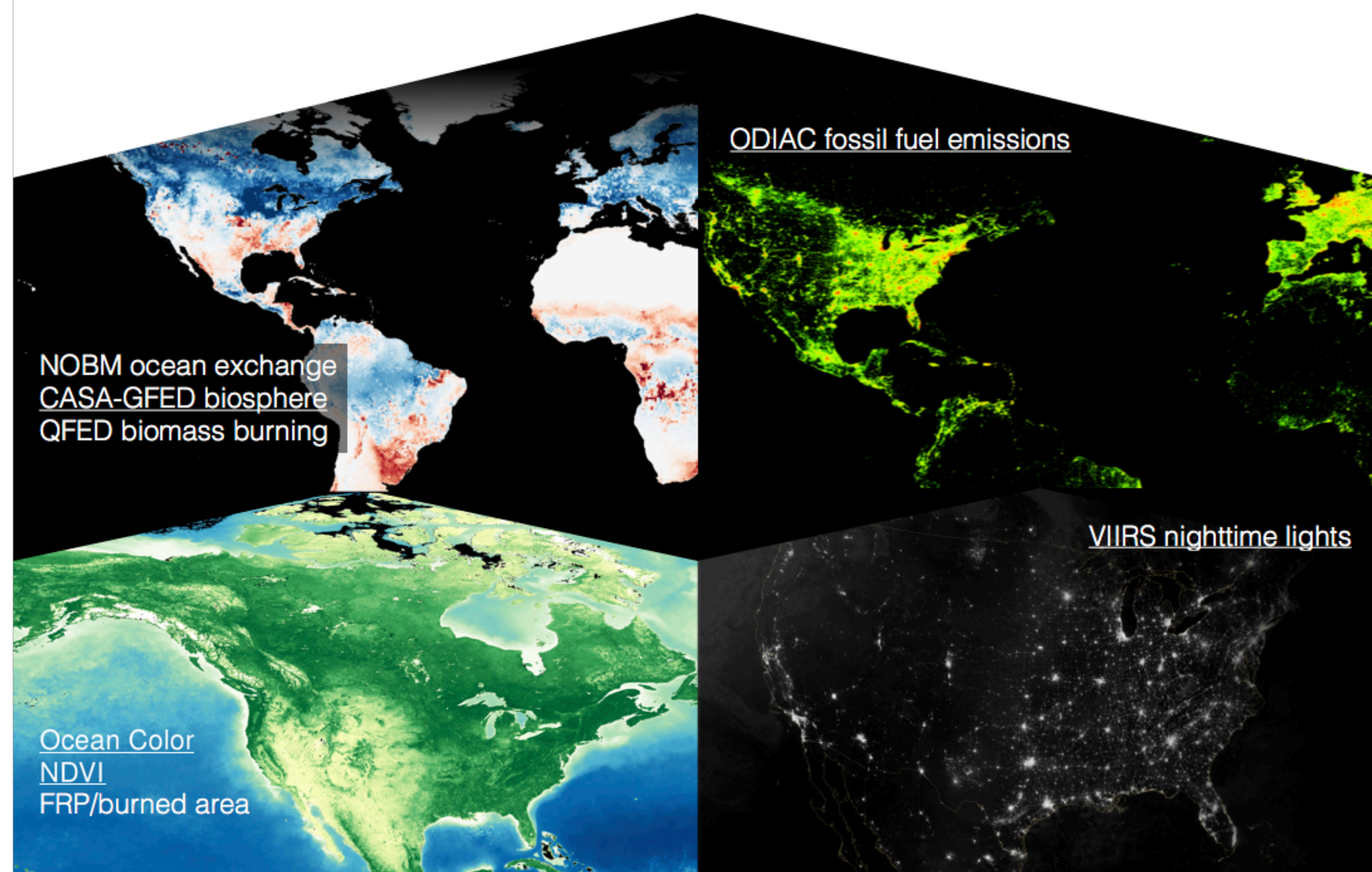
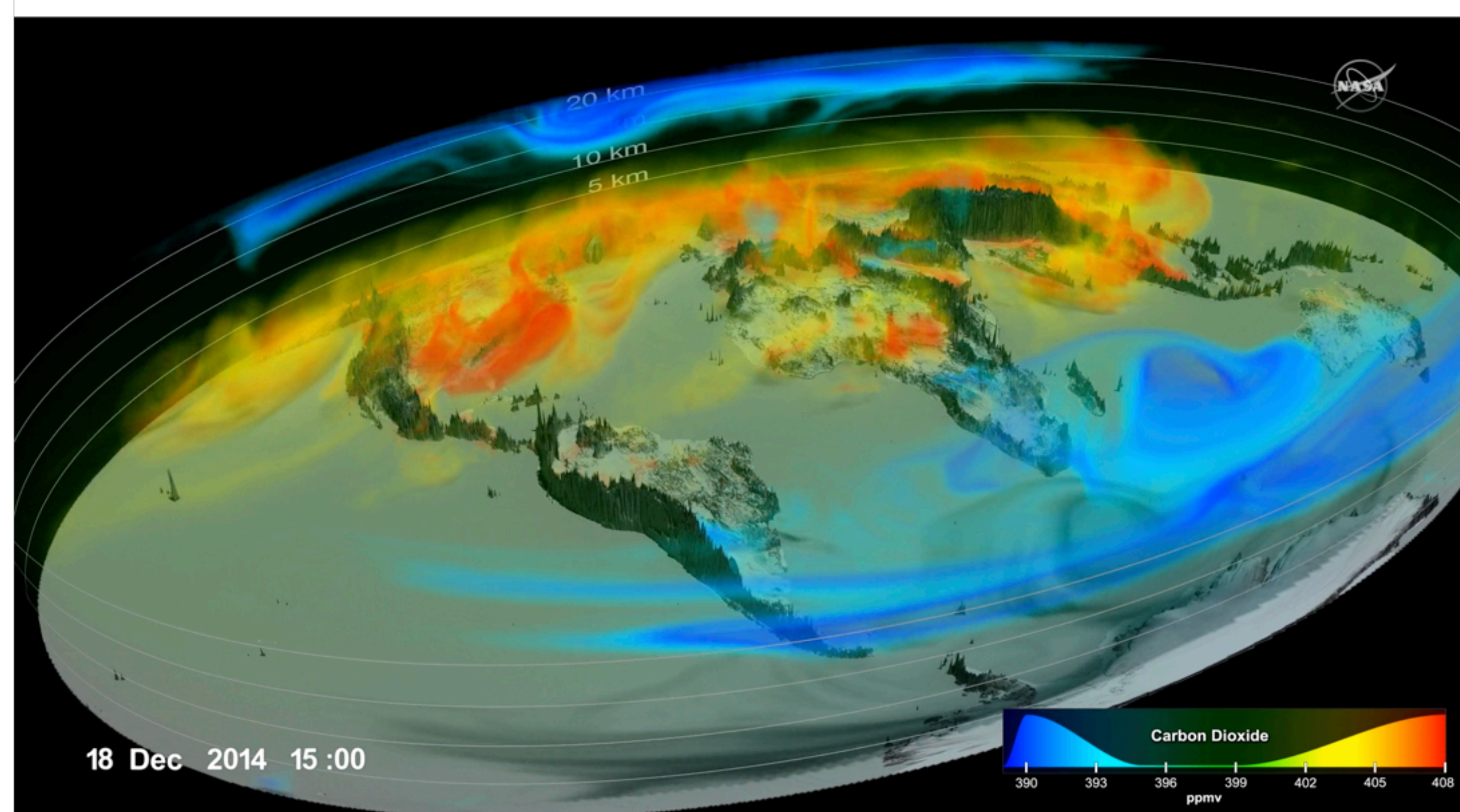
