Jet Propulsion Laboratory
California Institute of Technology

OCO-3 Version 11 Snapshot Area Mapping (SAM) Mode Observations

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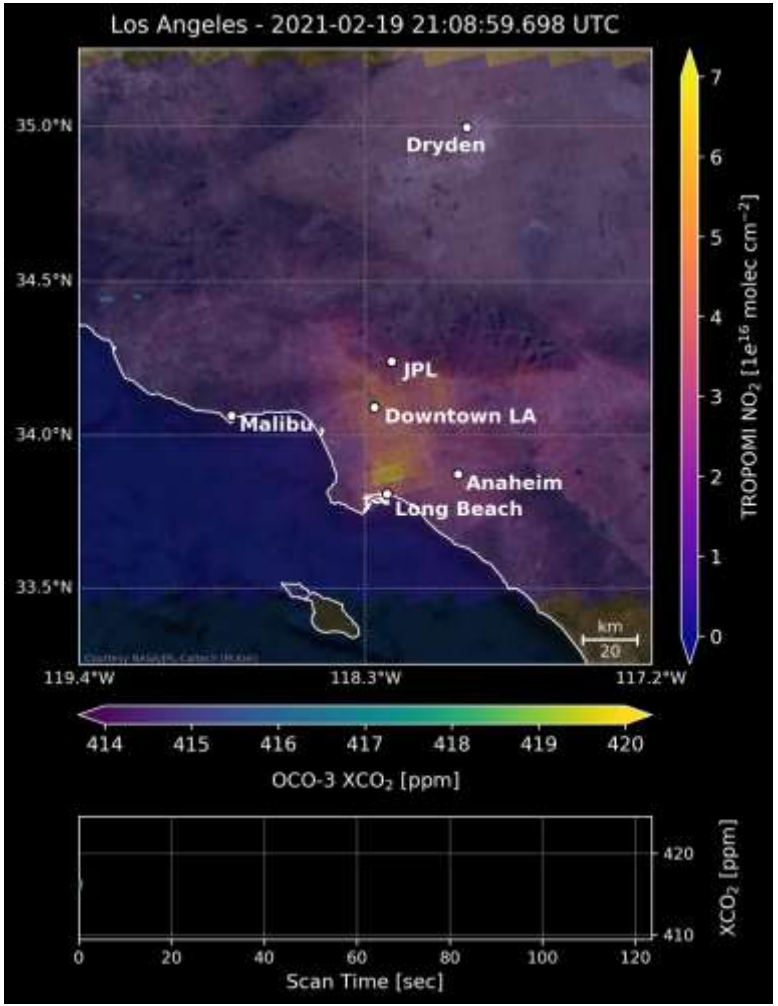
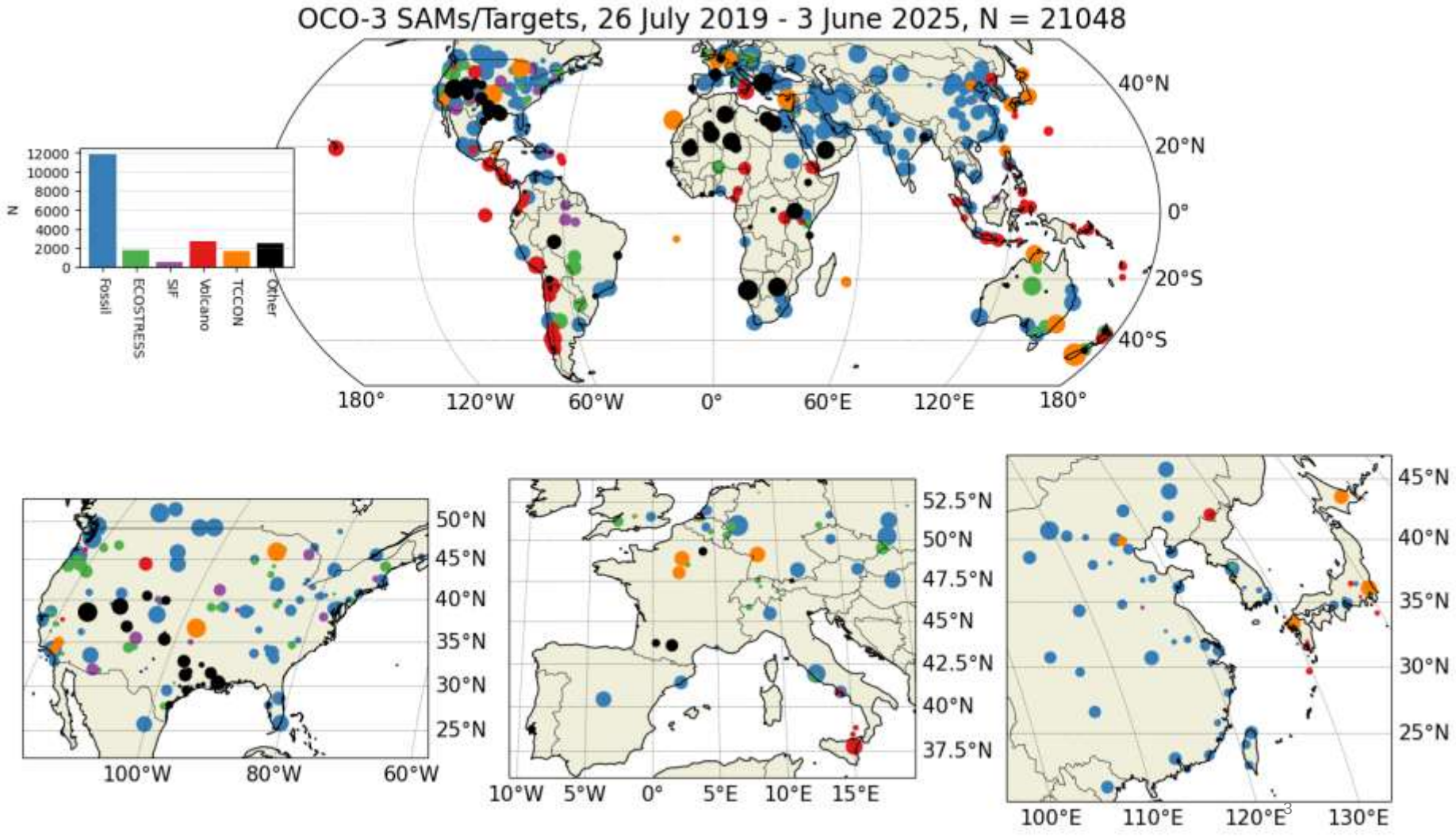
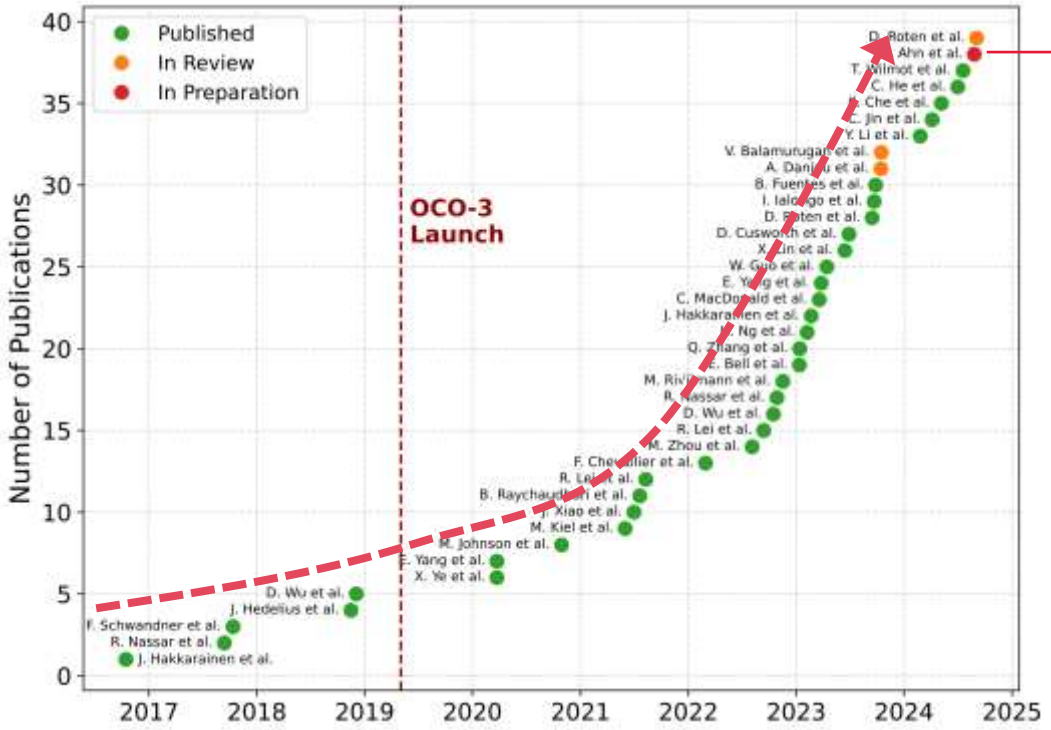
ACOS Version 11 (v11)

