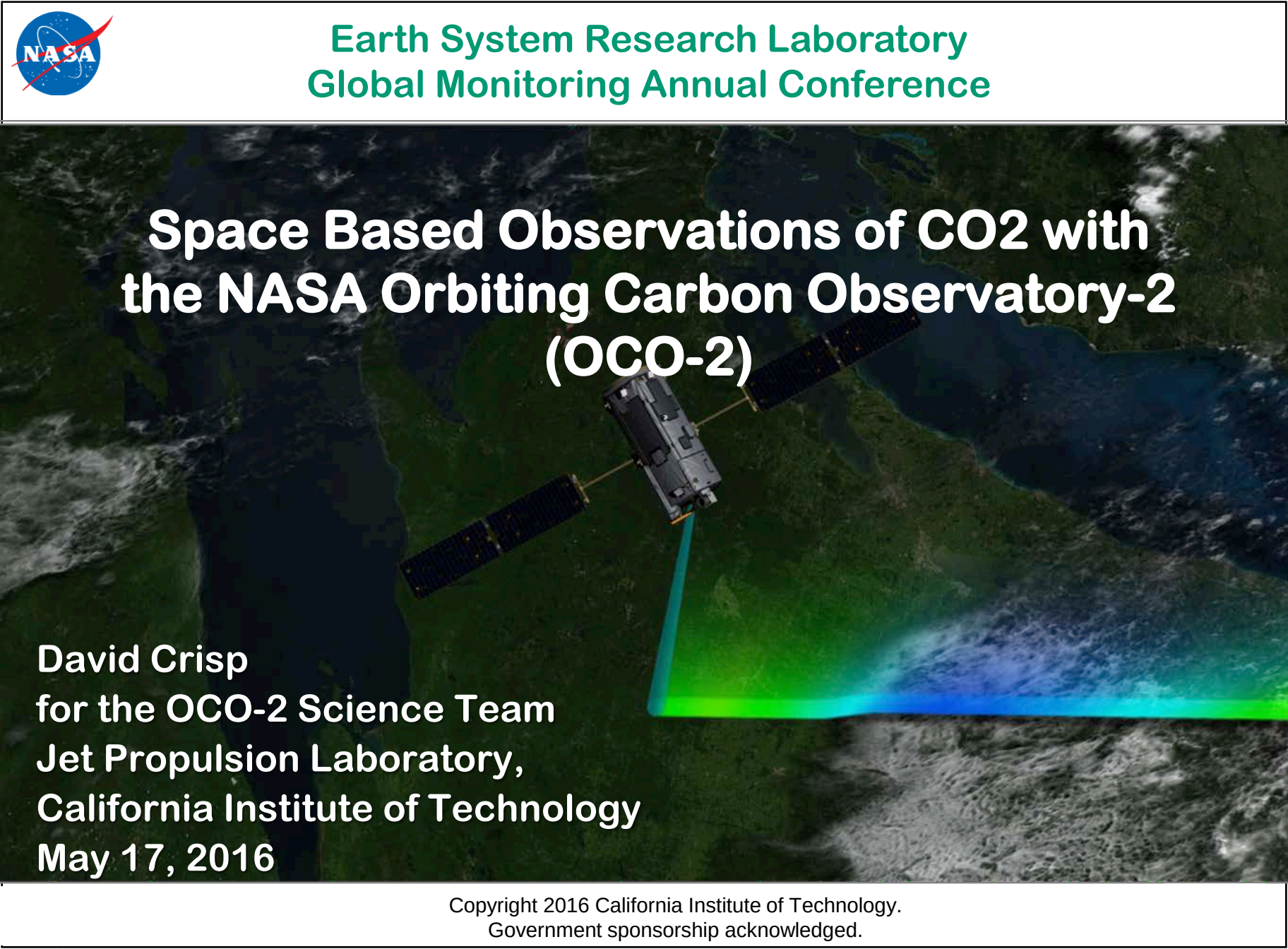
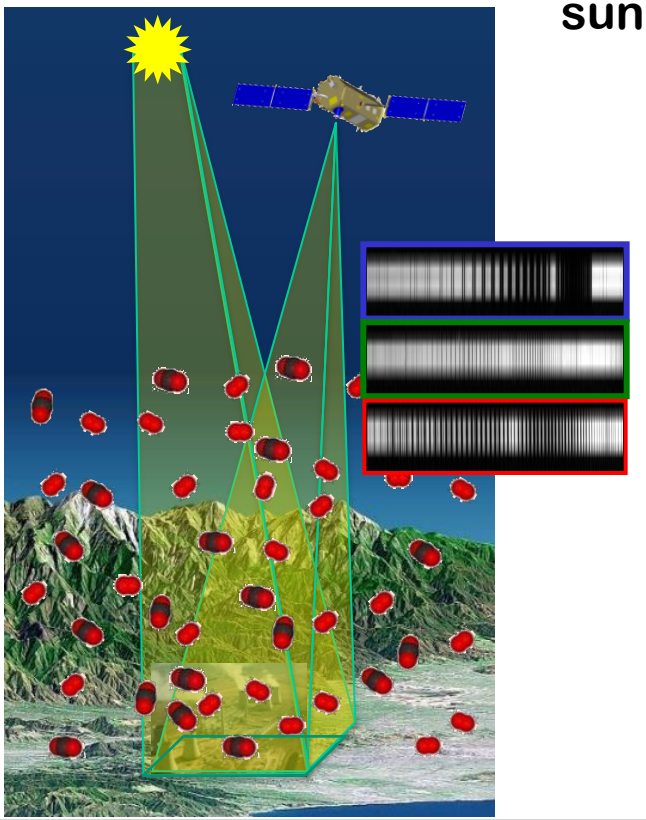


