranges from the Ural to the Altay, in the east Siberian mountains and Kamchatka. The available data series are sparse and most of the few measurements were discontinued in latter decades of the 20th century.

Ice covered area (km²): 59 600

Front variation
number of series: 24
average number of observations: 14
average time length (years): 55

Mass balance
number of series: 14
average number of observations: 14



Most of the glacier ice in Northern Asia is concentrated on the East Arctic Islands (total ice cover of about 56 000 km²) such as Novaya Zemlya (23 645 km²), Severnaya Zemlya (18 325 km²) and Franz Josef Land (13 735 km²). In addition, glaciers occur in the mountain ranges from the Ural to the Altay, and Kamchatka with a total area of about 3 500 km² (Dyurgerov and Meier 2005). The glaciers on the East Arctic Islands are not well investigated due to their remote location in the Barents and Kara Sea. They are very much influenced by the extent of sea ice and the North Atlantic oscillations, and some of them are tidewater glaciers. Dated moraines suggest LIA maxima around or after 1300 for some glaciers, and the late 19th century for others on Novaya Zemlya (Zeeberg and Forman 2001). The Altay extends over about 2 100 km from Kazakhstan, China, Russia to Mongolia, reaching its highest elevation of 4 506 m asl on Belukha Mountain in the Russian Altay. Until recently, investigations in the Altay failed to disclose evidence of early LIA advances (Kotlyakov et al. 1991). New studies based on lichenometry indicate extended glacier states in the late 14th and mid 19th century (Solomina 2000). The east Siberian Mountains, such as Cherskiy Range, Suntar-Khayata, and Kodar Mountains, show only small amounts of glacier ice and the knowledge on these glaciers is limited. Gurney et al. (2008) mapped more than 80 glaciers in the Buordakh Massif, in the Cherskiy Range (northeast Siberia), a region with a total glacierised area of about 70 km². The LIA maximum extents have also been delineated and have been dated to 1550–1850 AD (Gurney et al. 2008). The topography of Kamchatka is characterised by numerous volcanoes with heights up to 5 000 m asl. Therefore, some of the glaciers are strongly influenced by volcanic activities. Here, the maximum stage of the LIA was reached in the mid to late 19th century (Grove 2004), with advances of similar magnitudes in the 17th, 18th century (Solomina 2000).


Fig. 6.7.1 Maliy Aktru Glacier

The few available fluctuation series mainly come from the Russian Altay, with half a dozen front variation series covering the entire 20th century and three continuous mass balance series extending back to 1977, from Leviy Aktru and No. 125 (Vodopadniy), and to 1962 from Maliy Aktru. Some information is available from Kamchatka with front variation and mass balance measurements from 1948–2000 and 1973–1997, respectively, and a few short-term series from the Northern Ural and Severnaya Zemlya. Most of the observation series were discontinued at the end of the 20th century. A particular challenge in this region, as well as in parts of Central Asia, has been the breakdown

Fig. 6.7.1 Maliy Aktru Glacier located in the Russian Altay (photograph taken in July 2007). Source: W. Hagg, *LMU Munich*, Germany.
Fig. 6.7.2 Kozelskiy Glacier on Kamchatka in September 2007. Source: A.G. Manevich, *Russian Academy of Sciences*.
Fig. 6.7.3 Ice caps on Severnaya Zemlya, Russian Arctic. ASTER satellite image (63 x 47 km) and close-ups, 19 August 2003.


Fig. 6.7.2 Kozelskiy Glacier

of the Soviet system in 1989 and the related loss in expertise in and capacities for glacier monitoring. In Japan, mass balance measurements have been carried out since 1981 on Hamaguri Yuki, a perennial snow patch at 2 750 m asl in the Tateyama Mountain, Central Japan (Higuchi et al. 1980).

In the Arctic islands a slight reduction in the glacierised area by little more than one per cent over the past 50 years has been found (Kotlyakov et al. 2006). Tidewater calving glaciers in north Novaya Zemlya underwent a rapid retreat in the first half of the 20th century, half of them being stable during 1952 to 1964, with a more moderate retreat occurring up to 1993 (Zeeberg and Forman 2001). A study based on satellite images shows that from 40 outlet glaciers on north Novaya Zemlya, 36 retreated and only four advanced between 1990 and 2000 (Kouraev et al. 2008). Russian studies show that in the Urals, some glaciers have disappeared completely, while in the Altay, glaciers have been shrinking continuously since the mid 19th century (Kotlyakov et al. 2006) accelerating from seven per cent ice loss between 1952 and 1998 to four per cent between 1998 and 2006 (Shahgedanova et al. 2008). Comparisons with Landsat satellite images of 2003 have shown that the glacier extent of Suntar-Khayata has diminished by 19 per cent since 1945, and in the Cherskiy Range by 28 per cent since 1970 (Ananicheva 2006). On average, the scale of glacier shrinkage was much smaller in continental Siberia than in central Asia and along the Pacific margins (Solomina 2000). On Kamchatka both retreats and advances have occurred on glaciers influenced by volcanoes, whereas a general retreat was found on glaciers located in the coastal area (Kotlyakov et al. 2006).

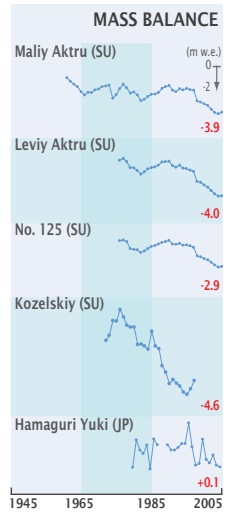



Fig. 6.7.3 Severnaya Zemlya

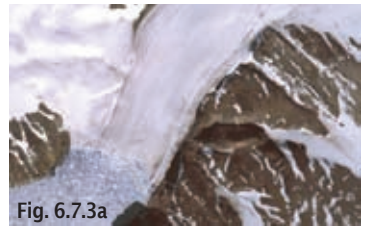


Fig. 6.7.3a

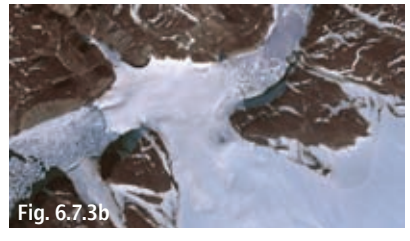


Fig. 6.7.3b


Fig. 6.7.3c