

**Figure S1.** HCHO vertical column densities over the NOMADSS aircraft campaign (C2). The upper panel shows data from OMI SAO HCHO product. The bottom panel shows GEOS-Chem model results sampled according to OMI's schedule (see text), and scaled to correct for the bias relative to aircraft measurements (Figure 3). OMI and GEOS-Chem results are regridded onto the  $0.5^\circ \times 0.5^\circ$  grids. The green rectangles represent the study domain (as shown in Figure 1), which is also defined in Table 1. Grids marked with black open circles are sampled by the aircrafts (*i.e.*, intercepted with flight tracks in Figure 1).

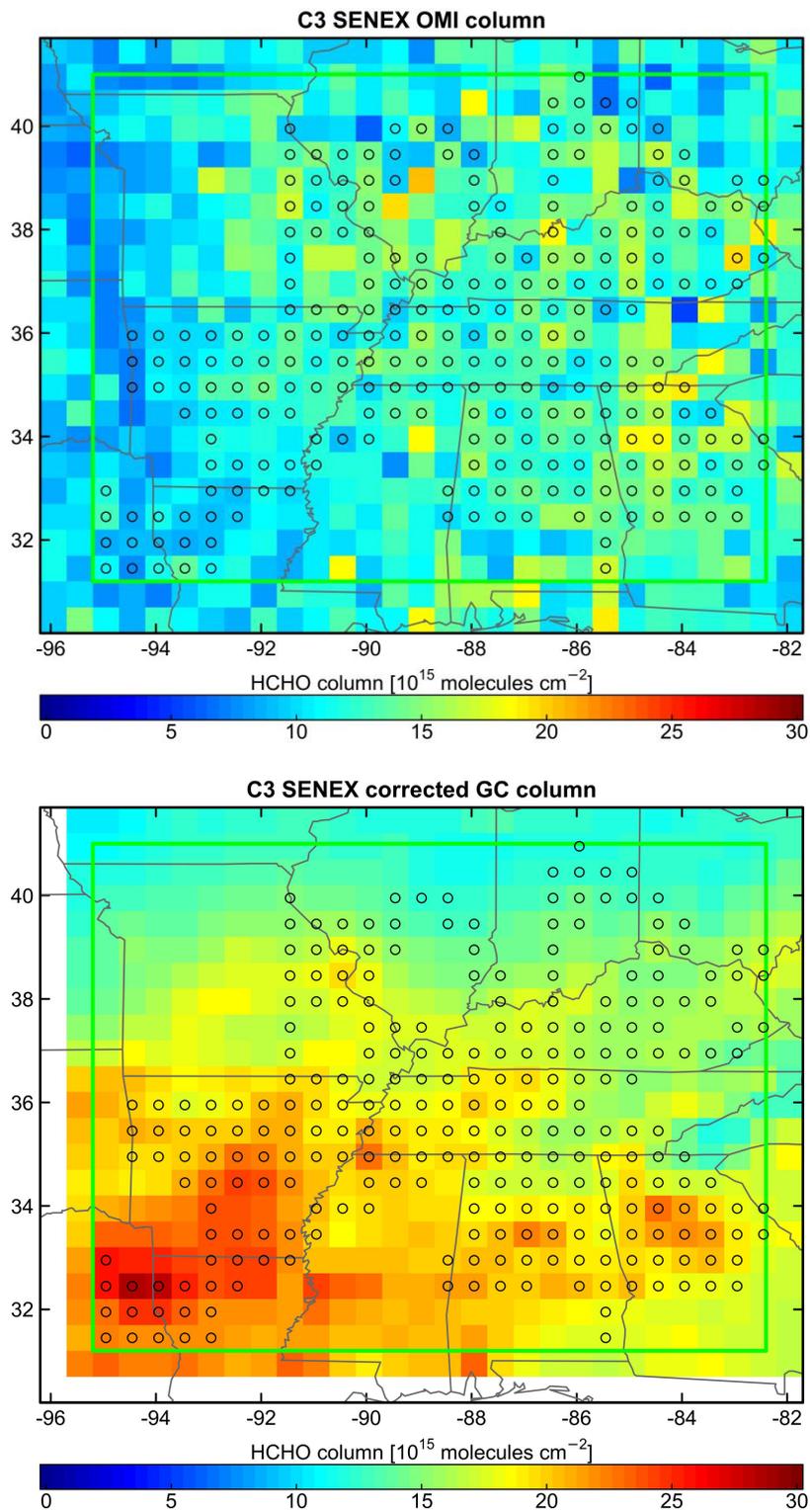
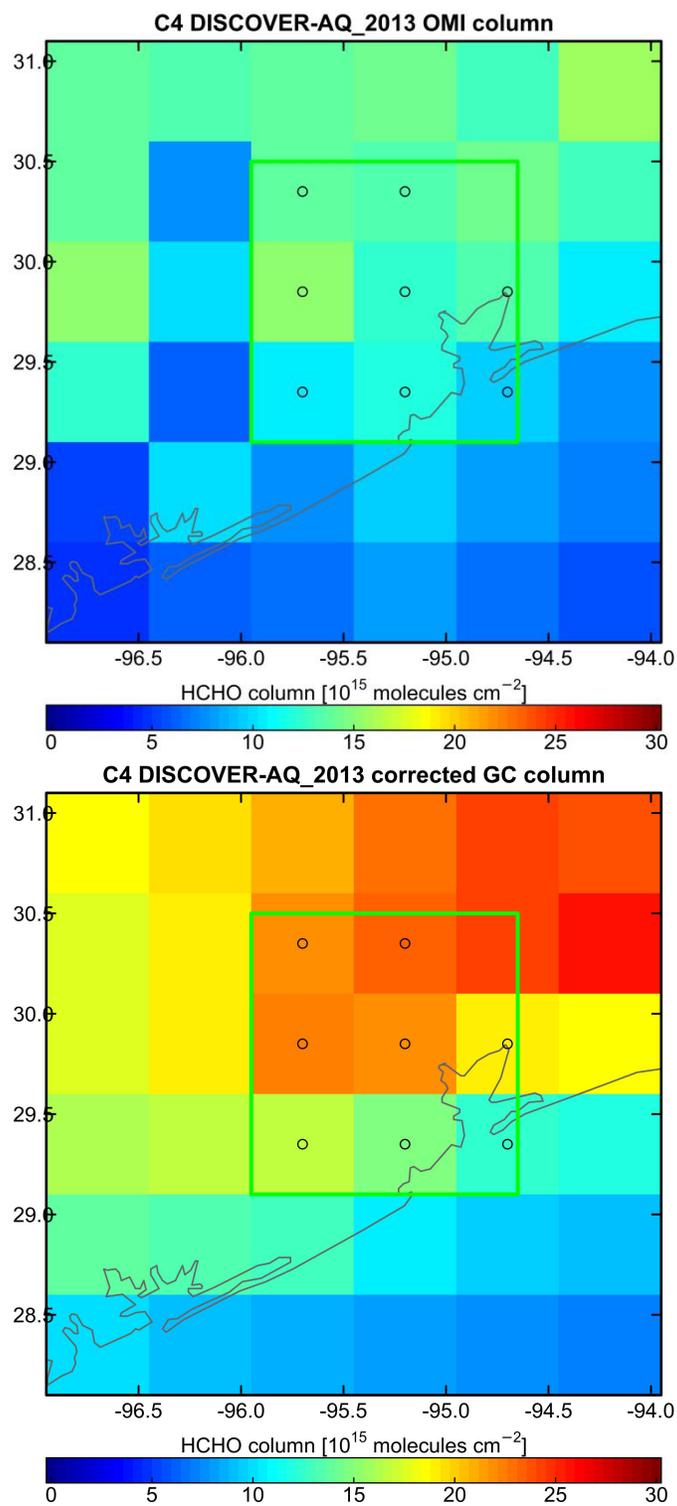
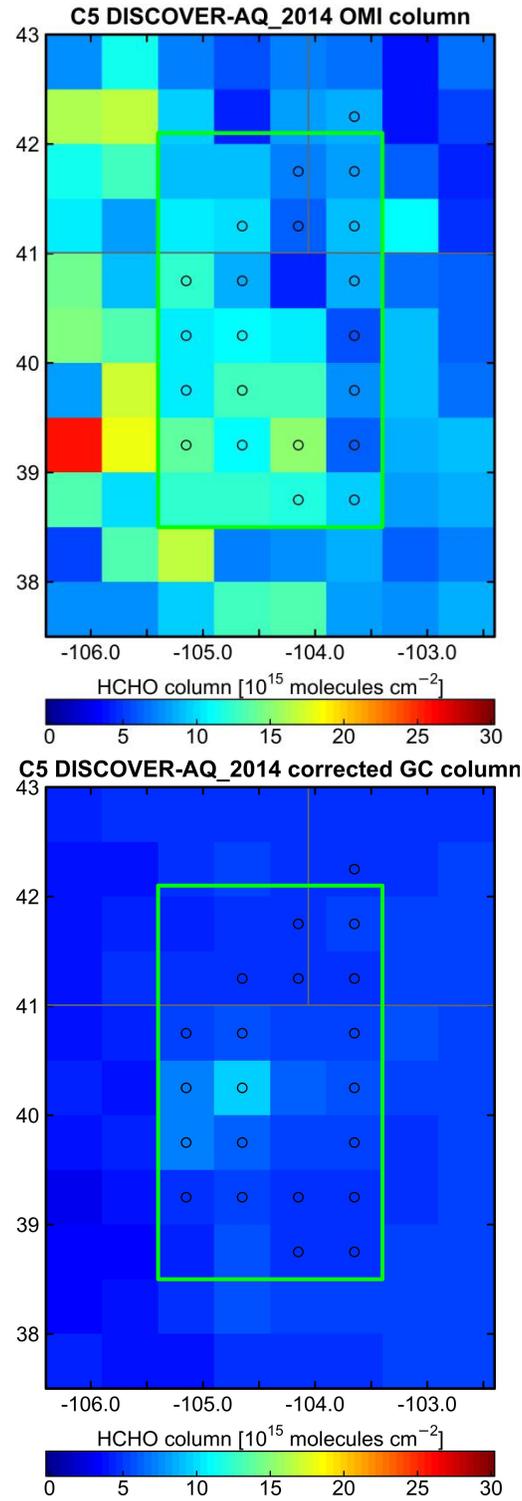


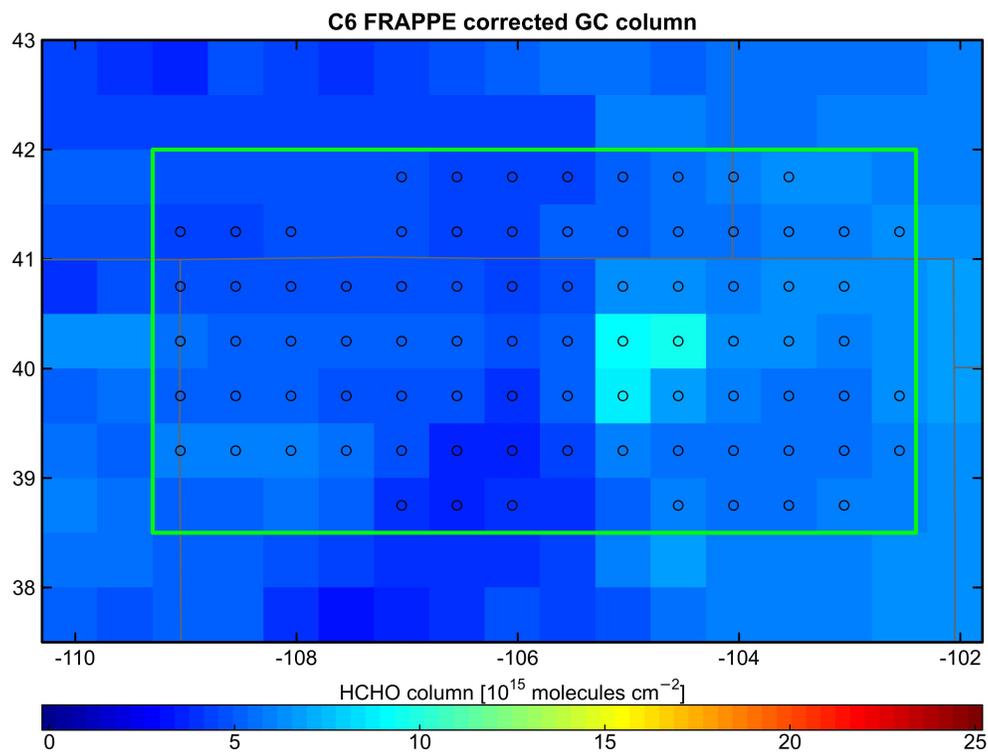
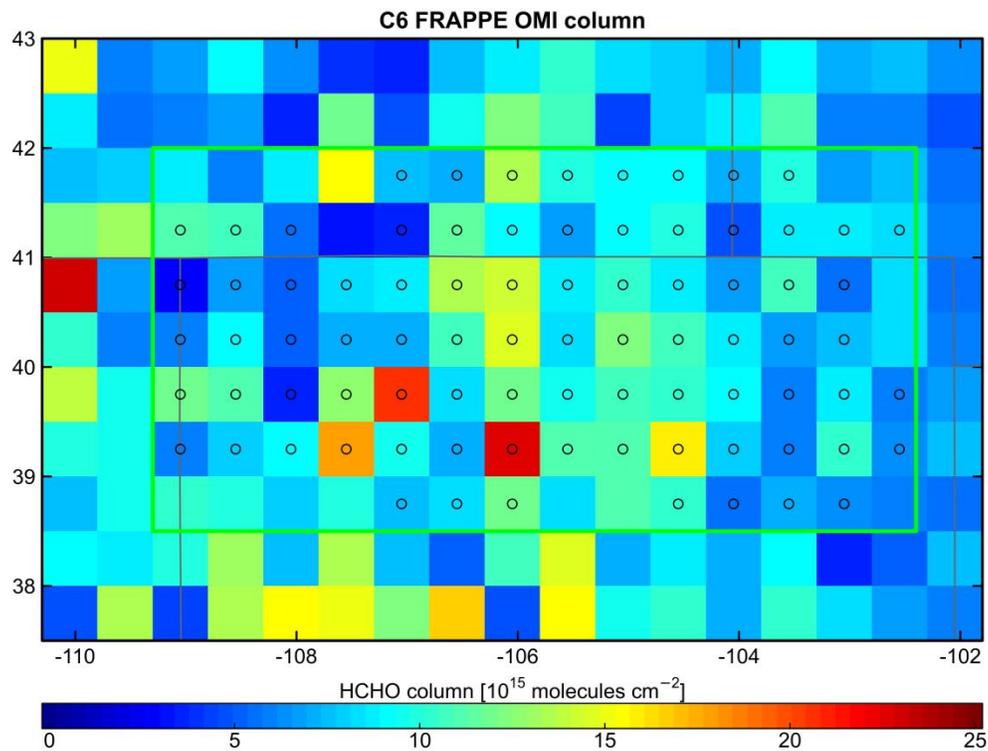
Figure S2. Same as Figure S1, but for the SENEX aircraft campaign (C3).