- OCO-3 data record has recently been reprocessed using the latest version (v11) of the Atmospheric Carbon Observations from Space (ACOS) dry-air mole-fraction of carbon dioxide (XCO_2) retrieval
- Major changes in v11 include:
  - Updated to the Copernicus Digital Elevation Model (DEM)
  - Switched from GEOS FP-IT to GEOS-IT for meteorology and aerosol priors
  - New ocean surface treatment (scaled Cox-Munk)
  - ABSCO updates (v5.2) and geolocation improvements
- OCO-3's Snapshot Area Mapping (SAM) mode: ~80 x 80 km^2 in ~2 min.

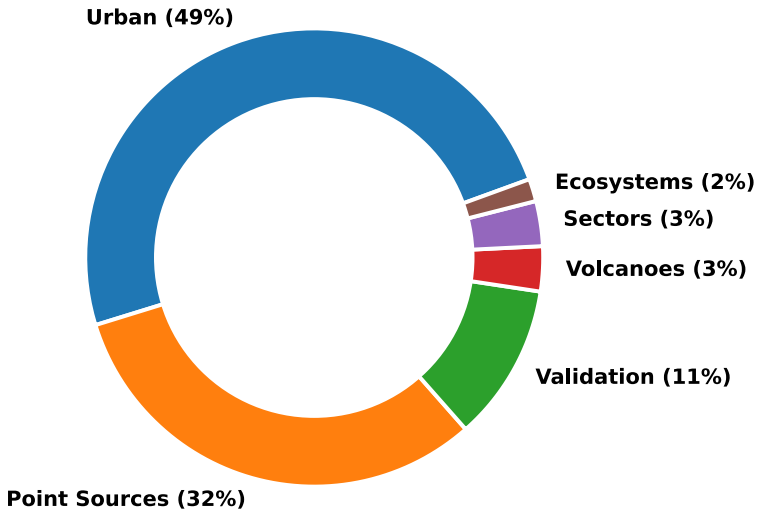



OCO-3 SAMs/Targets, 26 July 2019 - 3 June 2025, N = 21048
N
12000
10000
8000
6000
4000
2000
0
Fossil
ECOSTRESS
SIF
Volcano
TCCON
Other
40°N
20°N
0°
20°S
40°S
180°
120°W
60°W
0°
60°E
120°E
180°
50°N
45°N
40°N
35°N
30°N
25°N
100°W
80°W
60°W
52.5°N
50°N
47.5°N
45°N
42.5°N
40°N
37.5°N
10°W
5°W
0°
5°E
10°E
15°E
45°N
40°N
35°N
30°N
25°N
100°E
110°E
120°E
130°E