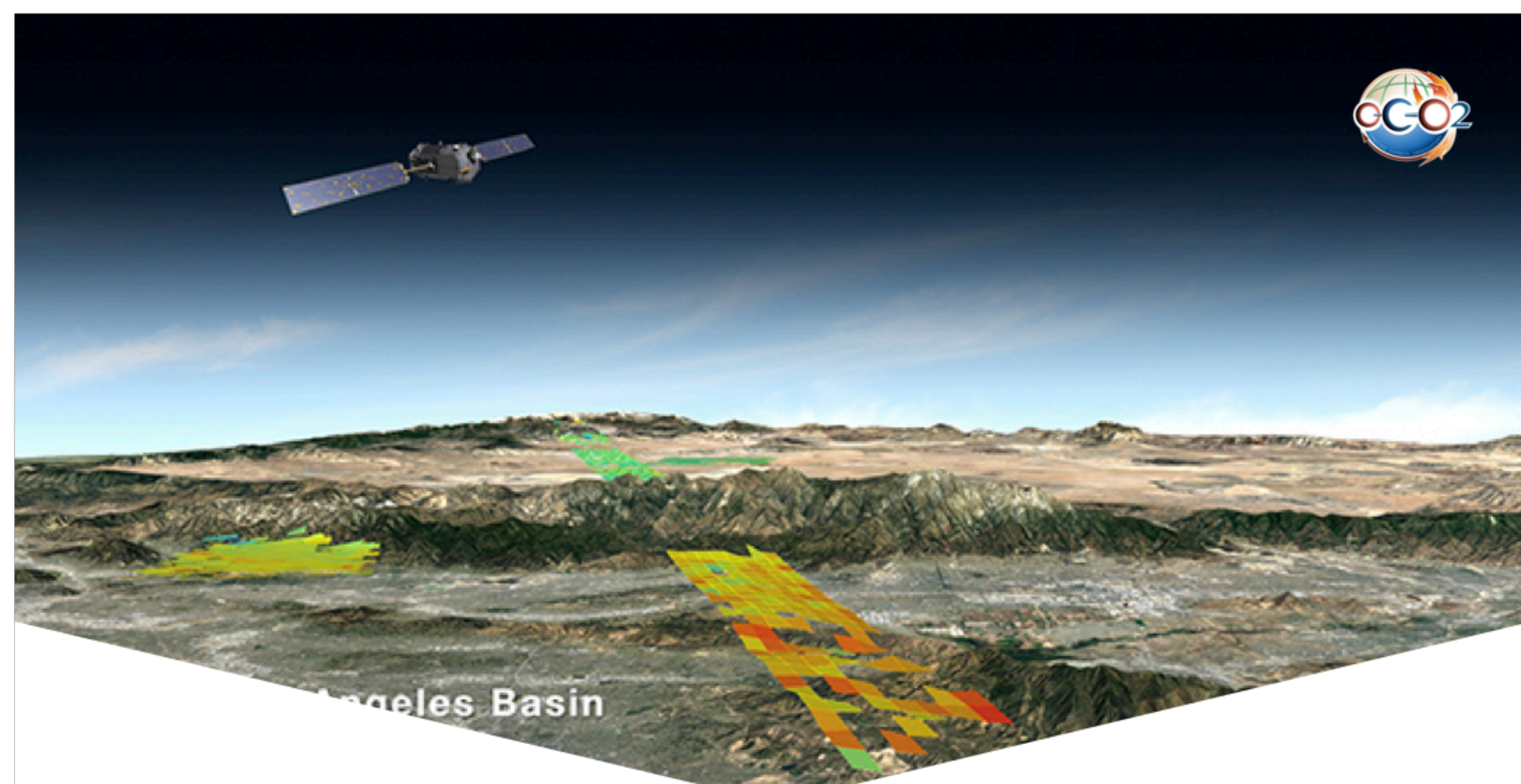


