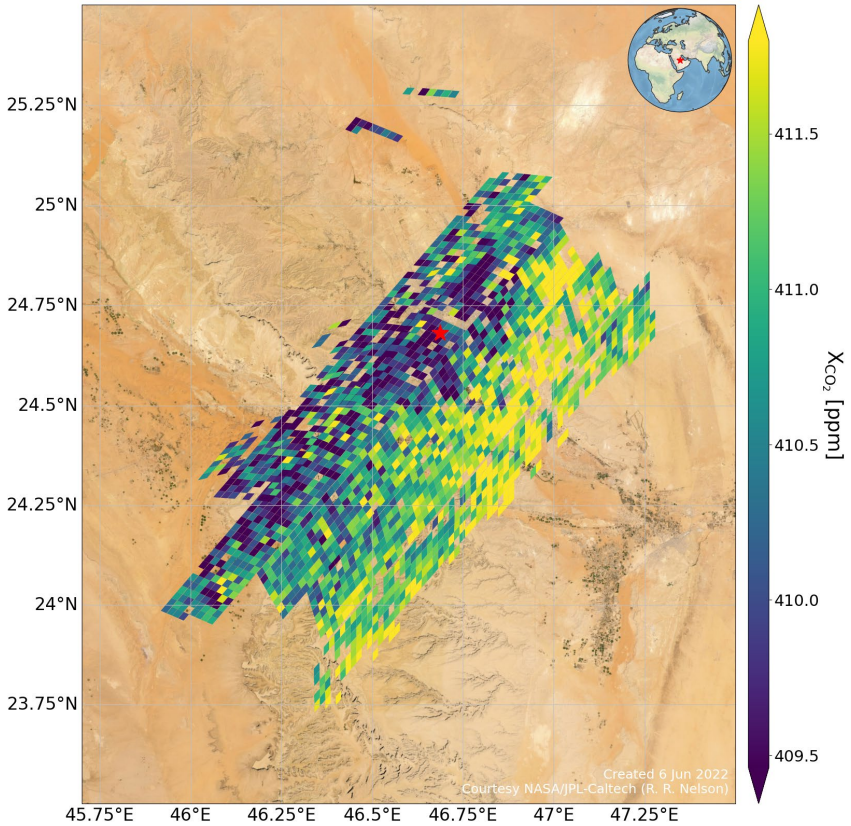

Monitoring anthropogenic emissions from space: insights from OCO-3's Snapshot Area Mapping (SAM)

