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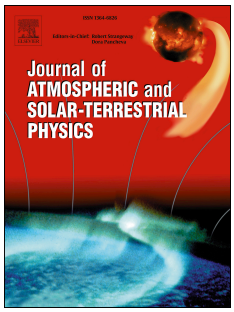

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Mechanisms for varying non-LTE contributions to OH rotational temperatures from measurements and modelling. I. Climatology

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Abstract

Rotational temperatures T_{rot} from OH line intensities are an important approach to study the Earth's mesopause region. However, the interpretation can be complicated as the resulting T_{rot} are effective values weighted for the varying OH emission layer. Moreover, the measured T_{rot} only equal kinetic temperatures T_{kin} if the rotational level population distribution for the considered OH lines is fully thermalised. In many cases, this basic condition of a local thermodynamic equilibrium (LTE) does not seem to be fulfilled. In order to better understand the non-LTE temperature excesses ΔT_{NLTE} and their variations, we used T_{rot} measurements based on 1,526 high-resolution spectra of the UVES spectrograph at the Very Large Telescope at Cerro Paranal in Chile in combination with T_{kin} weighted for the OH emission layer based on 4,496 nighttime temperature and OH emission profiles from the SABER radiometer onboard TIMED taken at a similar location. Both data sets were linked via climatologies consisting of the nighttime and seasonal temperature variations. The study focusses on the non-LTE effects at the vibrational level $v = 9$, which is directly populated by the OH-producing hydrogen–ozone reaction and therefore especially prone to

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