A distinct material isolation and pole-to-pole teleconnection on Mars

Chen-Shuo Fan[1], Cong Sun[1], Zhiang Xie[1], Yangcheng Luo[2], Lixiang Gu[1], Siteng Fan[1*]

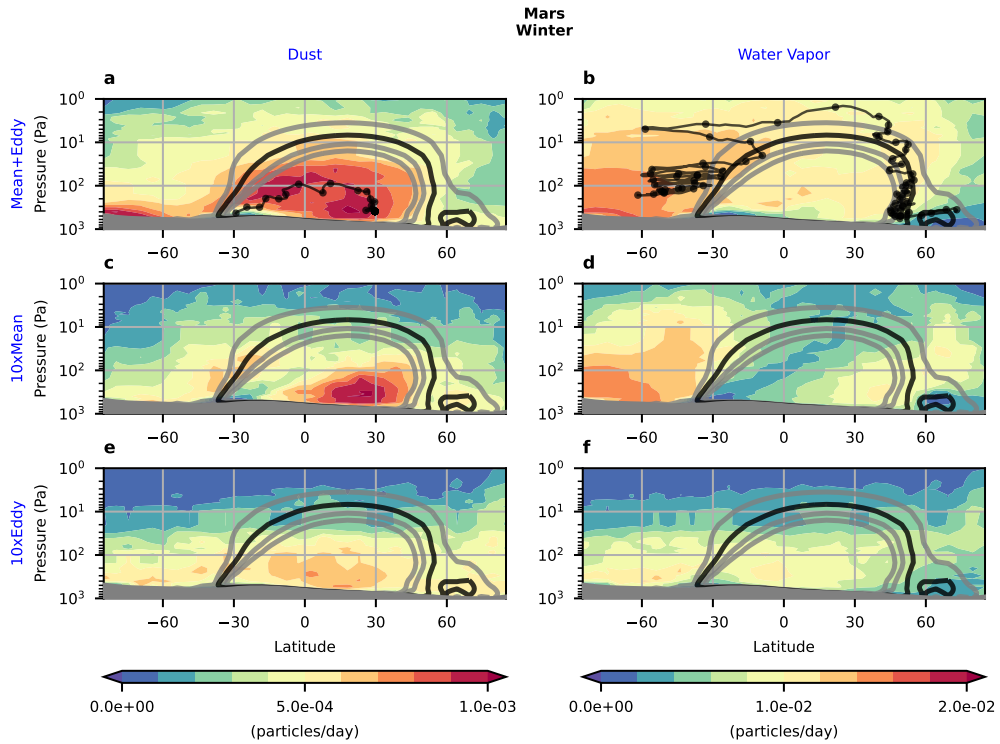
[1]Department of Earth and Space Sciences, Southern University of Science and Technology, Shenzhen, China.

[2]LMD/IPSL, Sorbonne Université, ENS, PSL, Ecole polytechnique, Institut Polytechnique de Paris, CNRS, Paris, France.

*Corresponding author. E-mail: fanst@sustech.edu.cn;

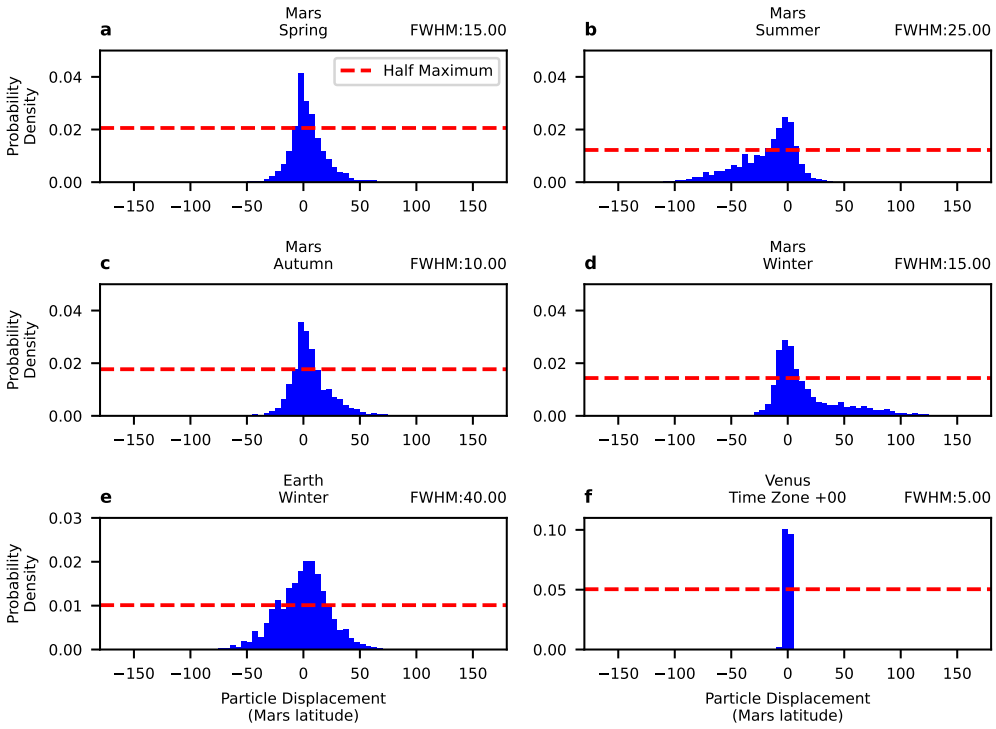
Supplementary Figure

Figure S1: Sensitivity of weighted tracer trajectory concentration to mean and eddy flows on Mars during northern winter solstice.



a–f, Tracers initialized and weighted by dust (**a,c,e**) and water vapor (**b,d,f**) at $L_S = 270$ for three experiments: the circulation control experiment (1x mean flow + 1x eddy flow) (**a,b**), mean flow sensitivity experiment (10x mean flow + 1x eddy flow) (**c,d**), and eddy flow sensitivity experiment (1x mean flow + 10x eddy flow) (**e,f**), respectively. Color shading shows trajectory concentration derived from a Lagrangian analysis of tracers tracked for one Martian month (see Methods). Example trajectories of selected tracers are shown in **a** and **b**.

Figure S2: Displacement of weighted tracer transport on Mars, Earth, and Venus.



a–f, Tracers initialized and weighted globally for the northern spring equinox ($L_S = 0$) (**a**), summer solstice ($L_S = 90$) (**b**), autumn equinox ($L_S = 180$) (**c**), and winter solstice ($L_S = 270$) (**d**) on Mars; the winter solstice (December) on Earth (**e**); and the day starting from noon at the prime meridian on Venus (**f**). Bars show the probability density of tracers shifted from their initial latitude to their final latitude derived from a Lagrangian analysis of tracers tracked for 30 Earth days (see Methods). Differences between final and initial latitudes (x-axis) are normalized to Martian latitude to account for variations in planetary radius. Red dashed lines indicate half the maximum probability density used to determine the full width at half maximum (FWHM), shown in the upper-right corner of each panel as a measure of distributional spread. In this study, half of the FWHM is defined as the diffusion latitude of the tracer.