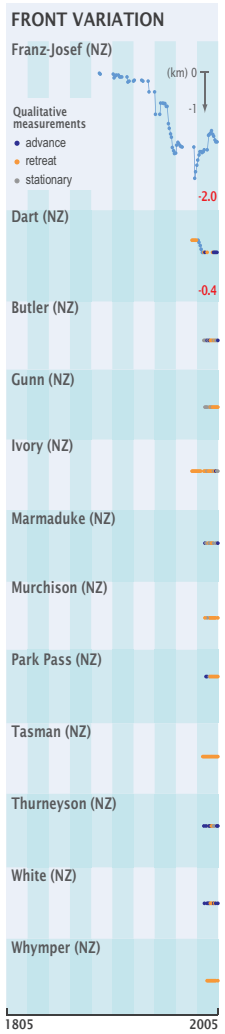
# 6.3 New Zealand

**Most glaciers are situated along the Southern Alps, with a few more on Mount Ruapehu Volcano on the Northern Island. The country has a long tradition of glacier observation; however, the majority of the available data series are of qualitative type and start in the 1980s.**

**Ice covered area (km²):** 1 160

**Front variation**
number of series: 99
average number of observations: 6
average time length (years): 14

**Mass balance**
number of series: 3
average number of observations: 3




The topography of New Zealand is characterised by evidence of the collision of the Indio-Australian Plate with the Pacific Plate and the resulting tectonic uplift, seismic activity and volcanism. Apart from a few glaciers on Mount Ruapehu Volcano on the North Island, the majority of glaciers are located along the Southern Alps spanning the length of the South Island between 42° and 46° south. Their climatic regime is characterised by high precipitation with extreme gradients. Annual average values amount to 4500 mm on the west side (Whataroa) of the Alps and maximum values of up to 15 000 mm (Chinn 1979, Griffiths and McSaveney 1983, Tomlinson and Sansom 1994). Mount Cook is the highest peak at 3 754 m asl. Below its flank, the Tasman Glacier – the largest glacier in New Zealand – is located. In total, the inventory of 1978 reported 3 144 glaciers covering an area of about 1 160 km² with an estimated total ice volume of about 53 km³ at that time (Chinn 2001). Glacier runoff is used for irrigation east of the main divide of the Southern Island and for hydro-electric power production, which accounts for over two-thirds of the nation's total generating outputs.


Fig. 6.3.1 Franz-Josef Glacier

The LIA maximum extent of New Zealand's glaciers occurred towards the end of the 18th century, with only minor retreats until the end of the 19th century (Gellatly et al. 1988, Anderson 2003, Winkler 2004). New Zealand has a long tradition of glacier observation going as far back as the 19th century and focusing on glacier front variations. The most comprehensive series is a detailed history of frontal positions of the Franz-Josef Glacier with the first survey made in 1893 (Harper 1894, Anderson and Mackintosh 2006).

However, the majority of the data series start in the 1980s and provide qualitative data only (advance, retreat, stationary). Glacier extents have been mapped for an inventory

**Fig. 6.3.1** Oblique aerial photograph showing the west coast of the South Island with Franz-Josef Glacier and Mount Cook (photograph taken on March 27, 2006). Source: M. Hoelzle, *University of Zurich*, Switzerland.

**Fig. 6.3.2** Brewster Glacier (on left) with almost no accumulation area. The oblique aerial photograph was taken during the end-of-summer snowline survey on 14 March, 2008. Source: A. Willsman (NIWA), as part of *New Zealand Foundation of Research, Science and Technology* contract C01X0701.

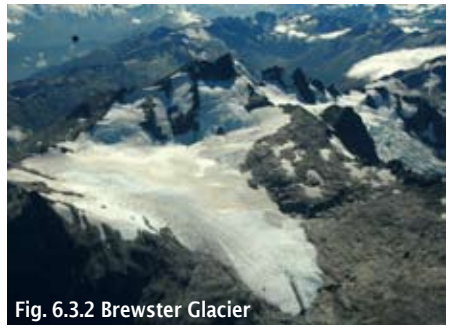
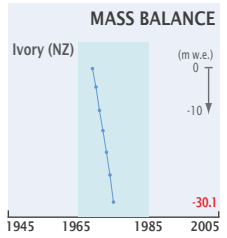


Fig. 6.3.2 Brewster Glacier

in 1978 (Chinn 1996), revealing an overall retreat from the moraines of the LIA extents. Since 1977 annual end-of-summer snowline surveys have been carried out by taking aerial photographs of 50 glaciers (Chinn et al. 2005). Limited mass balance data are available from two glaciers only, the Tasman and Ivory. Most recently a new mass balance monitoring program has been started with on-site support by the WGMS on Brewster Glacier.

Overall, New Zealand's glaciers lost between one-quarter (Chinn 1996) and almost half of their area (Hoelzle et al. 2007) between the timing of their LIA maximum extents and the 1970s. After the mid 1980s many glaciers on the west coast have gained mass and advanced noticeably. Since the beginning of the 21st century, the number of retreating glaciers has increased again. A net ice volume loss between 1977 and 2005 of about 11 per cent has been reported in a recent study (Chinn pers. comm.). This mass loss was attributed mainly to the downwasting of the 12 largest glaciers and the minor contributions from their calving into lakes, as well as from negative mass balances of smaller glaciers.



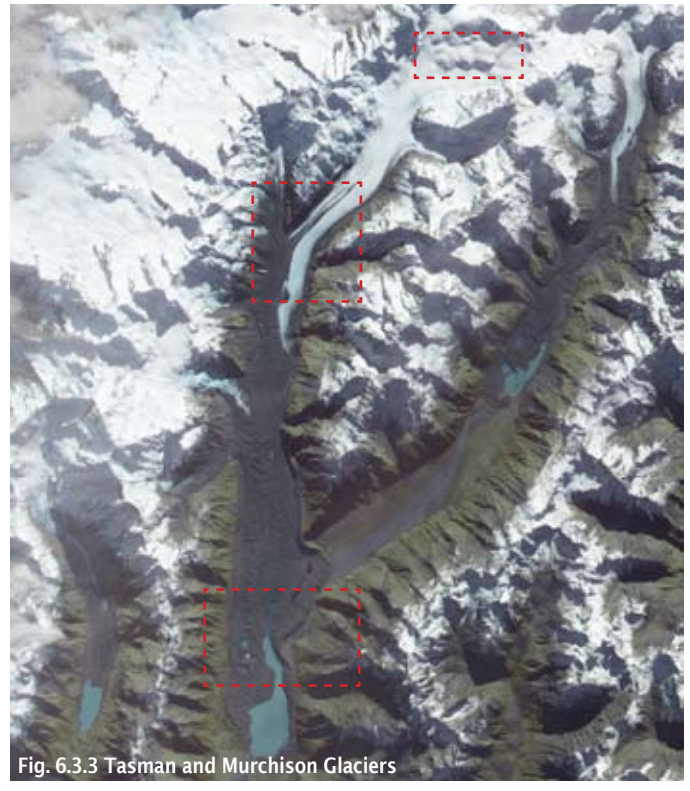



Fig. 6.3.3 Tasman and Murchison Glaciers

**Fig. 6.3.3** Tasman (left) and Murchison (right) Glaciers region. Source: ASTER satellite image (23 x 31 km) and close-ups, 29 April 2000.

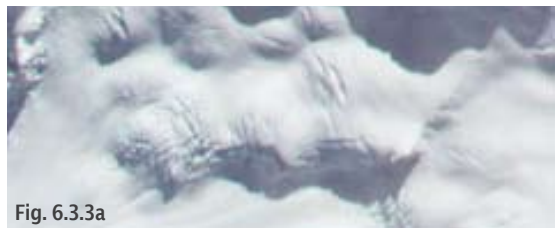


Fig. 6.3.3a


Fig. 6.3.3b

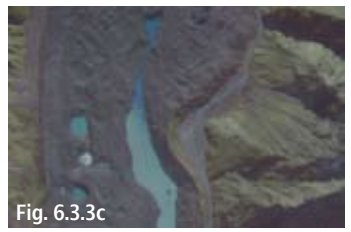


Fig. 6.3.3c