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Closure study between 183.31 GHz passive microwave and in-situ radiosonde measurements of water vapor in the atmosphere

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Water vapor is an effective greenhouse gas and has a strong effect on the Earth's Energy balance. Often water vapor is measured in-situ by radiosondes and remotely by passive microwave satellite sensors. Satellite and radiosonde measurements can not be compared directly because of their different nature. We can use the profiles measured by the radiosondes as an input data for a radiative transfer model and then compare the output of the model with the satellite data. One of the remote sensing techniques employs series measurements of radiant intensity at the water vapor absorption line centered at 183.31 GHz. Recently it was shown that there is a bias between the satellite and radiosonde measurements. Also this bias has a spectral shape – satellite data is warmer than radiosonde measurements near the center of the absorption line and satellite data is colder on the wings of the line. The source of the bias is not clear. The source can be problems with radiosonde or satellite data or imprecise spectroscopic data for radiative transfer models.
Objective of this study is to make a closure study of 183.31 GHz satellite and radiosonde measurements to check the agreement between them. To accomplish this we utilized up-to-date spectroscopic parameters of 183.31 GHz water vapor absorption line and the Global Climate Observing System (GCOS) Reference Upper-Air Network (GRUAN) processed radiosonde data for 5 stations around the globe. We used data for microwave sensors the Advanced Microwave Sounding Unit B (AMSU-B) and the Microwave Humidity Sounder (MHS). We examined data from 2009 to 2015. We used the Atmospheric Radiative Transfer Simulator (ARTS) to simulate radiosonde profiles.
We will present the comprehensive analysis of comparison. In most of the examined cases the data are comparable and consistent within the estimated uncertainty. Our comparison does not show spectral dependence of the bias.
The results indicate good agreement between the satellite and radiosonde measurements using up to date spectroscopic parameters and GRUAN processed radiosonde data.