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Observation and analyses of the summer diurnal cycle in the lower atmospheric boundary layer at Dome C, Antarctic plateau

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Six levels of meteorological sensors have been deployed along a 45-m tower at the French-Italian station of Concordia at Dome C on the Antarctic plateau. Dome C is one of the coldest places on earth, and strong surface-based inversions develop even in the summer. For 3 weeks in January and February 2008, the vertical profiles, the diurnal cycle and inter-diurnal variability of temperature, moisture and wind -each half an hour- have been measured and compared with the 6-hour ECMWF analyses and radiosounding. Considering the coarse vertical resolution in the ECMWF analyses, the agreement is fair although the temperature is 3°C warmer. The amplitude of the diurnal cycle of the relative humidity is overestimated, and the Ekman spiral, which builds up during the night in the observations is not reproduced in the analyses. The agreement of the radiosoundings with the tower observations is only partial. The radiosoundings are significantly biased at the surface but agree with the temperature and moisture at the top of the tower. A negative bias for wind speed at the surface turns to a positive bias at the top of the tower. Radiosondings are thus of limited use to study the lowest and most characteristic part of the boundary layer on the Antarctic plateau. In conclusion, the tower data provide a unique and valuable information to evaluate stable boundary layer parameterizations in meteorological and climate models in extreme atmospheric conditions.