Supporting Information for "A method to account for global subgrid-scale gravity-wave temperature perturbations in chemistry-climate models"

M. Weimer[1], C. Wilka[1,2], D. E. Kinnison[3], R. R. Garcia[3], J. Bacmeister[4], M.

J. Alexander[5], A. Dörnbrack[6], S. Solomon[1]

[1]Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA, USA

[2]Department of Earth System Science, Stanford University, Stanford, CA, USA

[3]Atmospheric Chemistry Observations & Modeling Laboratory, National Center for Atmospheric Research, Boulder, CO, USA

[4]Climate and Global Dynamics Laboratory, National Center for Atmospheric Research, Boulder, CO, USA

[5]NorthWest Research Associates/Colorado Research Associates, Boulder, Colorado, USA

[6]Institut für Physik der Atmosphäre, Deutsches Zentrum für Luft und Raumfahrt, Oberpfaffenhofen, Germany

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Introduction

Figure S1 gives examples of the impact on the chlorine species when using the sub-stepping approach but with three and five sub-steps instead of ten. By using fewer sub-steps than ten, the sampling of the wave (green dots in Fig. 1a of the main manuscript) has to be chosen. We decided to use $\overline{T} + \hat{T}$, $\overline{T}$ and $\overline{T} - \hat{T}$ of the wave for three times

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sub-stepping and $\overline{T} + \hat{T}$, $\overline{T} + \sqrt{2}\hat{T}$, $\overline{T}$, $\overline{T} - \sqrt{2}\hat{T}$ and $\overline{T} - \hat{T}$ for five sub-steps of the chemistry.

Figure S2 shows the relative difference of the SADs of stratospheric aerosols, which emphasizes the edge regions of the polar vortex.

Figure S3 shows the ozone changes in January 2007 including the troposphere and a simulation perturbing the initial temperature of REF.
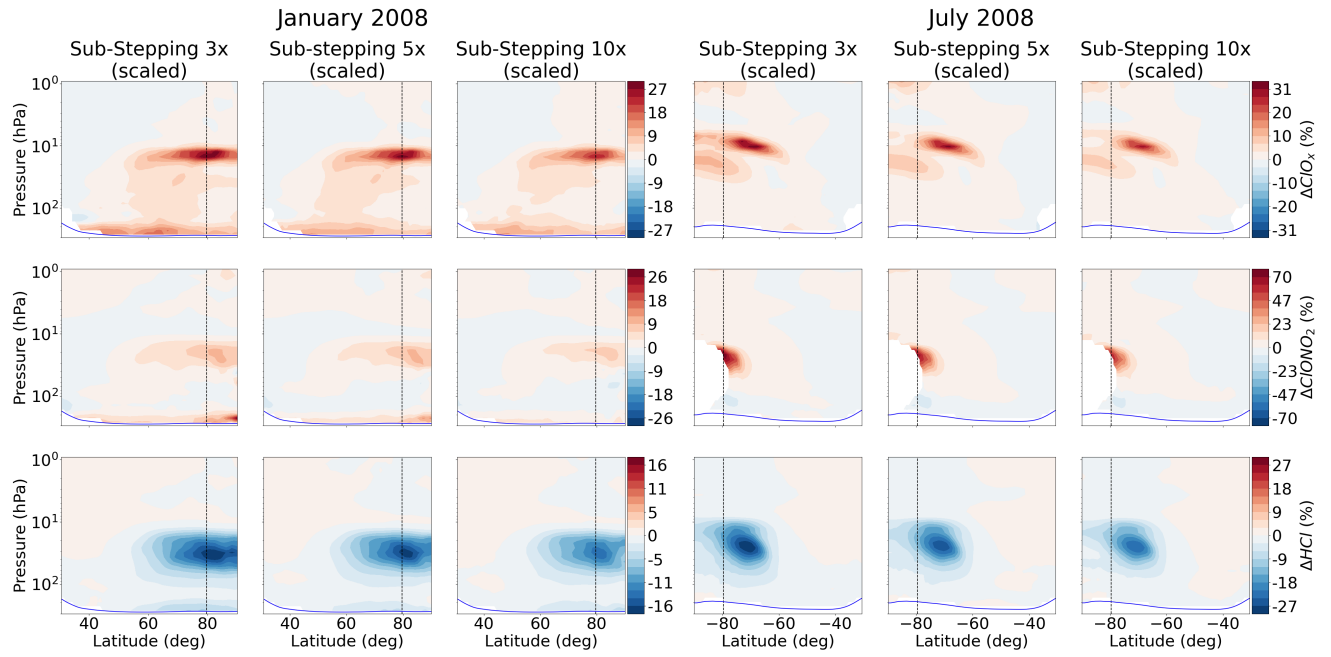
Figure S1. Same as Fig. 11 of the main manuscript, but using 3, 5 and 10 sub-steps of the chemistry.
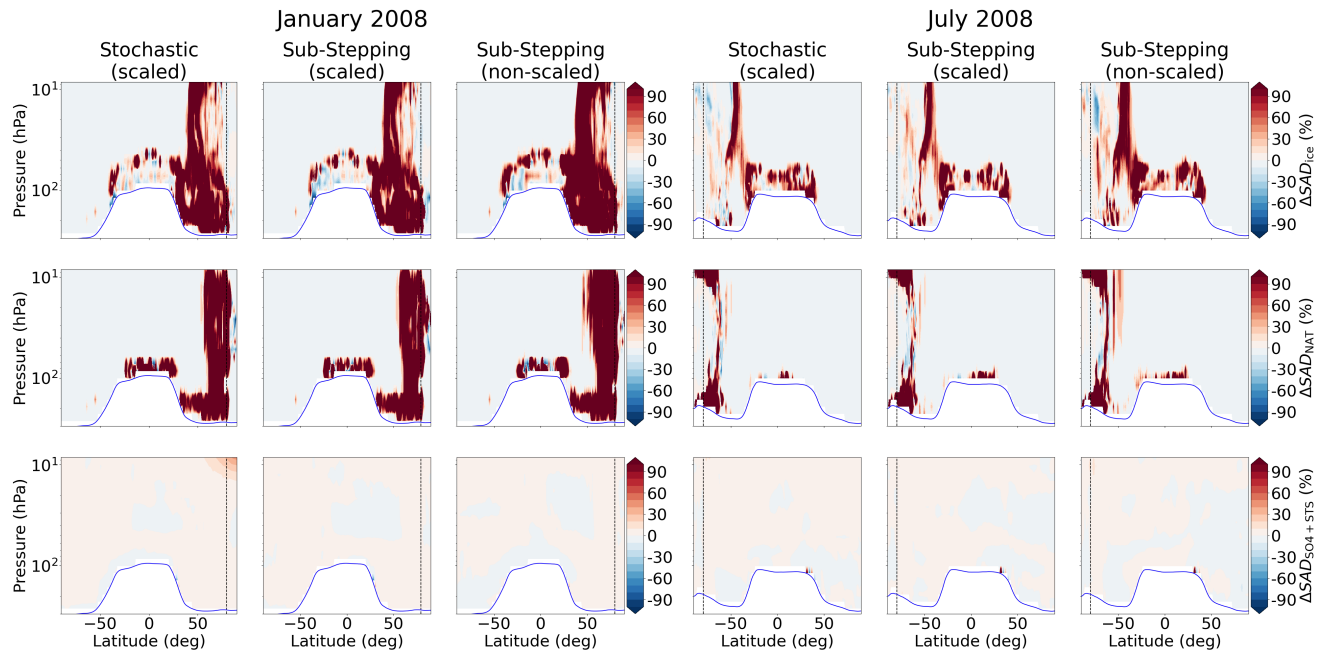

