

OCO-2 and OCO-3 Validation Strategy and Needs

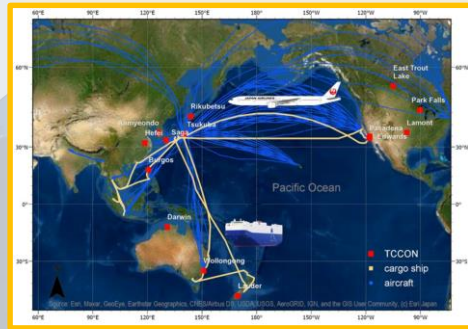
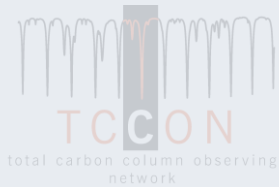
Abhishek Chatterjee

Jet Propulsion Laboratory, California Institute of Technology

Matthäus Kiel, Greg Osterman, Josh Laughner, Saswati Das, Dustin Roten, Vivienne Payne, OCO Validation Team

Tuesday, 24th October, 2023

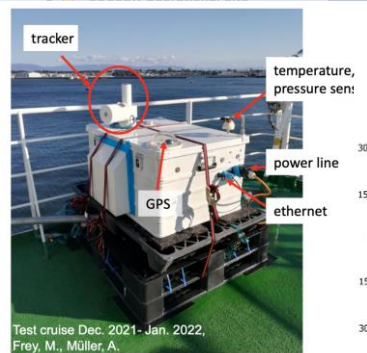
OCO Validation Strategy



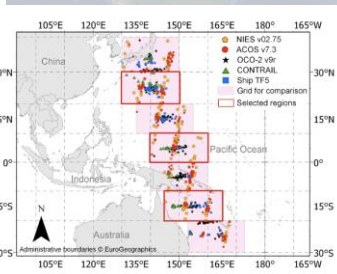
- TCCON Operational Site
- ▲ Past TCCON Site
- Future TCCON Site
- COCCON Operational Site

Ocean/Coast

(Sub)Tropics



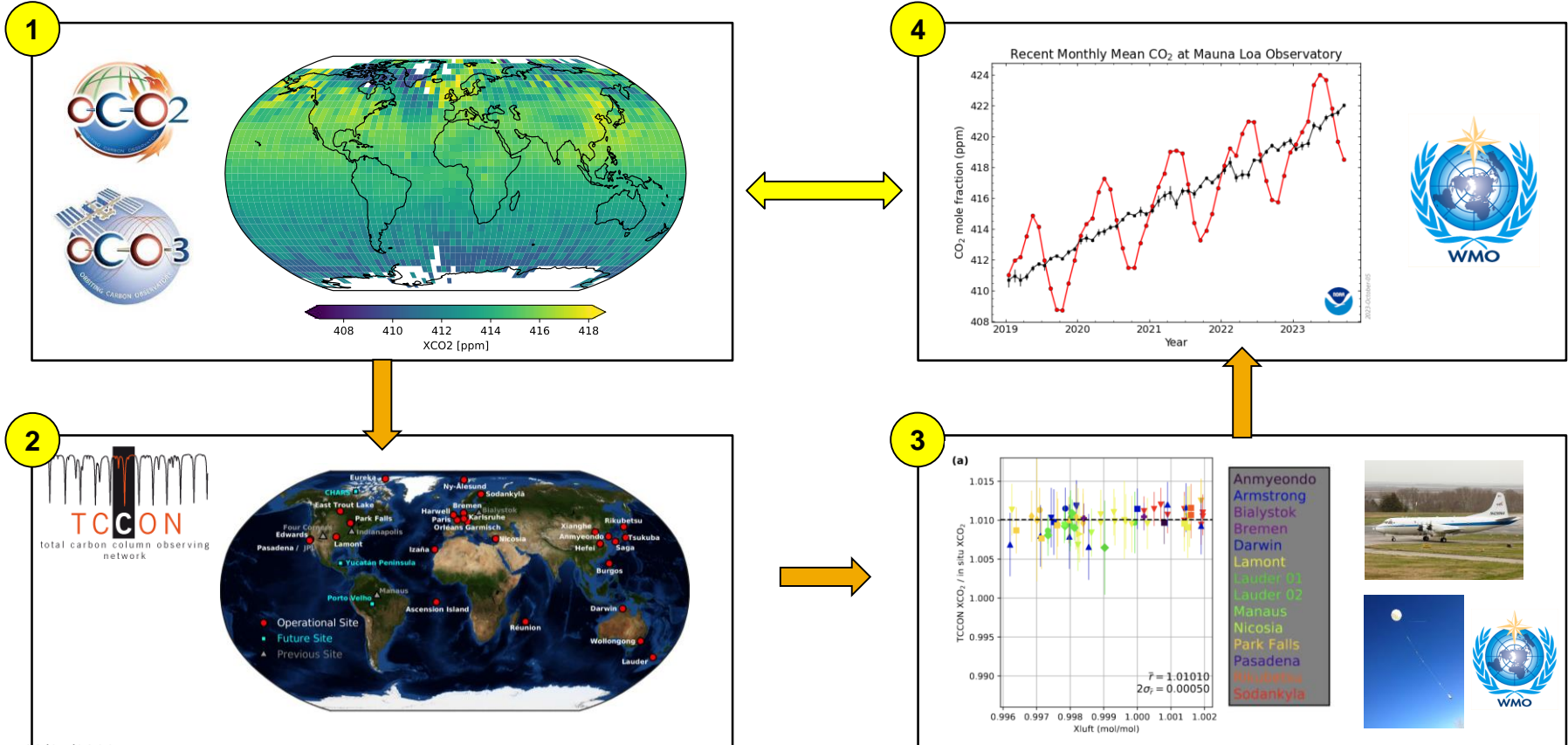
Müller et al.



