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Rotational Raman lidar measurements of atmospheric temperature from space:

results from a simulation study

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We simulated the performance of a space-borne temperature lidar based on the pure rotational Raman (RR) technique in the UV. Simulations reveal that a space-borne lidar system based on state-of-the-art transmitter/receiver technology is capable to perform night-time and daytime atmospheric temperature measurements satisfying WMO threshold observational requirements for most NWP and climate research applications under cloud-free conditions. Specifically, the system can provide night-time temperature measurements throughout the troposphere with an precision better than 1 K (max precision 0.5 K) and daytime measurements with an precision better than 2 K (max precision 1.4 K). The simulations also show that night-time performances above and below cirrus clouds with an optical thickness up to 0.65 result to be degraded with respect to clear sky performances, but still characterized by an error smaller than 2K.

The simulations also reveal that space-borne lidar systems for combined water vapour and temperature measurements have the potential to provide night-time and day-time measurements of relative humidity with an average precision throughout the troposphere better than 20 %, considering RR temperature measurements and water vapour data measured with the differential absorption lidar (DIAL) technique.

Simulations have been performed based on the application of an analytical model. The procedure to simulate the lidar signals and assess measurement precision will be described in detail at the conference together with the main results of the simulations.