Overview

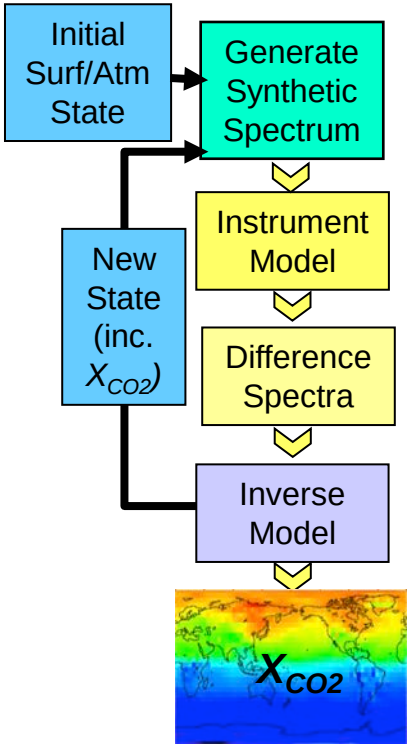
- Quick review of the OCO-2 mission architecture and observing strategy
- A quick look at OCO-2 X_{CO2} soundings
  - Global maps spanning the mission: 9/2014-2/2015
  - Point sources
- Status of data validation effort
- Introduction to Flux Inversion Results
- A glance into the future of space based greenhouse gas measurements

Measuring CO_2 from Space

- **Record** spectra of CO_2 and O_2 absorption in reflected sunlight

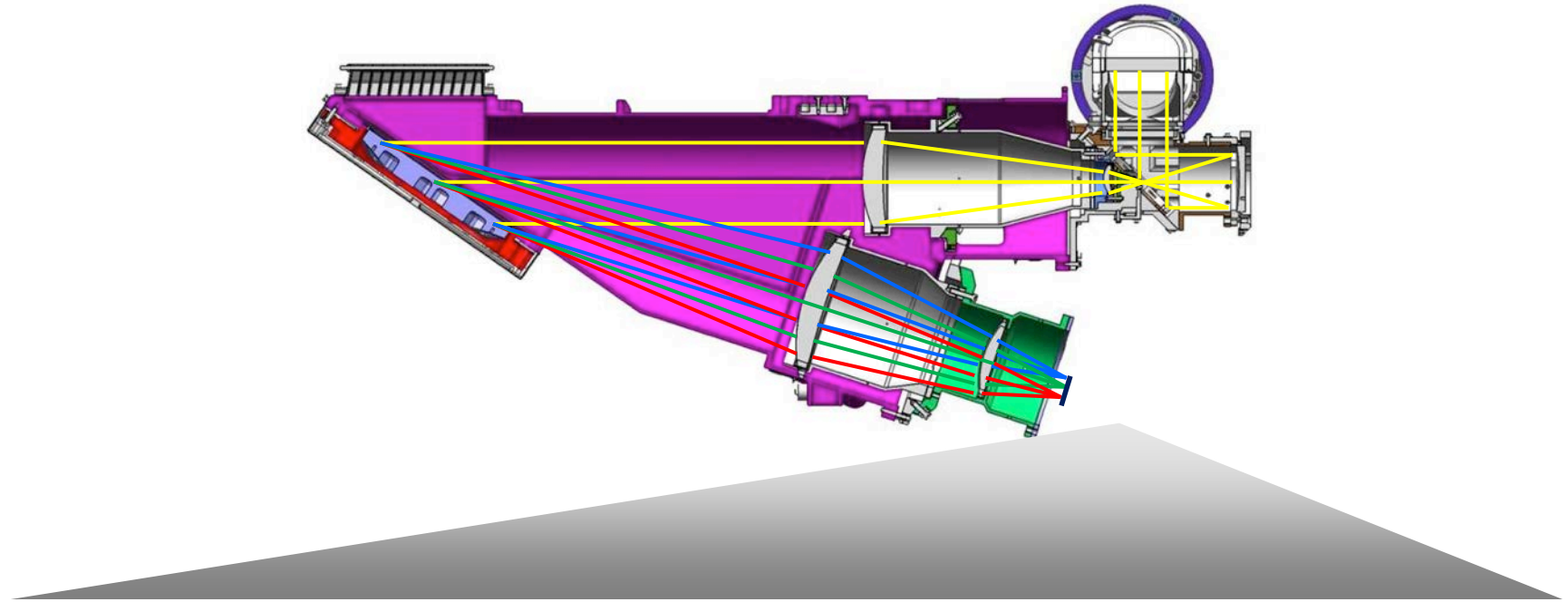


Retrieve variations in the ***column averaged CO_2 dry air mole fraction, X_{CO2}*** over the sunlit hemisphere



Validate measurements to ensure X_{CO2} accuracy of 1 ppm (0.25%)

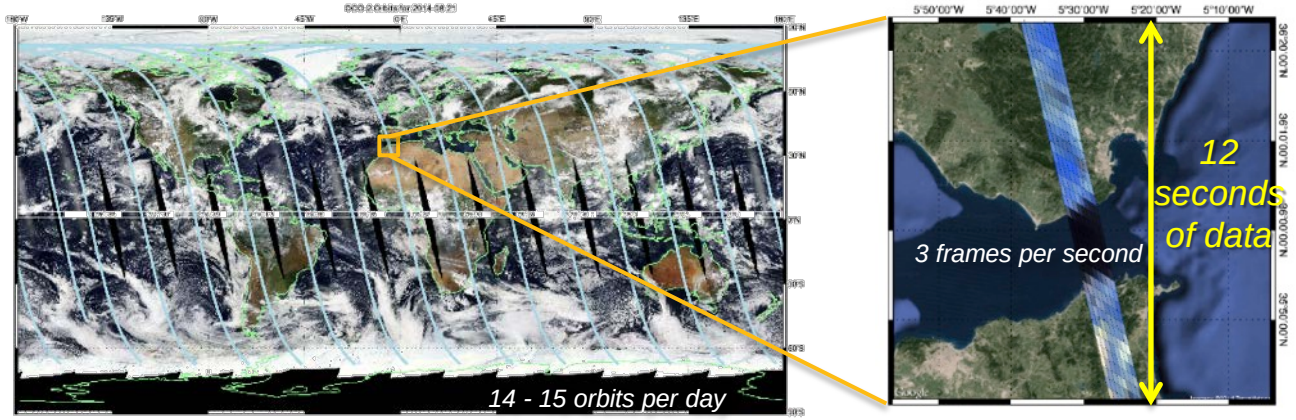
The OCO Instrument – Optimized for Sensitivity

