



The major SSW of Christmas 2018 observed by ground-based microwave radiometry with high time-resolution at Ny-Ålesund

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In the end of December 2018 a major sudden stratospheric warming (SSW) took place in the northern hemisphere. The polar vortex was strongly shifted away from the Pole in the mesosphere, starting on December 23, 2018 and eventually split in the stratosphere on January 2, 2019. We operate two ground-based microwave radiometers at the AWIPEV research base at Ny-Ålesund, Svalbard (79° N, 12° E) in the Arctic. The instruments measure ozone and water vapour volume mixing ratio (VMR) profiles in the middle atmosphere with a high time resolution. For ozone the time resolution is 2 hours and for water vapour it is 2–4 hours depending on the optical depth of the atmosphere. Ozone is observed in the four cardinal directions at an elevation angle of 22° which allows to observe gradients in the ozone distribution. Additionally daily mean horizontal wind profiles are retrieved from the measured ozone spectra. Using these unique datasets we analyse the SSW of December 2018 at Ny-Ålesund. During the SSW the temperature increased in the whole stratosphere above Ny-Ålesund by up to 50 K whereas in the mesosphere it dropped by about the same amount. Before the polar vortex split it shifted away from Ny-Ålesund towards North America starting in the mesosphere and proceeding down to the stratosphere. Stratospheric ozone VMR was increasing by about 2 ppm when the polar vortex moved away from Ny-Ålesund. Water vapour VMR increased in the mesosphere by more than 2 ppm whereas in the stratosphere it was decreasing by about 1.5 ppm. Previous to the SSW a strong wave activity was detected in the ozone time series in November 2018 with a period of about 3–4 days which is also seen in the water vapour data set. Simulations with the specified dynamics version of the Whole Atmosphere Community Climate Model (SD-WACCM) are used to investigate the chemical and dynamical influence on the ozone and water vapour variations during the SSW at Ny-Ålesund.