



Arctic winter 2009/2010 and 2010/2011 in comparison: Denitrification and polar stratospheric cloud formation

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Polar Stratospheric Clouds (PSCs) and denitrification, the permanent removal of nitric acid (HNO_3) by sedimenting HNO_3 containing PSC particles, play a key role in stratospheric ozone depletion. The two recent Arctic winter 2009/2010 and 2010/2011 were both quite unique. The Arctic winter 2010/2011 was one of the coldest winter on record leading to the strongest depletion of ozone ever measured. Though the Arctic winter 2009/2010 was rather warm in the climatological sense it was distinguished by an exceptionally cold stratosphere from mid December 2009 to mid January 2010 leading to prolonged PSC formation and strong denitrification. For investigating PSC formation during these two Arctic winter we apply ground-based measurements performed with the Esrange and the IRF lidar in the area of Kiruna, Northern Sweden ($69^\circ \text{ N } 21^\circ \text{ E}$) and space-borne lidar measurements from the CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations) Satellite together with microphysical box model simulations. To investigate denitrification during these two Arctic winter we apply measurements from the Odin Sub-Millimetre Radiometer (Odin/SMR) as well as measurements from the Microwave Limb Sounder on Aura (Aura/MLS). Though denitrification in 2009/2010 was until then the strongest in the entire Odin/SMR measurement period it was exceeded by the 2010/2011 winter where denitrification was nearly as severe as in the Antarctic. PSC occurrence during both winter was also quite different. While PSCs were present during the Arctic winter 2010/2011 over nearly four months, from mid December to end of March, they were not as persistent as the ones that occurred during the shorter (one month) cold period during the Arctic winter 2009/2010.