Supplementary Information for:

[Understanding Boreal Summer UTLS Water Vapor Variations in Monsoon Regions: A Lagrangian Perspective]

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This file contains Figures S1-S2, which provide supplementary data to support the findings presented in the main manuscript.
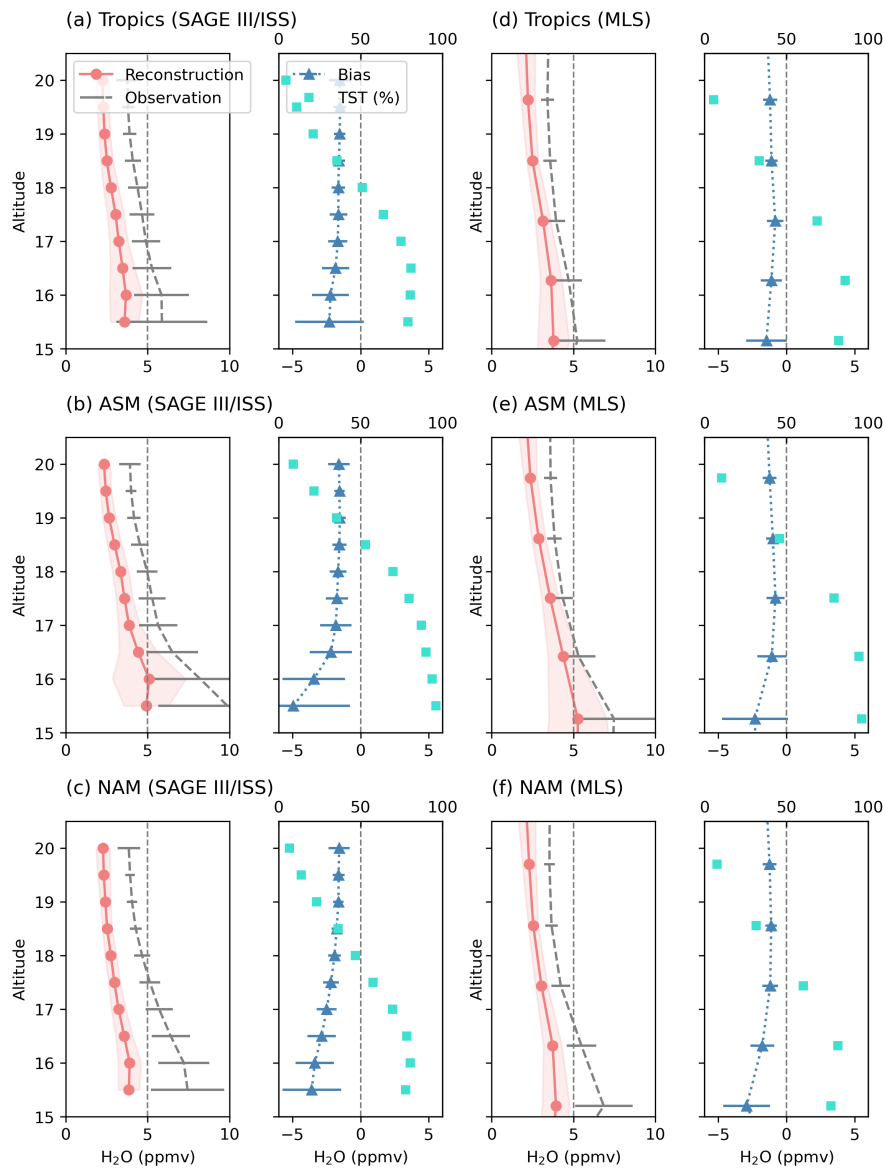
Figure S1. Vertical profiles of water vapor concentrations in August. For each subplot, it shows observed water vapor concentrations (grey dotted lines), reconstructed concentrations (red lines, TST-only), the bias between them (reconstructed values substract observed values, blue lines, lower x-axis), and the percentage of TST trajectories relative to the total number of trajectories (cyan squares, upper x-axis). Upper, middle and lower columns show the averaged values in tropics (35°S-35°N), ASM and NAM, from SAGE III/ISS (left panels) and MLS (right panels).
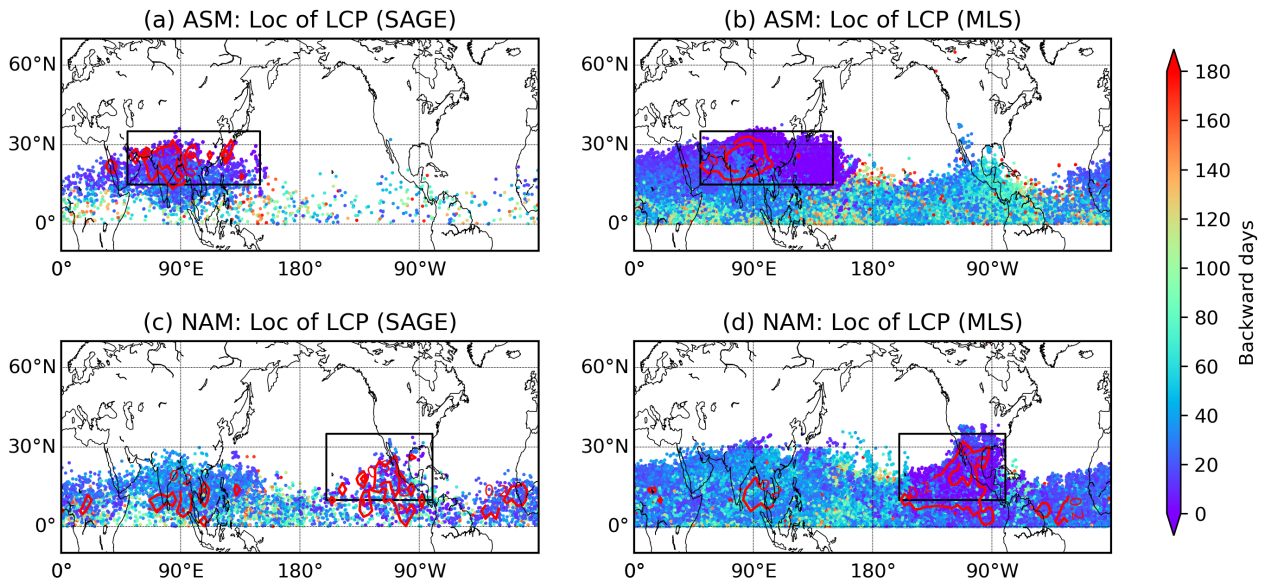
Figure S2. Horizontal distributions of the locations of the Lagrangian cold points (LCPs) used for water vapor reconstruction at 16.5 km derived from Experiment Lag and their probability density functions (PDFs). The locations of the LCPs are shown with colors representing the needed backward time to reach them, with starting points in ASM (a, b) and NAM (c, d). The scatters are plotted in ascending sequence according to the values of reconstructions. The red contour lines in these plots represent the PDFs of the locations with the top 10% highest reconstructed water vapor concentrations (same as the red contour lines in Fig. 5e-h). The left panels show results based on SAGE III/ISS, while the right panels show results based on MLS data. The black boxes indicate the original regions of starting points.