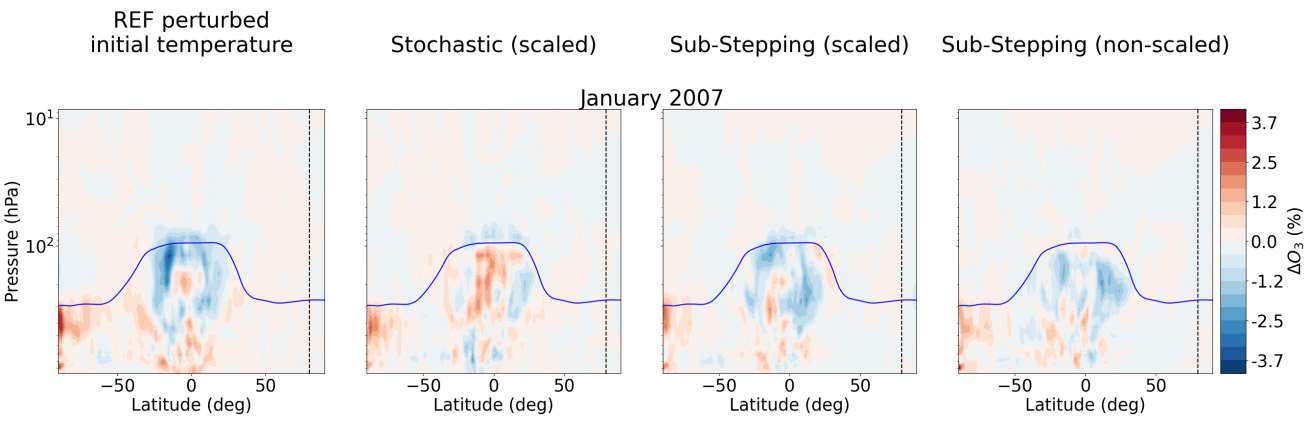**Figure S2.** Same as Fig. 10 of the main manuscript, but showing the relative differences.

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Figure S3. Zonal mean relative differences in ozone of a simulation perturbing the initial temperature by order $10^{-14}\,\mathrm{K}$, and the simulations shown in the main manuscript.