Utilization of SAMs within the scientific community continues to grow



e.g., see Ahn et al. Talk (6.10), Thurs. AM



Methodology

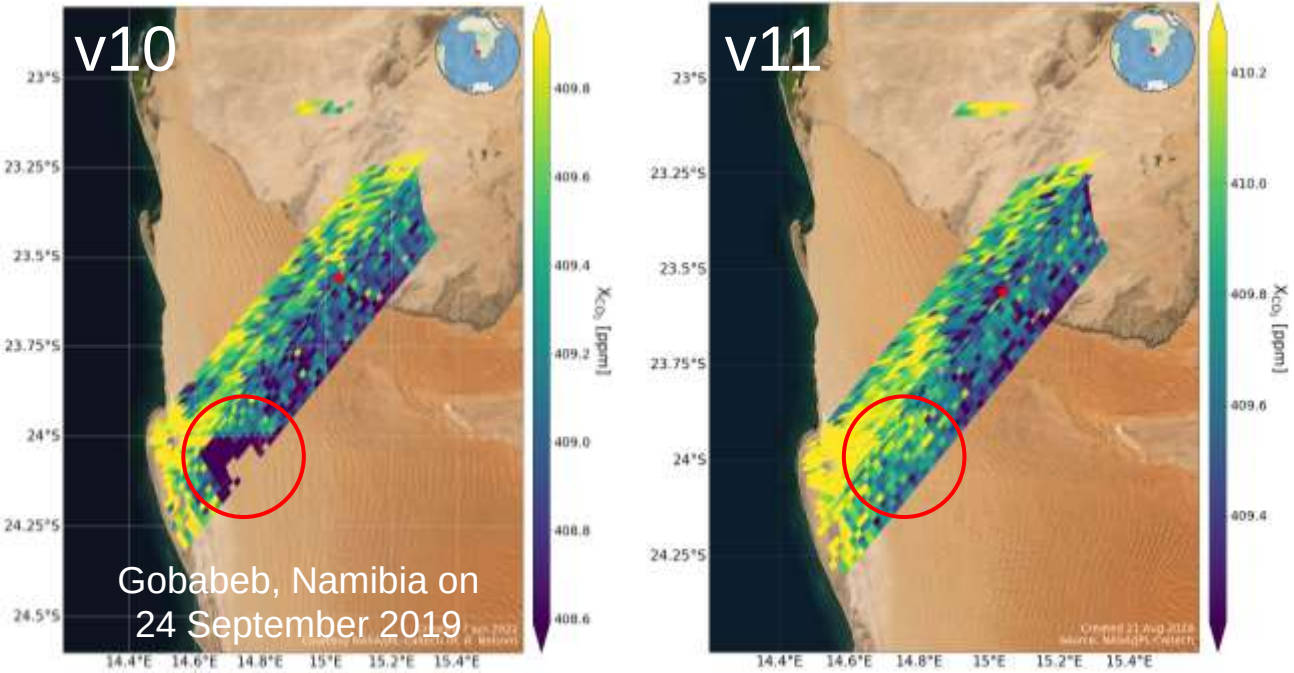
- Compared OCO-3 **v10** to **v11 SAMs** (only XCO_2 fields analyzed)
  - Looked at ~16000 SAMs/Targets from 6 Aug. 2019 – 12 Nov. 2023 (storage)
  - Final XCO_2 quality flag applied
  - Final bias correction applied

Conclusions

- **Most SAMs appear similar** in v11 versus v10
- For **some SAMs**, v11 represents a **clear improvement** over v10
- Some XCO_2 artifacts remain, which will hopefully be addressed in a future version!

