Supplement of

Variable effects of spatial resolution on modeling of nitrogen oxides

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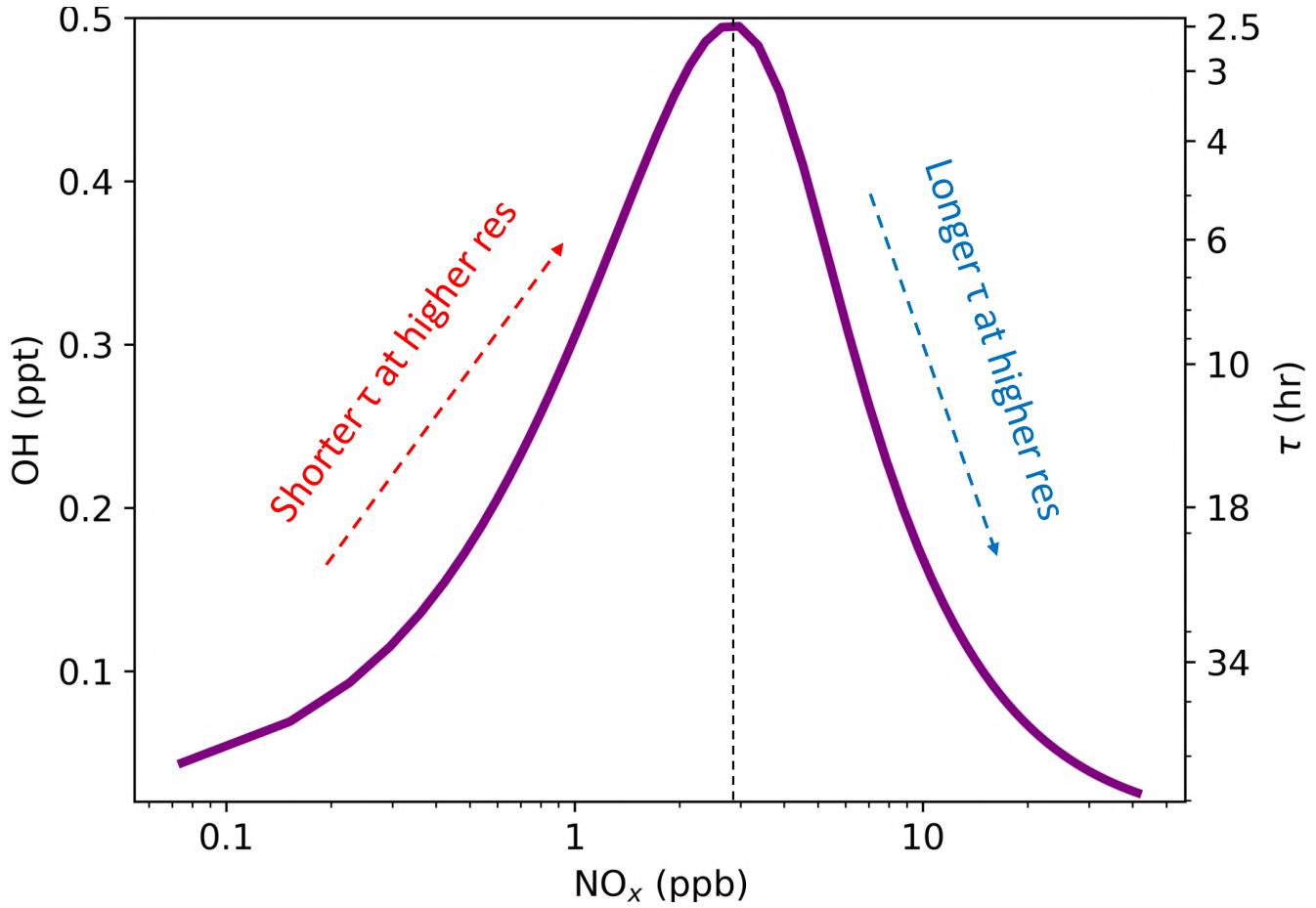

Figure S1. Illustration of the daytime NO_x-OH-lifetime feedback. Higher resolution modeling tends to concentrate the most NO_x emissions near sources, thus will decrease NO_x lifetime in the NO_x-limited regime (left) and increase NO_x lifetime in the NO_x-saturated regime (right). The steady-state concentrations were calculated assuming a NO_2/NO ratio of 4, an alkyl nitrate branching ratio of 0.04, a VOC reactivity of 3 s^{-1}, an initial ozone concentration of 25 ppb, and the production of HO_x is proportional to ozone.