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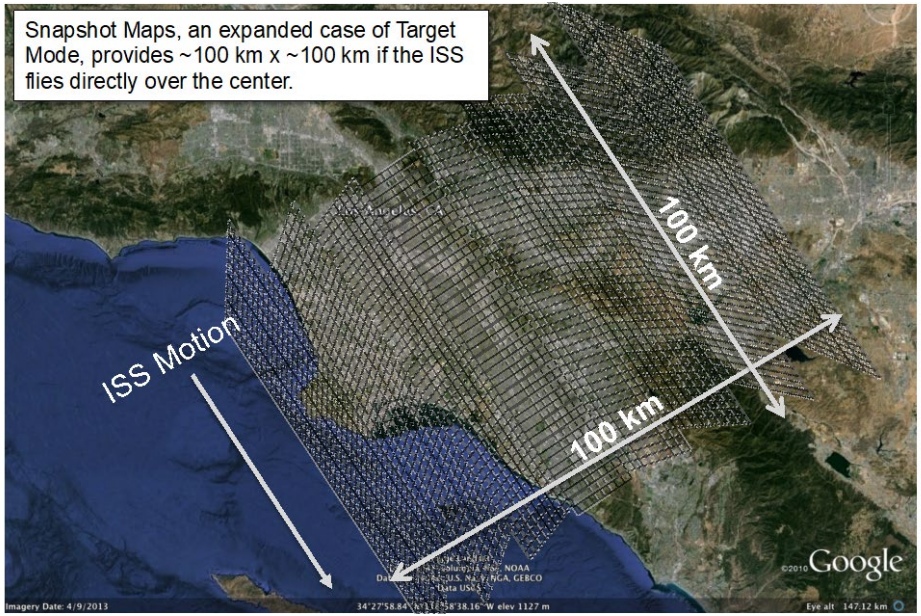
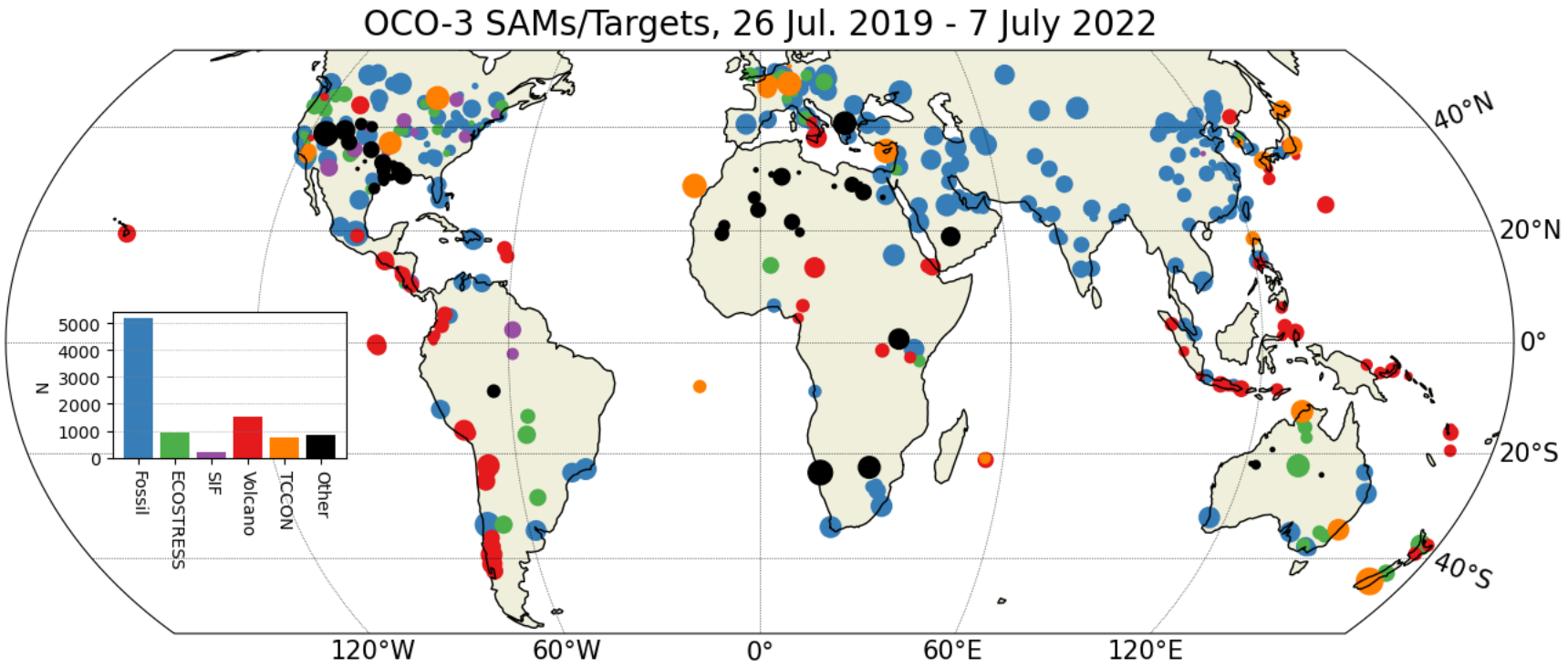
OCO-3's unique SAM (the fourth) observing mode