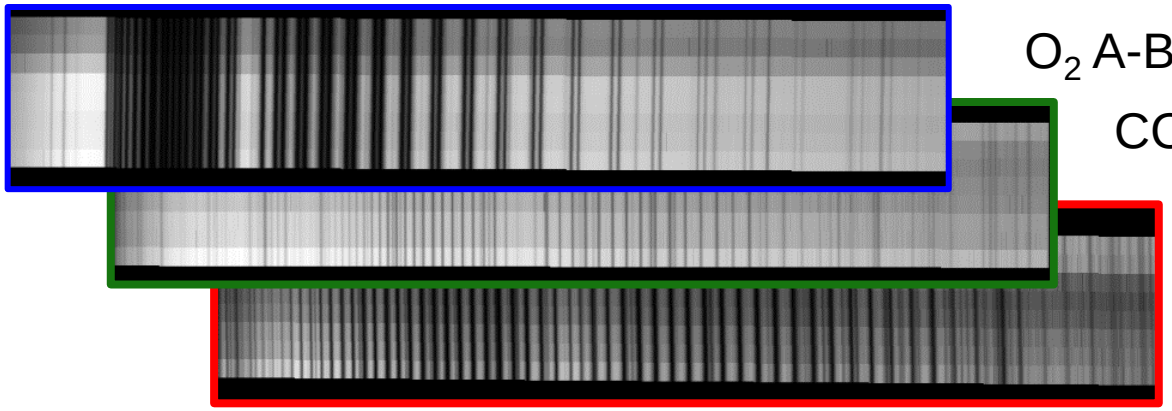


0.765µm O_2 A-Band | CO_2 1.61µm Band | CO_2 2.06 µm Band

Each 1/3 sec frame includes 8 spatial footprints with 1,016 wavelengths in 3 spectral channels.

OCO-2 Sampling Approach





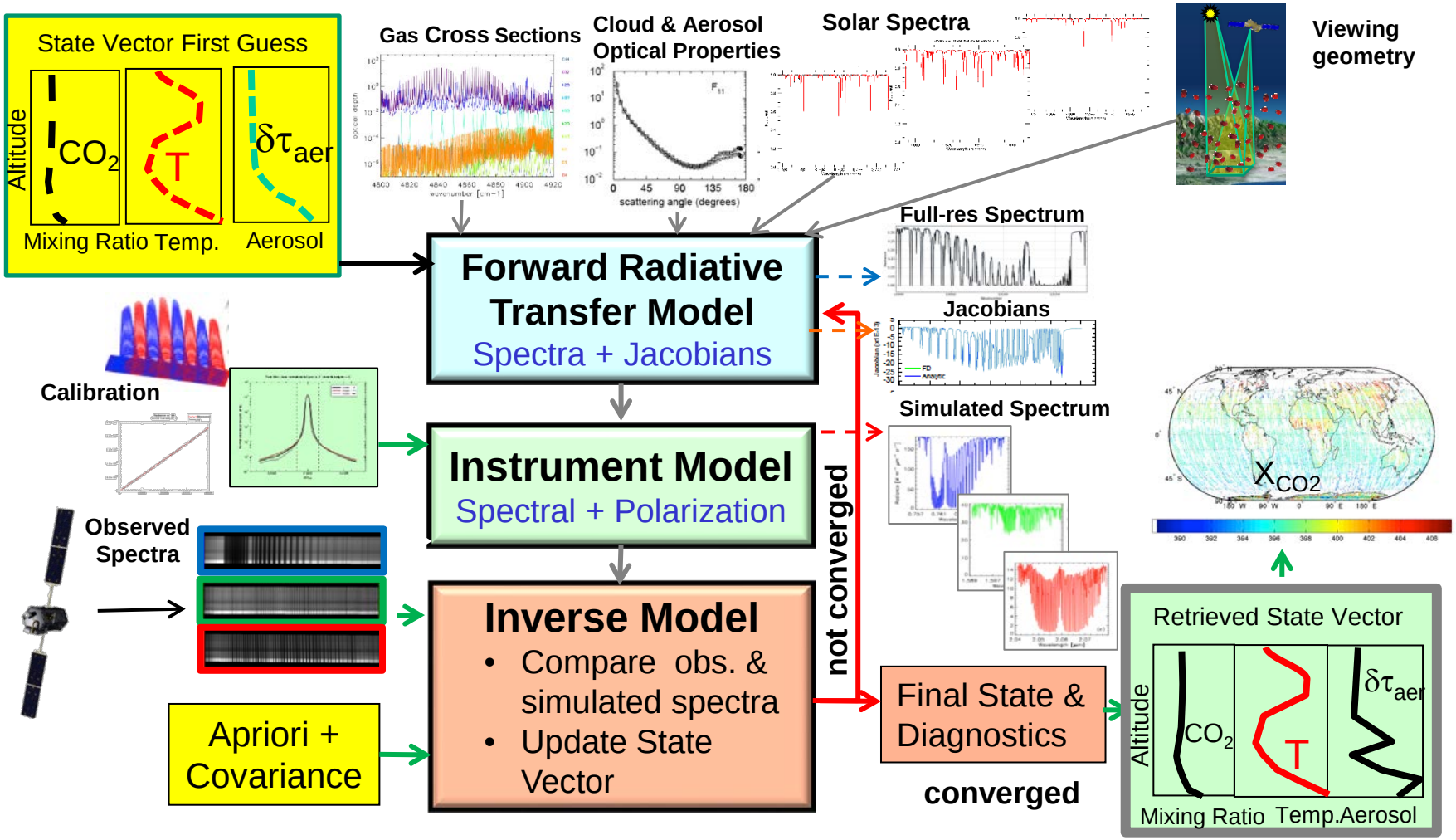
O_2 A-Band

CO_2 1.61 μm Band

CO_2 2.06 μm Band

The OCO-2 instrument collects 24 soundings each second as it flies over the sunlit hemisphere of the Earth, yielding almost 1 million soundings each day

