



Supplement of

Volcanic aerosol modification of the stratospheric circulation in E3SMv2 – Part 1: Wave–mean flow interaction

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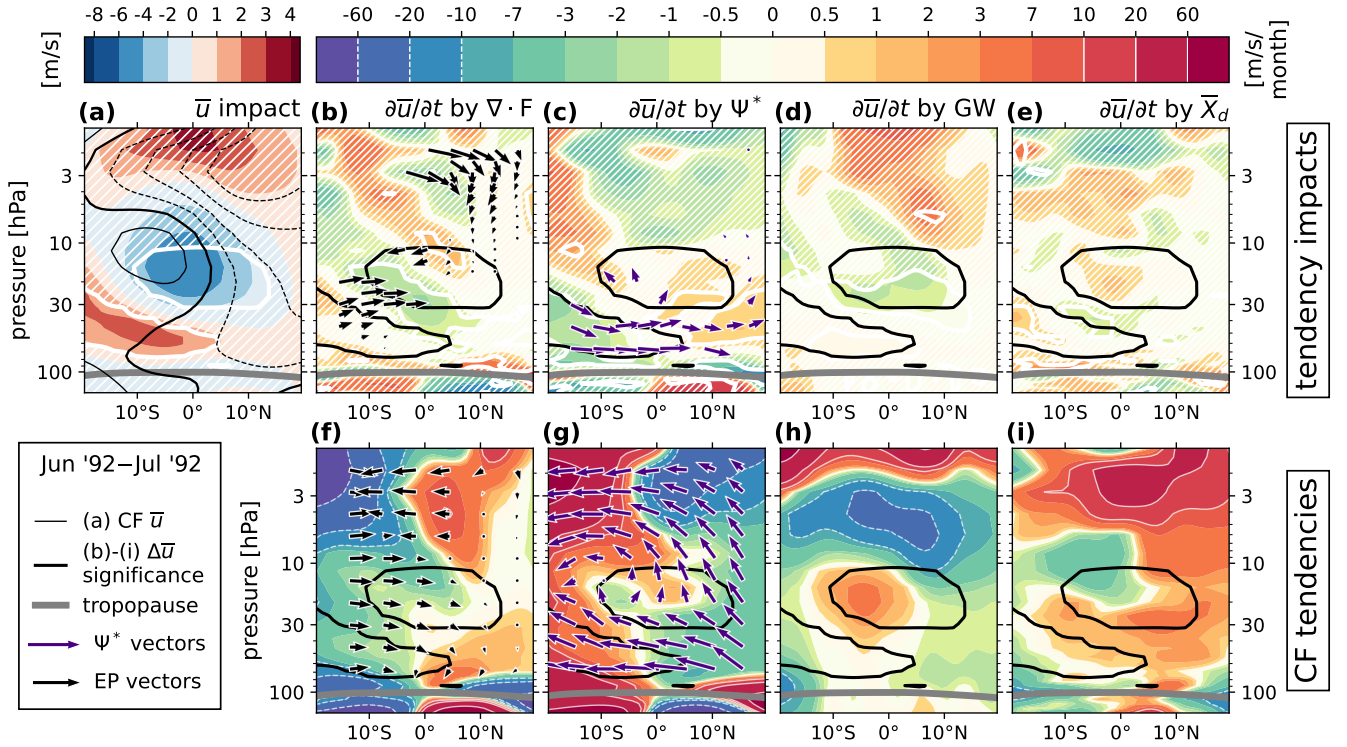


Figure S1. The complete TEM budget in the northern hemisphere meridional plane from 500 hPa to 0.5 hPa, averaged from June 1 1992 to July 1 1992. **(a)** the ensemble-mean $\Delta\bar{u}$ as filled contours (red/blue color scale), with the CF ensemble-mean \bar{u} overplotted as black contours, drawn every 10 m s^{-1} , with negative contours dashed and the zero-line in bold. For every other vertical pair of panels, the top and bottom panels show the ensemble-mean impact and CF ensemble-mean of a variable as filled contours (rainbow colorscale). Panels **(b)** and **(f)** show the EPFD forcing (Eq. (13)). Black vectors drawn in these panels show the significant ensemble-mean impact and the CF ensemble-mean EP flux vectors (Eq. (14, 15)), respectively, scaled according to Jucker (2021). In panel **(b)**, the vector lengths are scaled in length to two orders of magnitude smaller than the CF vectors in panel **(f)**. **(c)** and **(g)** show the residual-circulation forcing (Eq. (7) + Eq. (8)). Purple vectors drawn in these panels show the significant ensemble-mean impact and the CF ensemble-mean Ψ^* tangent vectors (Eq. (11)), respectively, scaled according to Appendix C. For both Ψ^* and the EP flux, vectors near and below the tropopause are removed. **(d)** and **(h)** show the gravity-wave forcing. **(e)** and **(i)** show the forcing by diffusion (Eq. (18)). On all panels, regions of 95% statistical significance are enclosed with a bold white contour for the variable plotted on the colorscale, and regions of insignificance are filled with white hatching. For spatial reference, the significance contour of the net impact $\Delta\bar{u}$ (bold white contour in panel **(a)**) is reproduced as a solid black contour in all other panels. Also plotted on all panels is the tropopause, as a bold grey curve. In the rainbow colorscale used for the tendencies, thin solid (dashed) white contours are drawn between all values larger than positive (negative) $10 \text{ m s}^{-1}\text{month}^{-1}$ in magnitude.

