

The Surface-Based Temperature Inversion on the Antarctic Plateau

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Data from South Pole and Dome C Stations are analyzed to characterize the surface-based temperature inversion that is one of the dominant features of the climate on the Antarctic Plateau. The primary data set from South Pole is a 10-year record of 2- and 22-m air temperatures, 10-m winds, and downward infrared flux reaching the surface, which was provided by the NOAA Climate Monitoring and Diagnostics Laboratory, supplemented by a coincident set of radiosonde data from the South Pole Meteorological Office and a one-winter record of temperatures at the surface and 20, 50, 100, and 200 cm above the surface. These data are used to produce a climatology of inversion strength between 2 and 22 m and to describe the monthly mean temperature profile from 2 m to 30 km (Figure 1). The sometimes surprising relationships between temperatures or inversion strength and the winds or downward infrared flux are also examined for the winter months. These analyses show that the median inversion strength is highest and the median temperature is lowest not with calm winds, but with winds of 3 to 5 m s^{-1} . Calculations suggest this may be due to the inversion wind, in which the presence of an inversion over sloped terrain causes a wind because of thermal wind balance. The surface to 2-m temperatures show that the inversion continues to the surface, with a median temperature difference across the 2-m layer of 1 K in winter and that over 60% of that change occurs in the first 20 cm. Finally, surface and 2- and 30-m air temperature observations made at Dome C Station (75°S, 123°E, 3200 m) during the summer of 2004/2005 show that the diurnal cycle of temperature and inversion strength becomes very significant away from the Pole. Figure 1 shows that the mean daily variation in temperature decreases from 13 K at the surface to just 3 K at 30 m, and the time of the maximum shifts later as distance from the surface increases. In summer, the mean inversion strength at night between 2 and 30 m at Dome C, 6 K, is stronger than almost any inversion observed between 2 and 22 m at South Pole at that time of year.

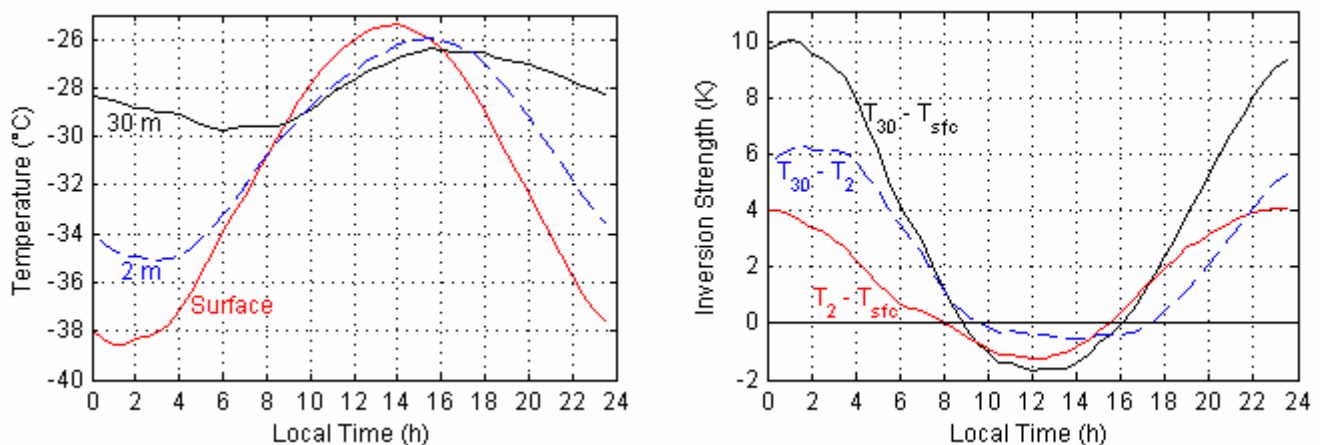


Figure 1. Half-hourly mean temperature (left) and inversion strength (right) at Dome C Station for December 22, 2004, to January 31, 2005. Local time is UTC+8.