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Biogenic isoprene emissions driven by regional weather predictions using different initialization methods: case studies during the SEAC^{4}RS and DISCOVER-AQ airborne campaigns

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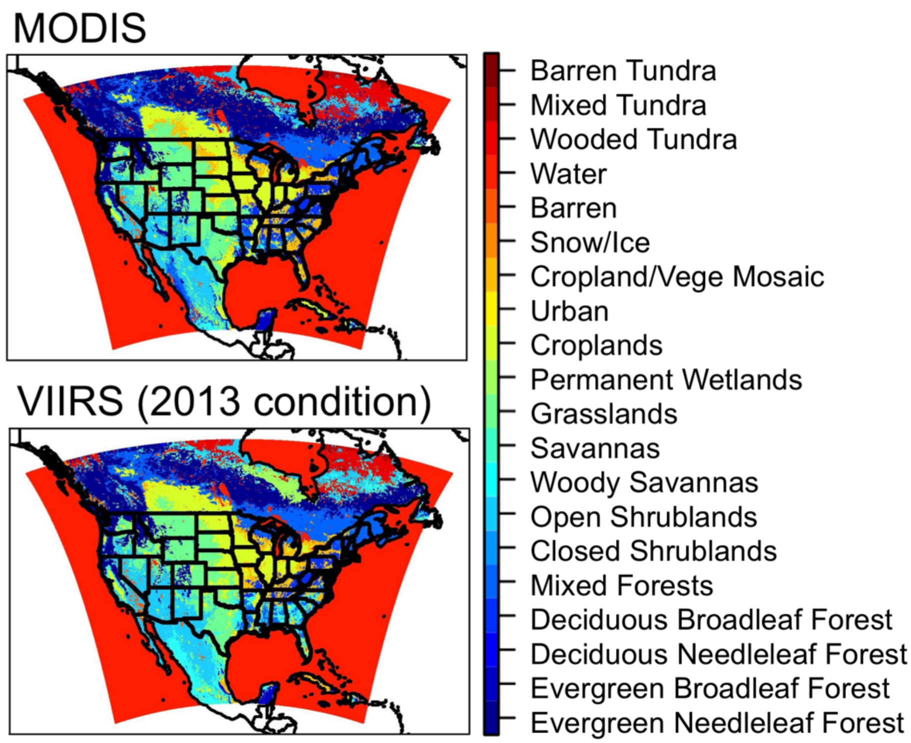

Figure S1: International Geosphere-Biosphere Programme-modified 20-category (upper) MODIS and (lower) Visible Infrared Imaging Radiometer Suite (VIIRS) grid-dominant land use/land cover types, shown on the 12 km NUWRF grid. The MODIS option was used in this study, and the VIIRS option is under test.

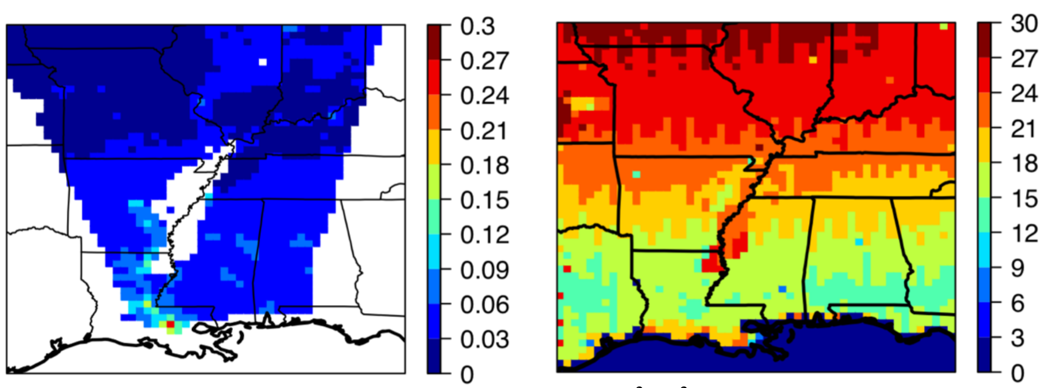

Figure S2: (left) Surface soil moisture uncertainty (in m^3/m^3) from the 0.25°×0.25° CCI product, on 11 September, 2013. It is defined as the standard deviation of the satellite observations. (right) Size (number of days) of usable soil moisture data in September 2013 from the CCI product.