An 8-year, high-resolution reanalysis of atmospheric CO₂ mixing ratios based on OCO-2 and GOSAT-ACOS retrievals

B. Weir^{1,2}, A. Chatterjee^{1,2}, L.E. Ott², and S. Pawson²

1) USRA/GESTAR, 2) NASA GSFC/GMAO



The NASA GMAO reanalysis blends OCO-2 and GOSAT-ACOS retrievals (top) with GEOS model predictions (bottom) to estimate the full 3D state of CO₂ every 3 hours (middle).

This poster describes monthly **atmospheric growth rates** derived from the reanalysis and **an application to aircraft data** with the potential to aid bias correction.

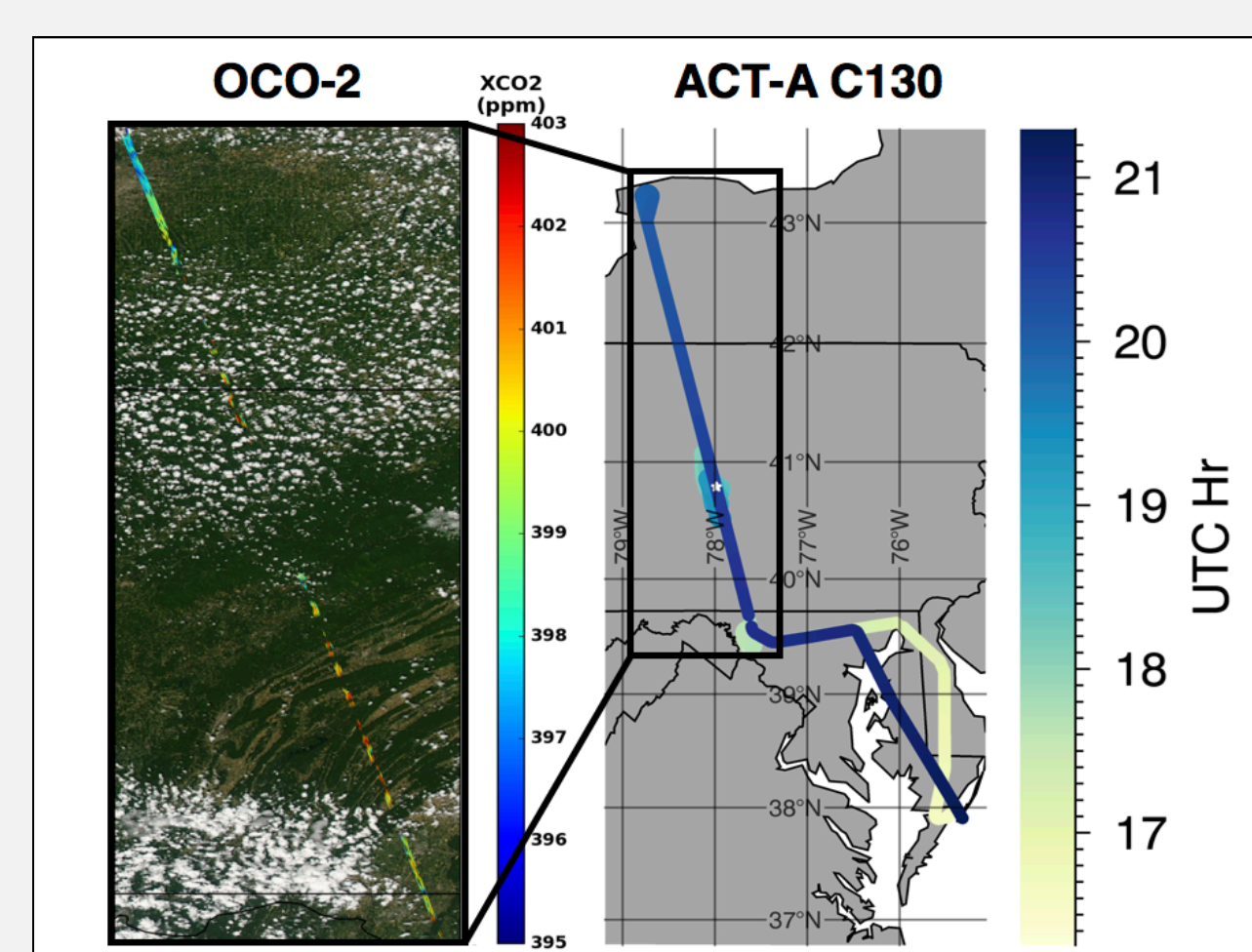


Fig 1. OCO-2 overpass and ACT flight path for 27 July 2016.

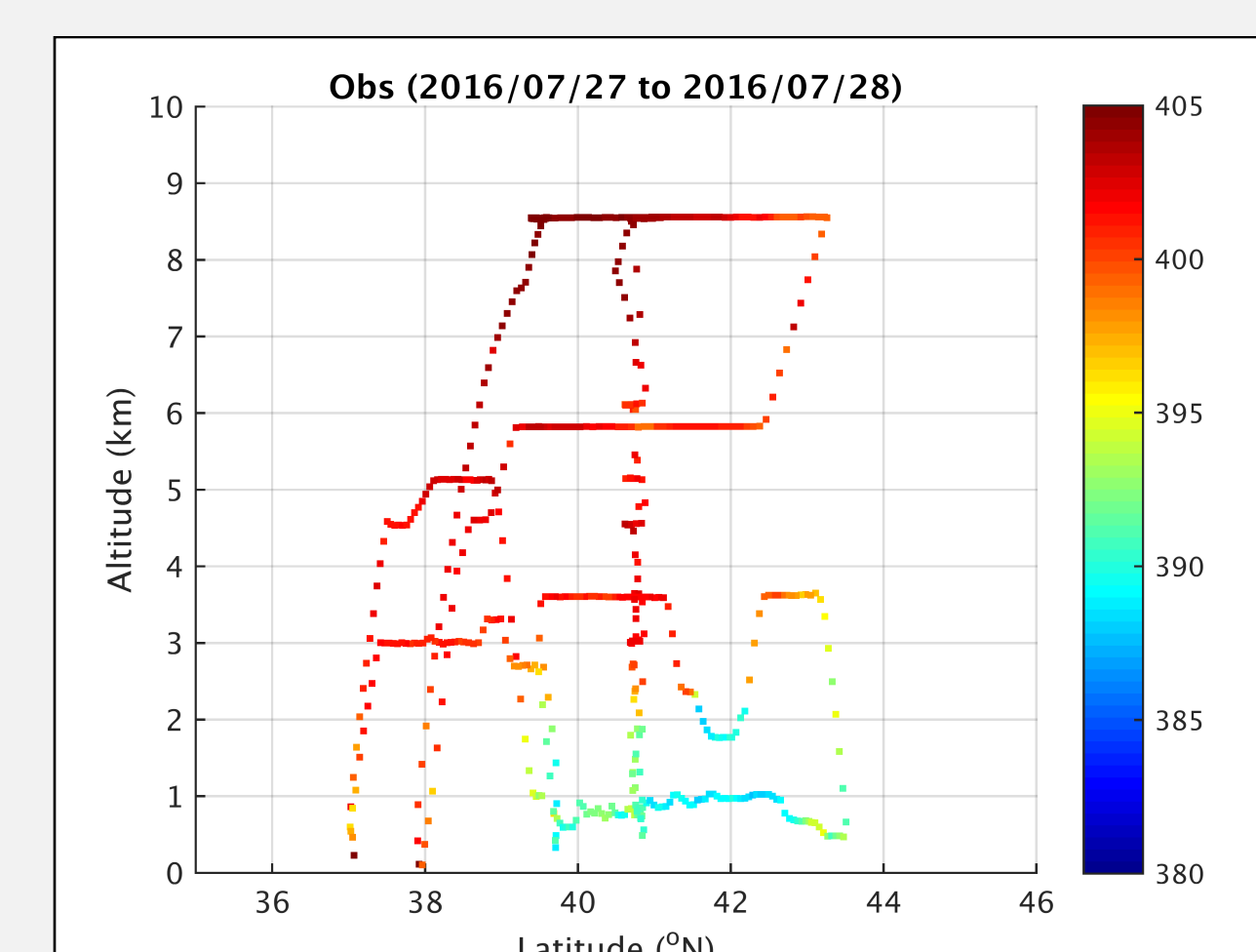


Fig 2. Measured CO₂ from ACT aircraft.