McKain et al.

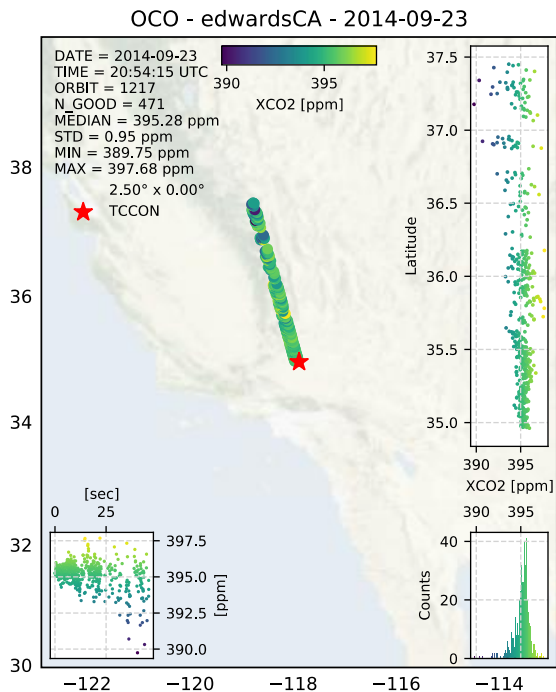


TCCON as a Transfer Standard

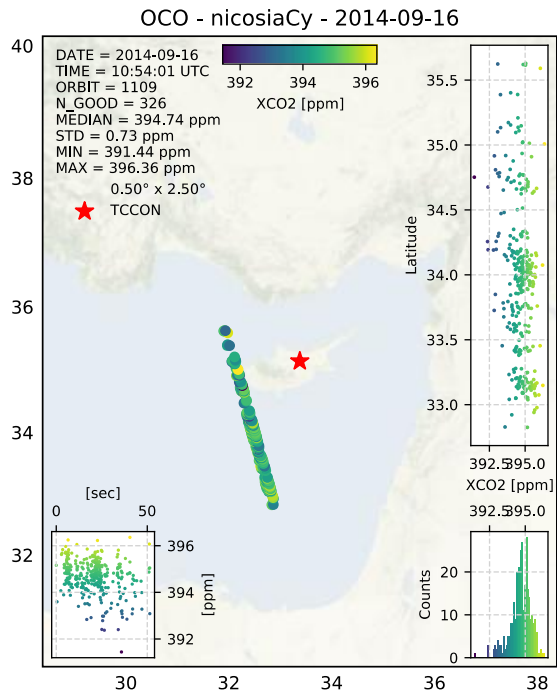


Sampling Collocated TCCON Data

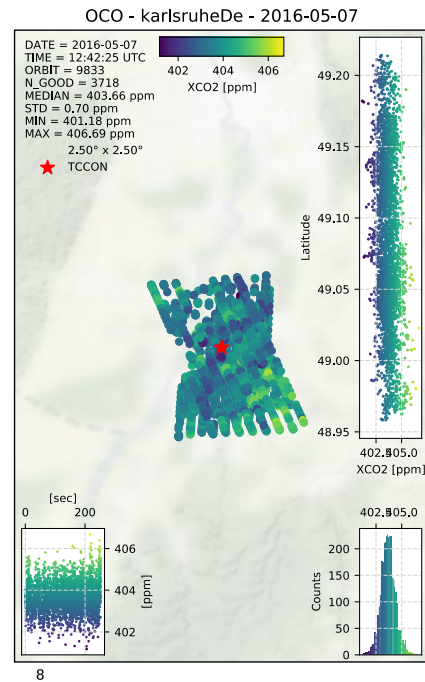
Land



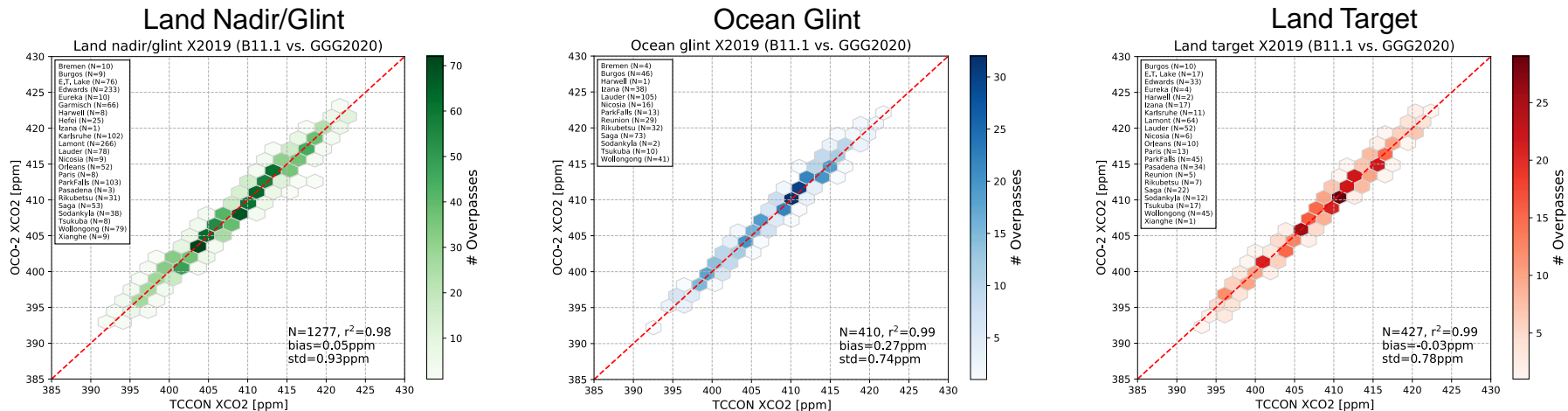
Ocean



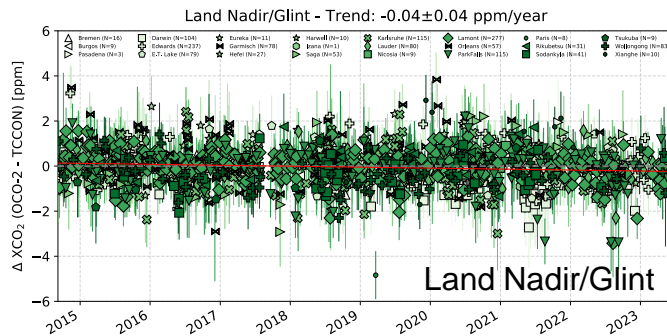
Target



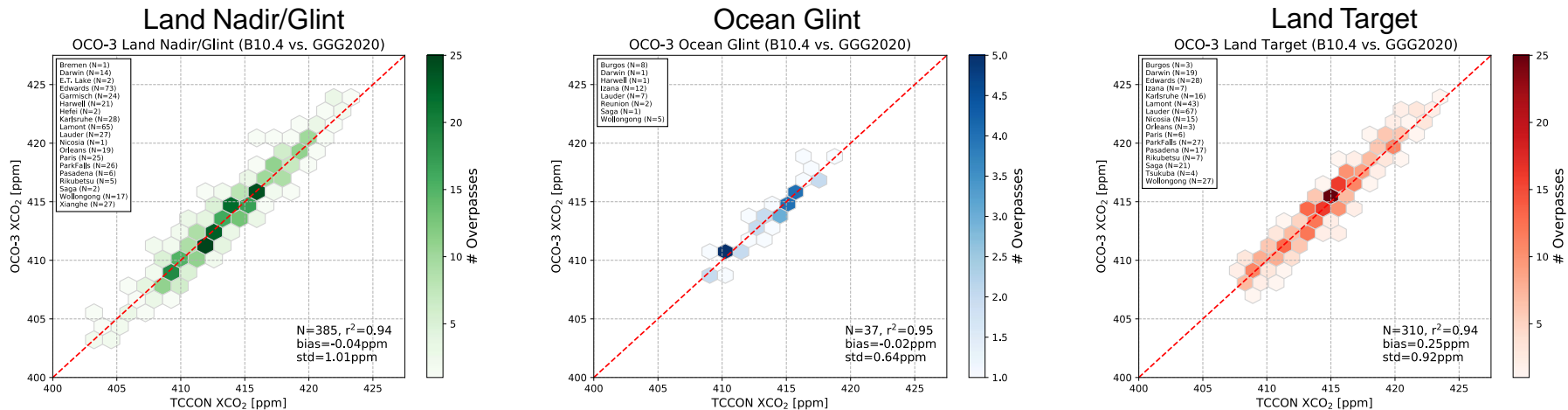
OCO-2 Validation against TCCON GGG2020



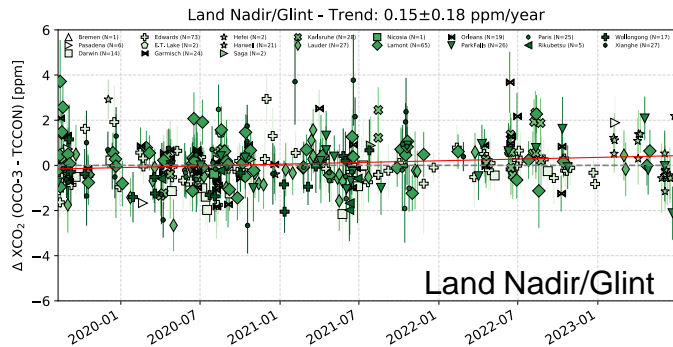
Time
Dependence



OCO-3 Validation against TCCON GGG2020

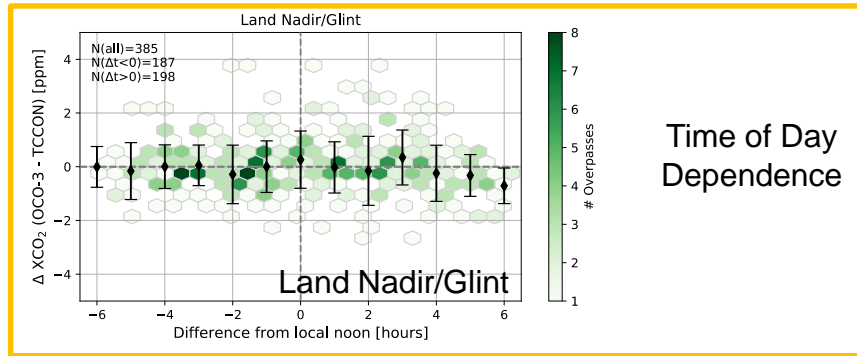


Time
Dependence



10/27/2023

Time of Day
Dependence



Lessons Learned / Validation Needs

- **Preferred stations/locations:** coastal sites, high albedo sites, remote vs. urban, under-represented areas over land (tropics, high-northern latitudes), ocean/island sites (ocean glint retrievals have more stringent accuracy requirements than land retrievals)