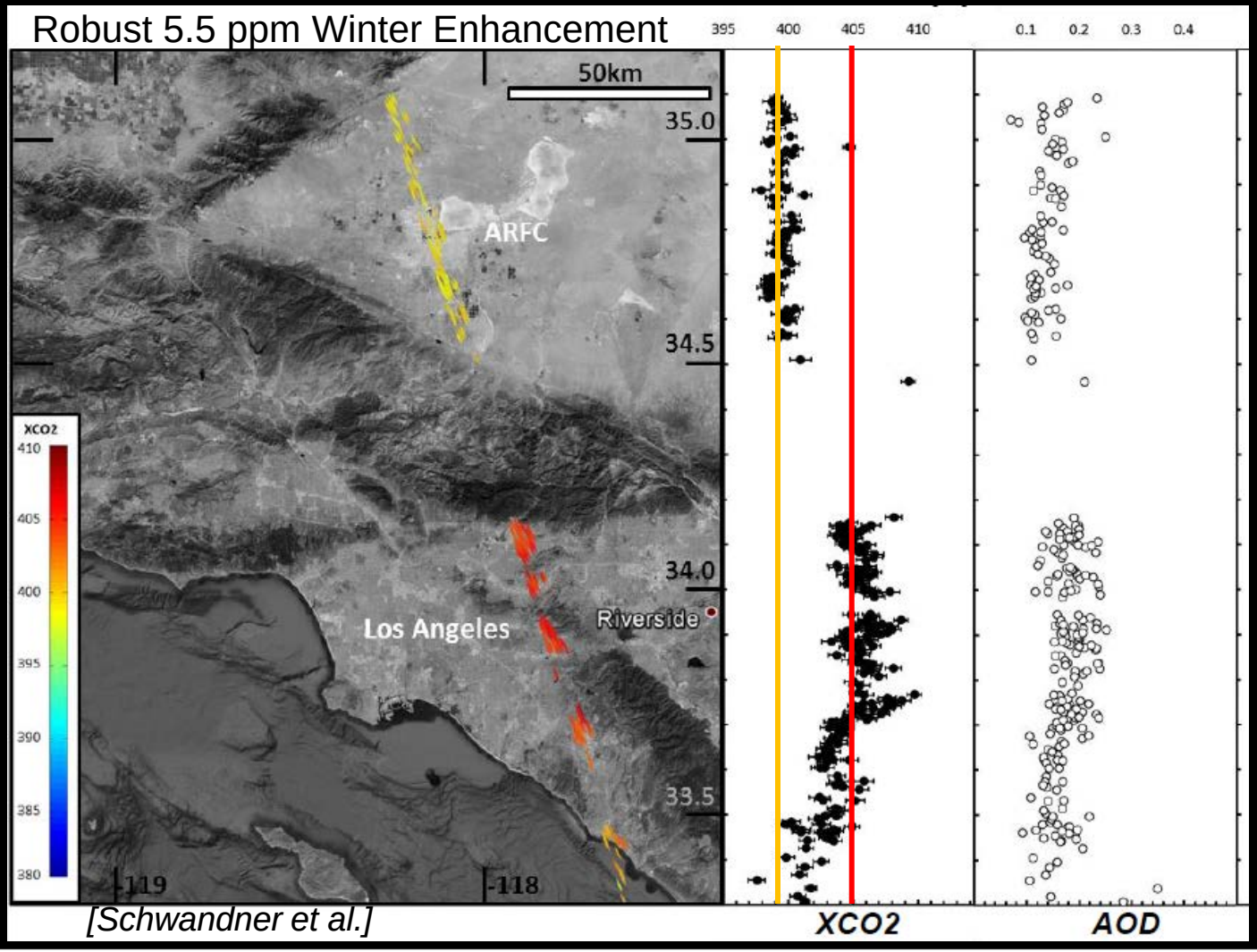
The OCO-2 XCO2 Retrieval Algorithm



A Quick Look at the First 17 Months of Operations

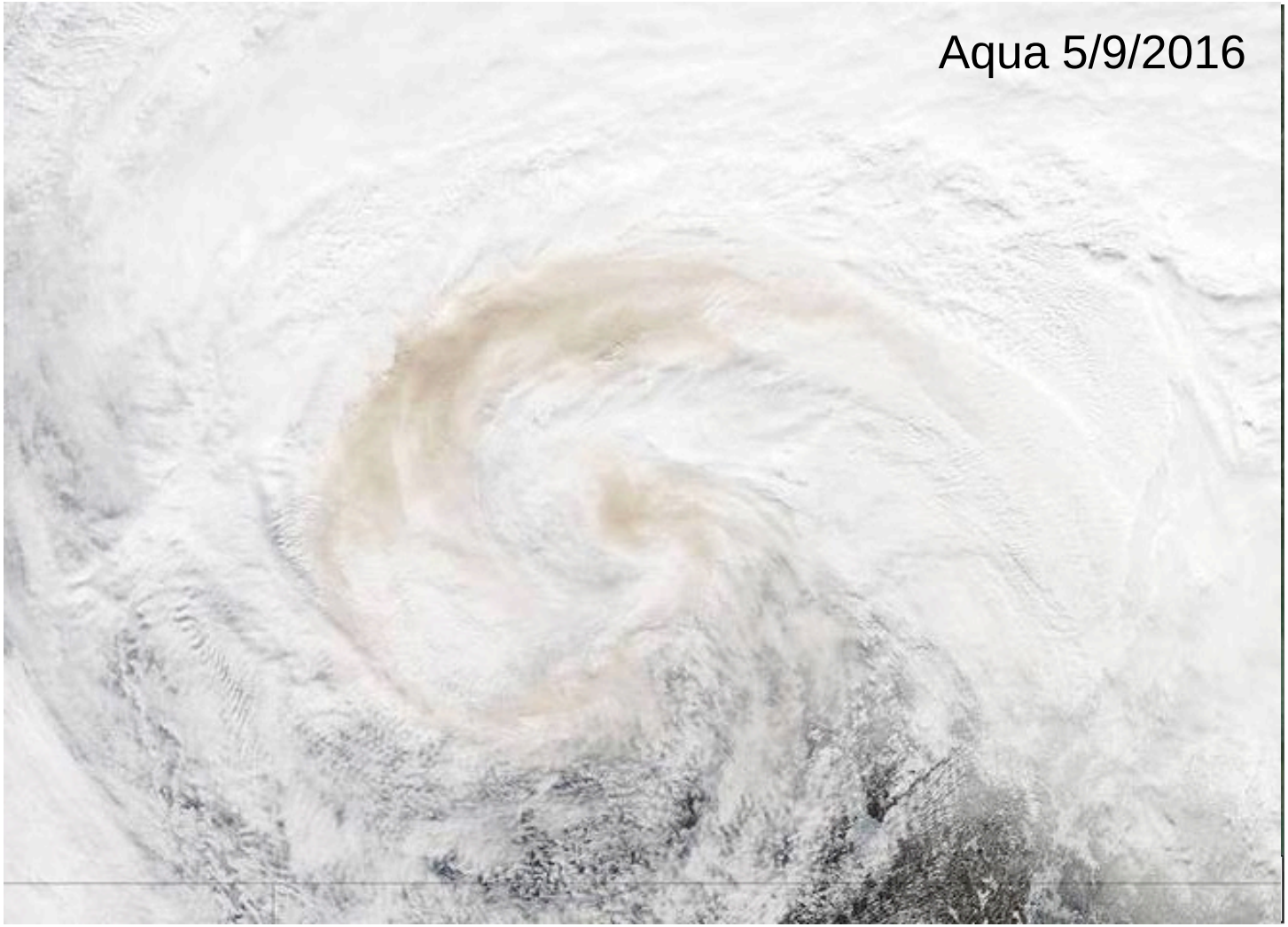
Small-Scale Emission Structures

