Contribution of energetic particle precipitation to natural ozone variability in Antarctica

Alessandro DAMIANI[1], Bernd FUNKE[2], Manuel LOPEZ PUERTAS[2], Pavle ARSENOVIC[3] and Eugene ROZANOV[3,4]

[1] *CEReS, Chiba University, Chiba, Japan*

[2] *Instituto de Astrofisica de Andalucia, CSIC, Granada, Spain*

[3] *Institute for Atmospheric and Climate Science, ETH, Zurich, Switzerland*

[4] *Physikalisch-Meteorologisches Observatorium, World Radiation Center, Davos, Switzerland*

Energetic particle precipitation (EPP) events commonly refer to particles of different energy and origin which, depending on solar activity, impact and ionize the polar atmosphere. Their frequency is negatively correlated to their energy, so intense energetic events able to affect the lower atmosphere are sporadic. On the other hand, low energy electrons consistently precipitate into the upper atmosphere but their effects can propagate downwards. In polar regions EPP is supposed to be one of the main drivers of the natural variability of the upper atmospheric ozone because it enhances the abundance of odd nitrogen (NO_x) and odd hydrogen (HO_x) species which efficiently destroy ozone. Nevertheless, an accurate assessment of its impact on long time scales is still lacking. To fill this gap, we investigated the ozone variability in response to EPP forcing by exploiting satellite observations from Solar Backscatter Ultraviolet Radiometer and Microwave Limb Sounder as well as an EPP-induced NO_x parameterization based on MIPAS/Envisat. The significant stratospheric and mesospheric ozone depletion found suggests the need of taking the EPP forcing into account in climate models. This has been confirmed by recent simulations performed with the coupled chemistry-climate model SOCOL3-MPIOM.

Key words: ozone, energetic particle precipitation, Antarctica