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Observations and analysis of polar stratospheric clouds detected by POAM III and SAGE III during the SOLVE II/VINTERSOL campaign in the 2002/2003 Northern Hemisphere winter

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Abstract. The Polar Ozone and Aerosol Measurement and Stratospheric Aerosol and Gas Experiment instruments both observed high numbers of polar stratospheric clouds (PSCs) in the polar region during the second SAGE Ozone Loss and Validation (SOLVE II) and Validation of INTERnational Satellites and Study of Ozone Loss (VINTERSOL) campaign, conducted during the 2002/2003 Northern Hemisphere winter. Between 15 November 2002 (14 November 2002) and 18 March 2003 (21 March 2003) SAGE (POAM) observed 122 (151) aerosol extinction profiles containing PSCs. PSCs were observed on an almost daily basis, from early December through 15 January, in both instruments. No PSCs were observed from either instrument from 15 January until 4 February, and from then only sparingly in three periods in mid- and late February and mid-March. In early December, PSCs were observed in the potential temperature range from roughly 375 K to 750 K. Throughout December the top of this range decreases to near 600 K. In February and March, PSC observations were primarily constrained to potential temperatures below 500 K. The PSC observation frequency as a function of ambient temperature relative to the nitric acid-trihydrate saturation point (using a nitric acid profile prior to denitrification) was used to infer irreversible denitrification. By late December 38% denitrification was inferred at both the 400–475 K and 475–550 K potential temperature ranges. By early January extensive levels of denitrification near 80% were inferred at both potential temperature ranges, and the air remained denitrified at least through early March.

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