STATE OF THE CLIMATE IN 2006

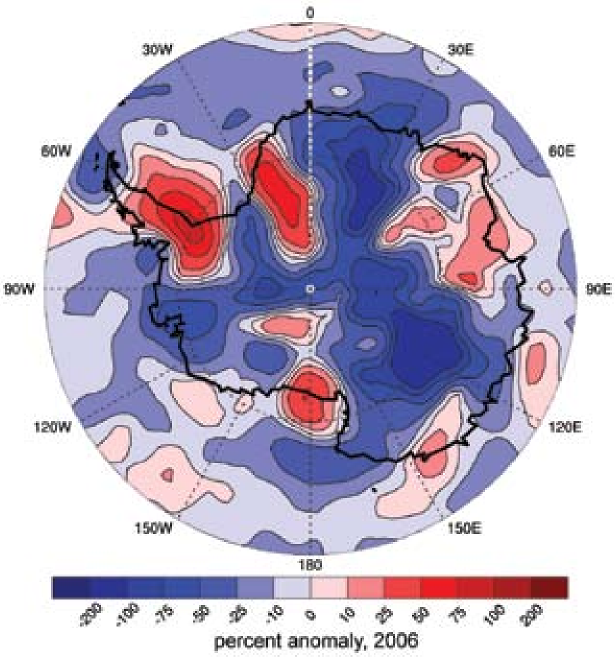

Fig. 5.21. Detrended precipitation anomalies (% yr^{-1}) from NN2 for 2006 compared with the 1979–2006 mean.

other satellite-based techniques (e.g., Velicogna and Wahr 2006) are increasingly being used to study surface and total ice sheet mass balance for periods of < 1 decade. The most recent model studies and observational data indicate there has been no trend in snowfall in recent decades (Van de Berg et al. 2005; Monaghan et al. 2006).

Precipitation fields from the NOAA/NWS/NCEP/DOE Reanalysis II (NN2; a successor to the NCEP–NCAR Reanalysis) are employed here to assess Antarctic snowfall for 2006. In recent studies (e.g., Bromwich et al. 2004b), snowfall trends in NN2 have been found to have an anomalous upward trend from 1979 onward, compared to other model-based records, snowstake measurements, and ice core records; however, the interannual variability of the snowfall is in very good agreement with other models (Monaghan et al. 2006). Therefore, a detrended NN2 record (linear mean trend subtracted) roughly approximates the "flat" trends that more accurate models predict. Using this we calculate a 2006 snowfall anomaly pattern compared to the 1979–2006 mean (Fig. 5.21).

In general, the anomaly over the continent interior is negative, and is positive over most of the Antarctic Peninsula and western Weddell Sea. Smaller positive trends over the Amery and northern Ross Ice Shelves suggest that the mean wavenumber-3 pattern (Fig. 5.17a) had a strong impact on precipitation. While the pattern of precipitation anomaly and circulation anomaly are consistent with a mildly positive SAM for 2006, the link between the SAM and precipitation is not as robust as the link for temperature (Genthon et al. 2003). Continentwide, the mean anomaly is small (–6%), with no month exceeding two standard deviations from the mean. The observed downward fluctuation would contribute an increase to sea level of approximately 0.30 mm for the year.

5) Sea ice extent and concentration—R. Massom, S. Barreira, and T. Scambos

Sea ice extent anomalies varied widely during the year, from record-low January and March extent (March was –18% relative to the 1979–2006 mean) to record highs of +4% for September and October, based upon analysis of monthly mean SSM/I-derived sea ice concentration data produced by the NSIDC

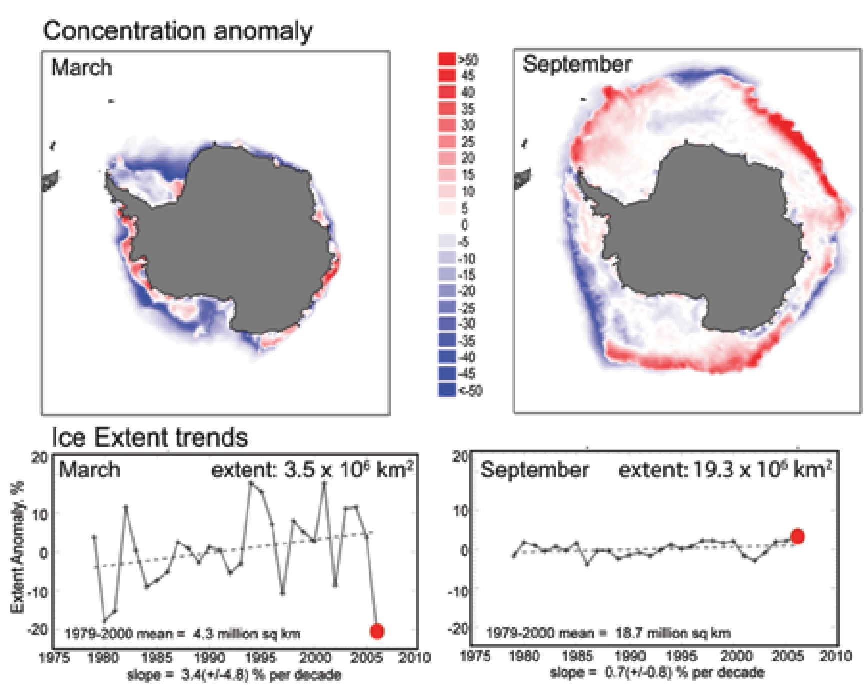

Fig. 5.22. (top) Sea ice concentration anomaly (%) for March and September, 2006, and (bottom) trends in sea ice extent.

