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A new parameterization of polar stratospheric clouds based on the effective growth of NAT particles in the chemistry-climate-model EMAC

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Polar stratospheric clouds (PSCs), consisting of STS, NAT and ice particles, play a major role in polar ozone depletion. On the one hand there is the activation of chlorine reservoirs at the surface of the PSCs, on the other hand PSCs lead to the stratospheric denitrification with the effect of a delay in the deactivation of active chlorine in polar spring.

Due to the relevance of a good representation of these PSCs in global chemistry-climate-models (CCMs) a new algorithm based on efficient growth of NAT particles, developed by van den Broek et al. [2004], has been implemented into the submodel PSC of the CCM ECHAM5/MESSy for Atmospheric Chemistry (EMAC).

We present results of an EMAC simulation from 2000 to 2012, performed with the new NAT parameterization. The simulated results are analyzed regarding the composition of PSCs and their distribution in the polar regions as well as their influence to the ozone related chemistry. The new results are compared with an EMAC simulation with the old standard thermodynamical NAT parameterization. A comparison with PSC measurements retrieved by the satellite instrument MIPAS on ENVISAT [Höpfner et al., 2006] show the quality of the new PSC scheme in EMAC.

With the help of an additional sensitivity simulation it can be shown that the significance of heterogeneous reactions on ice particles, in comparison to liquid particles, is subordinate regarding chlorine activation and ozone depletion in Antarctic winter and spring as noted in Drdla and Mueller [2012].