Two 3D models (dynamical and chemical) were used for simulation of SPE impact on middle atmosphere composition and dynamics.

The initial version of **GCM** was developed in Cologne University, Germany (*Jakobs et al.*, 1986; *Dameris et al., 1989; Berger and Dameris, 1993*), and was set up at the Laboratory of Atmospheric Chemistry and Dynamics, Central Aerological Observatory (CAO), Russia. New version developed at CAO (COA/COMMA) is a global mechanistic gridpoint model with a vertical extension from the ground (lower boundary was fixed at 3 km in model runs) up to 130 km with the following resolution: longitudinal step - 22.5^0 ; latitudinal step - 5^0 ; height increment – 5.7 km. For the heights above 100 km dynamical viscosity, thermal heat conduction, and ion drag are considered. Mechanical dissipation processes can be taken into account by using an explicit gravity wave drag parameterization (Lindzen, 1981). Solar radiation is absorbed by water vapor, carbon dioxide, ozone, and molecular oxygen in the model. For terrestrial (infra-red) radiation water vapor, carbon dioxide (LTE and non-LTE) parameterization developed by *Fomichev* (1993) and *Chou*, ozone, and nitric oxide are included.

The **3D chemical-transport model** developed at CAO has the same horizontal resolution as the dynamical model (vertical resolution equals 2 km) and calculates the concentrations of 30 minor components participating in 70 chemical and 35 photochemical reactions in the range 0-90 km. The reaction rate constants, absorption cross-sections, solar radiation intensity, and quantum outputs were assigned in the tabulated form according to S*ander et al.* (2003). In so doing, we took into account also the annual variation of zenith angle of the Sun at a given point and its dependence on the height above the surface of the Earth. The Chapman functions have been used in accordance with *Swider and Gardner (1967)*, when zenith angle was more than 75^0 . Current photolysis rates have been calculated for each hour during the integration of the model. The technique of "chemical families" (Turco and Whitten,1974) was used for solving the aeronomical part of the chemical-transport model basic equations:

O_x (O_3 + O + $O(^1D)$);
NO_y (N + NO + NO_2 + NO_3 + $2N_2O_5$ + HNO_3 + HO_2NO_2 + $ClNO_3$);
Cl_y (Cl + ClO + OClO + ClOO + HOCl + HCl);
HO_x (H + OH + HO_2 + $2H_2O_2$).

The list of long-lived species in the model looks as follow:

N_2O, CCl_4, $CFCl_3$, CF_2Cl_2, CH_3Cl_3, CH_4, H_2O, H_2, and CO_2.

Vertical structure of molecular oxygen (O_2) and concentration of the air (M) were fixed in the photochemical calculations. Heterogeneous removal for H_2O_2, HNO_3, HCl, and HO_2NO_2 was included in the troposphere.

We assumed also fixed mixing ratio for long-lived and "chemical families" components at lower and upper boundaries during calculations in order to formulate the boundary conditions. Corresponding mixing ratio values have been found in *NASA/TM-1999-209554* publication, which contains the result of *Models and Measurements Intercomparison* (1999). Used in our scenario boundary conditions corresponded to 1992.

An accurate, non-diffuse method for three-dimensional advection of trace species suggested by *M. Prather* (1986) was used to solve continuity equation for each transported species ("families" and long-lived species). The chemical constituents were initiated in model runs with profiles obtained from a one-dimensional model (*Krivolutsky et al., 2001c*). Wind components used for transport by advection were obtained by simulation with the 3D dynamical model for each day of the year. So, we used daily averaged global zonal, meridional, vertical wind components, and temperature in model runs with chemical- transport model. More details concerning chemical 3D model can be found in a special *Technical Scientific Report* (*Krivolutsky et al., 2002*).

Ionization rates caused by SPE of October 2003 in grid-points of 3D chemical model was calculated by Maik W.