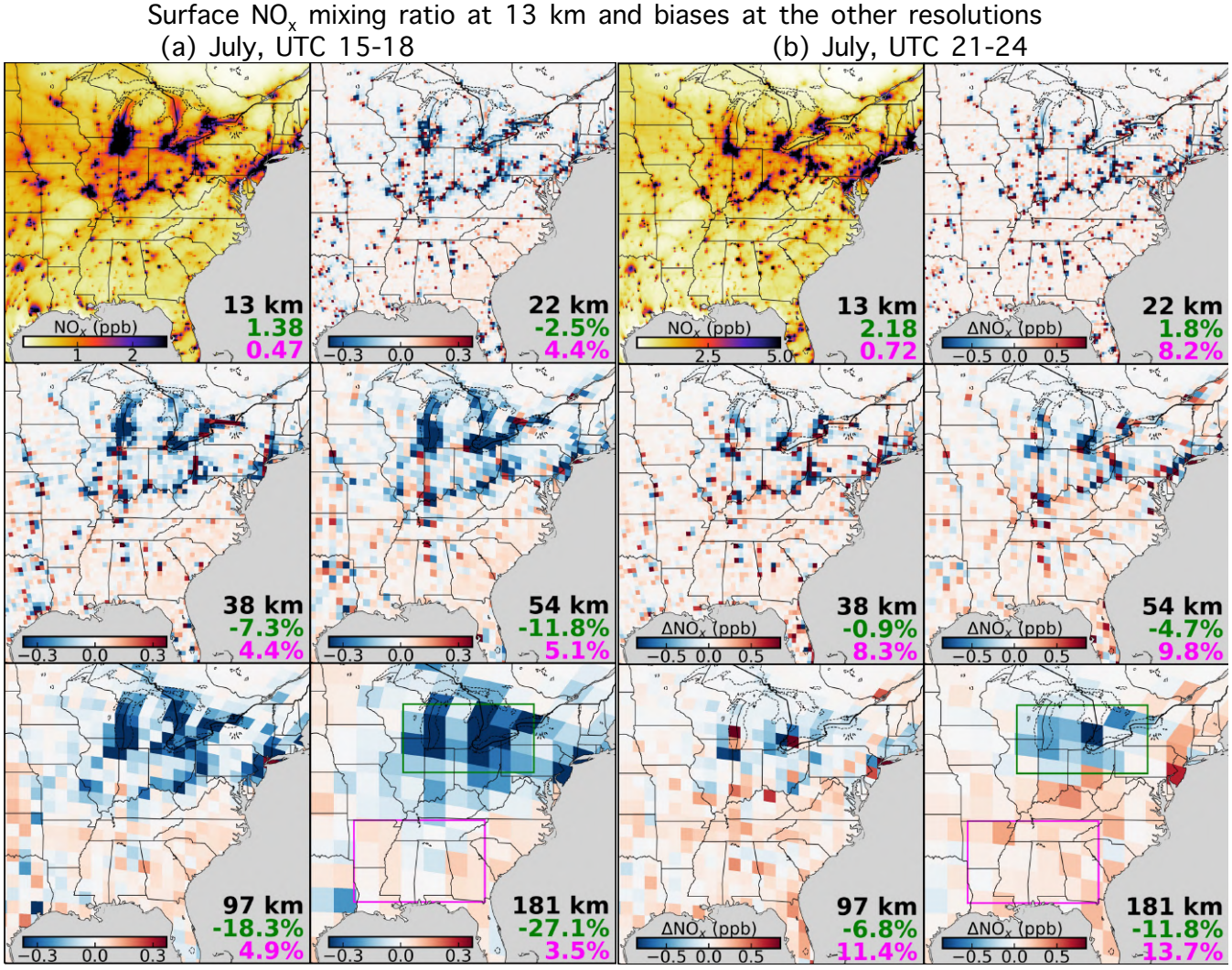

Figure S2. Similar to Figure 1c but for morning (a. UTC 15-18 or CST 9-12) and afternoon (b. UTC 21-24 or CST 15-18), respectively.