2015/01/13 Glint orbit 2848 over Los Angeles and Antelope Valley



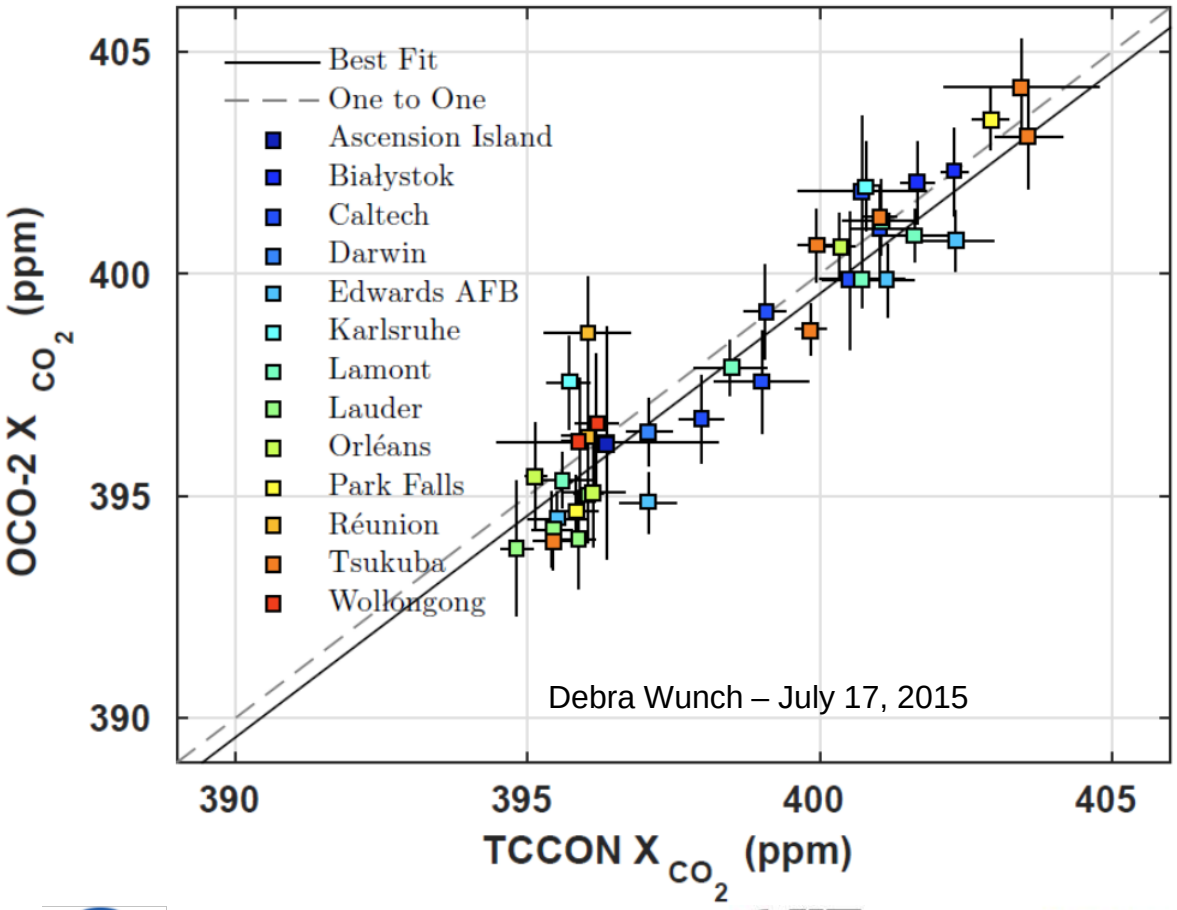
[Schwandner et al.]

Small-Scale Emission Structures
Alberta Tar Sands, Canada [Schwandner et al.]



