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On the factors controlling the 2-m air temperature in the Antarctica in winter

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We studied the impact of large-scale heat advection, wind induced turbulent mixing and cloud forcing at twelve Antarctic stations, located both at the coast and the interior of the continent. Near surface wind, temperature and cloud observations were obtained from the database of the British Antarctic Survey. We calculated the heat advection at each station at the height of 30 m and at 500 hPa pressure level, through the wind and temperature fields of the ECMWF Reanalysis (ERA 40). We concentrated on the winter season, when the temperature variations are largest, and we analysed data from 1998 to 2002. Distinguishing between the effects of cloud radiative warming, turbulent mixing and lateral heat advection is challenging since these three factors often act simultaneously causing rapid warming events. Moreover, warm-air advection from the sea toward the continent is most often associated to offshore depressions, which generate a strong pressure gradient perpendicular to the coast, favouring the development of a near-surface downslope flow from the continent to the coast and a warm airflow toward the continent at higher elevations. Thus, some coastal stations experienced on average warmer temperatures during downslope winds from the interior of the continent, while warm maritime air was flowing southward at the upper levels to replace the divergent wind at the surface. In general, we saw that the impact of the air masses advected toward the continent is largely dependent on the topography of the studied areas, and on the location of stations with respect to the main depression centres typically present offshore around the continent.