

Supplementary information

Stratospheric Transport and Tropospheric Sink of Solar Geoengineering Aerosol: A Lagrangian Analysis

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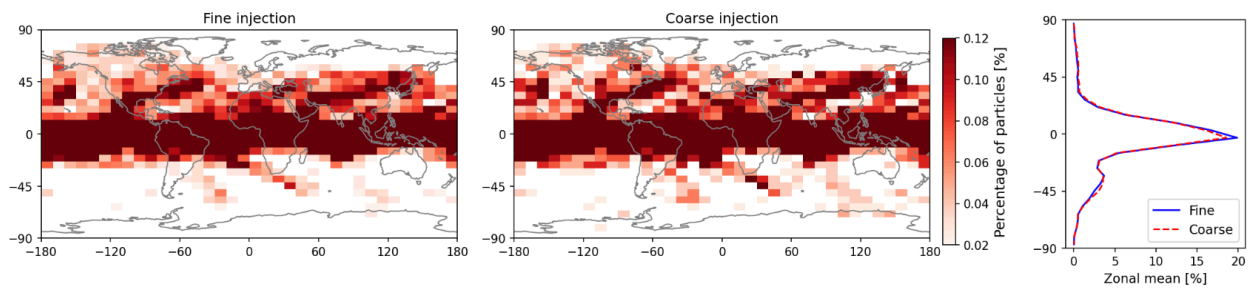
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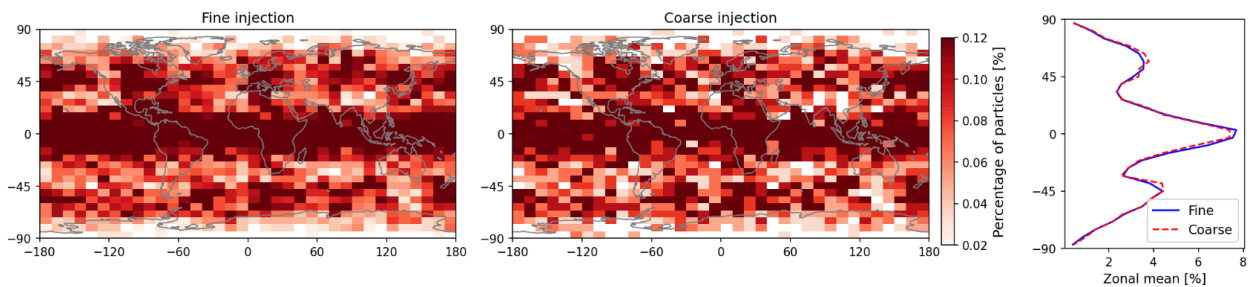
Supplementary Text 1. Sensitivity of stratospheric particle transport to injection resolutions

Here, we simulated a pair of simulations to compare particle transport in the stratosphere based on Fine versus Coarse Injection. The Coarse Injection means injecting particles in a coarse mesh with 15° in longitude and 3° in latitude in a tropical band (15° S to 15° N, -180° to 180°), which is the injection resolution used in this study (see Methods in the main text). The Fine Injection means injecting particles in a fine mesh with 5° in longitude and 1° in latitude.