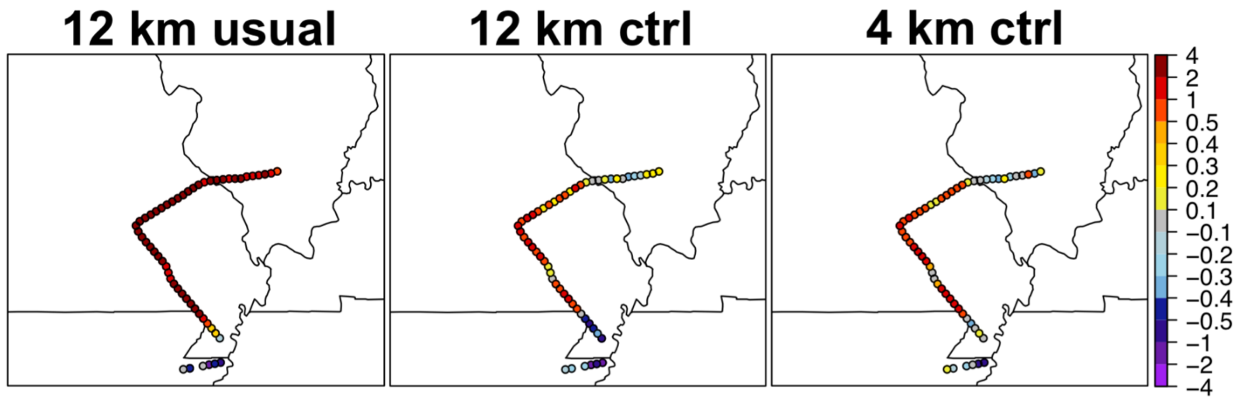

Figure S3: Air temperature biases (in °C) along the DC-8 flight path at near 13 local standard time on 11 September, from (left) the 12 km usual run; (middle) the 12 km ctrl run; and (right) the 4 km ctrl run.

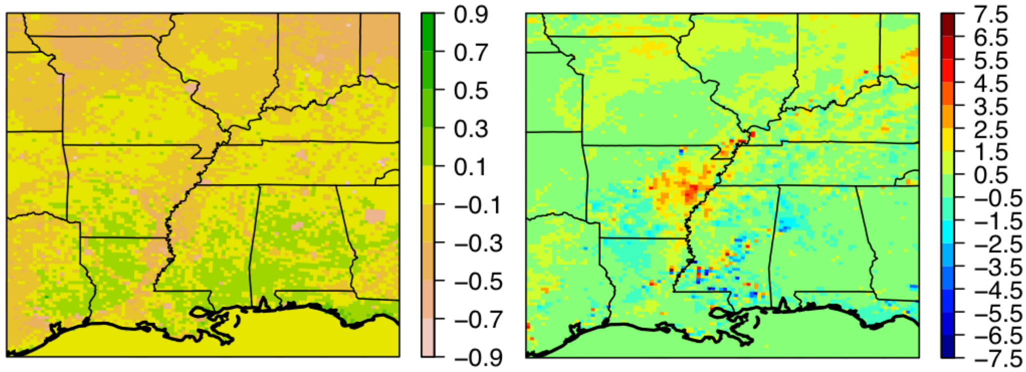

Figure S4: (left) The difference between daily near real-time GVF and the climatological monthly-mean GVF on 11 September, shown on the 12 km model grid, and (right) the resulting differences in NUWRF usual runs (12 km usual_veg-12 km usual, as defined in Table 1) surface air temperature in °C at 13 local standard time on this day.

