

6.10 North America

North American glaciers are located on mountains in the west of the continent from Alaska down to the Canadian and US Rockies, and on volcanoes in Mexico. A lot of the length change observations were discontinued at the end of the 20th century, but there still are several long-term mass balance series.



Most of the mountain ranges in North America are found on the west of the continent, parallel to the coastline. Prominent are the “Rocky Mountains”, which spread over more than 3 000 km from the Mexican border through the United States and into Canada and eastern Alaska. To the north they extend into the Alaska Range and the Brooks Range. The highest peak of the continent is Mount McKinley / Denali (6 193 m asl), which is situated in the Alaska Range. Glaciers and ice fields in the region presented here cover almost as much area as in the Canadian Archipelago (see section 6.11 Arctic Islands) with about 75 000 km² in Alaska and about 49 000 km² in the conterminous USA and western Canada. In the latter, glaciers are situated in the Rocky Mountains and Interior Ranges, and along the coast of the Pacific Ocean, where they are in some regions continuous with Alaskan Glaciers (Williams and Ferrigno 2002). In general, the climate of the mountain ranges shows strong variations depending on latitude, altitude and proximity to the sea. Therefore, the glaciers in the south are much smaller and occur at higher elevations than in the higher latitudes, where some glaciers extend down to the shore. In Mexico, small glaciers occur on the peaks of three volcanoes, namely on Pico de Orizaba, Iztaccíhuatl, and Popocatepetl (White 2002).

In conterminous USA and Canada glaciers reached their LIA maximum extent in the mid

Fig. 6.10.1 Gulkana Glacier in the Alaska Range, USA. Photograph was taken October 5, 2003. Source: R. March, *United States Geological Survey*.

to late 19th century (Kaufmann et al. 2004). In Alaska, the LIA maxima were attained at various times; for the northeast Brooks Range it was the late 15th century, and for the Kenai Mountains, the mid 17th century (Grove 2004). However, most of the Alaskan glaciers reached the LIA maximum extent between the early 18th and late 19th centuries (Molnia 2007). Although several dozen front variation observations exist for the 20th century, most of the series were discontinued in the 1980s or 1990s. Half of the 45 reported mass balance series cover ten or more measurement years. Among these there are seven with 39 or more years of observations, including for example Peyto Glacier in the Canadian Rockies, Place and **South Cascade** Glacier in the Cascade Mountains, as well as Lemon Creek, **Gulkana** and **Wolverine** Glacier in Alaska, with some extending as far back as the early 1950s. Half of the mass balance series were not continued into the 21st century.



Fig. 6.10.1 Gulkana Glacier

Fig. 6.10.2 South Cascade Glacier in the Canadian Rockies. Photograph was taken in 2001. Source: M.N. Demuth, *Natural Resources Canada*.

Fig. 6.10.3 Section of Kenai Mountains, Alaska, USA, with Wolverine Glacier to the middle bottom. Source: ASTER satellite image (37 x 48 km) and close-ups, 8 September 2005.

Ice covered area (km²): 124 000

Front variation

number of series: 221
 average number of observations: 5
 average time length (years): 37

Mass balance

number of series: 45
 average number of observations: 16

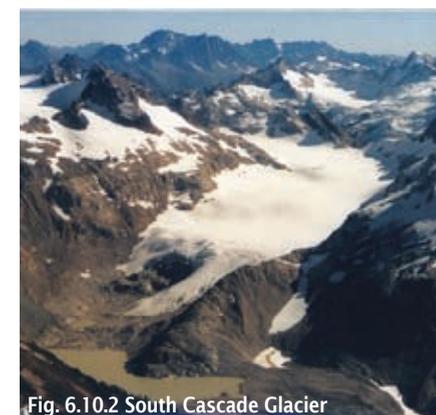


Fig. 6.10.2 South Cascade Glacier

The glacier observations show a general retreat after the LIA maximum, particularly at lower elevations and southern latitudes (Molnia 2007), which slowed down somewhat between the 1950s and 1970s (La Chapelle 1960) and accelerated again after the 1970s. Distinct exceptions to this overall trend are found in the fluctuations of certain tidewater glaciers such as Muir (Saint Elias Mountains), Columbia 627 (Chugach Mountains), or Taku Glacier (Alaskan Panhandle). Mass balance measurements show strong accelerating ice losses since the mid 1970s (Demuth and Keller 2006, Josberg et al. 2007, Moore and Demuth 2001) which was confirmed by remote sensing studies in Alaska and Canada (Arendt et al. 2002, Demuth et al. 2008, Larsen et al. 2007). In the Western Cordillera of the Rocky Mountains the glacier area loss

since the LIA is estimated at about 25 per cent (Fountain et al. 2006, Luckman 2000, Luckman 2006). Small glacier diminution appears to be a distinct feature of the past century and a half of ice observation in some regions (Canadian Rocky Mountain eastern slopes: Demuth et al. 2008; North Cascades: Granshaw and Fountain 2006). It is recognised in both instances however, that topographic controls and glacier dynamics can be the source of significant local and regional variability (e.g., DeBeer and Sharp 2007).

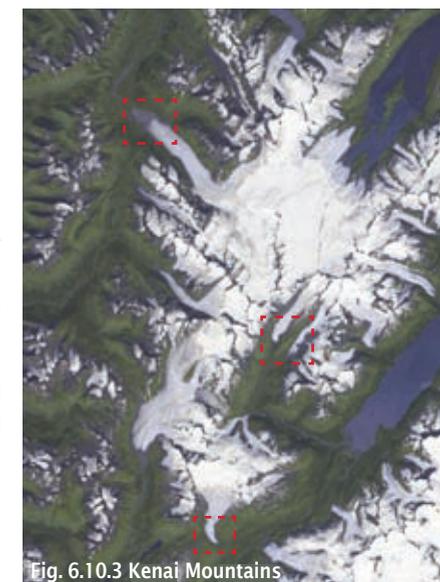


Fig. 6.10.3 Kenai Mountains

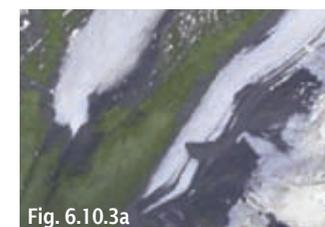


Fig. 6.10.3a



Fig. 6.10.3b



Fig. 6.10.3c