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### THERMOSPHERE-MESOSPHERE-STRATOSPHERE COUPLING DURING STRATOSPHERIC SUDDEN WARMINGS

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The occurrences of stratospheric sudden warmings accompanied by elevated stratopause events (ESEs) strongly couple the stratosphere with the mesosphere and the thermosphere above, and modulate the inter-annual variability of the transport of trace species from the polar mesosphere into the polar stratosphere. During such ESEs, the Arctic stratopause is highly dynamic, as it plunges down before reforming at mesospheric altitudes and being brought back down to its climatological position by a downward mean meridional circulation driven by planetary and gravity waves. Such ESEs and their concomitant mesospheric descent can strongly affect the transport of species such as the nitrogen oxides (NO<sub>x</sub>) produced in the MLT region by energetic particle precipitation. The secondary ozone layer in the upper mesosphere is also modulated by the occurrences of ESEs. Higher up, the meridional circulation cells straddling the MLT regions can also be modulated by ESE events.

We study ESEs that occurred in recent years with the NCAR whole-atmosphere WACCM\_SD model with specified dynamics. We focus in particular on the ESE of January 2013. We examine its impact on the downward transport of EPP-induced NO<sub>x</sub>, as well as of other trace species like carbon monoxide or water vapour, and how it effectively couples the middle and upper atmosphere.