The Snapshot Area Mapping (SAM) mode -

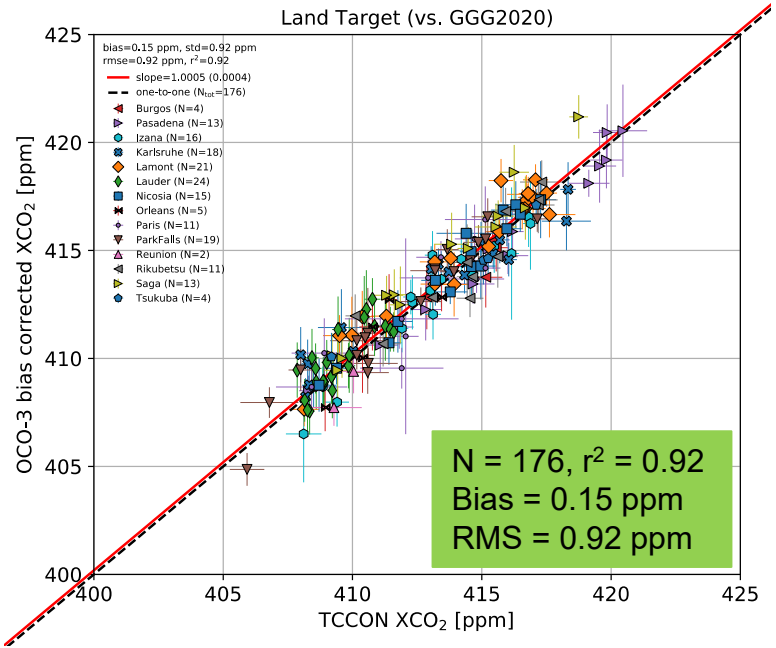
- captures details of carbon cycle processes from local human activities (megacities, power plants) and the biosphere with "map"-like measurements
- complements the near-global sampling provided by OCO-2 and OCO-3