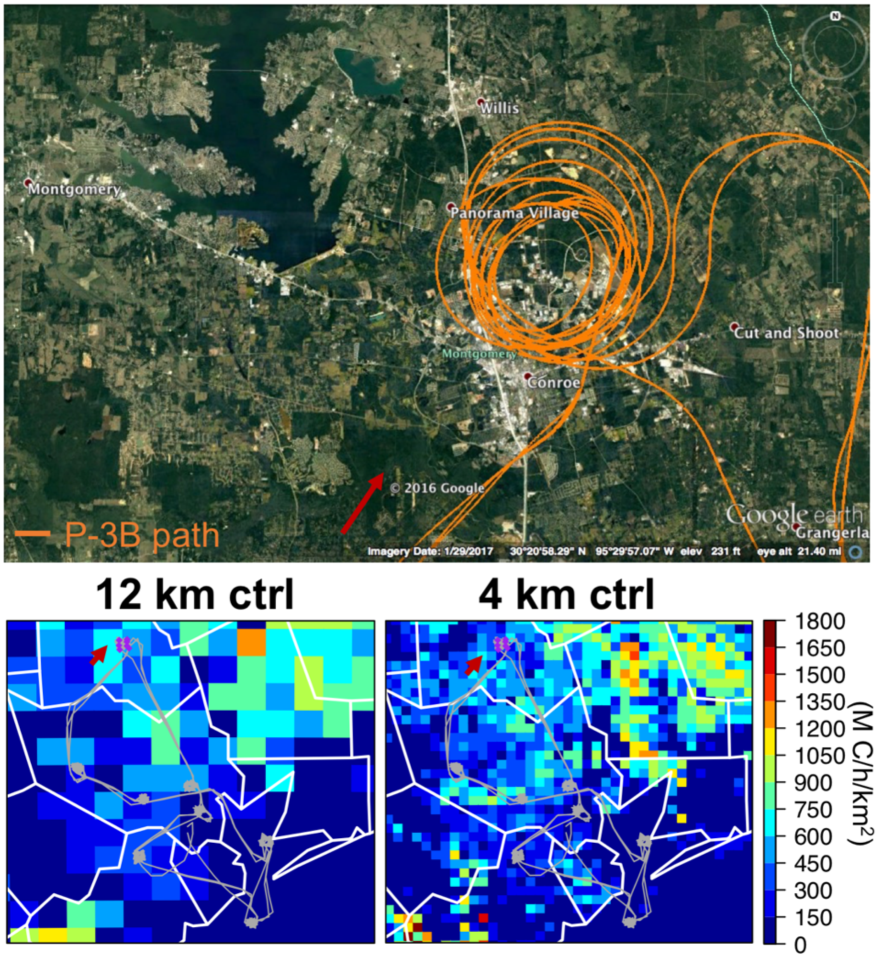

Figure S5: Illustration of how representation error (i.e., due to different data resolutions) and the neglect of horizontal transport in deriving emissions from aircraft data affected the discrepancies among 12 km, 4 km NUWRF- and aircraft-derived emissions, on 11 September, 2013. Multiple P-3B aircraft data points correspond to several NUWRF model grids, and the averaged NUWRF-MEGAN emissions were used in the comparisons. The bottom panels (adapted from Figure 6b of the manuscript) show that for the grids collocated with the west side of the aircraft spiral (built-up land as indicated in the upper panel Google image), 4 km emissions are significantly lower than 12 km emissions. In the forestal/agricultural areas (highlighted by red arrows) southwest to the spiral, 4 km and 12 km emissions are similar. It is very likely that higher emissions are from regions outside the spiral as the 4 km results indicate, and they were transported to the aircraft-sampled regions. On the 12 km grid, spatial variability of the emissions is not well distinguished, in part due to the failure of accurately representing the sharp change in land cover type at this resolution. The impact of horizontal transport does not appear to be evident. Therefore, we see smaller discrepancies between the modeled and observation-derived.

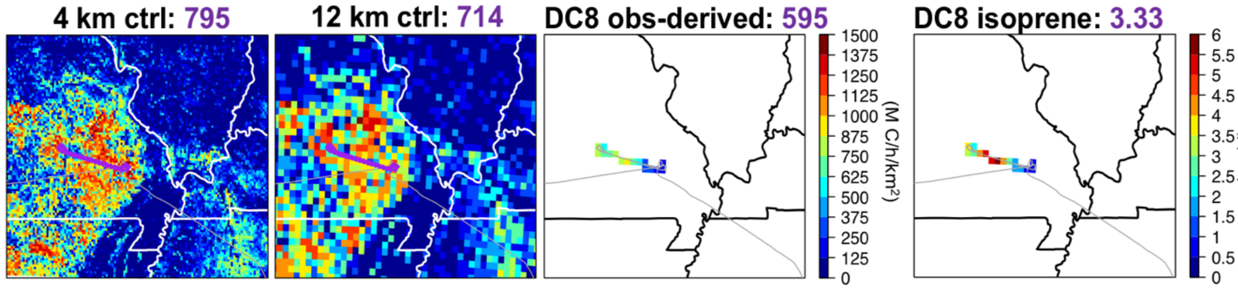

Figure S6: (Left three columns) Isoprene emissions around the "isoprene volcano" areas in Missouri from NUWRF-MEGAN at 14 local standard time and aircraft observations on 06 September, 2013. The mean values along the DC-8 flight path during 13:20-14:30 local standard time (when aircraft observations were made along four West-East transects) are indicated in purple in the figure captions. (Right column) Observed isoprene concentrations in ppbv along the DC-8 flight path during 13:20-14:30 local standard time, with the mean values shown in the figure captions. The observations and observation-derived isoprene emissions were averaged to the 12 km NUWRF grid for the plots. The 12 km ctrl NUWRF-MEGAN isoprene emissions overall have a slightly lower positive mean bias (~20%) from the observation-derived emissions than the 11 September result (~26%), whereas the positive biases of 4 km ctrl NUWRF-MEGAN emissions (~34%) are larger than the 11 September result (~22%). The largest overprediction occurs near the east side of the transects, where the biases are higher in the 4 km case than in the 12 km case. These biases are also shown by Wolfe et al. (2015) in their MEGAN emissions computed using a different meteorological input.