Sea Ice Index project (Fig. 5.22; see Fetterer and Knowles 2004). However, by December 2006, sea ice extent was below average again. Strong regional variability is also apparent in ice extent and concentration anomalies. For the austral sea ice minimum period (February–March), the record low is primarily a result of greater-than-average March retreat in the Weddell Sea. This is likely a result of the intense warmth (up to 5°C above average) in the eastern Weddell in March, and a circulation pattern that favored southward and eastward wind-driven drift of the pack. In the autumn growth season, positive anomalies in the Amundsen Sea and western Indian Ocean sectors are balanced by negative anomalies in the South Atlantic (Weddell Sea) and Ross Sea/WPO sectors. The winter ice cover in August is characterized by major negative anomalies (indicative of wind-driven ice compaction) in the Bellingshausen–Amundsen Seas plus WPO sectors and a lesser negative anomaly skirting the Greenwich meridian. These are counterbalanced by equally large positive anomalies in the Weddell Sea, Ross Sea, and Indian Ocean sectors. This pattern persisted through September–October. In fact, the Indian Ocean sector experienced large positive extent and concentration anomalies from April through November. Locations of extent anomalies, and the overall record extent during the winter maximum, suggest an influence from the earlier positive SAM mode and strong positive wavenumber-3 anomaly, and the presence of lower-than-average temperatures near the winter ice edge (see Massom et al. 2006; Raphael 2004).

6) Seasonal melt extent and duration—H. Liu, Lei Wang, and K. Jezek

The extent, onset date, end date, and duration of snowmelt on the Antarctic Ice Sheet during the 2005/06 austral summer, and a time series spanning 1979/80 to the 2003/04 summers, have been derived using passive microwave remote sensing (Liu et al. 2005). The 25 season mean melt extent is 1.277 million km^2, or 9.34% of the continent's area. During the 2005/06 summer, melt extent, including all areas with at least one day of surface melting, was 1.009 million km^2, or 7.4% of the continent (Fig. 5.23). This is the second lowest extent during this period, after 1999/2000 (Liu et al. 2006). The 2005/06 melt season extended from 5 November to 4 March. Peak melt extent occurred on 7 January.

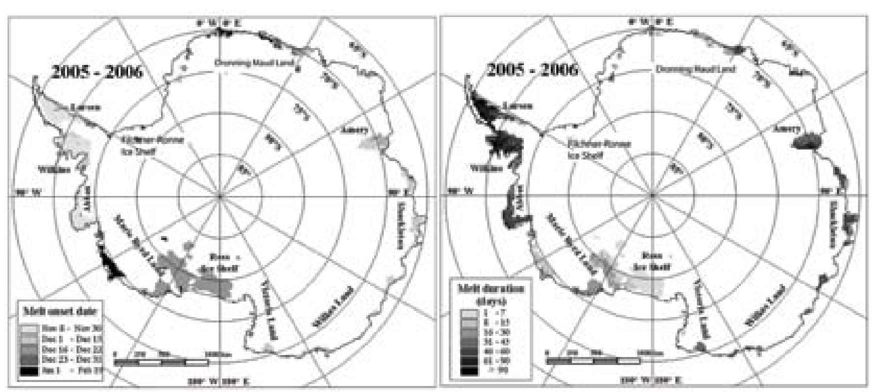

Fig. 5.23. Melt onset date and melt season duration in days, for the 2005/06 melt season.

Extensive and continuous melt occurred on the ice shelves of the Antarctic Peninsula, and the Amery, Abbot, West, and Shackleton Ice Shelves. Melt areas are also scattered along the coasts of Wilkes Land and in glacial valleys in the Transantarctic Mountains. A brief but extensive surface melting occurred over the west Antarctic ice streams and Ross Ice Shelf in mid-December and again in January, coinciding with warm air temperature anomalies there during this time (Fig. 5.19b). Regionally, 2005/06 was a normal melt year for the Antarctic Peninsula, Amery Ice Shelf, Shackleton Ice Shelf, and West Ice Shelf, an extremely high melt year for the Ross Ice Shelf and Abbot Ice Shelf, and an extremely low melt year for the Ronne–Filchner Ice Shelf, and the ice shelves along the Queen Maud Land and Wilkes Land coasts.

7) 2006 austral springtime ozone depletion—P. A. Newman, B. J. Johnson, D. Lubin, S. J. Oltmans, and R. C. Schnell

Springtime ozone depletion in 2006 was by a small margin the most severe ever recorded as measured from the NASA Aura satellite's OMI. The ozone hole's area had an average late-September extent of 27.4 million km^2 (Fig. 5.24). The ozone hole area is estimated by integrating the area of observations with total ozone values less than 220 DU from the NASA TOMS instruments and the Aura OMI satellite instrument. A record-minimum column ozone abundance of 85 DU was recorded on 8 October over east Antarctica. This is consistent with the extremely cold temperatures in that same altitude range during this period (~ −85°C), which led to extensive PSC formation. Aura MLS observations revealed high ClO abundances (> 1 ppbv) filling nearly all of the polar