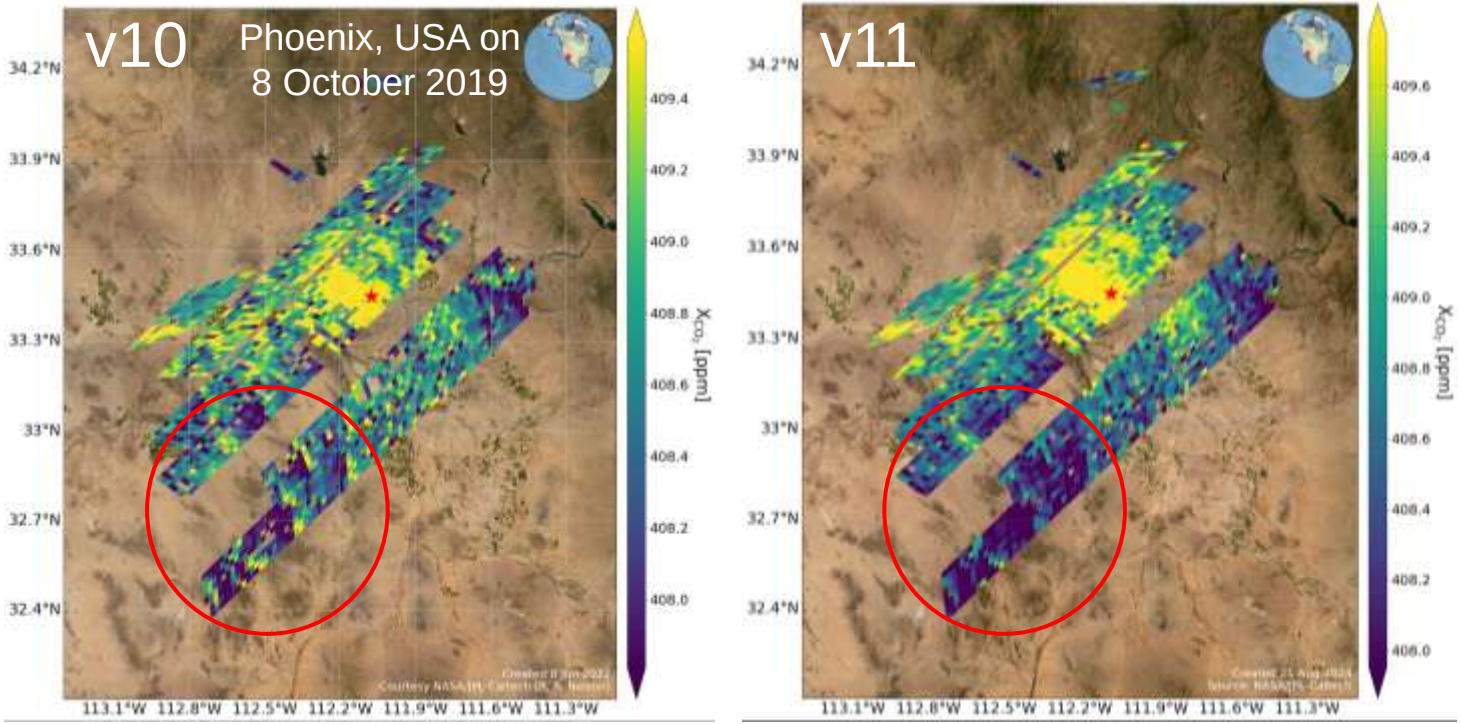
DEM Improved

- Fewer topography-induced errors
  - v10 DEM errors were causing the retrieved surface pressure to differ from the prior (“dp”), which propagated into BC XCO_2



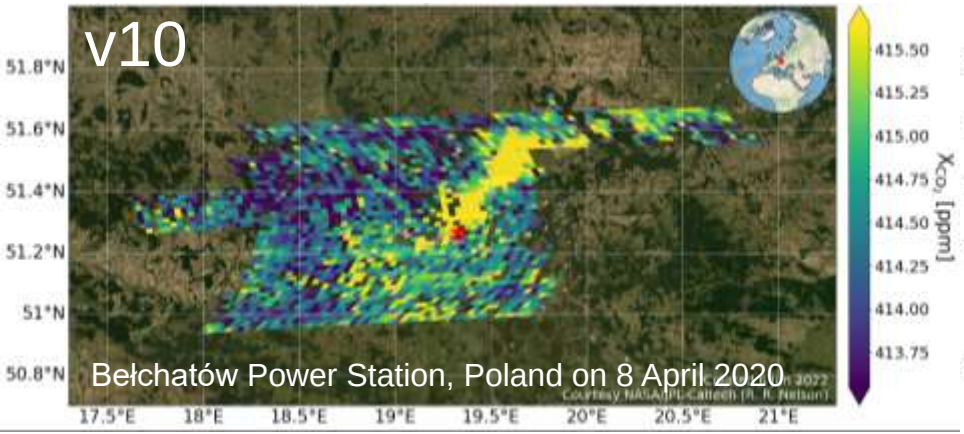
DEM Improved

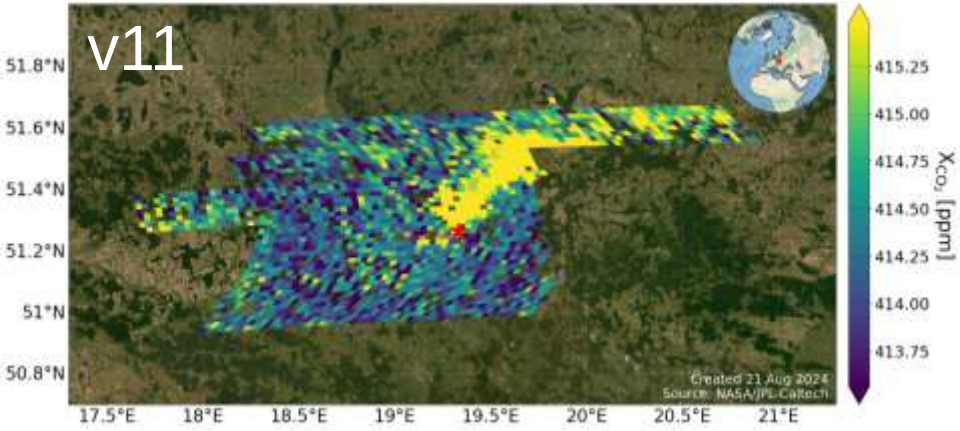
- Fewer topography-induced errors enables a more accurate background XCO_2 estimate for urban CO_2 emission estimates



DEM Improved

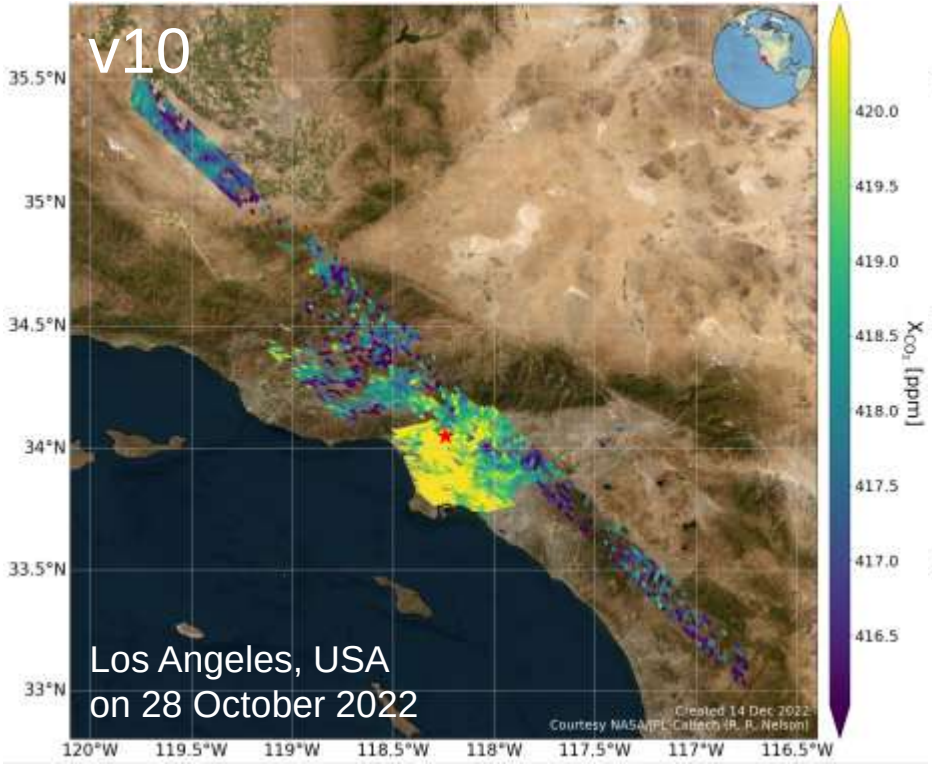
- Some power plant XCO_2 plumes are easier to identify because the background XCO_2 has fewer DEM-driven artifacts

