

GLORIA observations of de-/nitrification during the Arctic winter 2015/16 POLSTRACC campaign

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Denitrification, the condensation and sedimentation of HNO_3 -containing particles in the winter stratosphere at high latitudes, is an important process affecting the deactivation of ozone-depleting halogen species. It modulates the vertical partitioning of chemically active NO_y and the vertical redistribution of HNO_3 can affect low stratospheric altitudes under sufficiently cold conditions. The capability of associated nitrification to disturb the NO_y budget of the climate-relevant lowermost stratosphere (LMS) has hardly been investigated in detail and represents a challenge for model simulations. The Arctic winter 2015/16 was characterized by exceptionally cold stratospheric temperatures and widespread polar stratospheric clouds (PSCs) that were observed from mid-December 2015 until the end of February 2016 down to the LMS. Observations by the GLORIA (Gimballed Limb Observer for Radiance Imaging of the Atmosphere) spectrometer during the POLSTRACC (Polar Stratosphere in a Changing Climate) aircraft mission allow us to study the development of nitrification of the Arctic LMS during and after the 2015/16 PSC period with high vertical resolution. The vertical cross-sections of HNO_3 distribution along the HALO (High Altitude and Long range research aircraft) flight tracks derived from GLORIA observations show the result of significant vertical redistribution of NO_y with strong nitrification of up to ~ 6 ppbv in the LMS. We compare the results of the GLORIA observations with simulations by the state-of-the-art chemical-transport model CLaMS and the climate-chemistry model EMAC and discuss the capability of these models to reproduce nitrification of the Arctic LMS.