Target Observations

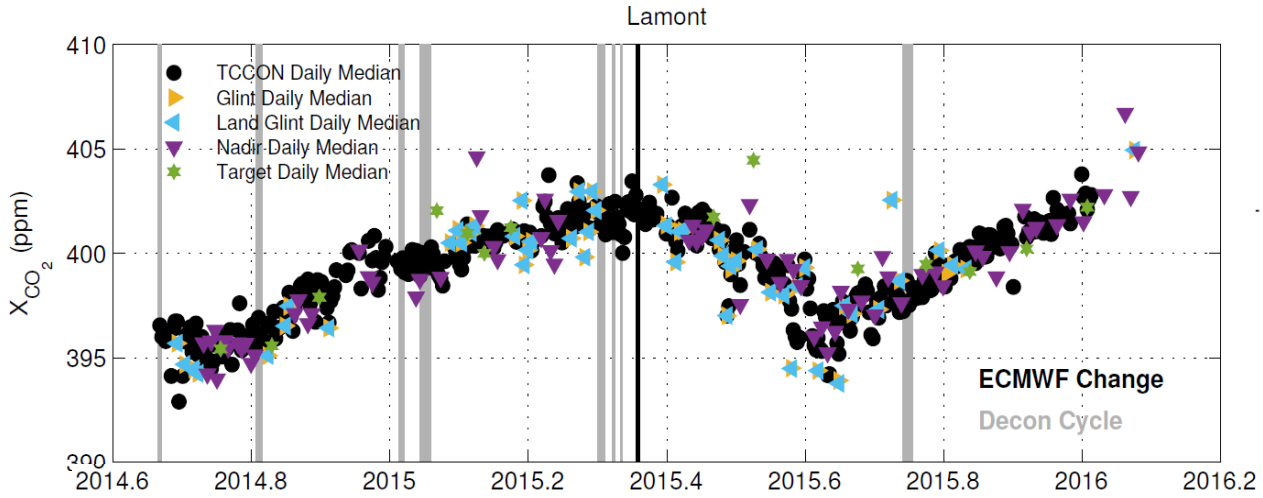
Comparison of TCCON and OCO-2 X_{CO2}

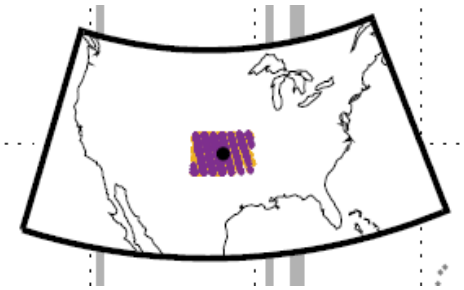


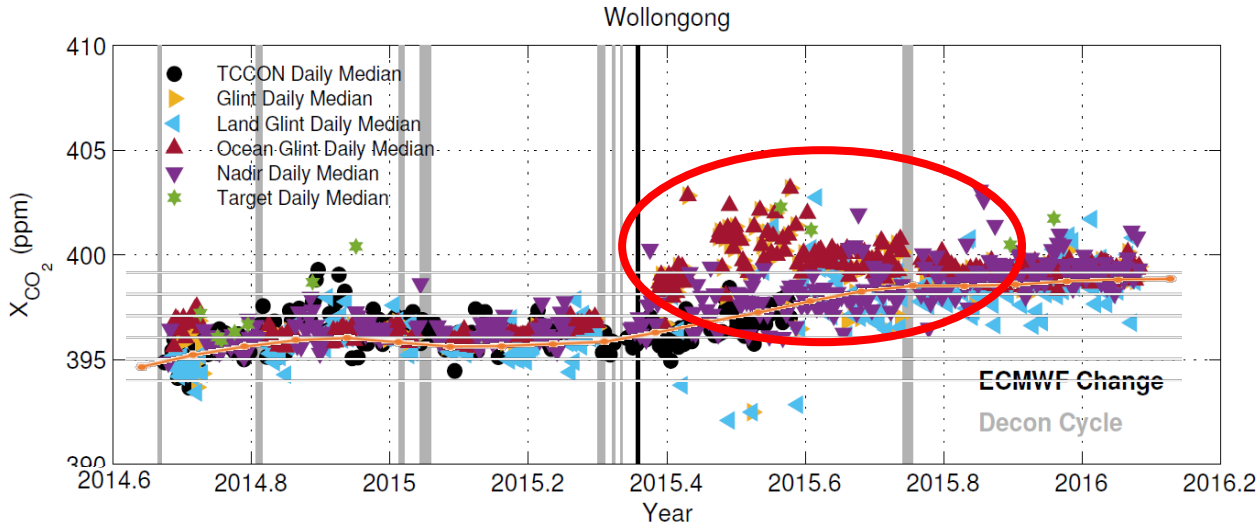
Comparisons with Total Carbon Column Observing Network (TCCON) stations are being used to identify and correct biases in target observations.

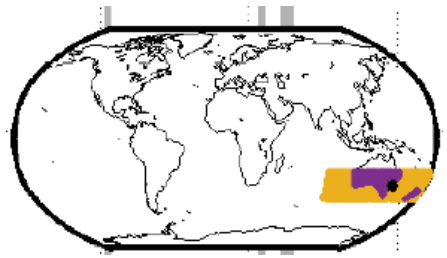
After applying a preliminary bias correction, differences are approaching 1 ppm.