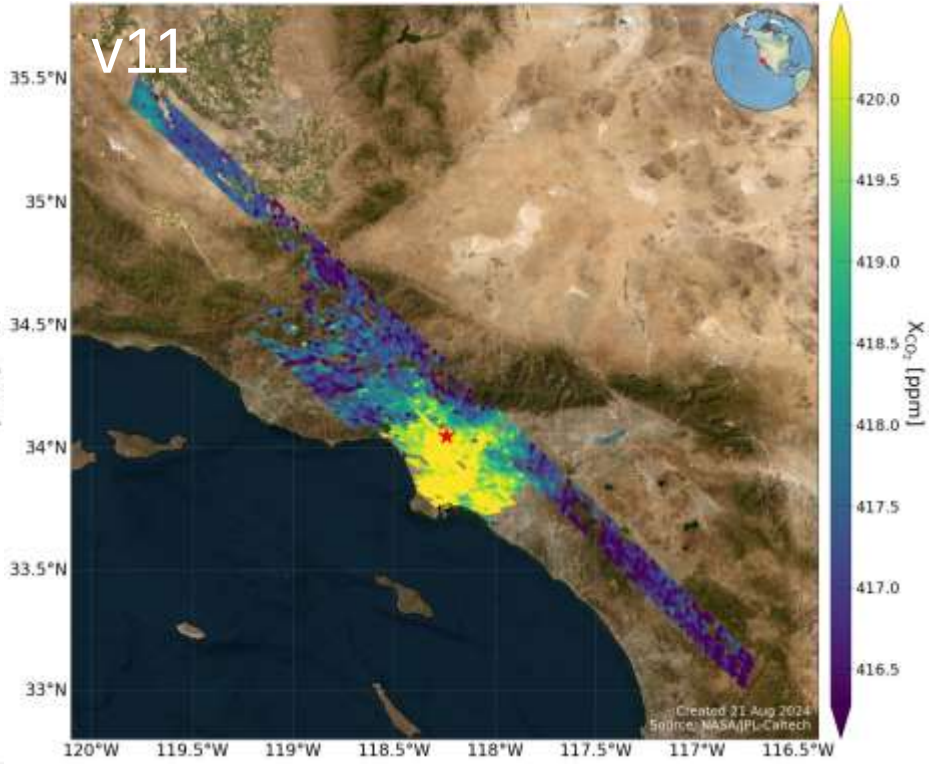




DEM Improved

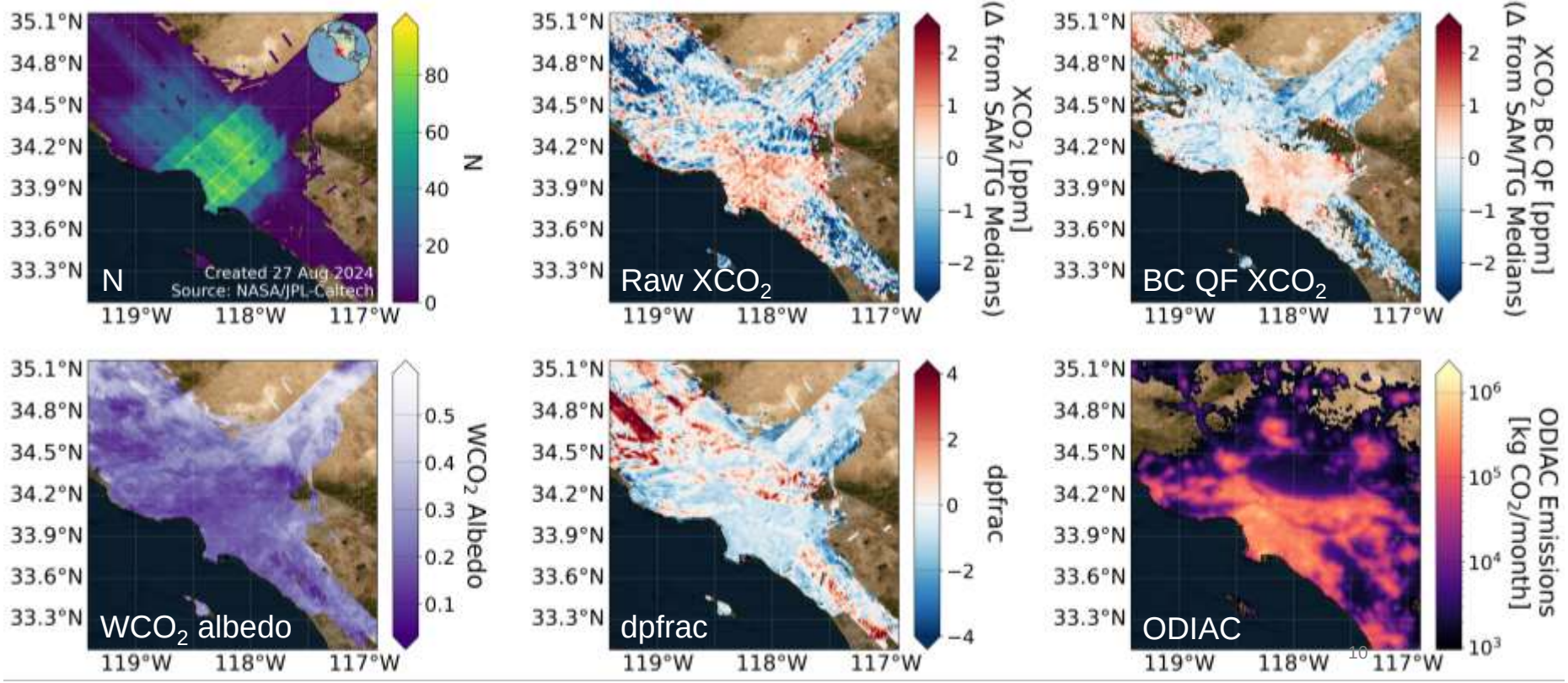
- Some urban XCO_2 plumes are easier to identify in v11 due to improved coverage and fewer artifacts