Aircraft-based analysis

Systematic model and satellite retrieval errors with coherent regional and seasonal patterns limit our ability to infer surface fluxes from satellite retrievals.

Here, we assimilate aircraft data from ACT-America into the GEOS model and compare the results to an OCO-2 overpass. **The assimilation indicates that the model PBL was too high. Overall, the mean difference with OCO-2 v7b is reduced from 0.59 ppm to 0.28 ppm.**

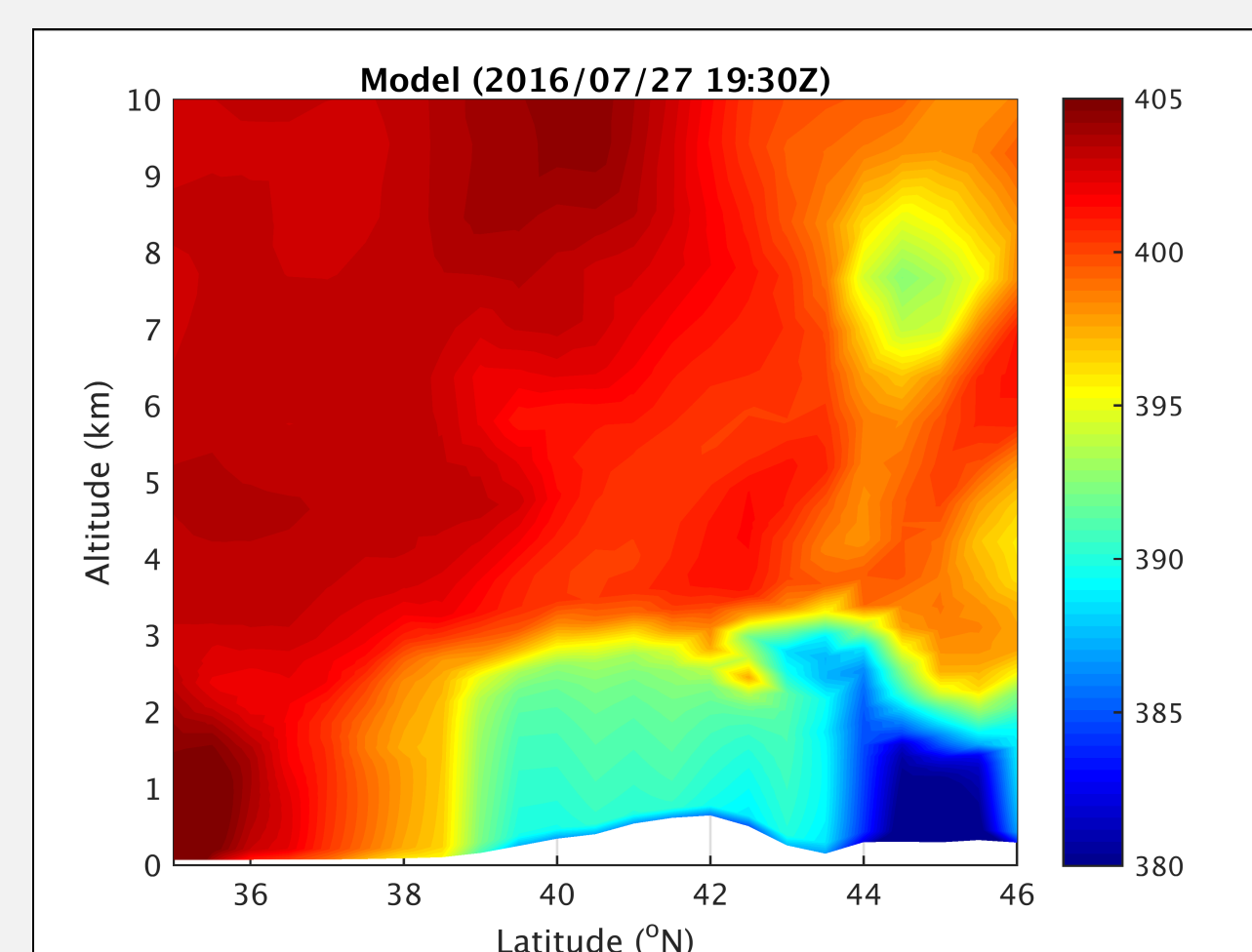


Fig 3. GEOS forecasted values before assimilation.