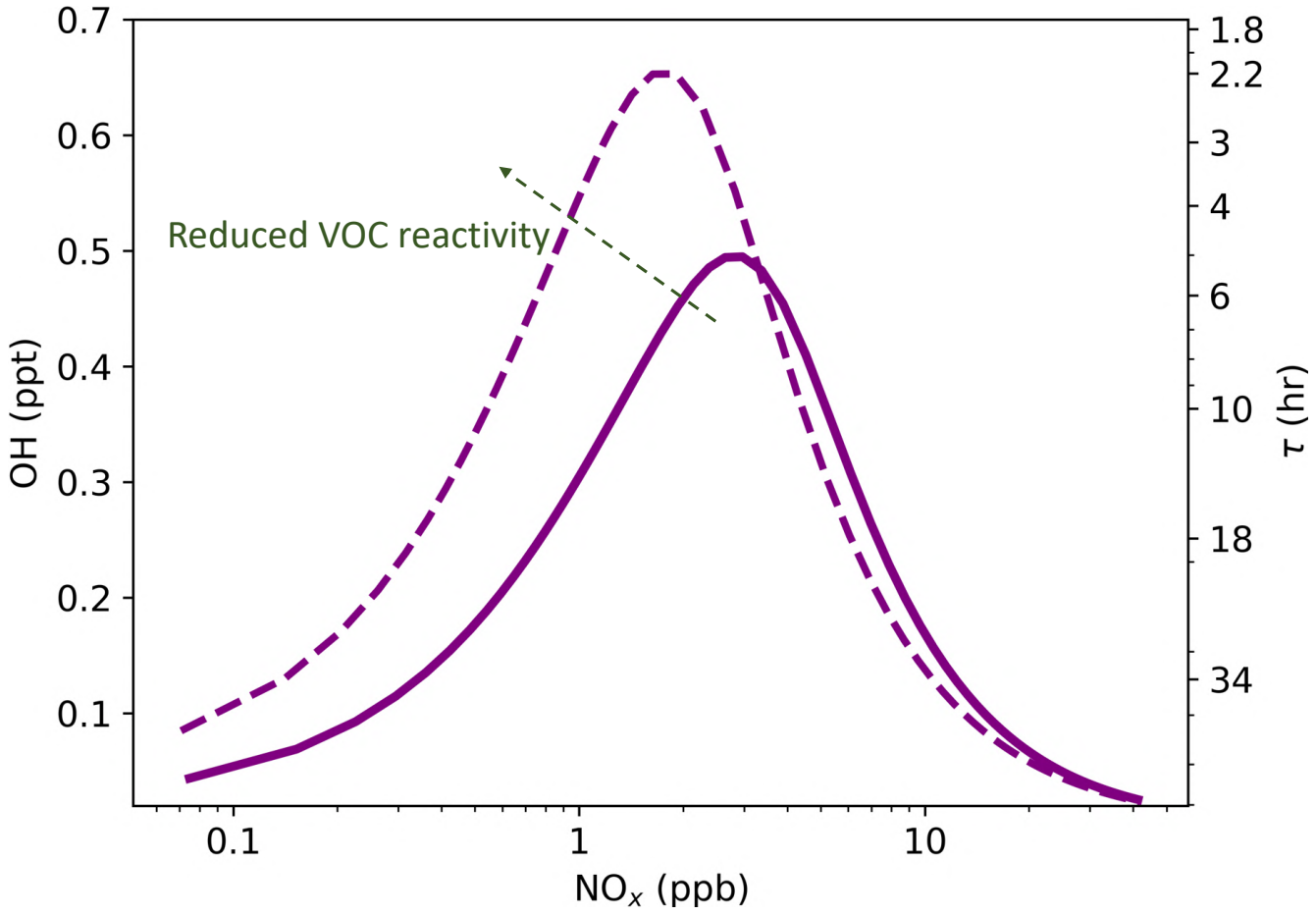

Figure S3. As in Figure S1 but including an additional scenario where the VOC reactivity is reduced by 50% (dashed).