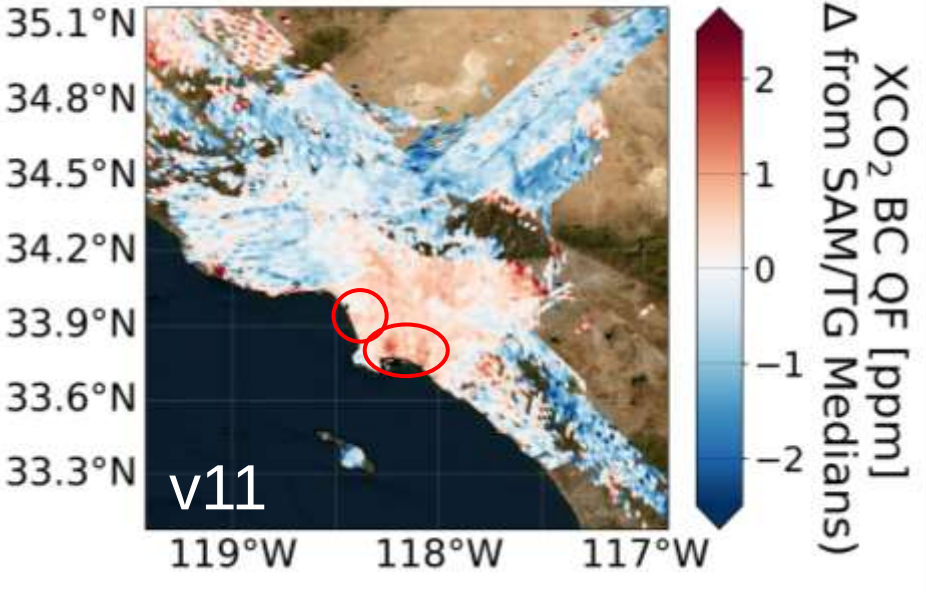
Site-Average Plots

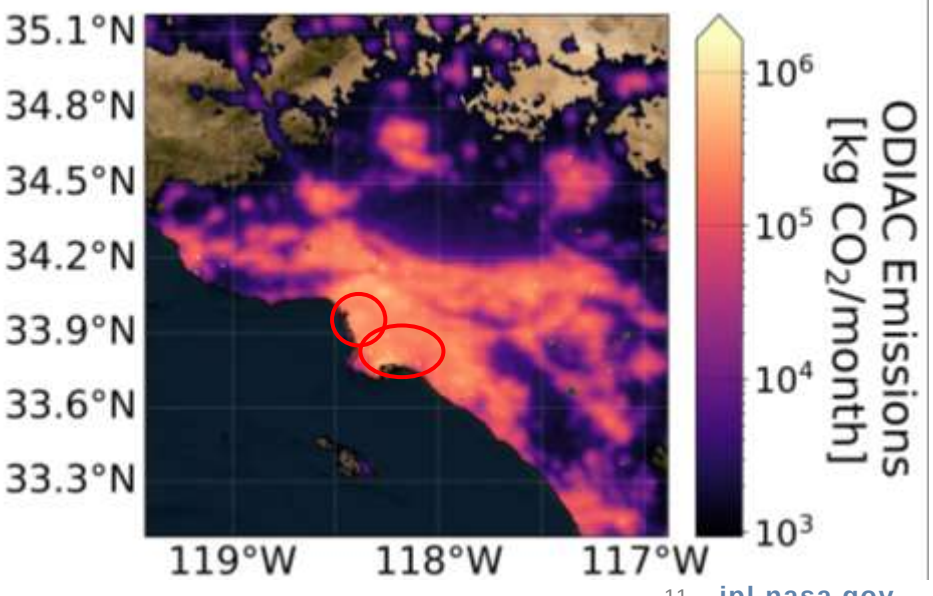
- All OCO-3 SAMs for a given site averaged onto a 0.25°x0.25° lat-lon grid



Los Angeles (Number of SAMs = 98)