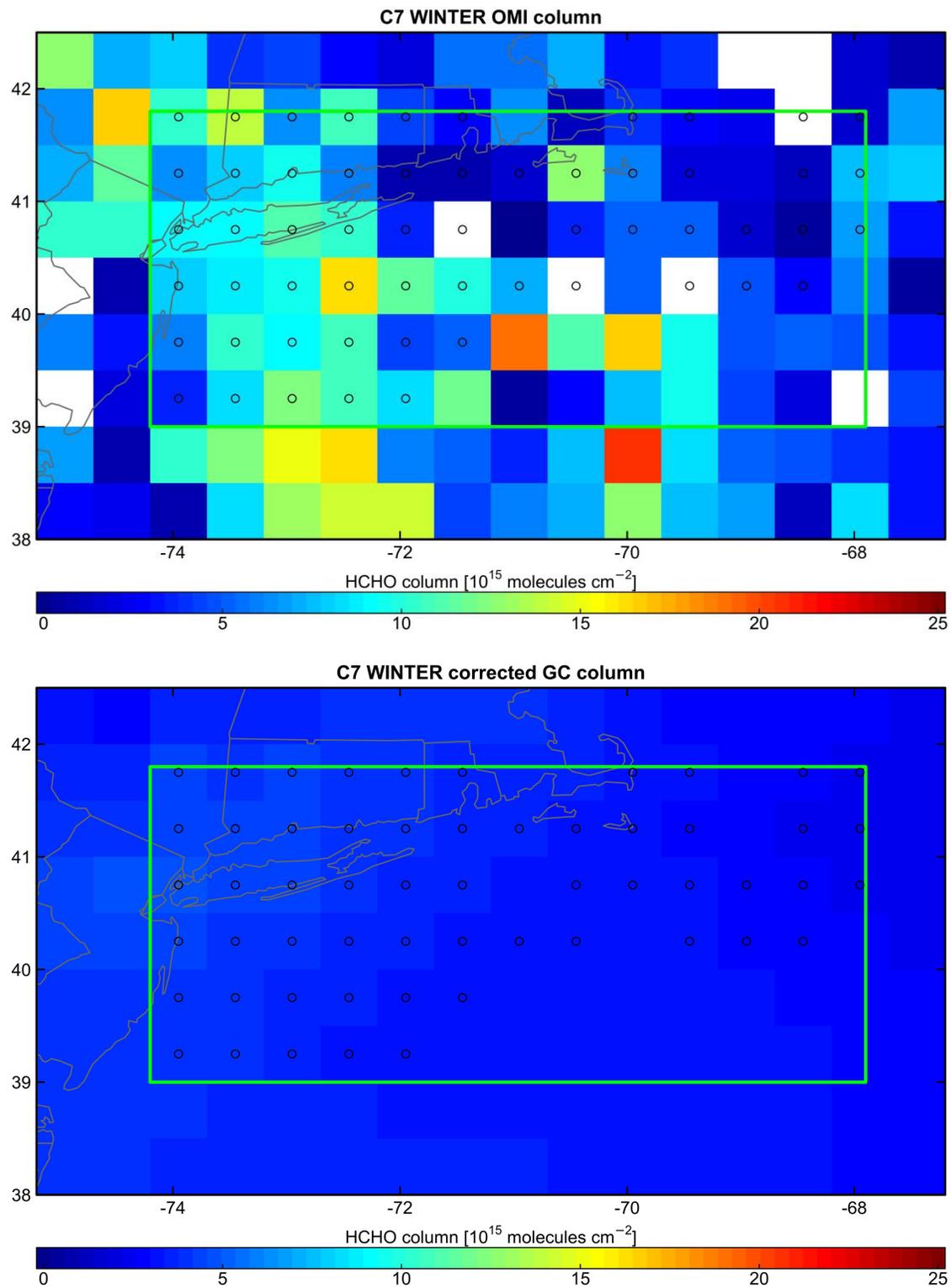
**Figure S3.** Same as Figure S1, but for the DISCOVER-AQ Texas 2013 aircraft campaign (C4).



**Figure S4.** Same as Figure S1, but for the DISCOVER-AQ Colorado 2014 aircraft campaign (C5).



**Figure S5.** Same as Figure S1, but for the FRAPPÉ aircraft campaign (C6).