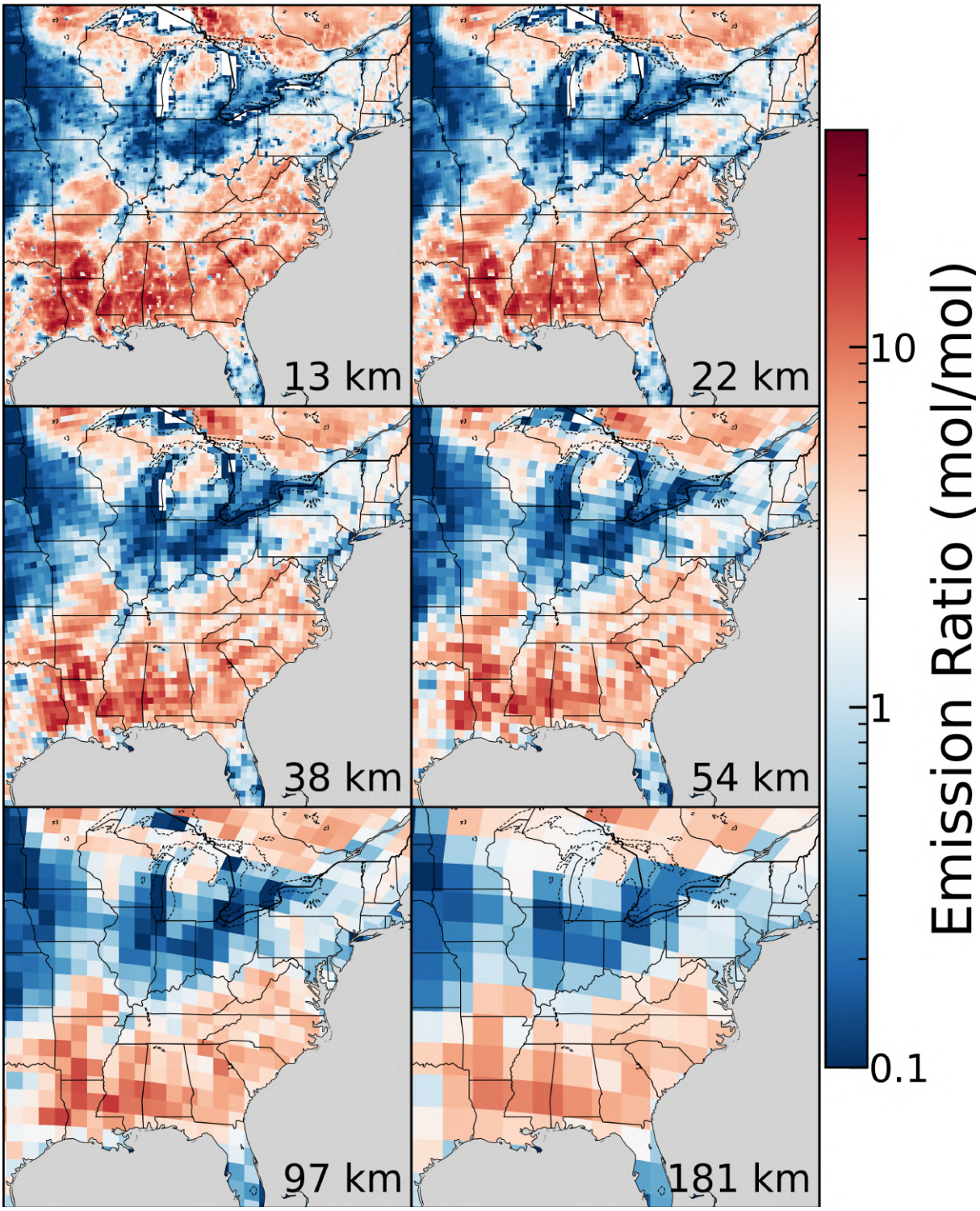

Figure S4. Similar to Figure 1a but including all the six resolutions.

