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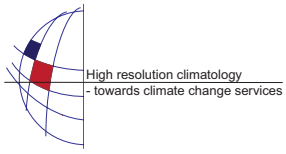

Influence of Galactic Cosmic Rays on the atmospheric composition and temperature

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We present a 3D Chemistry Climate Model study on the influence of Galactic Cosmic Rays (GCRs) on atmospheric composition, temperature and dynamics. For the GCR-induced ion-pair production rates we use a new parameterization (Usoskin, Kovaltsov & Mironova, 2010), which extends from the thermosphere to the ground. We find a statistically significant influence of the GCR ionization on tropospheric ozone, NO_x, HO_x and temperature. GCR-induced enhancements in NO_x exceed 20 % in the southern hemispheric polar region up to a height of 20 km, whereas HO_x is showing a decrease of about 3 % at the upper troposphere / lower stratosphere over the southern hemisphere. In the southern hemispheric troposphere, where ozone is generally NO_x-limited, the model suggests that GCRs lead to an increase of up to 3 % in ozone. Conversely, the northern hemisphere has a stronger anthropogenic influence, being less susceptible to GCR effects. In the northern high latitudes an ozone decrease between 10 and 20 km of up to 3 % is found, caused by the additional production of $ClONO_2$ followed by heterogeneous chlorine activation. The annual mean temperature response to GCRs is only slightly influenced (95 % level of significance), with a maximum increase of 0.3 K. We conclude that GCRs may be important for upper tropospheric and lower stratospheric ozone than previously thought.