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Lidar temperature soundings from 1 - 100 km: Mean state, variability and comparison of different latitudes

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Temperature soundings are performed by lidar at the mid-latitude station of Kühlungsborn (54°N, 12°E) and the high-latitude station ALOMAR (69°N, 16°E). At Kühlungsborn observations have been done during more than 240 nights since autumn 2002, each of 3 - 15 h length. This large data set provides comprehensive information on the seasonal variation of temperatures from the troposphere to the lower thermosphere (about 1 - 100 km). Amplitudes and phases of harmonic fits are derived for annual, semi-annual, and quarter-annual variations. The amplitude of the quarter-annual component is less than 3 K in all altitudes, while the annual variation is largest with amplitudes of up to about 30 K (85 km). Comparisons of fitted and observed temperatures demonstrate that the fits are nicely representing the mean state in all altitudes without a bias. The night-to-night variation is largest between October and March throughout the whole altitude range, and low in summer. Within the particular nights the temperature variation due to gravity waves and tides can be derived for up to 15 h of observation. The average temperature variability has been calculated for the altitude range 20 - 100 km as covered by the Kühlungsborn soundings, showing in general higher variability in winter compared to summer. We will present the seasonal variation of wave activity for different altitudes. The ALOMAR R/M/R lidar provides temperature data in an altitude range of 30 - 85 km in winter (polar night) and 30 - 65 km in summer (polar day). We will compare the ALOMAR and Kühlungsborn wave activity in terms of absolute temperature and potential energy on a seasonal basis.