



Low tropospheric temperature and moisture inversions – A study with a 25-year radiosonde data set at Neumayer Station, Antarctica

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To derive paleotemperatures from ice cores, the relationship between stable isotope ratios of precipitation and the condensation temperature at the deposition site is used. However, as only a few records of Antarctic condensation temperature are available, the temperature at the top of the inversion layer has been often used as a surrogate for condensation temperature.

A 25-year data set of pressure, temperature, humidity, wind-speed and -direction obtained from 7664 radiosoundings performed at the German Antarctic research station “Neumayer” were used for a detailed study of temperature and humidity inversions during the time period 1993-2017. In particular, inversion strength (depth and lapse rate), frequency and seasonality and the relationship to wind-speed and -direction were investigated. 3-hourly SYNOP data (past and current weather conditions) were employed to distinguish between inversions during clear-weather conditions, which are caused by radiation processes, and advection-type inversions during the passage of cyclones. For the latter, the association with moisture transport was studied, too. It could be shown that humidity and temperature inversions are not necessarily directly related, but could occur at different times and different altitudes. Also multiple inversions were found for both temperature and humidity.

These results can be further used to improve the paleoclimatological interpretation of ice cores and to contribute to the progress of numerical atmospheric modeling (e.g. precipitable water estimates) in coastal Antarctic regions.