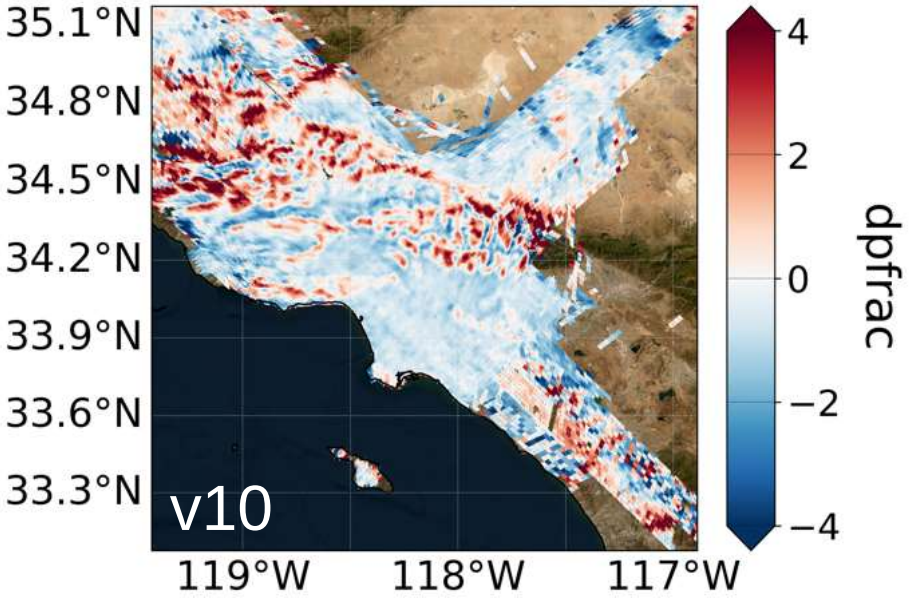
- Higher XCO_2 values are seen in the LA basin
- XCO_2 patterns visually match ODIAC CO_2 emissions
  - e.g., the Ports of Los Angeles/Long Beach, Los Angeles International Airport

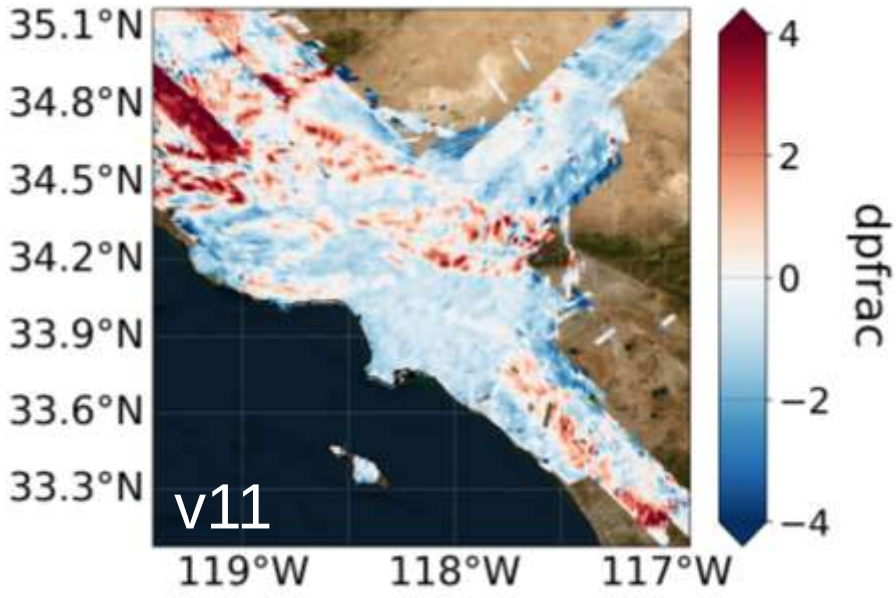




Los Angeles (Number of SAMs = 98)

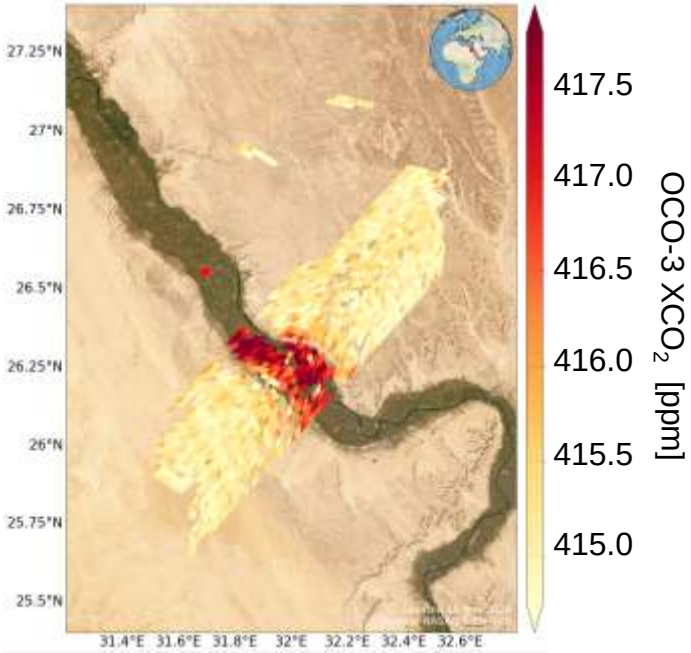
- The artifacts in dpfrac (similar to dp) are smaller in v11, a result of using a more accurate DEM



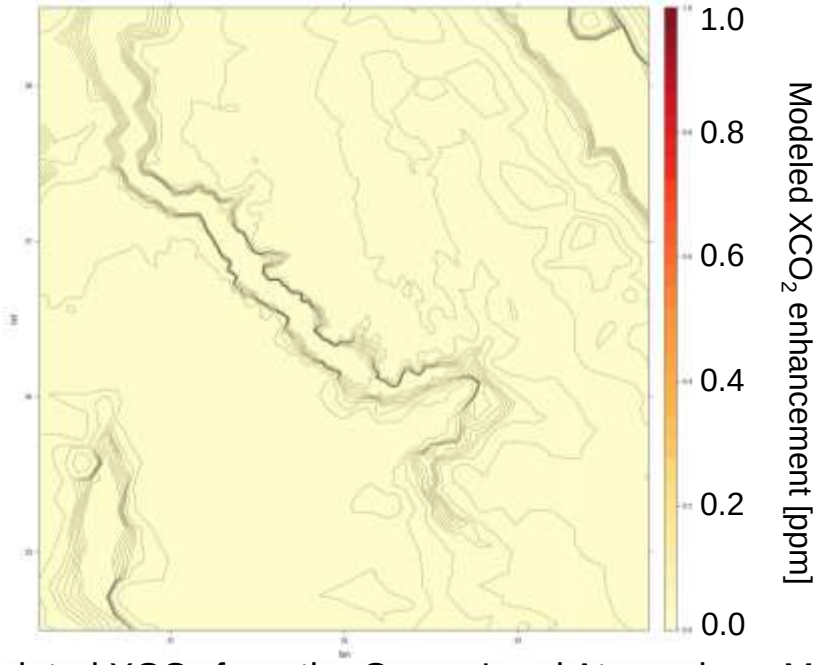


Artifacts Remain

- The OCO-3 v11 XCO_2 enhancement (left) is large (~1–3.5 ppm) relative to a high-res model (right) in the Nile River Valley, suggesting a potential albedo-induced bias