**Figure S6.** Same as Figure S1, but for the WINTER aircraft campaign (C7).

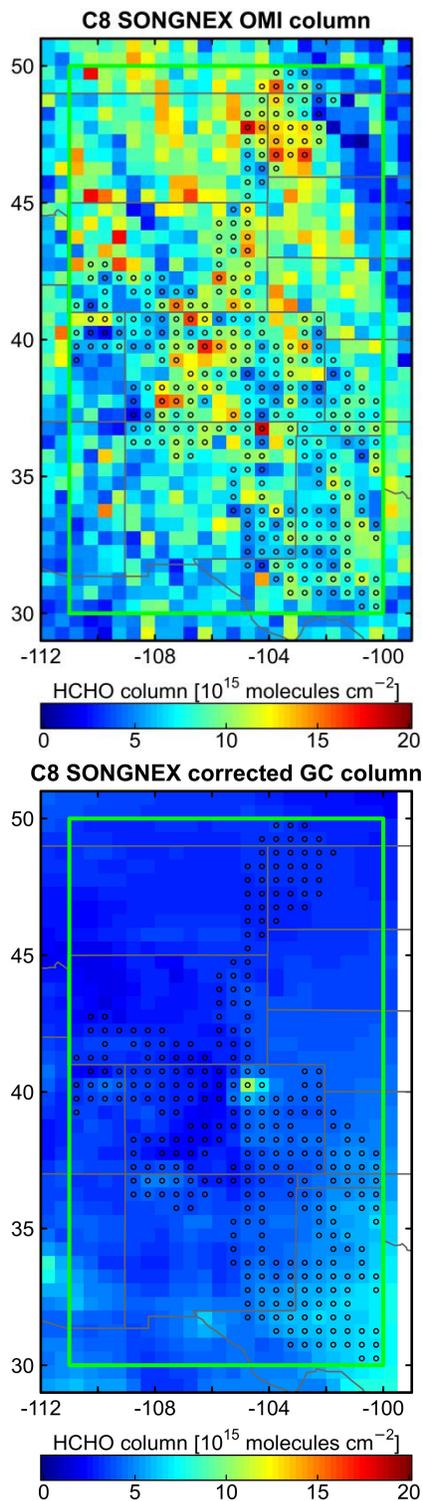


Figure S7. Same as Figure S1, but for the SONGNEX aircraft campaign (C8).

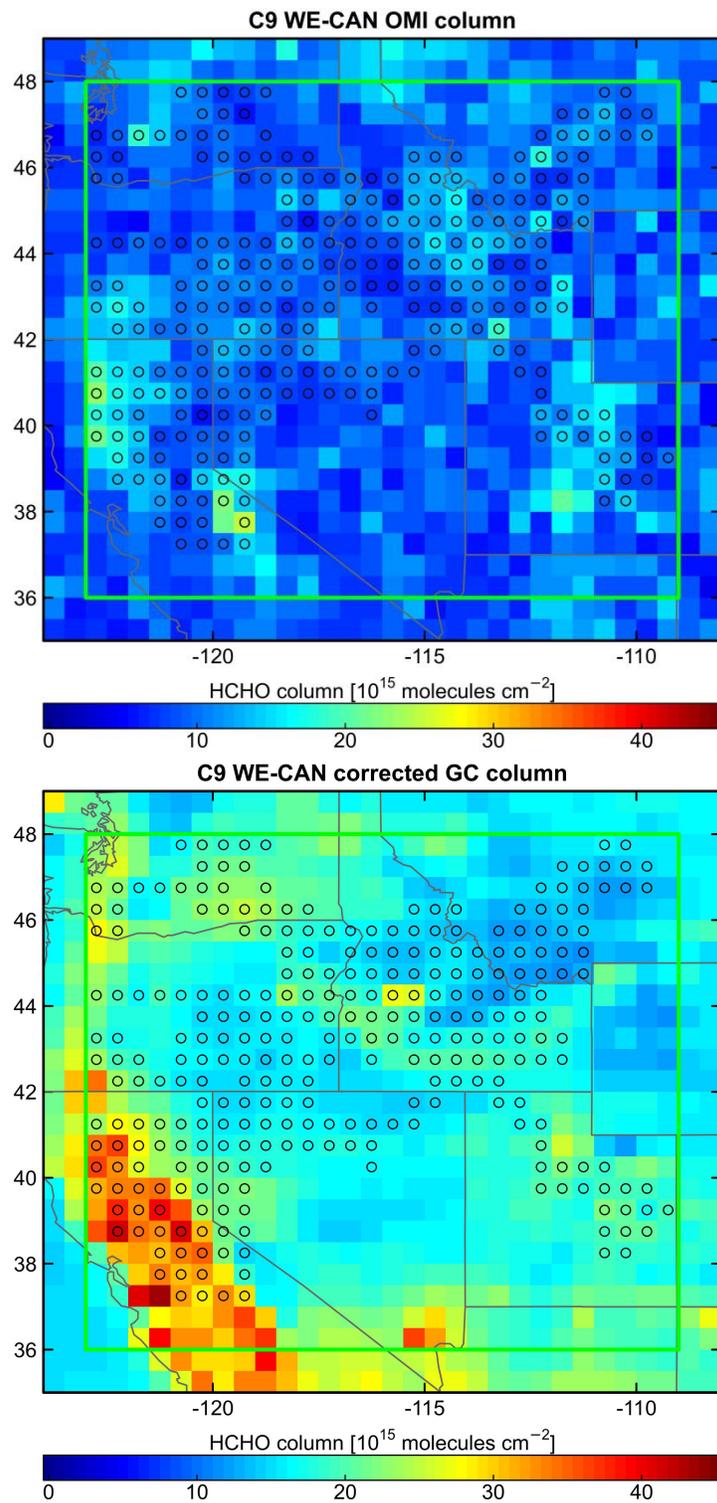