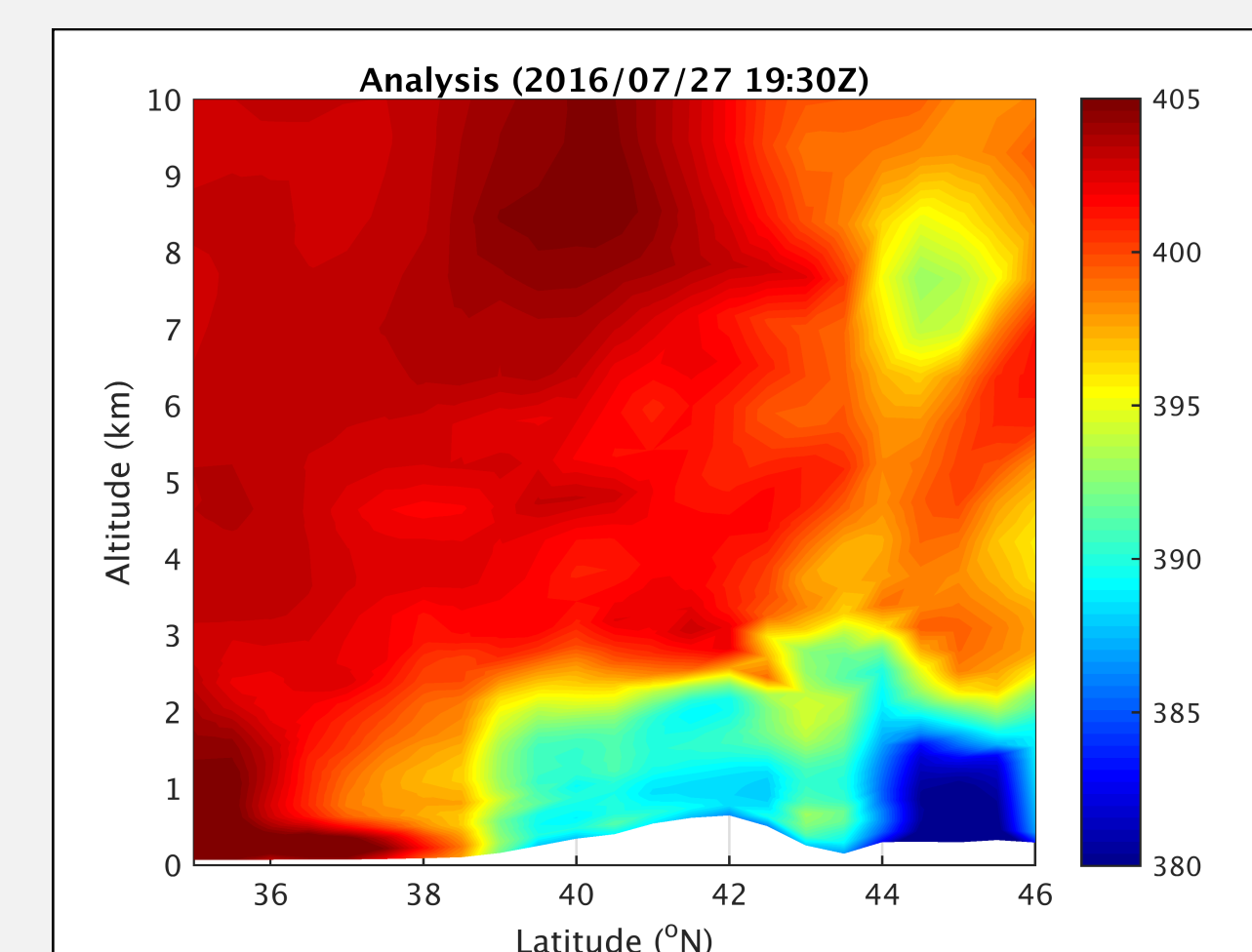


Fig 4. Curtain for aircraft data assimilated into the GEOS model. Note the decrease in PBL height over 39° to 42°N from Fig 3.

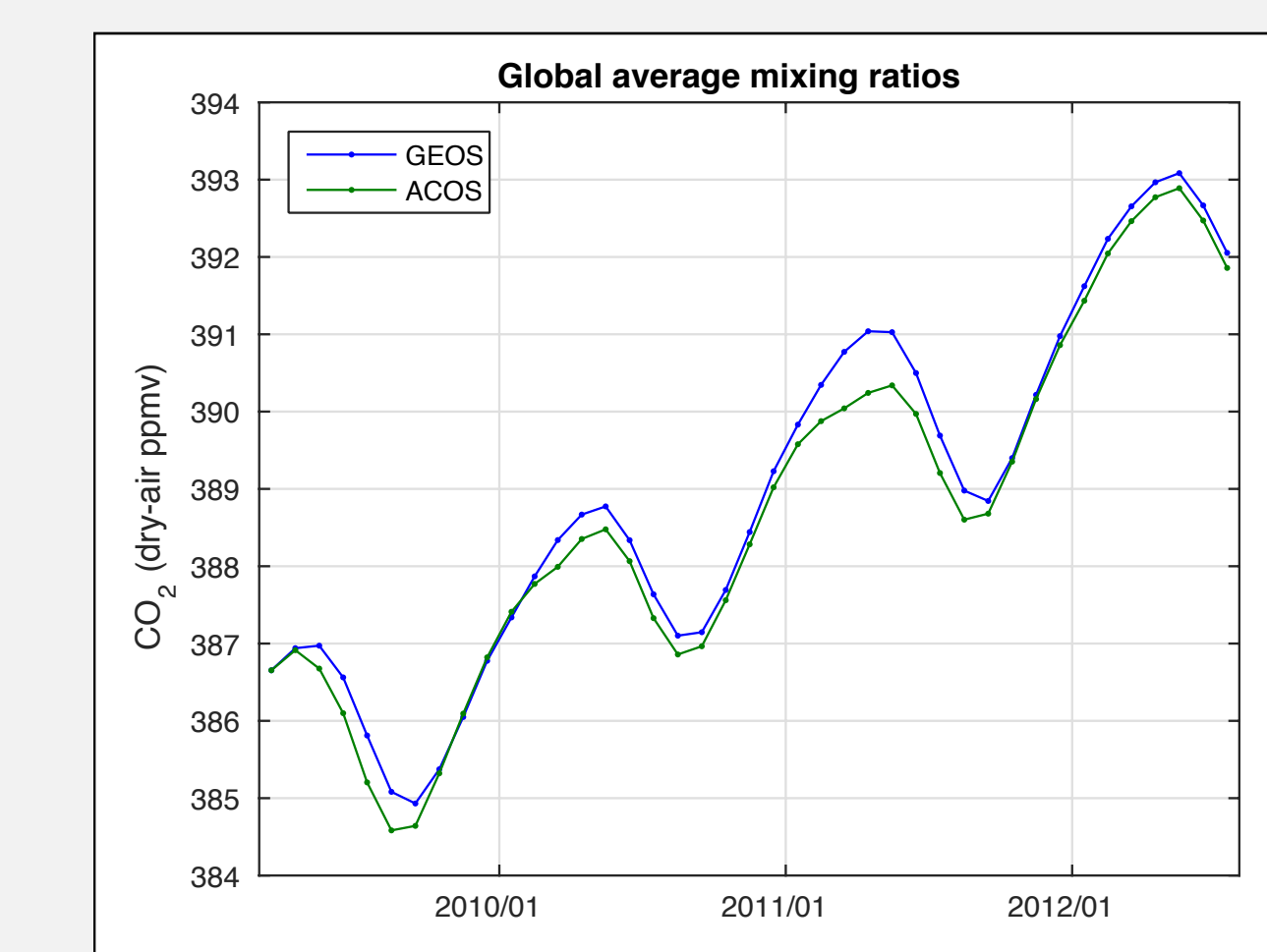


Fig 1. Global average mixing ratios from (blue) GEOS with no assimilation and (green) reanalysis of GOSAT-ACOS data.