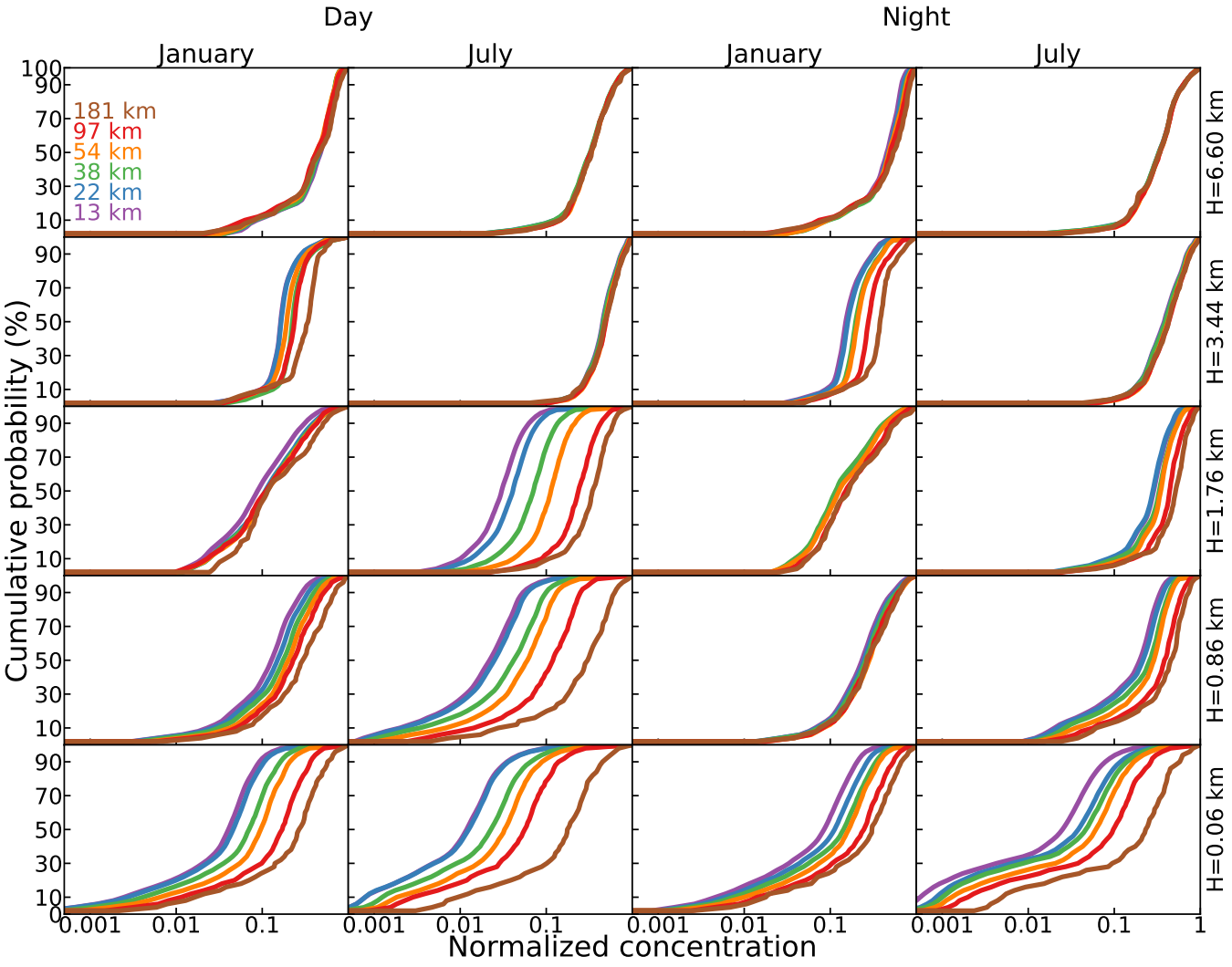

Figure S5. Cumulative histogram of simulated NO_x concentration (normalized to 0-1) at different altitudes (rows, each corresponding to the 1st, 7th, 13th, 19th and 25th layer of GEOS-Chem) and resolutions (colors) within the eastern US domain. The NO_x spatial heterogeneity is reduced at coarser vs. finer resolutions, at colder vs. warmer seasons, at higher vs. lower altitudes, and at nighttime vs. daytime.