OCO-3 SAM of Sohag, Egypt on 8 Feb. 2021



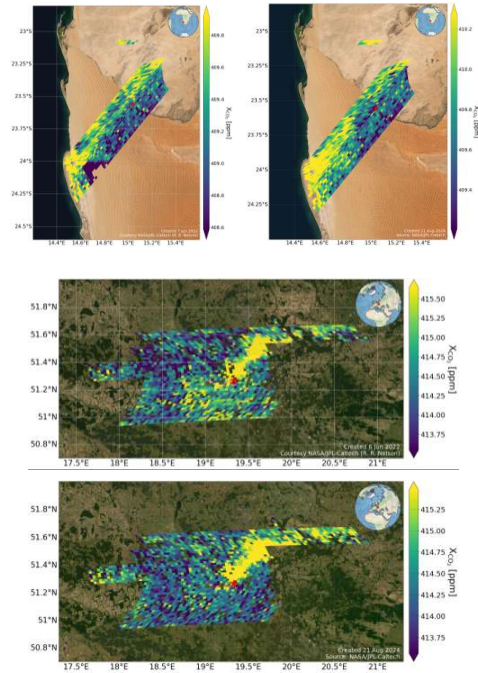
Simulated XCO_2 from the Ocean Land Atmosphere Model (OLAM) for 4 Feb. 2020 (from Andrew Schuh)

Conclusions

- **Most SAMs appear similar** in v11 versus v10

- For **some SAMs**, v11 represents a **clear improvement** over v10
  - DEM improvement leads to fewer topography-induced XCO_2 errors
  - Sometimes smoother-looking XCO_2 fields, which aid in estimating urban backgrounds and identifying point source plumes

- Some XCO_2 artifacts remain, which will hopefully be addressed in a future version!



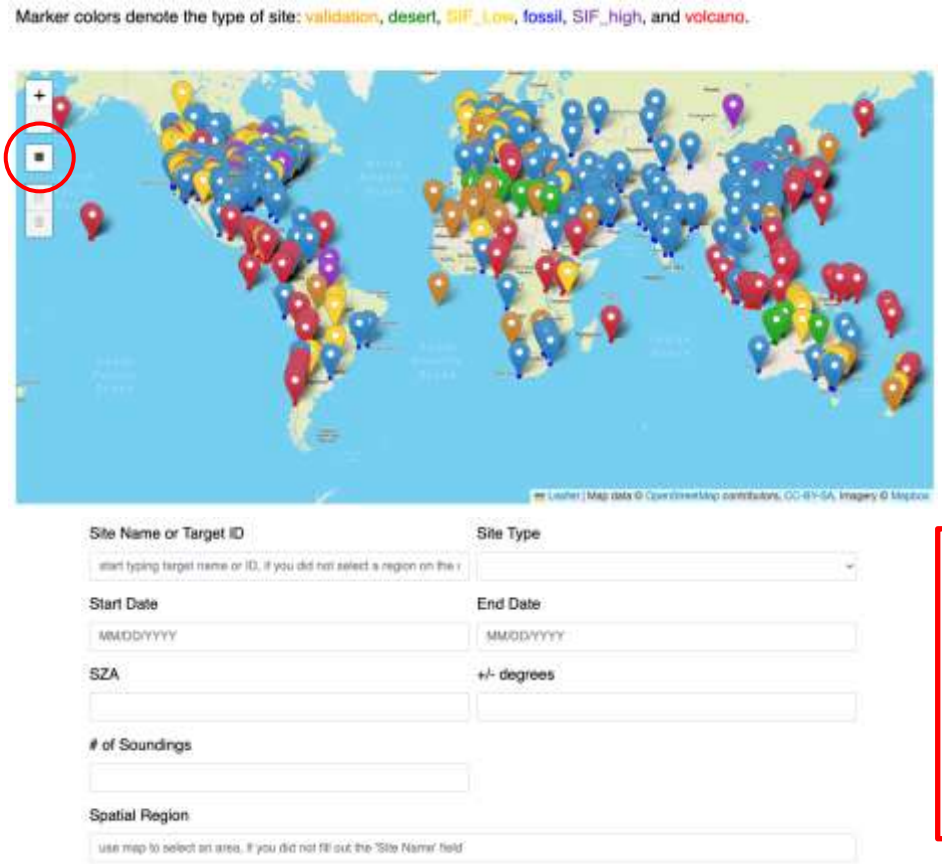
OCO-3 SAMs

Low latency

- External users are quickly informed of SAMs being collected

Custom search

- Sub-setting tools to filter and/or select a region with multiple SAMs
- Download subsetted .nc4 files!



Quick-look plots

- XCO_2 (Raw)
- XCO_2 (BC+QF)
- O_2 A-Band Radiance
- SIF
- dp
- TROPOMI NO_2, CO
- Geostationary imagery (GOES, Himawari)

Add your site!

- We can support your ground/airborne campaigns or sites of interest!
- “Request a SAM”

https://ocov3.jpl.nasa.gov/sams/

Thank You!

GES DISC
OCO-3 v11 Lite
XCO_2 files: