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Energetic particle precipitation signatures in surface temperature variability ?

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Recent model studies have suggested that the Odd Nitrogen, NOx, created by ionization from Energetic Particle Precipitation (EPP) and the consequent ozone loss through catalytic loss cycles could have an effect on stratospheric and tropospheric (e.g. surface level) temperatures. According to model predictions, these effects could potentially be comparable to the effects induced by the solar cycle at high latitudes.

Significant mesospheric and stratospheric NOx enhancements have been observed during times of high solar activity e.g. during Solar Proton Events. NOx can also be transported from high latitude ionosphere, where it's created by energetic particle precipitation (protons and electrons), down to lower mesosphere and stratosphere.

In this presentation use the ERA-40 (ECMWF Re-Analysis) surface level air temperature data set from 1957 to 2002 to examine winter and spring time polar temperature variations in relation to variations in EPP levels. In agreement with previous modelling we found that the variation in energetic particle precipitation can lead to a few degree variations in the winter time surface air temperature in the Northern as well as Southern polar regions. In the Southern Hemisphere significant winter time temperature variations were observed mainly in the West-Antarctic region.

The results suggest that EPP may have important impacts on surface level temperature variability. However, the populations of the precipitating particles that produce lower ionospheric NOx production are not well known and provide future challenges for the VERSIM community.