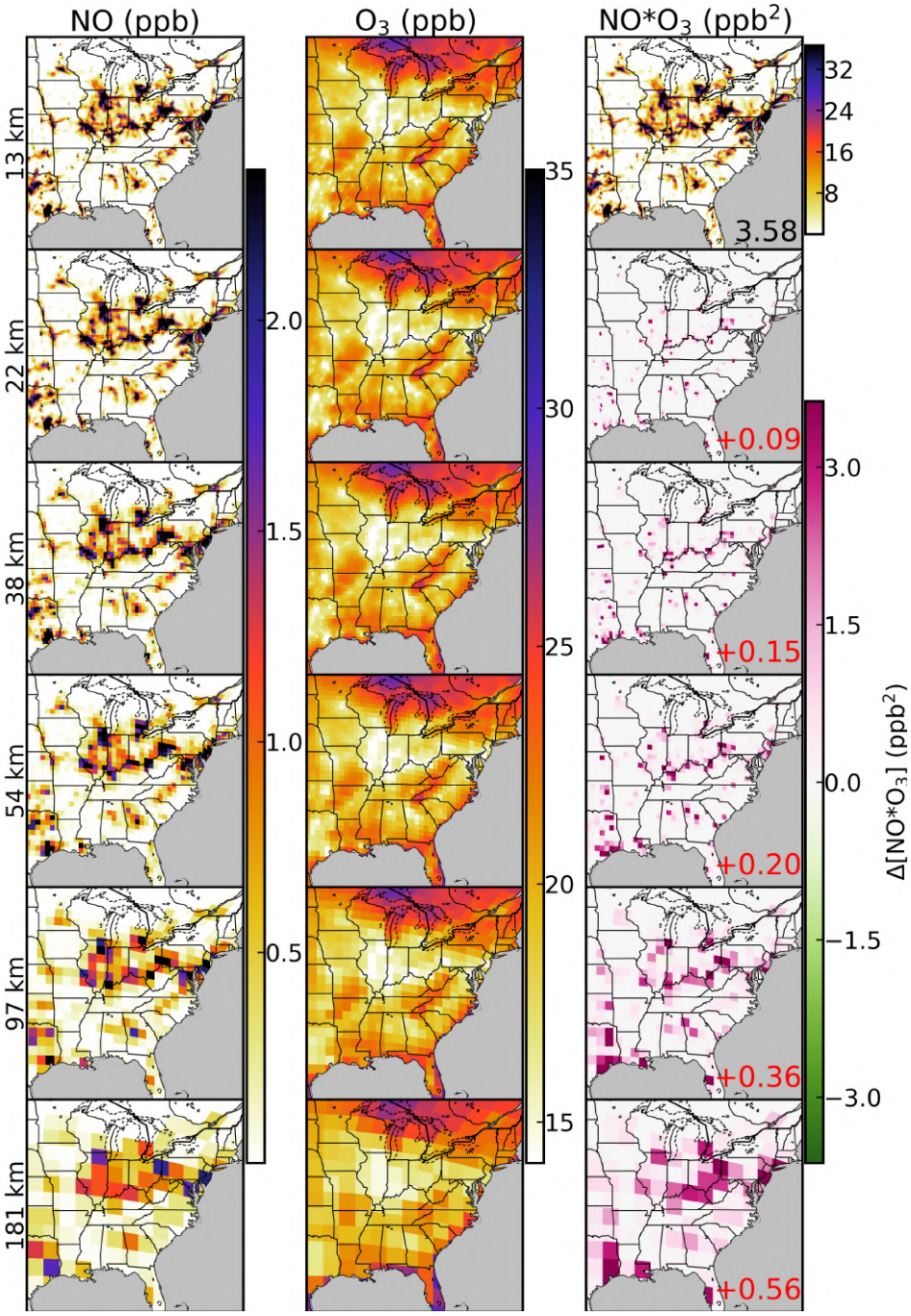

Figure S6. Illustration of the resolution-dependent nighttime NO-O_3 titration efficiency. Left and middle panels are mean surface NO and O_3 concentration at UTC+6 in January 2015, at 13 km (uppermost panels) and regridded to the other resolutions. The rightmost panels show their products at 13 km resolution, and differences if calculated at the other coarser resolutions. Domain-mean products and differences are inset.

