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In-situ Particle Measurements in the Winter Arctic lower Stratosphere: Implications for Particle Nucleation, Volatility and the Meteoritic Aerosol Contribution

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Number concentrations of total and non-volatile aerosol particles with size diameters >0.01 μm as well as particle size distributions (0.4 – 23 μm diameter) were measured *in-situ* in the Arctic lower stratosphere (10-21 km altitude). The measurements were obtained during the campaigns European Polar Stratospheric Cloud and Lee Wave Experiment (EUPLEX) and Envisat-Arctic-Validation (EAV) which took place from January to March 2003. Measurements were conducted onboard the Russian high-altitude research aircraft Geophysica using the low-pressure Condensation Nucleus Counter COPAS (Condensation Particle Counter System) and a modified FSSP 300 (Forward Scattering Spectrometer Probe). Typical total particle number concentrations around 18-20 km altitude range at 10-20 cm^{-3} (ambient conditions). The measurements indicate a nucleation source of particles in the polar vortex middle stratosphere. Correlations with the trace gases nitrous oxide (N_2O) and trichlorofluoromethane (CFC-11) are discussed. A separate channel of the COPAS instrument measures the fraction of aerosol particles non-volatile at 250°C. Inside the polar vortex a much higher fraction of the particles was non-volatile than outside the vortex. This is most likely due to an increased fraction of meteoritic material in the particles which is transported downward from the mesosphere and upper stratosphere over the poles. The non-volatile fraction of particles serves also an excellent vortex tracer. The total number of parti-

cles >0.01 μm increases inside the vortex compared to outside while N_2O is decreasing which indicates a source of new particles in the polar stratosphere. The number concentrations of particles > 0.4 μm decrease markedly inside the polar vortex, also a consequence of subsidence of air from higher altitudes inside the vortex. In the lowermost stratosphere up to about 360 K, repeatedly high concentrations of 100-1000 particles per ccm were measured. Possible explanations for these observations will be discussed in detail.