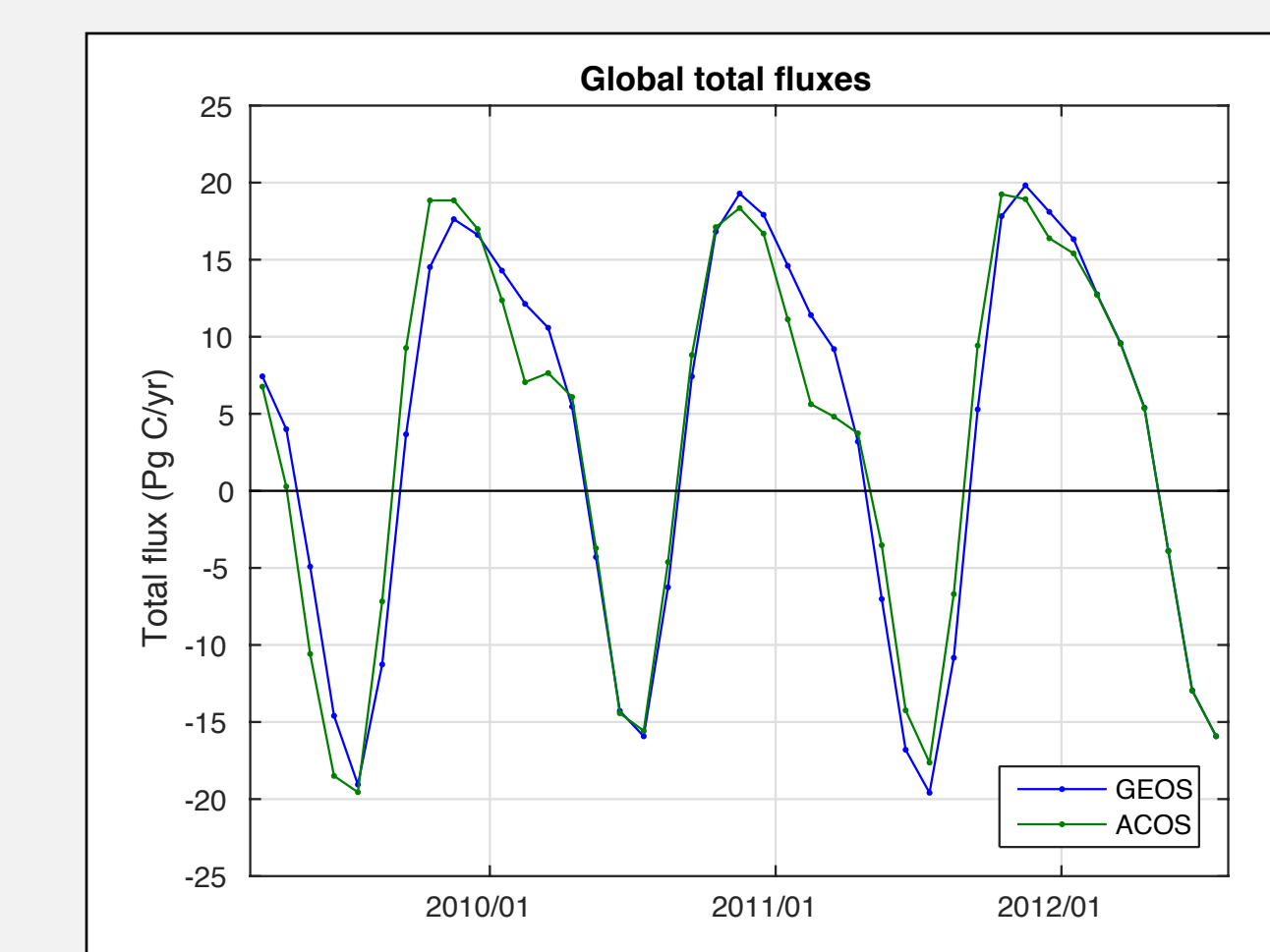


Fig 2. Global total fluxes computed as the change in monthly means from Fig 1. Note the change in Jan. thru Mar.

Atmospheric growth rate

Since OCO-2 and GOSAT-ACOS observe the column integral of CO₂ and have a 16-day repeat cycle, they have the potential to better constrain atmospheric growth rates on sub-annual time scales than data restricted to the PBL. Here, we compute monthly growth rates and show that the **satellites suggest the model has too much outgassing in boreal winter.**

