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Energetic particle precipitation in the atmospheric chemistry general circulation model ECHAM5/MESSy1

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Energetic particle precipitation (EPP) provides a source of NOx throughout the middle and upper atmosphere. Solar variability leads to variations in particle energy and flux, therefore understanding the effects of the different types of EPP is essential for simulating solar variability effects on the atmosphere. Here we focus on the EPP indirect effect: In the winter polar thermosphere and mesosphere downward transport of NOx produced via EPP can lead to significant enhancements of NOx in the stratosphere. We present a simple parametrization of the EPP indirect effect for global models with a top layer around the mesopause region. The additional NOx source parametrization is based on a measure of geomagnetic activity, the Ap index, as has been suggested in the past. Because this index has been measured since 1932, the parametrization is suitable for model simulations spanning many decades. It is therefore possible to quantify interannual variability on timescales even longer than satellite measurements of NOx enhancements due to the EPP IE. We have evaluated the parametrization using the atmospheric chemistry general circulation model ECHAM5/MESSy1. Initial results focussing on the assumptions and shortcomings of the method will be presented. Finally, the importance of the EPP IE as seen in the employed model is compared to other EPP sources of NOx also present in the model.