Temporal Changes in X_{CO2} Impact of Bias Corrections



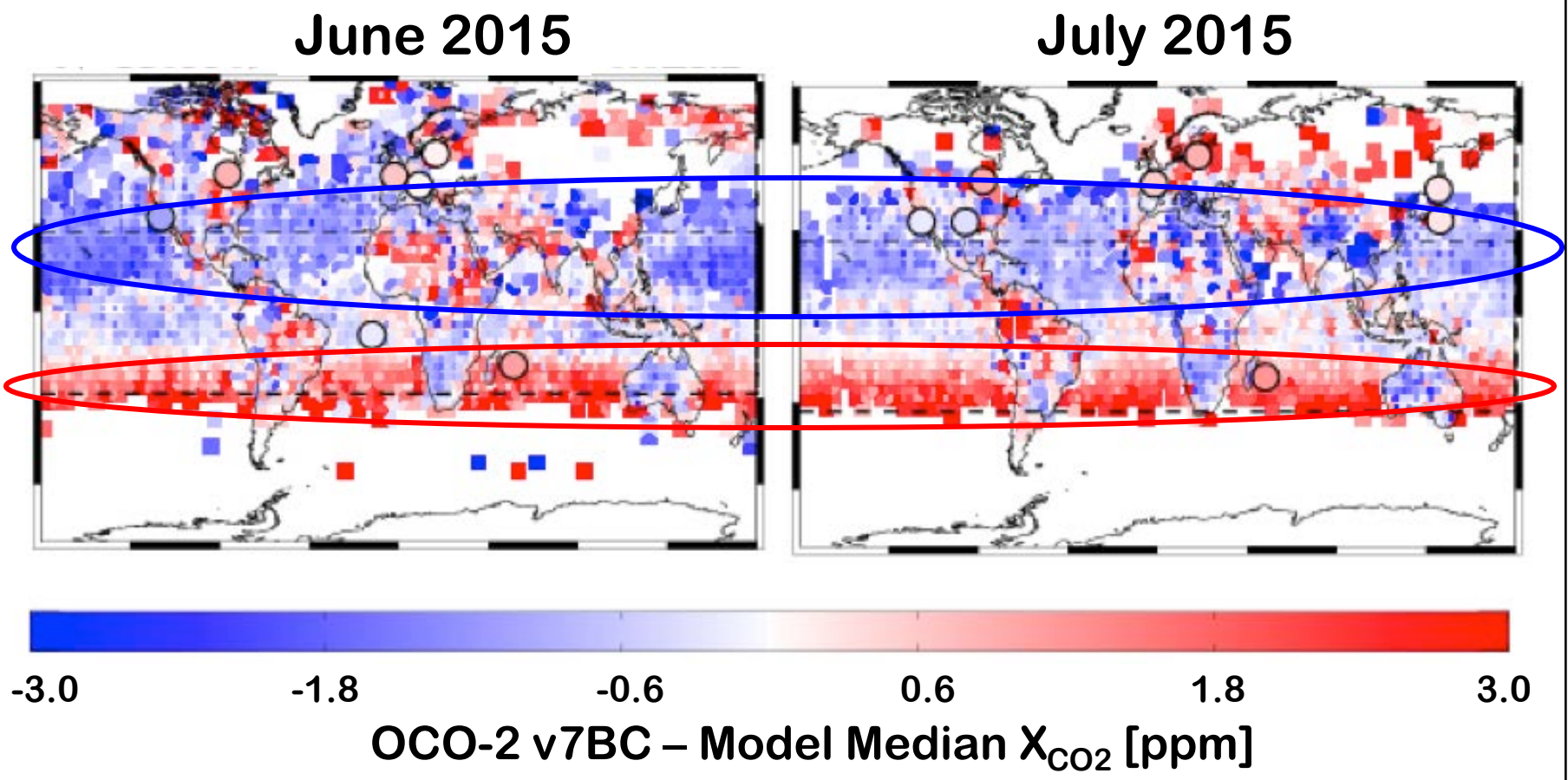






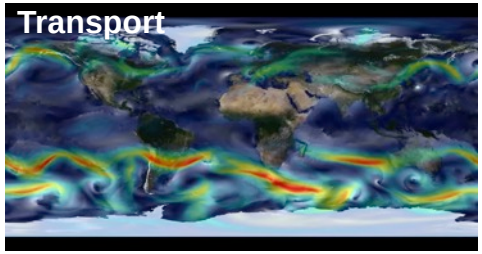
CSIRO Marine and Atmospheric Research and Australian Bureau of Meteorology (Cape Grim Baseline Air Pollution Station)

Biases Relative to Multi Model Medians

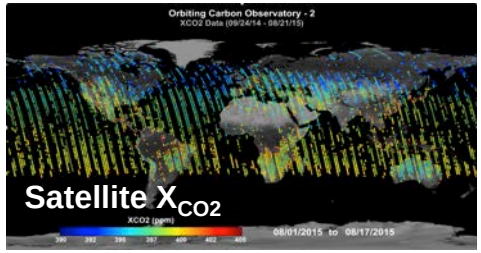


- High bias at high southern latitudes in southern winter
- Persistent low bias over tropics