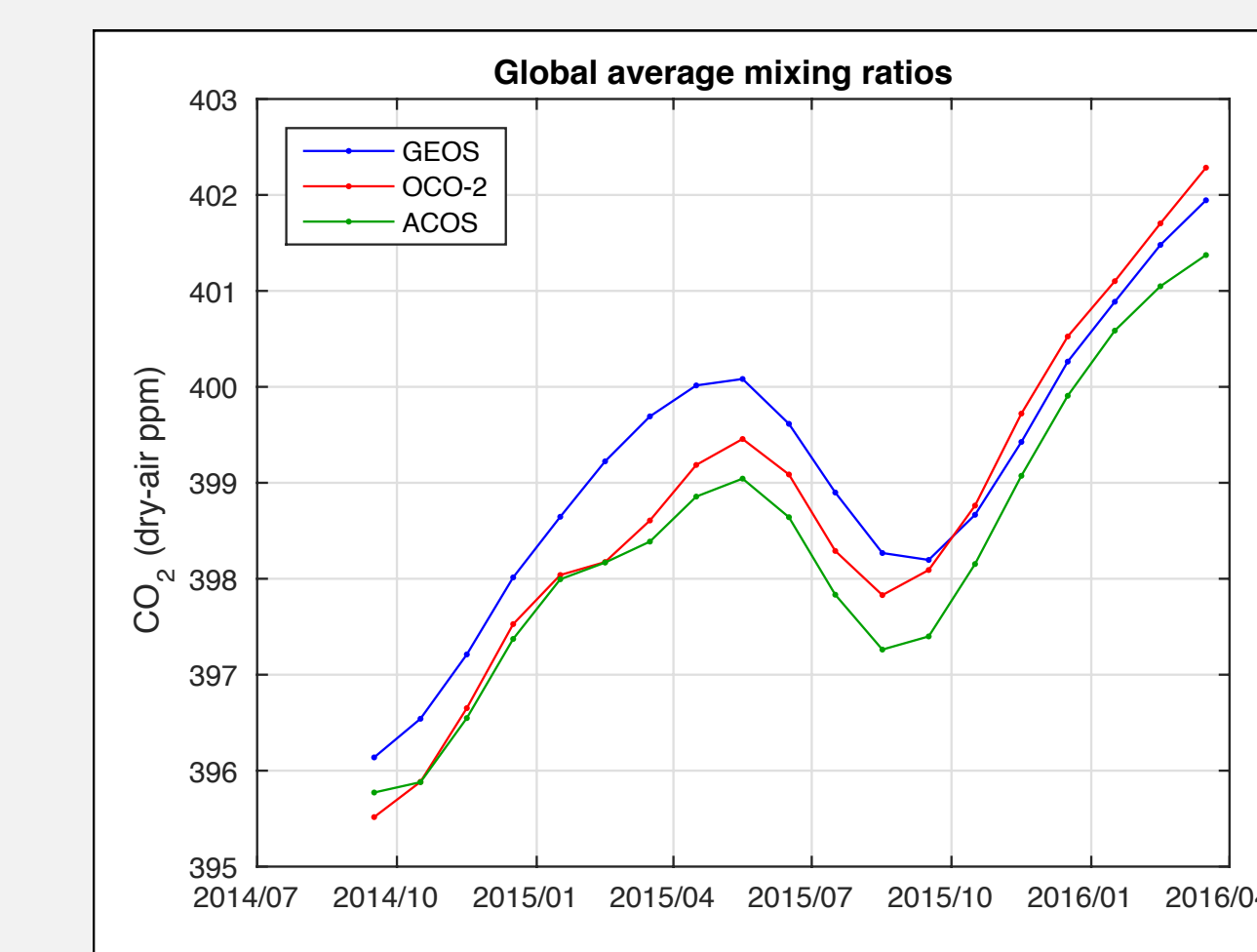


Fig 3. Same as Fig 1, but now with (red) reanalysis of OCO-2 data.

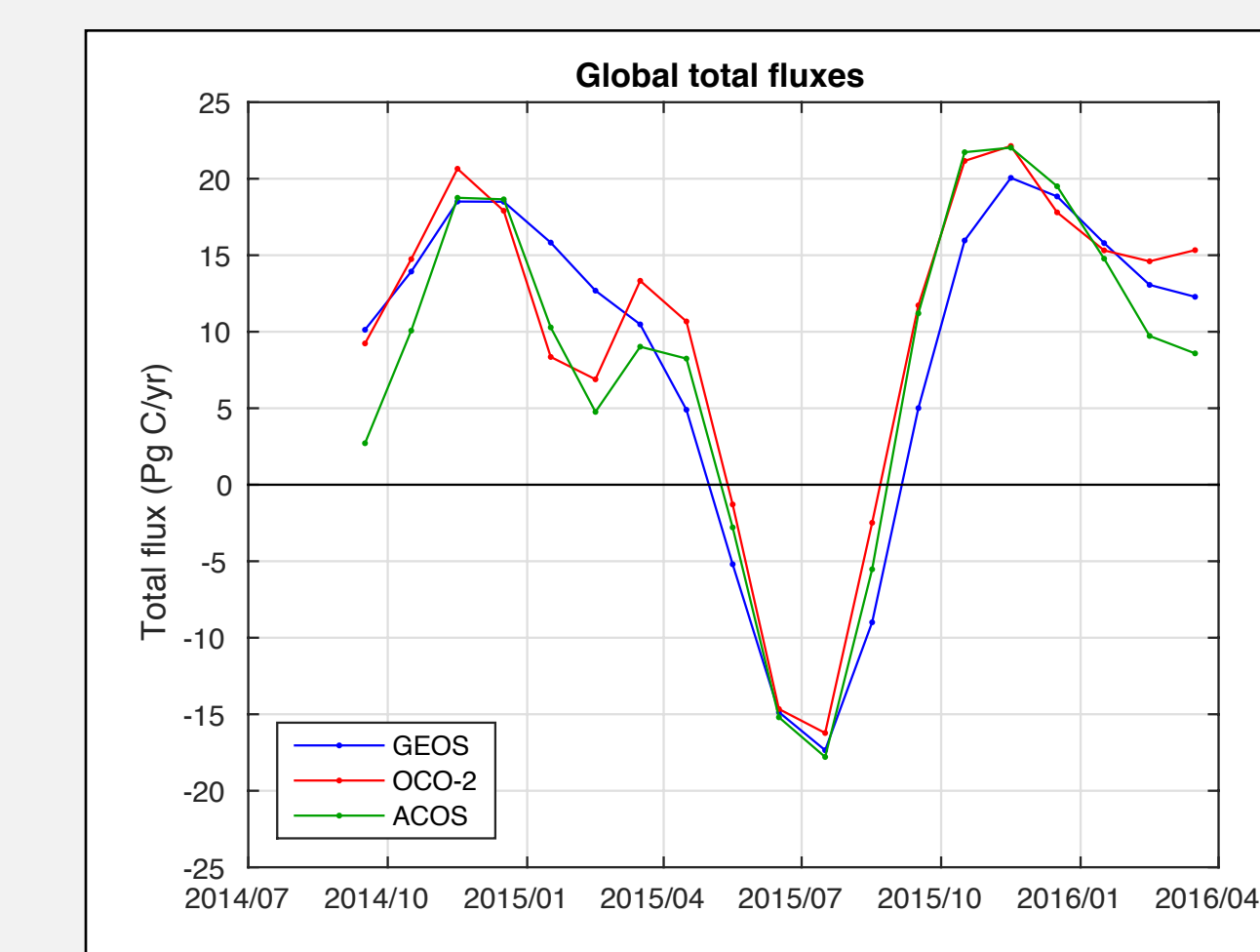


Fig 4. Same as Fig 2, but now with (red) reanalysis of OCO-2 data.

