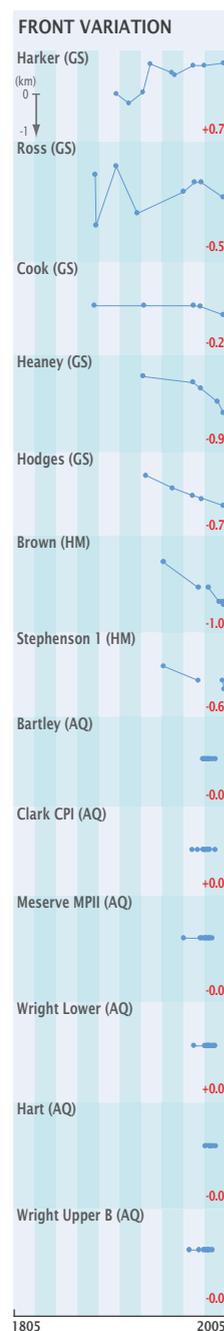


## 6.8 Antarctica

Mainly due to the remoteness and the immense size of the ice masses, little is known about the distribution and changes in the large number of glaciers and ice caps around the continental ice sheet in Antarctica and on the Subantarctic Islands.



The vast majority of glaciers and ice caps in the Antarctica are located on the Antarctic Peninsula and around the Antarctic Ice Sheet, with an overall estimated area ranging from 70 000 km<sup>2</sup> (Dyurgerov and Meier 2005) to 169 000 km<sup>2</sup> (Shumsky 1969). This large uncertainty results from the difficulty to differentiate clearly between the various glaciers and ice caps, and the ice bodies closely linked to the continental ice sheet. Weidick and Morris (1998) describe three categories of local glaciers outside the ice sheet: coastal glaciers, ice streams which are discrete dynamic units attached to the ice sheet, and isolated ice caps. Coastal local glaciers are most obvious in the McMurdo Dry Valleys within Victoria Land and on the Antarctic Peninsula. The latter is covered by a long, relatively narrow and thin ice field nourishing valley glaciers, which cut through the coastal mountains and terminate in ice cliffs at sea level. Ice streams range from smaller ones on the southern part of the Antarctic Peninsula to larger ones flowing from the central Antarctic Plateau down to the Ross or Filchner-Ronne ice shelves. Examples of



Fig. 6.8.1 Mapple and Melville Glaciers

Fig. 6.8.1 Oblique aerial photograph with Antarctic Peninsula plateau in the background (March 11, 2007). From north to south (right-left) the Mapple and Melville Glaciers, which are calving at present into the Larsen B embayment. Both glaciers nourished formerly the Larsen B ice shelf, which collapsed within a few weeks in February–March 2002, during the warmest summer ever recorded in the region. Source: P. Skvarca, *Instituto Antártico Argentino*.

the third type are the ice rises on the Larsen and Filchner-Ronne ice shelves. Berkner Island, the largest ice rise in the world, is located on the latter (Swithinbank 1988). Evidence of the timing of LIA glacier maxima south of the Antarctic Circle (66° 30' S) is sparse due to the lack of organic material for dating (Grove 2004).

In addition to Antarctica, glaciers and ice caps are situated on Subantarctic Islands such as the South Shetland Islands, South Georgia, Heard Island and Kerguelen, with a total estimated ice cover of roughly 7 000 km<sup>2</sup> (Dyurgerov and Meier 2005). On the South Shetland Islands, at least ten glacial events were found to have occurred between 1240 and 1991 (Birkenmajer 1998, Clapperton 1990). South Georgia is located about 1 400 km east-southeast of the Falkland / Malvinas Islands. More than half of it is ice covered, with most of the glaciers extending to the sea (Clapperton et al. 1989a, b). Clapperton et al. (1989a, b) described LIA advances beginning after the late 13th century and culminating in the 18th, 19th and 20th centuries. Heard Island is situated in the Southern Indian Ocean, 1 650 km north of the Antarctic continent. The island is characterised by two volcanoes; the larger and still active one, Big Ben, reaching 2 750 m asl. Some 21 glaciers are identified on the volcanic cone (Ruddell 2006); typically, they widen and steepen toward the sea, and terminate in ice cliffs (Grove, 2004). A total of 70 per cent of the island is ice covered (Ruddell 2006, Thost and Truffer 2008).

Fig. 6.8.2 Wright Lower Glacier with Lake Brownworth, Dry Valleys in Antarctica (January 14, 2007). The Wright Lower Glacier is fed from the Wilson Piedmont Glacier. The Onyx River dewaters from Lake Brownworth into the drainless Lake Vanda. The nunatak is called King Pin (820 m) and at the far back Mt Erebus (3794 m), the most southern active volcano, is visible. Source: D. Stumm, *University of Otago*, New Zealand.