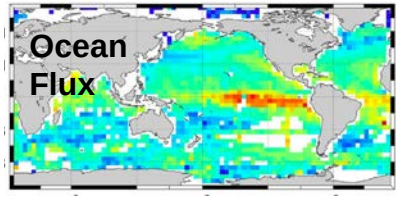
“Top-Down” Flux Inversion Estimates

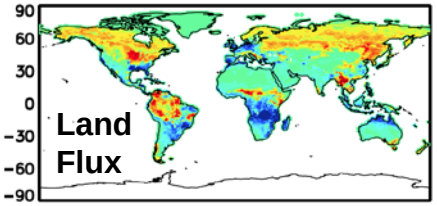


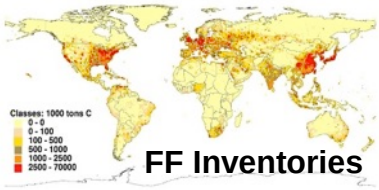
In situ CO_2



Prior Fluxes



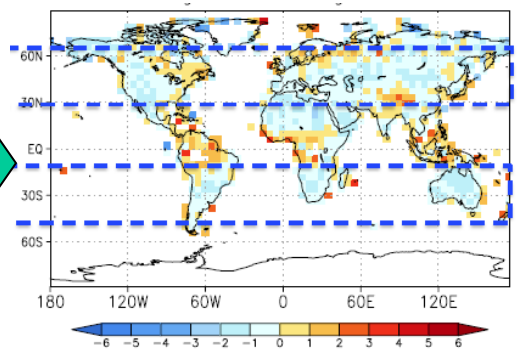




Flux Inversion Model

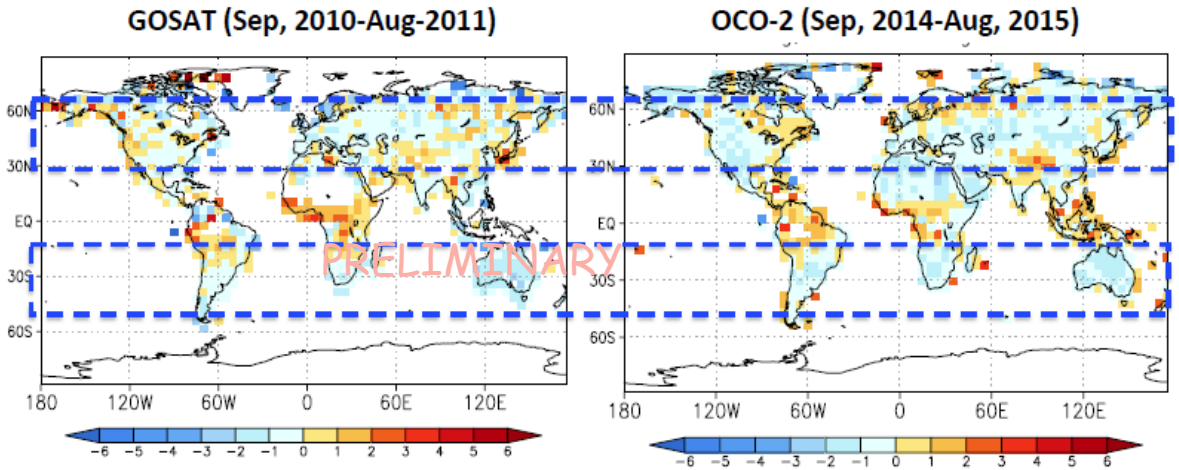
$$\frac{\partial C}{\partial t} = E - kC$$

Optimizer

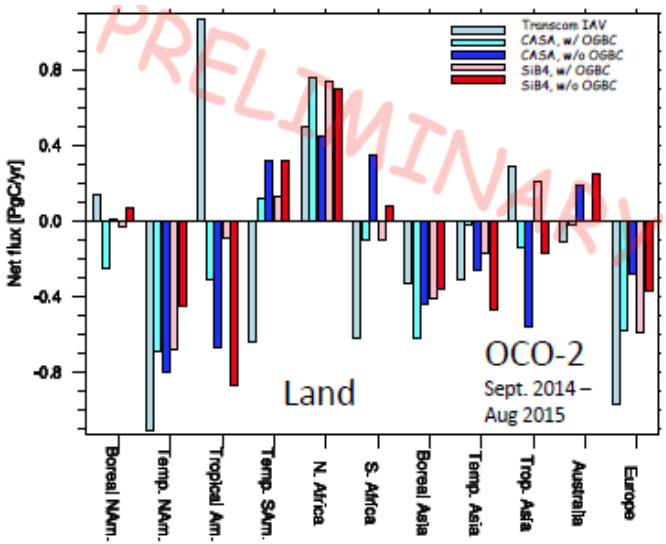


Optimized Fluxes

Preliminary CO_2 Flux Inversion Results



GOSAT & OCO-2 inversions indicate larger sources in tropics and larger sinks at higher latitudes [J. Liu et al.]



CO_2 flux amplitude depends on bias correction applied to OCO-2 data [D. Baker]

The Evolving Near-Infrared Atmospheric Carbon Measurement Capabilities

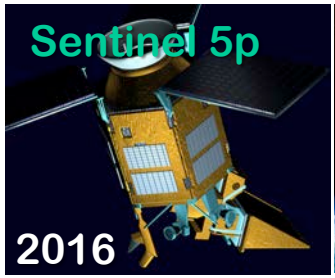
PAST

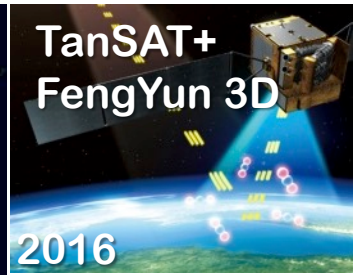
If carefully coordinated, these missions can be integrated into an ad hoc constellation and their measurements can be combined to produce a continuous data record.

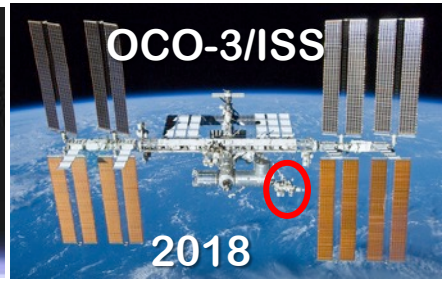
PRESENT

However, none of these missions provides the capabilities needed to quantify fossil fuel emissions and other human activities. For that, we need a constellation.

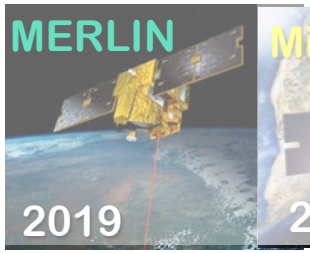
NEAR FUTURE

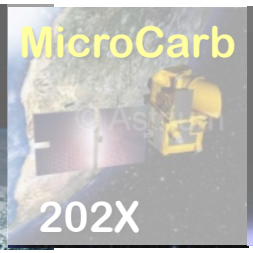


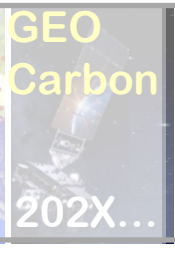




LATER







Summary

- OCO-2 was successfully launched on 2 July 2014, and began routine operations on 6 September 2014
  - Now returning about 100,000 full-column measurements of X_{CO2} each day over the sunlit hemisphere
  - These products are being validated against TCCON and other standards to assess their accuracy
- Over 18 months of data has been delivered to the Goddard Earth Sciences Data and Information Services Center (GES-DISC) for distribution to the science community
  - September 6 2014 – 4 May 2016 delivered

http://disc.sci.gsfc.nasa.gov/OCO-2

- This product is now being used by the carbon cycle science community to identify and quantify the CO_2 sources and sinks on regional scales over the globe

Coming Attractions!

- P-11 David F. Baker, et al., Using In Situ CO2 Measurements to Help Understand GOSAT and OCO-2 Column CO2 Retrievals
- Brendan Byrne, Dylan Jones, and Kim Strong, Sensitivity of CO2 Flux Inversions to the Temporal and Spatial Distribution of Observations
- P-12 Heather Q. Cronk, et al., A Multi-sensor Approach to Cloud and Aerosol Detection in Support of OCO-2 XCO2 Retrieval Validation
- P-32 Robert R. Nelson and C.W. O'Dell, Total Column Water Vapor from OCO-2
- P-9 *Xinxin Ye*, Imprint of Urban CO2 Emissions Detected by OCO-2 Observations of Total Column CO2

Thank You for Your Attention

Questions?