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On the consistency of the formation of polar stratospheric clouds (PSCs) and their chemical impact : in situ measurements and modeling approach.

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A balloon campaign at Kiruna (Sweden, 67.9˚S-21.1˚E) was conducted in January 2006 within the frame of the ENVISAT satellite validation. *In situ* measurements of gas mixing ratios and particle size distributions were obtained simultaneously in the Arctic stratosphere. *In situ* vertical profiles of O_3, CO, CH_4, CO_2, N_2O, NO_2,HNO_3 and HCl were provided by the SPIRALE balloon-borne infrared spectrometer between 13 and 27.3 km with high vertical resolution (∼5m). The optical aerosol counter STAC was mounted on board the payload, allowing *in situ* characterization of the vertical particle distribution in six size bins between 0.4 and 2.0 μm.

Very complex structures are observed on the HNO_3 and HCl vertical profiles with very low values in the 20.7–22 km layer. Correlations, especially for O_3-HNO_3, are used to characterize specific layers and to identify different processes leading to the observations. The correlations curves obtained show the presence of denitrified layer. The high vertical resolution enables the identification of possibly localized renitrification.

Clusters of backward trajectories have been calculated to investigate the thermal histories of the sampled air masses. During the week before the measurements, low temperatures close to the nitric acid trihydrate (NAT) saturation temperature were encountered along backward trajectories.

The MIPLASMO (Microphysical and Photochemical Lagrangian Stratospheric Model of Ozone, *Riviere et al. 2003*) has been then used to investigate PSC formation and the impact of sedimenting particles on chemistry. Several homogeneous nucleation rates proposed in the literature have been tested to address the question of NAT formation above the ice nucleation temperature.

Riviere, E.D., Terao, Y. and Nakajima, H., 2003, A lagrangian method to study stratospheric nitric acid variations in the polar regions as measured by the Improved Limb Atmospheric Spectrometer. *J. Geophys. Res*, **108**, 4718.