



Supplement of

Influence of sudden stratospheric warming with elevated stratopause on the hydroxyl in the polar middle atmosphere

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Influence of Sudden Stratospheric Warming With Elevated Stratopause on the Hydroxyl in the Polar Middle Atmosphere

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Introduction

The purpose of this supplement is to evaluate the effect of the emission input file on OH in SD-WACCM-X. Emission input files for the CESM FXSD component are available only up to 2015. In this study, prescribed emission data were applied prior to 2015, while for later years the emission fields were set to missing values using the following settings in user_nl_cam:

```
ext_frc_type   = 'CYCLICAL',  
ext_frc_specifier = '',  
srf_emis_type = 'CYCLICAL',  
srf_emis_specifier = ''.
```

Sensitivity experiments were performed for three pre-2015 years (2009, 2010, and 2013) with and without prescribed emissions. The results (Figure S1) show nearly identical OH evolution. For example, in 2009 both simulations captured the pronounced decrease in OH peak concentration during the warming phase, with similar consistency for 2010 and 2013. Although minor differences occur in the absolute OH variations, the dynamical processes and response characteristics of the SSW remain unaffected. These tests confirm that the absence of emission input after 2015 has a negligible impact on the simulated OH response to SSWs, supporting the robustness of the results in the main text.

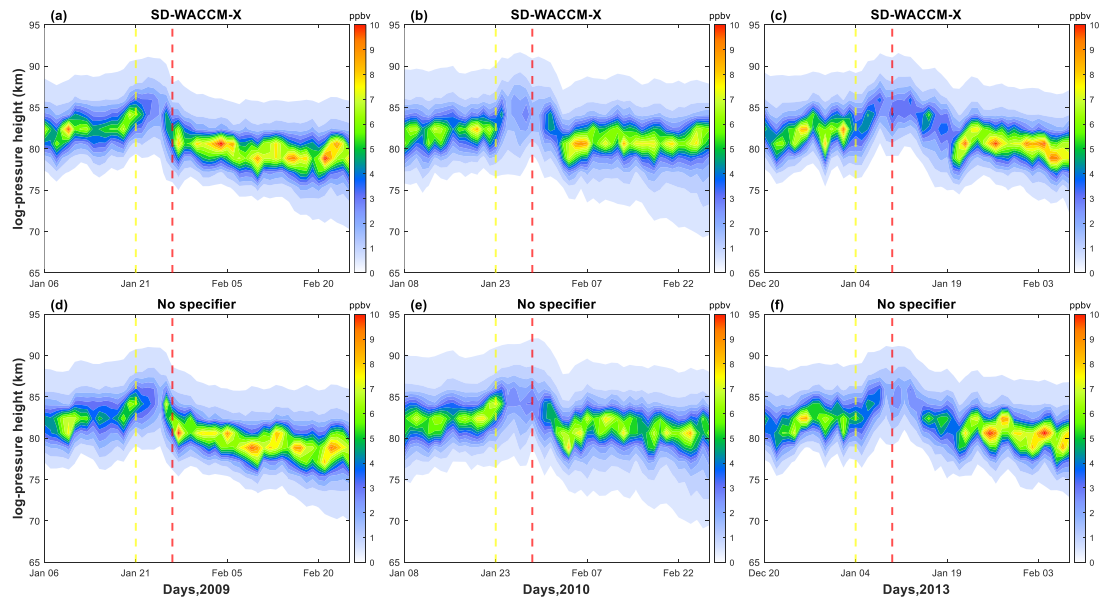


Figure S1. Temporal variation of OH concentrations in the polar region. Panels from left to right correspond to 2009, 2010, and 2013, and from top to bottom to SD-WACCM-X and SD-WACCM-X (No Specifier) simulations. Vertical dashed yellow and red lines are the onset of the stratosphere warming stage and the elevated stratopause stage, respectively.