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# Summer to winter diurnal variabilities of temperature and water vapour in the surface atmosphere as observed by HAMSTRAD over Dome C, Antarctica

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The HAMSTRAD ($H_2O$ Antarctica Microwave Stratospheric and Tropospheric Radiometers) microwave radiometer operating at 60 GHz (oxygen line, thus temperature) and 183 GHz (water vapour line) has been definitively deployed at the Dome C station, Concordia, Antarctica (DC, 75˚06'S, 123˚21'E, 3233 m asml) in January 2010 to study long-term trends in tropospheric absolute humidity and temperature. The great sensitivity of the instrument in the lowermost troposphere helped to characterizing the diurnal cycle of temperature and $H_2O$ from the austral summer (January 2010) to the winter (June 2010) seasons in the Planetary Boundary Layer (PBL) from the surface to 200 m. A strong diurnal cycle in temperature and $H_2O$ (although noisier) has been measured in the summertime close to the surface, decreasing in intensity with height, and phase-shifted by $\sim$4 hours above 50 m with a strong correlation $H_2O$-temperature in the entire PBL ($> 0.6$). In the fall season, whilst the diurnal cycle in temperature and $H_2O$ is less intense, a 12-hour phase-shift is observed above 30 m. In wintertime, the intensity of the diurnal cycle is very weak (but not null) and propagates from the surface to 200 m. In situ sondes scanning the entire 24 hours Local Solar Time (LST), radiosondes (RS) launched at 20:00 LST and European Centre for Medium-Range Weather Forecasts (ECMWF) analyses at 02:00, 08:00, 14:00 and 20:00 LST agree very well with the HAMSTRAD diurnal cycles for temperature and relatively well considering absolute humidity. For temperature, ECMWF tends to show a smoother vertical gradient and a much colder atmosphere from 0 to 100 m compare to RS and HAMSTRAD, particularly obvious when moving from the summer to the winter season. For $H_2O$, HAMSTRAD measures a much wetter atmosphere and a diurnal cycle close to the surface much weaker than the RS, the in situ sondes and the ECMWF.