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Mesospheric H_2O Densities Retrieved from SABER/TIMED Measurements

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The SABER instrument on board the TIMED Satellite is a limb scanning infrared radiometer designed to measure temperature, minor constituent densities and energetics of the mesosphere and lower thermosphere (MLT). The H_2O densities are retrieved from 6.3 μm band radiances. The populations of $H_2O(\nu_2)$ vibrational levels are in the non-Local Thermodynamic Equilibrium (non-LTE) above the altitude of $\sim$55 km, and, therefore, the interpretation of measured 6.3 μm radiance requires utilizing the H_2O non-LTE model that accounts for various excitation and quenching processes of the H_2O vibrational levels as well as for the vibrational-vibrational (V-V) energy exchange with O_2, N_2, and CO_2 molecules. In this study we applied the updated ALI-ARMS non-LTE model coupled with the detailed model of kinetics of the O_2/O_3 photolysis products for upgrading and optimizing the SABER operational H_2O non-LTE model. The latter has been then validated using coincidental SCISAT1/ACE occultation measurements to verify the CO_2(020)-O_2(X,v=1), O_2(X,v=1)-H_2O(010) V-V, and O_2(X,v=1)-O V-T rates at mesopause temperatures. These rates are crucial for the adequate H_2O density retrievals in the MLT. The first distributions of seasonal and meridional H_2O densities retrieved from the SABER 6.3 μm radiances applying the updated SABER operational H_2O non-LTE model are demonstrated and discussed.