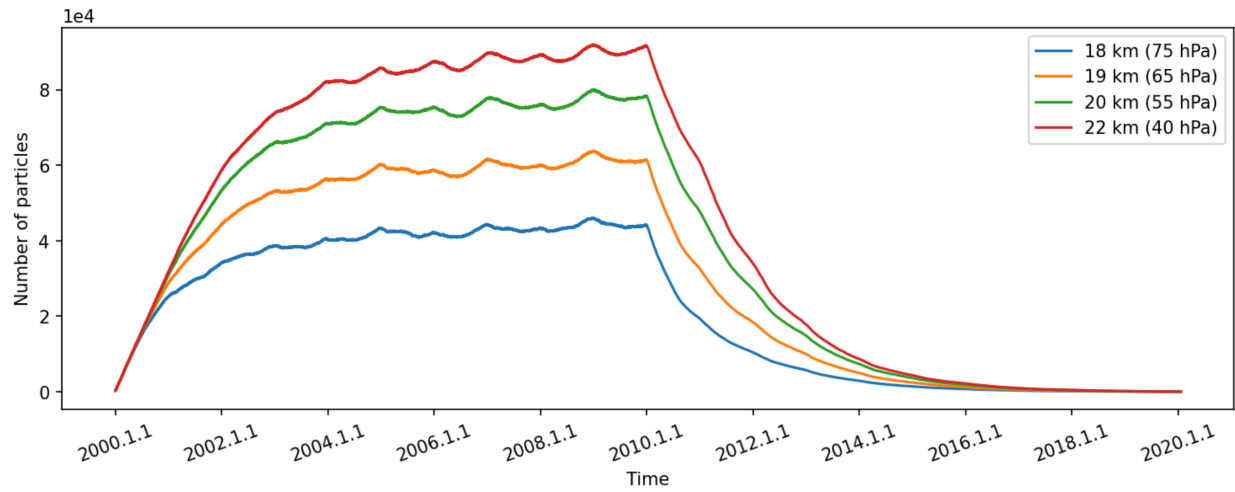
In the simulation, passive particles are injected once every 3 days at 19 km (65 hPa) within the tropical (from 15° S to 15° N in latitude, from -180° to 180° in longitude) stratosphere for 1 month (2000.1.1-2000.2.1). Supplementary Figure 1a (1b) shows the global distribution of percentage of particle number in the stratosphere 1 month after Fine (Coarse) Injection (i.e., 2000.3.1). The special correlation coefficient between Supplementary Figures 1a and 1b is 0.98. Similarly, the particle distribution 1 year after Fine (Coarse) Injection (i.e., 2001.2.1) is compared in Supplementary Figures 2. The special correlation coefficient between Supplementary Figures 2a and 2b is 0.86.



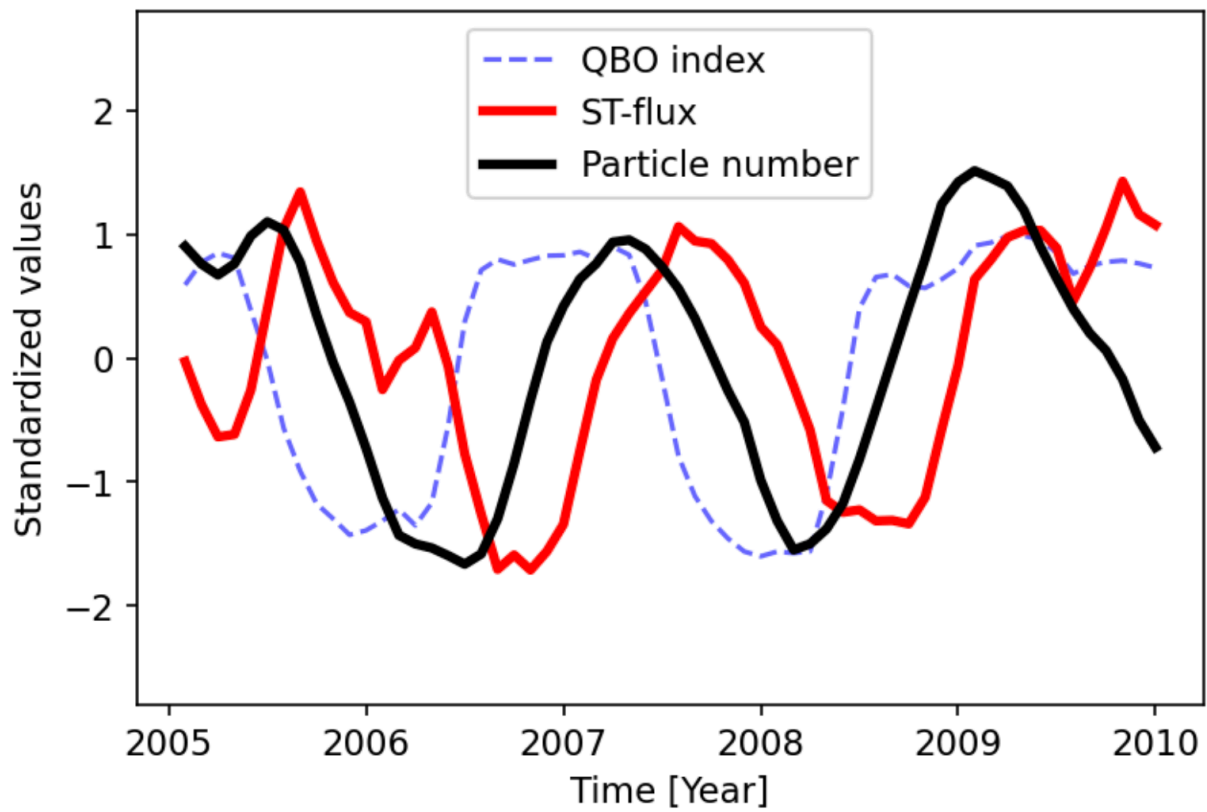
Supplementary Figure 1. Global distribution of percentage of particle number in the stratosphere 1 month after injection (2000.3.1) from Fine Injection (a) and Coarse Injection (b), and (c) shows the zonal mean of (a) and (b).



