

The OCO-2 and OCO-3 missions: Status, results and plans

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"Changing of the guard"





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"Changing of the guard"





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Orbiting Carbon Observatory-2 (OCO-2)

- Launched July 2, 2014
- Sun-synchronous polar orbit (A-Train)



Orbiting Carbon Observatory-3 (OCO-3)

- Launched May 4, 2019
- ISS (JEM-EF), ± 52° inclined orbit







OCO-2 vs. OCO-3 Instrument Overview

	OCO-2	OCO-3	Nadir	OCO-2/OCO-3 Simultaneous Nadir Overpass, 2020-04-28 OCO-3 Solar Day 05579, OCO-2 Orbit 30974, Δt = 7 sec 110.95'E 111.1'E 111.25'E 111.4'E 111.55'E 111.7'E
launch	02 July 2014	04 May 2019		7.65'5
orbit	sun-synchronous, A- Train	precessing, ISS, 51.6° inclination		7.8"5
coverage	pole-to-pole, 1330h ect	52°S – 52°N, variable	Land	7.95°S
footprint size @nadir	3 km ²	3.5 km ²	Glint	
spectrometer	3 bands: 0.765 µm, 1.61 µm, 2.09 µm, 20,000 resolving power (OCO-3 was built as the OCO-2 spare)		£	
observed species	CO ₂ dry-air column (XCO ₂) solar-induced fluorescence (SIF)		Ocean	OCO-3 Os A Band Radiances 110 ¹⁰⁹ Photons//ser m ² sr um1 OCO-2/OCO-3 Simultaneous Nadir Overpass, 2021-10-23 OCO-3 Solar Day 13992, OCO-2 Orbit 38886, Δt = 575 sec 6.45*W 6.3*W 6.15*W 6.15*W
observation modes	nadir, glint, target	nadir, glint, target, SAM		14.25'N
off-nadir viewing	move spacecraft	pointing mirror assembly two mirrors: azimuth and elevation, moving independently	Target, SAM	14.1°N 13.95°N 13.8°N
repeatability of observations	same local time every orbit; spatial repeat after 233 orbits (16 days)	none! local time a little earlier each day; day-by-day change in latitude coverage	Land	Mali (sub- Saharan)

The OCO-2 swath width changes along the orbit as the spacecraft rotates to mitigate polarization effects. The OCO-3 instrument, with its pointing capability, maintains a uniform swath width. **Figures: T. Kurosu**



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5



OCO-2 and OCO-3 provide different, but complementary coverage



Figures show numbers of soundings for the duration of the OCO-3 mission.

OCO-2, launched in 2014, provides a longer time record than OCO-3, launched in 2019.

OCO-2 also provides more extensive latitudinal coverage.

OCO-2 observations are more numerous over oceans, while OCO-3 provides more dense coverage over land.

In the regions where both datasets overlap, there will be science and applications that can be explored.



OCO-3 target and Snapshot Area Map observations





v10 Level 2 products for OCO-2 and OCO-3

- For OCO-2: There is no evidence of any significant time dependence in the OCO-2 v10r XCO₂ relative to TCCON.
- For OCO-3: The latest version of the XCO₂ data (v10.4r) includes an empirical correction to XCO₂ account for time-dependent L1B calibration issues.
 - See posters by Taylor, Kiel!



OCO-2 and OCO-3 v10 Level 2 XCO2 and SIF products are publicly available at the NASA GES DISC:

- <u>https://disc.gsfc.nasa.gov</u>
- v10r OCO2_L2_Lite_FP: bias-corrected XCO2 with other select fields, aggregated as daily files
- v10r OCO2_L2_Lite_SIF: solar induced chlorophyll fluorescence aggregated as daily files
- v10.4r OCO3_L2_Lite_FP: bias-corrected XCO2 with other select fields, aggregated as daily files
- v10r OCO3_L2_Lite_SIF: solar induced chlorophyll fluorescence aggregated as daily files



2014-09 to 2022-02

2019-08



- Updates to inputs and algorithm
 - Physically motivated and/or made to address known issues with v10
 - See L. Kuai poster for more info on algorithm testing/evaluation
- Updates include:
 - Digital Elevation Map
 - L1B: Gain degradation, dispersion trend, instrument line shape (ILS), noise model, footprint dependence
 - ABP (mitigation of previous issue with inadvertent flagging of most soundings over South Atlantic Anomaly)
 - IMAP (increased SIF throughput)
 - Spectroscopy (ABSCO) updates (2.06 micron CO₂, water vapor lines in CO₂ bands) see F. Oyafuso poster
 - ABSCO scaling factors (mitigation of overall CO_2 bias, CO_2 profile shape issues)
 - Ocean surface treatment (improves linearity of retrievals over ocean)
 - Minor updates to land BRDF
 - CO₂ prior profiles
 - Sounding selection rules
 - Fix issue with SIF availability in Lite files for target mode observations

The OCO-2 spacecraft and instrument are in excellent health.

Items highlighted in blue:

Increasingly important for robustness of L2 algorithm and products as mission progresses in time.





Level 2 XCO2 and SIF products: Status and plans

Figures: B. Fisher, T. Taylor

• v11 for OCO-2

- OCO-2 is in excellent health
- V11 provides important updates to allow robust processing into the future
- OCO-2 processing switched over to v11 on 1st March 2022
 - No more v10 data after this date
- Reprocessing campaign is underway!
 - Expect to complete reprocessing
 summer 2023

v11 for OCO-3

- OCO-3 v10.4r processing is ongoing
- OCO-3's time on the ISS expected to end January 2023
- OCO-3 data will be reprocessed with v11 as part of end of mission activities
- v11 for OCO-3: Additional OCO-3-specific
 L1B calibration updates







Thank you!