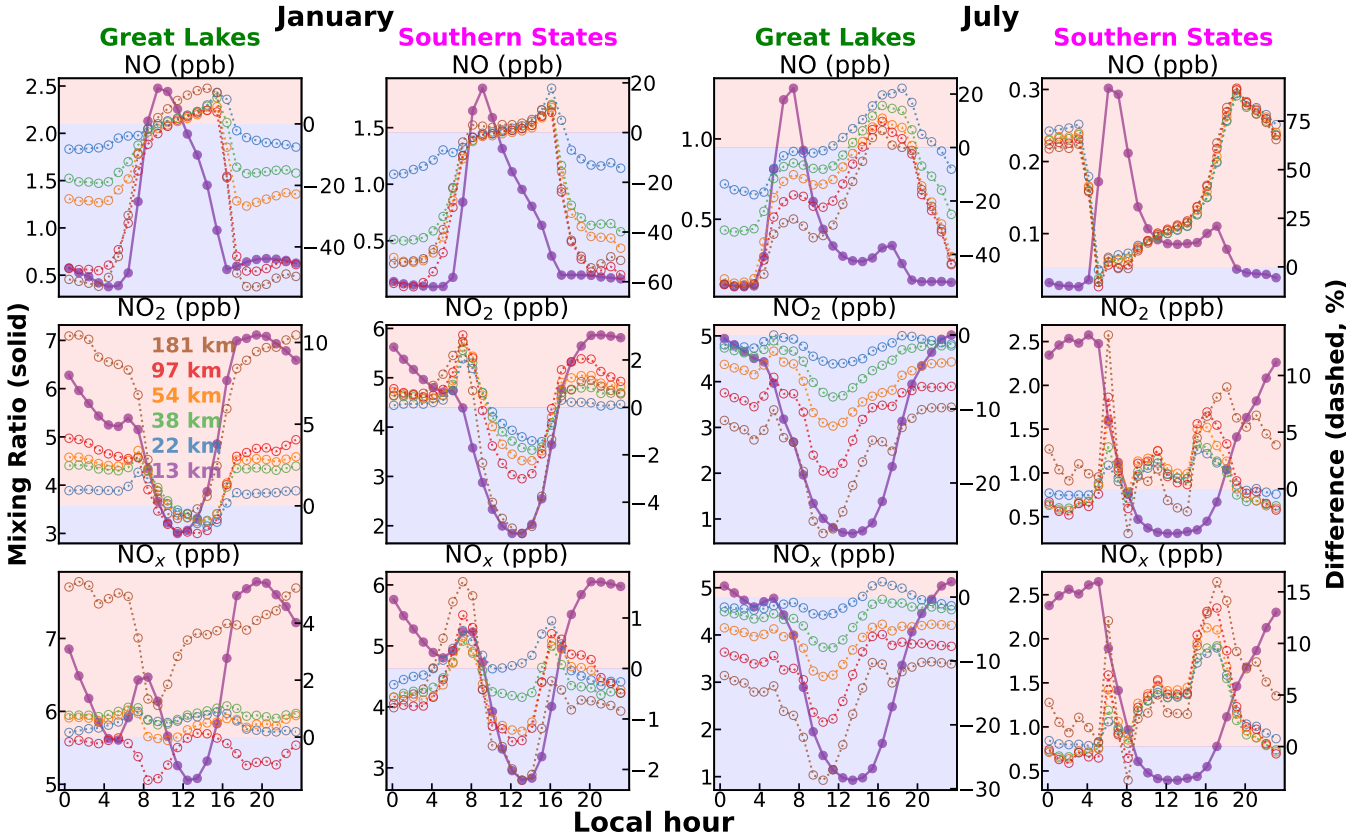

Figure S7. Similar to Figure 3 but for surface NO, NO_2 and NO_x.