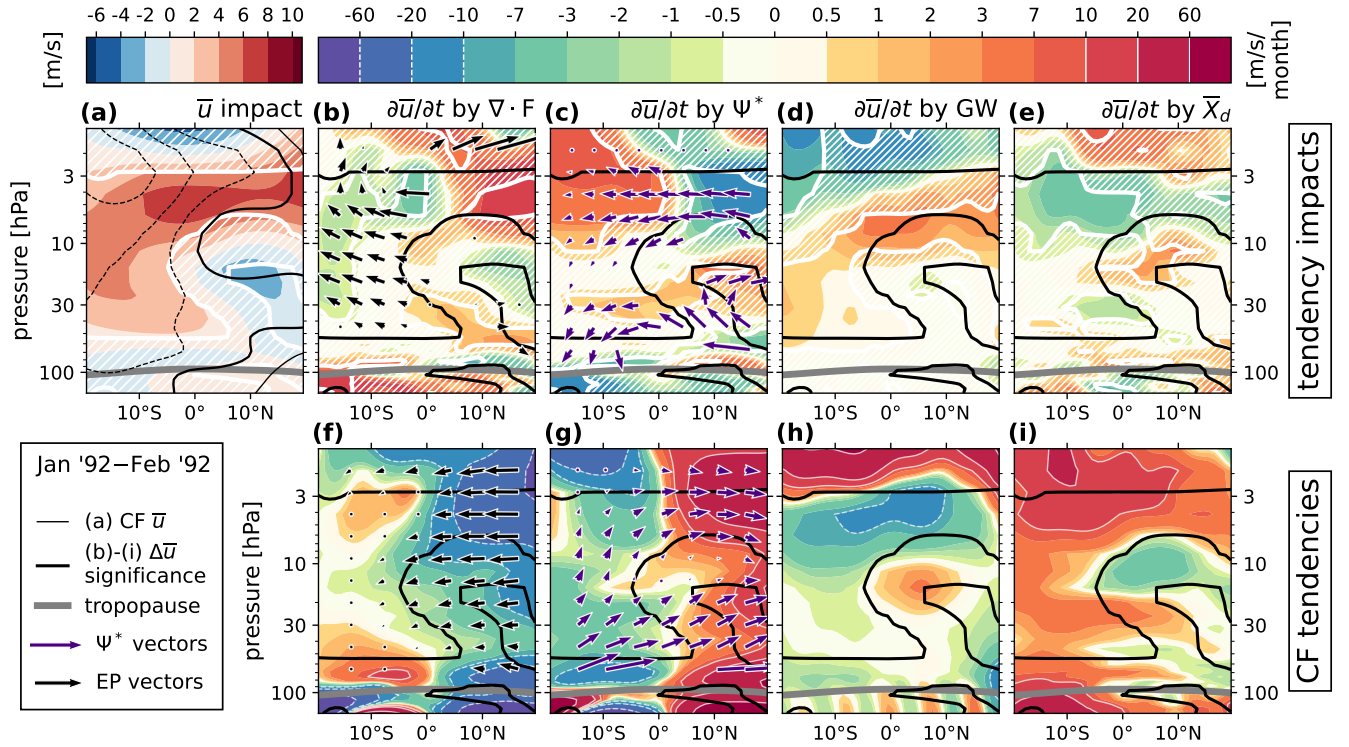


Figure S2. The complete TEM budget in the equatorial meridional plane from 500 hPa to 0.5 hPa, averaged from January 1 1992 to February 1 1992. See the caption of Fig. S1 for full panel descriptions.

References

Jucker, M.: Scaling of Eliassen-Palm flux vectors, *Atmospheric Science Letters*, 22, e1020, <https://doi.org/10.1002/asl.1020>, 2021.