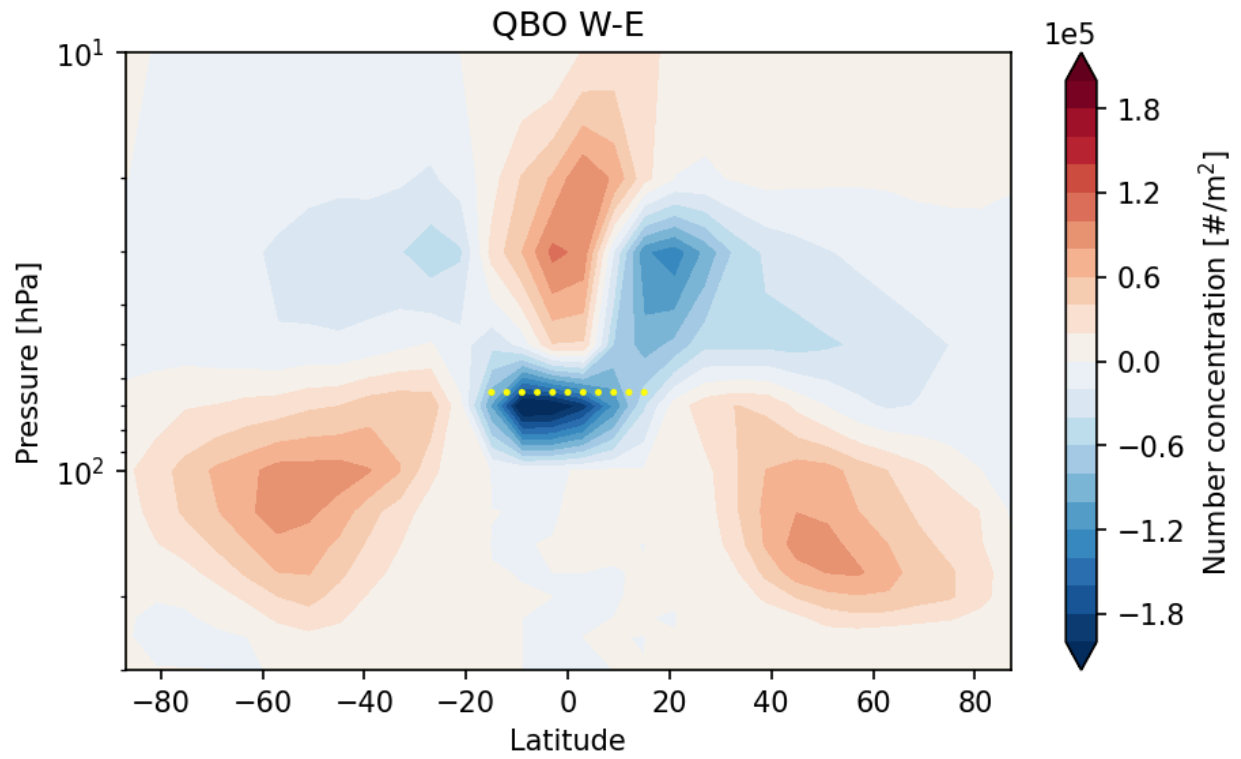
Supplementary Figure 2. Global distribution of percentage of particle number in the stratosphere 1 year after injection (2001.2.1) from Fine Injection (a) and Coarse Injection (b), and (c) shows the zonal mean of (a) and (b).



Supplementary Figure 3. Time series of the total particle number in the stratosphere for injections at 18, 19, 20, and 22 km. Similar to Figure 1.



Supplementary Figure 4. Time series of QBO index, particle number, and ST-flux. Similar to Figure 2b.



Supplementary Figure 5. The differences of particle number concentration (zonally integrated particle number concentration with a unit of particles per square meter ($D_y \times D_z$)) between QBO West and East phases.