- **Towards “Super Sites”?** Collocation of tiered observing strategy for GHG (in situ, AirCores, total column), aerosol, cloud, P, T, H₂O measurements?
- **Expansion of COCCON?** Need to better define combining different ground-based FTS-based validation sources (e.g., TCCON + COCCON).
- **How to sustain continued support to networks?** Personnel? New sites? Spare parts (LASER)? Travel standard? AirCore network?
- **Uncertainty budget needed for ground-based networks.**

We cannot always get the overpass / obs. mode / revisit frequency we want!

Lessons Learned / Validation Needs

Retrieval inputs and outputs

- ▶ XCO_2
 - ▶ Land, ocean, coasts, long-term changes
- ▶ Other retrieved quantities: surface pressure, surface albedo, aerosol optical depth, temperature, CO_2 grad del, clouds, etc.
- ▶ Input data: ABSCO, meteorology, DEM
- ▶ SIF

Derived quantities

- ▶ Changes in XCO_2 (spatial and temporal gradients)
- ▶ Fluxes
 - ▶ Local
 - ▶ Regional
 - ▶ Country-scale
 - ▶ Global

Main focus
Some focus
Little focus
No focus

Summary from the “*Validation Needs*” Session at the OCO Science Team meeting in March 2023
Credit: D. Wunch (U. Toronto), M. Kiel (JPL)



**Can you tell the
difference
between
caffeinated
coffee
and decaf?**

If so, you have detected a concentration of 400 parts per million (ppm). There's more than 400 ppm of carbon dioxide in Earth's atmosphere. **Small amounts of powerful substances have big effects.**

CLIMATE.NASA.GOV

QUESTIONS?

abhishek.chatterjee@jpl.nasa.gov



Jet Propulsion Laboratory
California Institute of Technology