



The atmosphere between 1 and 105 km: current state and coupling of layers in summer and winter

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Regular temperature soundings in the whole range between 1 and about 105 km altitude are performed since summer 2002 at the mid-latitude station of Kühlungsborn (54°N , 12°E). More than 1800 h of simultaneous lidar observations by a potassium resonance lidar and a Rayleigh-Mie-Raman lidar yield a representative data set of absolute temperatures and their variability between 1 and about 105 km altitude. To derive the seasonal variation of mean temperatures a harmonic fit has been applied to the nightly mean temperature profiles. A two-level mesopause structure was found with an altitude of about 86–87 km (nearly 144 K) in summer and approx. 102 km (about 170 K) during the rest of the year. The stratopause altitude is about 48 km with little variation throughout the year, and temperatures varying between 258 K and 276 K. The altitude dependent amplitudes and phases of the annual and semi-annual components will be presented. E.g. the amplitude of the annual component at 87 km (summer mesopause) is about five times higher than around 48 km or 100 km altitude. Beside the general temperature structure we will present examples of the temperature variability on different scales. Planetary wave activity can be described by the standard deviation of monthly mean profiles and is partly related with sudden stratospheric warmings occurring in winter even above our mid-latitude station. Additionally, the seasonal variation of gravity wave activity will be examined. The large altitude range covered by our soundings allows studying the vertical coupling between the stratosphere and the (upper) mesosphere. We will examine the vertical coupling for different situations both in winter (during/outside of sudden stratospheric warmings) and summer (with/without presence of noctilucent clouds).