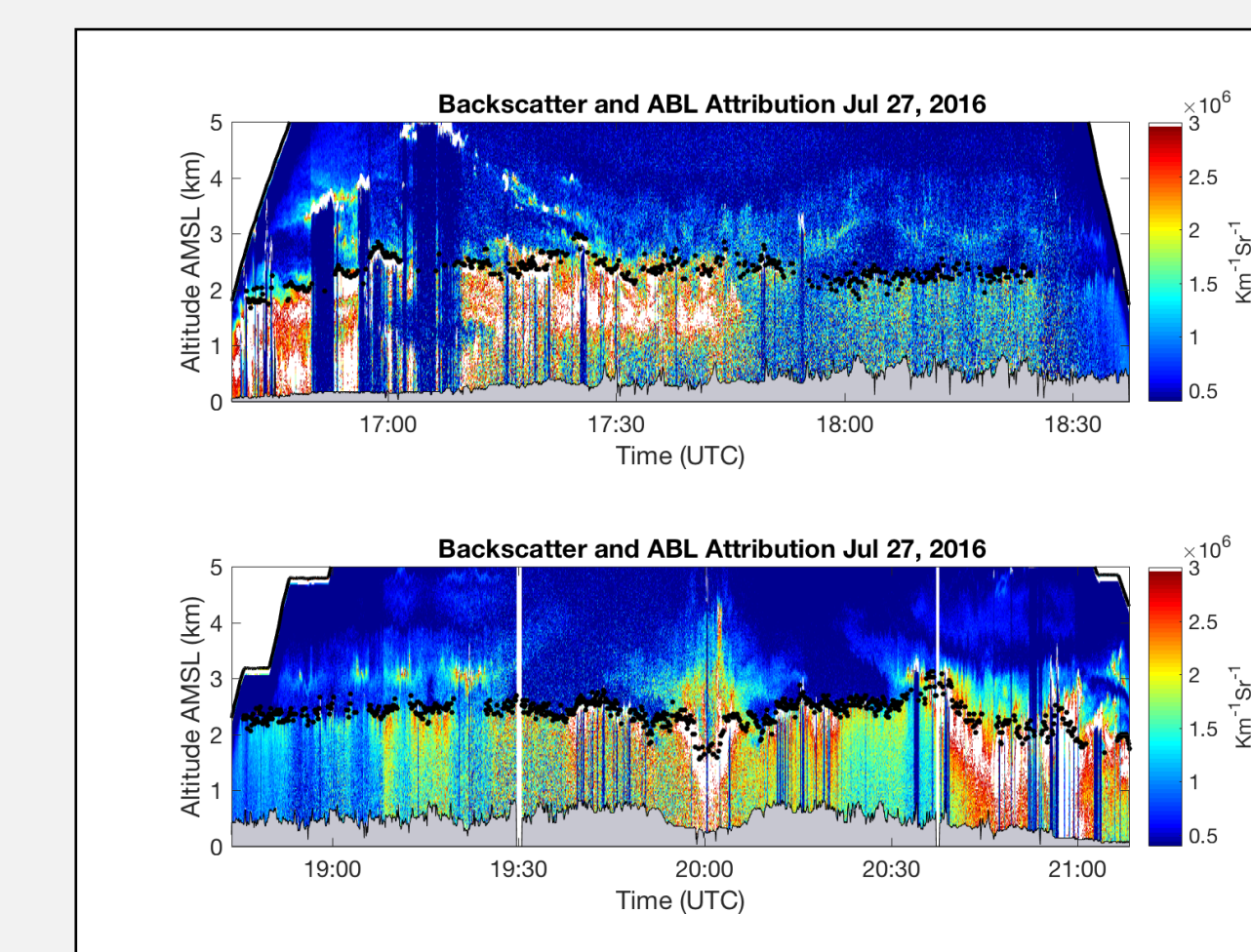


Fig 5. PBL height determined from Cloud Physics Lidar measurements. These heights are closer to those from Fig 4.

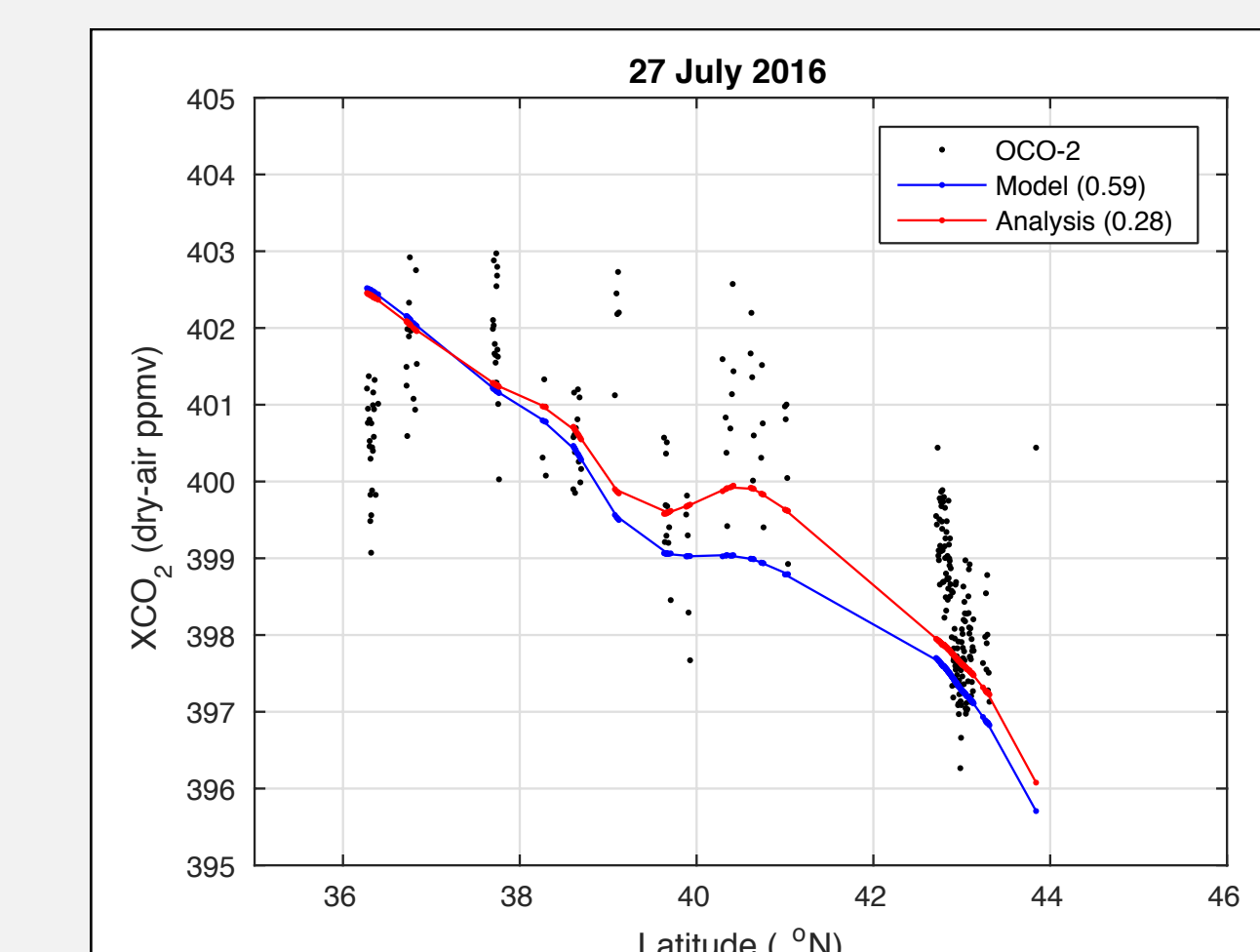


Fig 6. Comparisons to column CO₂ (XCO₂) from OCO-2 v7b. The analysis decreases the bias from 0.59 ppm to 0.28 ppm.

Acknowledgements: the OCO-2 project at JPL, CalTech, the ACT-America campaign, NASA GSFC SVS, the NASA CMS project, Sandip Pal, Chris O'Dell, Emily Bell, John Miller, & everyone I forgot

