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# Solar induced perturbations in the middle atmosphere: is it just a matter of magnitude?

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There is a growing body of evidence to suggest that the middle atmosphere can have an important role in influencing tropospheric processes, and thus possibly impacting on climate. Mainly because of the stratospheric peak in the ozone concentration, the middle atmosphere is significantly influenced by the solar input, and thus represents an important connection between the Sun and the Earth's atmosphere.

In previous work, we have shown how changes in ozone induced by solar variability alter temperature and transport in the middle atmosphere, somewhat affecting the net heating to the troposphere. Here we focus on solar proton events (SPEs), such as the large SPE of October 2003, to understand the sensitivity of the atmospheric system to perturbations at different scale.

We use a mechanistic 3-dimensional model of the middle atmosphere and simulate the SPE perturbation in ozone using spatial locations and magnitudes observed by the MIPAS instrument onboard the ENVISAT satellite. Level1B MIPAS data have been analysed with the 2-dimensional GEOFIT model. We then modulate the time-dependence of the perturbation following the proton fluxes observed by the satellite GOES-11.

Because of the increasing interest in understanding the possible impact on climate of small scale natural processes (such as sprites), we present model results for short and long term perturbations, discussing whether time-dependence and location of the perturbations may increase the impact of lower magnitude events.