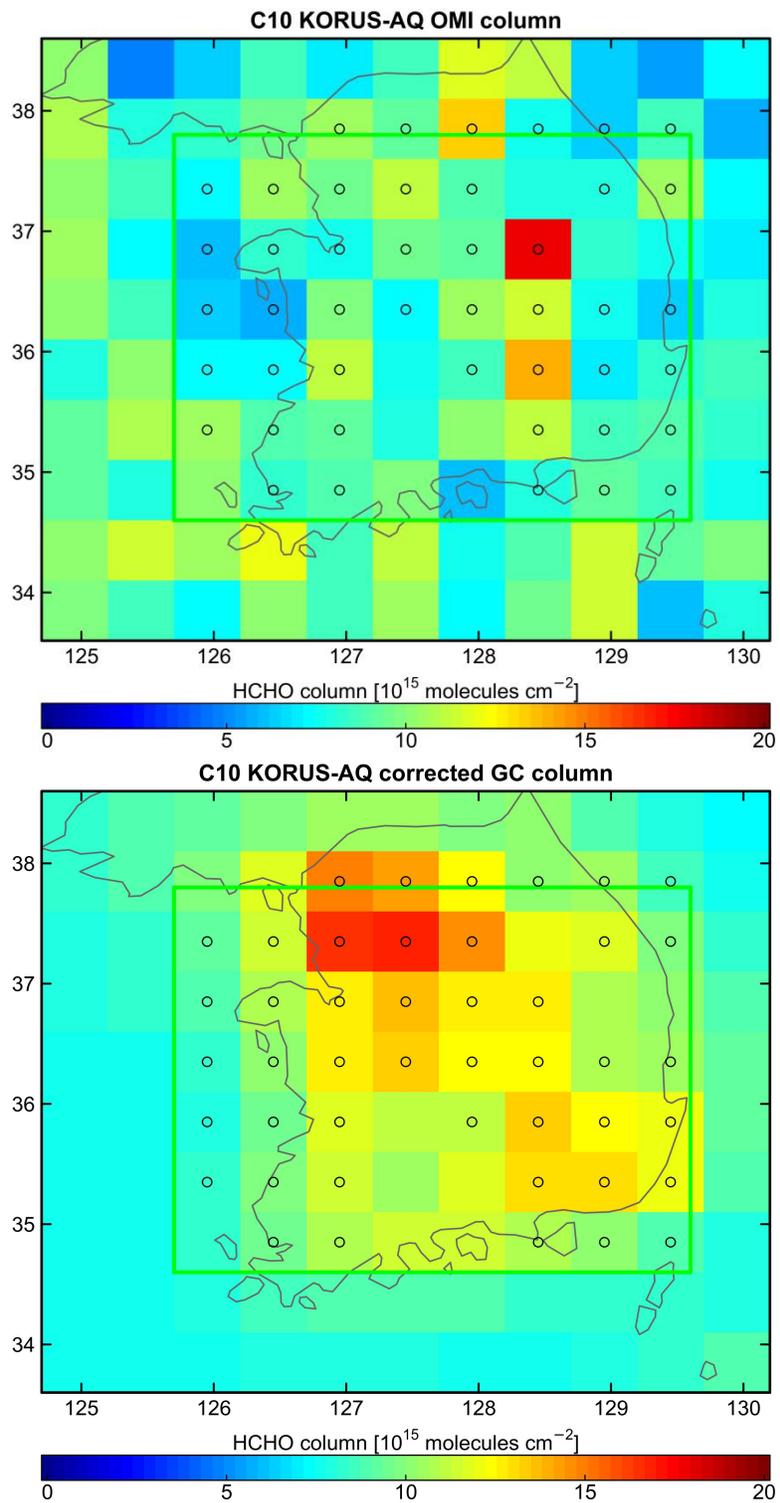
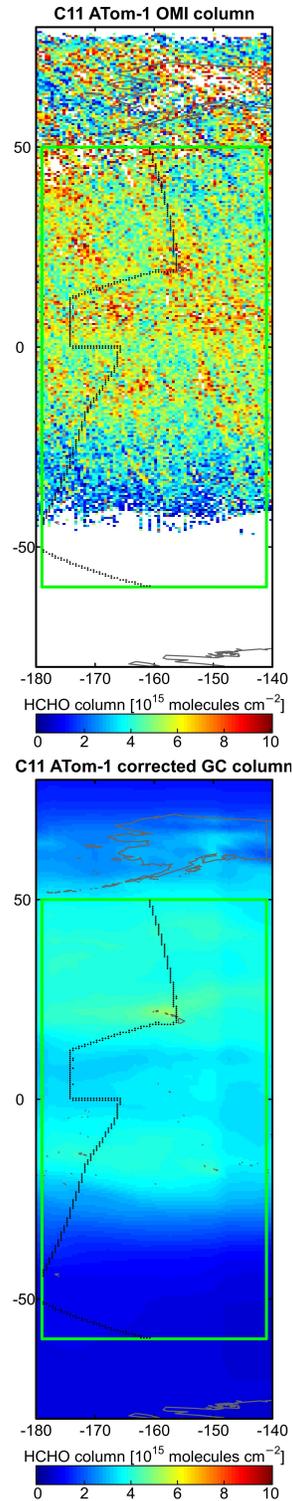


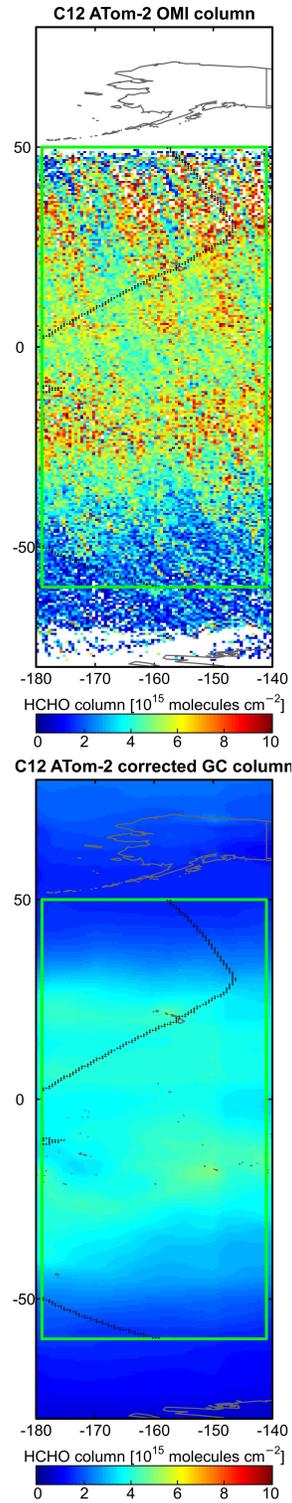
Figure S8. Same as Figure S1, but for the WE-CAN aircraft campaign (C9).



**Figure S9.** Same as Figure S1, but for the KORUS-AQ aircraft campaign (C10).



**Figure S10.** Same as Figure S1, but for the ATom-1 aircraft campaign (C11).



**Figure S11.** Same as Figure S1, but for the ATom-2 aircraft campaign (C12).