Formation of polar stratospheric clouds simulated in a two dimensional model of the atmosphere

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A microphysics code has been implemented in a two dimensional model of the atmosphere to study formation of polar stratospheric clouds containing HCl or HNO_3 .The model range from pole to pole in latitude and from the ground to about 20Km in altitude. Resolution in latitude is 10° and about 0.8Km in altitude. This is an eulerian model with prescribed eddy diffusion coefficients and the circulation obtained from observations. The chemistry of the model follows the family approach for NO_x ,Cl_x anf HO_x while the ozone is fixed and changed seasonally. The aerosol code is based on a assigned population of condensation nucleii and includes the processes of condensation,coagulation and sedimentation. Aerosol growth is simulated in nine different size bins ranging between 0.01u and 2.56u.

The model has been built to study aerosol layers formation in the upper troposphere and lower stratosphere and has been validated for sulfate aerosol resulting from a rather complex sulfur chemistry.

In order to simulate the effect of low temperature on the formation of polar clouds the basic temperature has been lowered in the winter polar region by a maximum of 10,20 and 30K. The optical thickness and cloudiness coverage can be estimated as well as the reduction in concentration of NOx. The resulting population of aerosol is analyzed in terms of the possible perturbation to the heating rates and the heterogeneous chemistry. Heating rates are calculated with an accurate radiative code which takes into account the effect of the particulate both in the solar and infrared wavelength range. Heterogeneous reaction rates are calculated by considering the size distribution of the aerosol and together with the changed chemical composition of the polar region can be used to estimate the depletion effects on ozone.