Ice covered area (km<sup>2</sup>): 77 000

### Front variation

number of series: 48  
average number of observations: 3  
average time length (years): 30

### Mass balance

number of series: 1  
average number of observations: 4

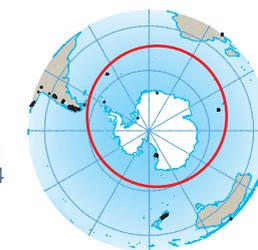


Fig. 6.8.2 Wright Lower Glacier

A number of front variation series as derived from expedition reports, aerial photographs and satellite images are available from the Dry Valleys in Antarctica extending back to the 1960s, as well as from South Georgia, back to the late 19th century, and from Heard Island back to 1947. In summer 1999–2000, a detailed mass balance monitoring program was initiated on Glaciar Bahía del Diablo, a glacier on Vega Island, at the northeastern side of the Antarctic Peninsula (Skvarca and De Angelis 2003, Skvarca et al. 2004). Additional reconstructions and measurements are reported in the literature, e.g. from Kerguelen (e.g., Frenot et al. 1993) and South Shetland Islands (e.g., Hall 2007), with no data having been reported to the WGMS.

Cook et al. (2005) mapped 244 glaciers on the Antarctic Peninsula and adjacent islands, most of them terminating in the sea. Their analyses of aerial photographs and satellite images showed that 87 per cent of the glaciers have retreated over the last six decades. A general glacier recession trend of different spatial pattern on the

Fig. 6.8.3 Bahía del Diablo on Vega Island, at the northeastern side of the Antarctic Peninsula. Source: ASTER satellite image (37 x 20 km) and close-ups, 27 January 2006.

Antarctic Peninsula was previously reported by Rau et al. (2004), who investigated the ice-front changes north of 70° S over the period 1986–2002. Large retreat and thinning rates over the past two decades have been reported from glaciers terminating on land on Vega and James Ross Islands, as well as strong glacier acceleration, surges and retreats subsequent to the collapse of the Larsen Ice Shelf A and B sections (De Angelis and Skvarca 2003, Rott et al. 2002, Skvarca and De Angelis 2003). Glaciers on South Georgia receded overall by varying amounts from their more advanced positions in the 19th century, with large tidewater glaciers showing a more variable behavior and remaining in relatively advanced positions until the 1980s. Since then, however, most glaciers have receded; some of these retreats have been dramatic and a number of small mountain glaciers are about to disappear (Gordon et al. 2008). According to expedition records, little or no change occurred on glaciers at Heard Island during the first decades of the 20th century (Grove 2004). However, in the second half, recession of glaciers has been widespread. A recent study yields a reduction in the overall ice extent of about 29 per cent from 1947 to 2003 (Thost and Truffer 2008), interrupted by a re-advance of some glaciers in the 1960s (Radok and Watts 1975).

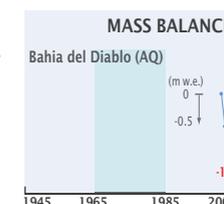


Fig. 6.8.3a

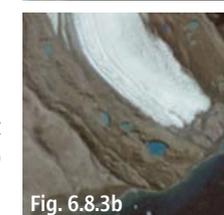


Fig. 6.8.3b

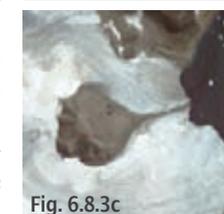


Fig. 6.8.3c

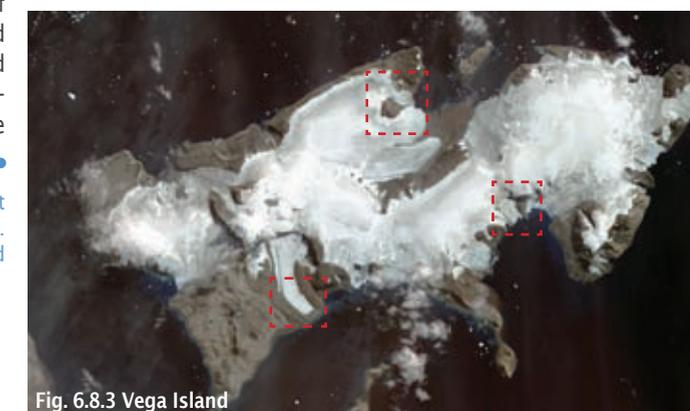


Fig. 6.8.3 Vega Island