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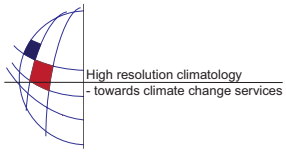

Accumulated precipitation in cloud model coupled with chemistry module

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The scavenging of pollutants by cloud particles and precipitation is an important sink of atmospheric pollution and subsequently determines the spatial distribution of the deposition of pollutants. Microphysical processes in a cloud have an important influence on the start and duration of rainfall and the uptake of pollutants. Accumulated precipitation as a one measure of wet deposition was considered. In this purpose, complex 3D cloud-resolving mesoscale ARPS (Advanced Regional Prediction System) model developed in the Center for analysis and prediction of storms (CAPS) at the University of Oklahoma was coupled with an aqueous chemistry module. The cloud model included six water categories: water vapor, cloud water, rainwater, cloud ice, hail and snow. The chemistry module has five chemical species: gases H2O2, SO2, O3, and aerosols SO42- and NH4+. Each chemical constituent in each microphysical category was represented by differential equation for mass continuity, in the form of mixing ratio. The source and sink terms of these chemical species are transfer of a chemical species from one microphysical category to another and the chemical reactions (e. g. oxidation of cloud water SO2 by H2O2 and O3 to cloud water sulfate).

The cloud model was initiated by a single sounding and was used the real orography as a very important factor in cumulonimbus formation and development. It is assumed that initial concentrations of chemical fields fall off exponentially, from the given values of mixing ratios at the lowest model level. Numerical experiments was conducted for two environments: continental background and moderately polluted.

As a result, accumulated precipitation of all chemical species (APCS) can be determined. It gives the spatial distribution of chemical species. In the initial phase of cumulonimbus life, there is one maximum of accumulated precipitation and maximum of APCS correspond to it. As the cloud developed primary maximum of APCS subdivide, following the accumulated precipitation division. The total mass of APCS for two hour integration was calculated.