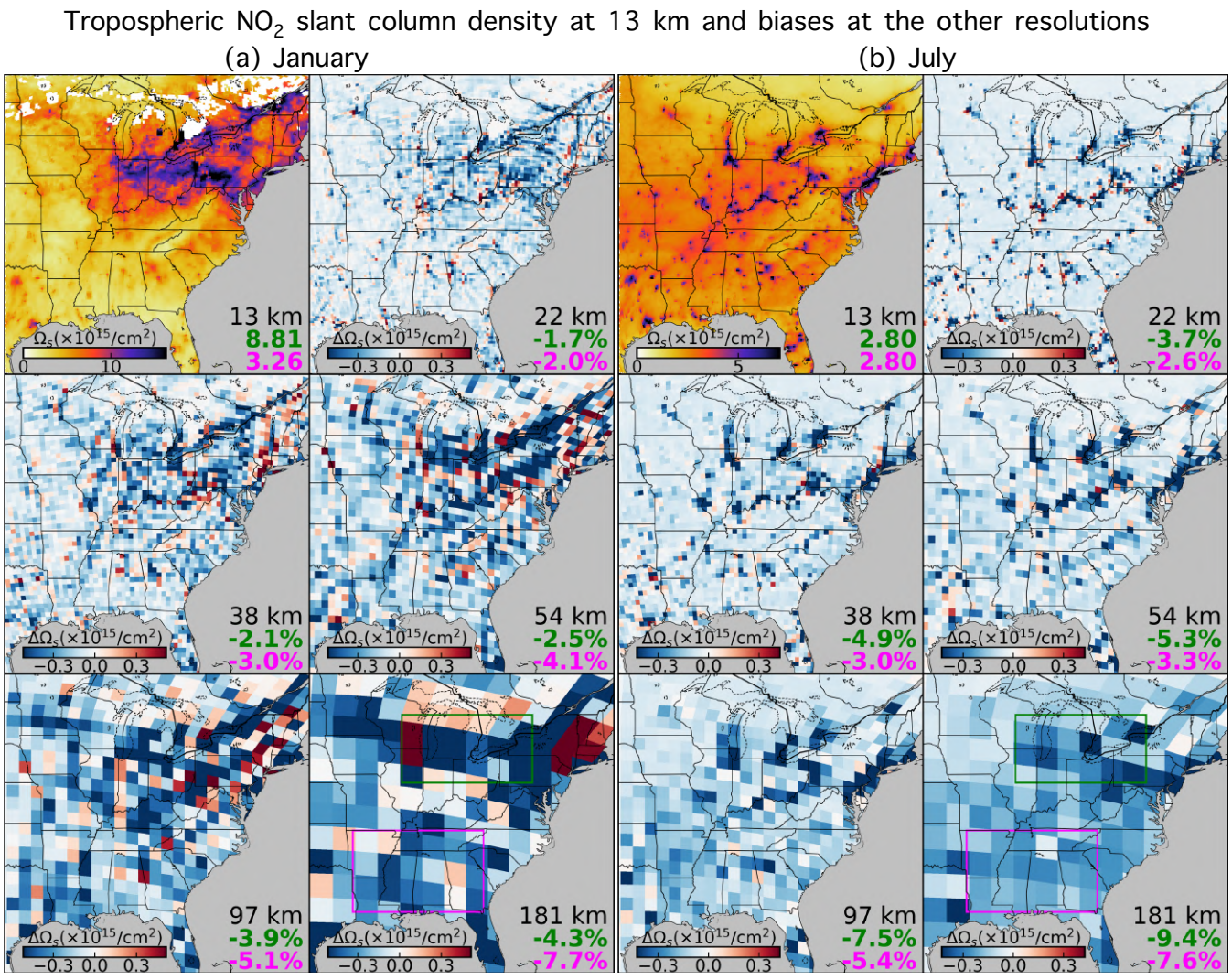

Figure S8. Similar to Figure 7 but for slant column density (Ω_s, molecules/cm^2) calculated from GEOS-Chem NO_2 mixing ratios and scattering weights corresponding to TROPOMI observations. The small blank (white) areas in January have no available TROPOMI retrievals under clear sky and snow-free conditions.