Distribution of SAMs across the globe



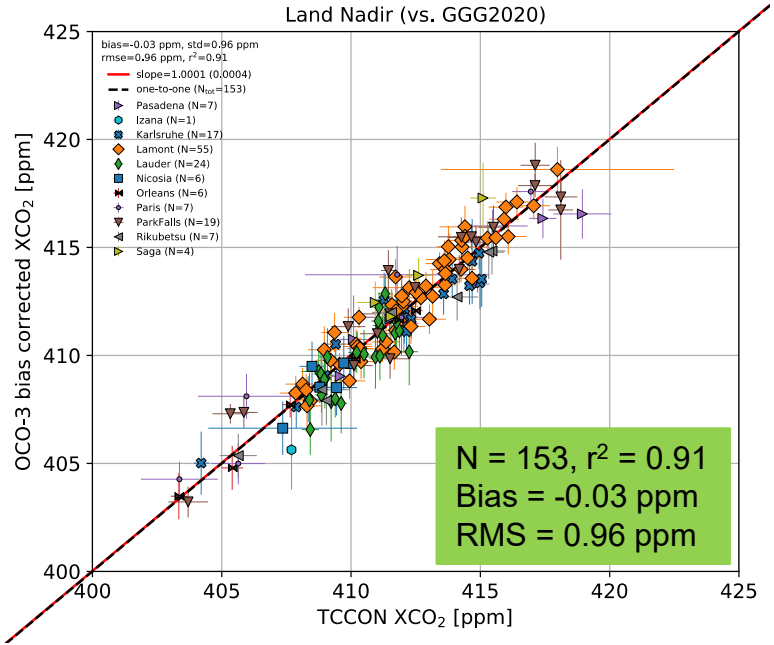
Validation of OCO-3 B10.4r data

Land Target



N = 176, r^2 = 0.92
Bias = 0.15 ppm
RMS = 0.92 ppm

Land Nadir

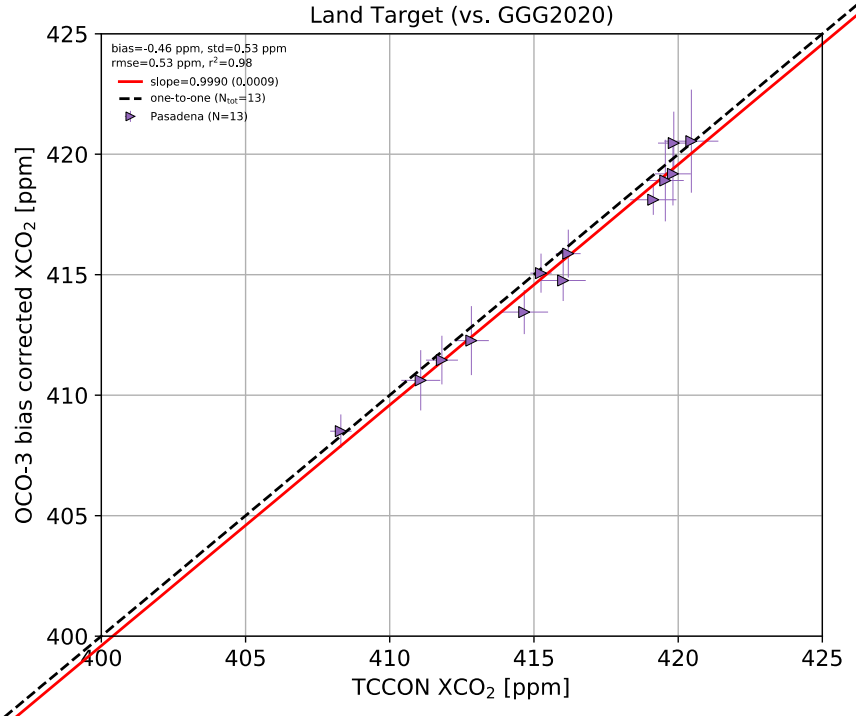


N = 153, r^2 = 0.91
Bias = -0.03 ppm
RMS = 0.96 ppm

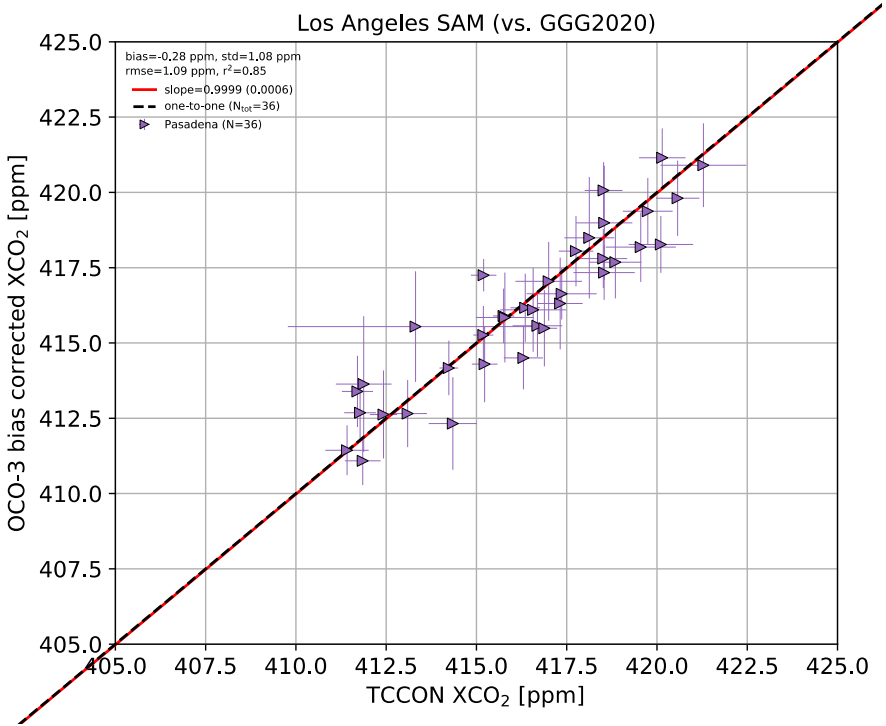
Also see 1-P07 M. Kiel poster

Validation of OCO-3 SAM B10.4r data

Target

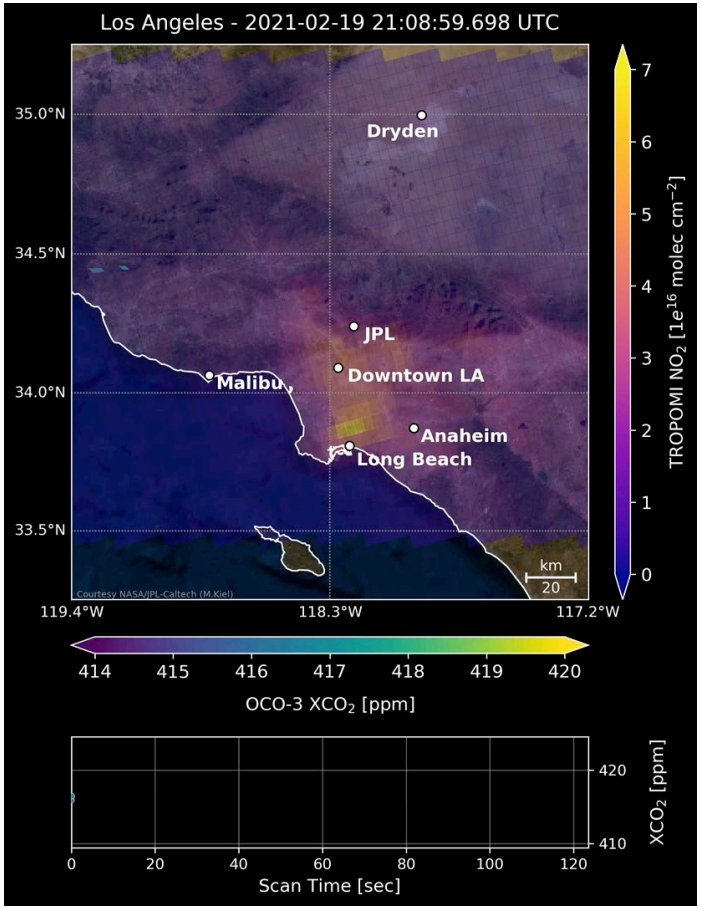


SAM



Also see 1-P07 M. Kiel poster

Understanding urban and megacity emissions

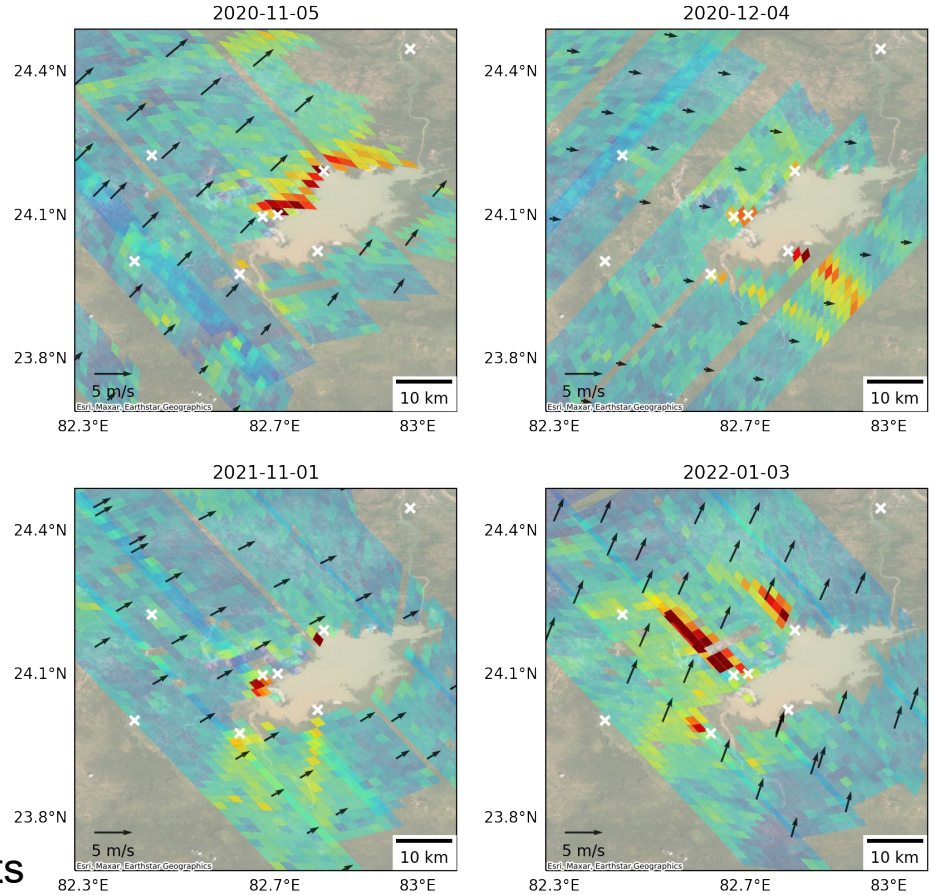


- Dense SAM observations reveal intra-urban CO_2 variations over the Los Angeles region
- Spatial variations are mainly driven by the complex fossil fuel emission patterns and meteorological conditions in the LA basin, in good agreement with those from co-located ESA TROPOMI measurements of co-emitted NO_2 (plotted in the background)
- These, other findings for various megacities, are being captured in Kiel et al. 2021 (RSE), Wu et al. 2022 (ACP, in review), Roten et al. 2022 (ACP, in review), Danjou et al. 2022 (RSE, in review)

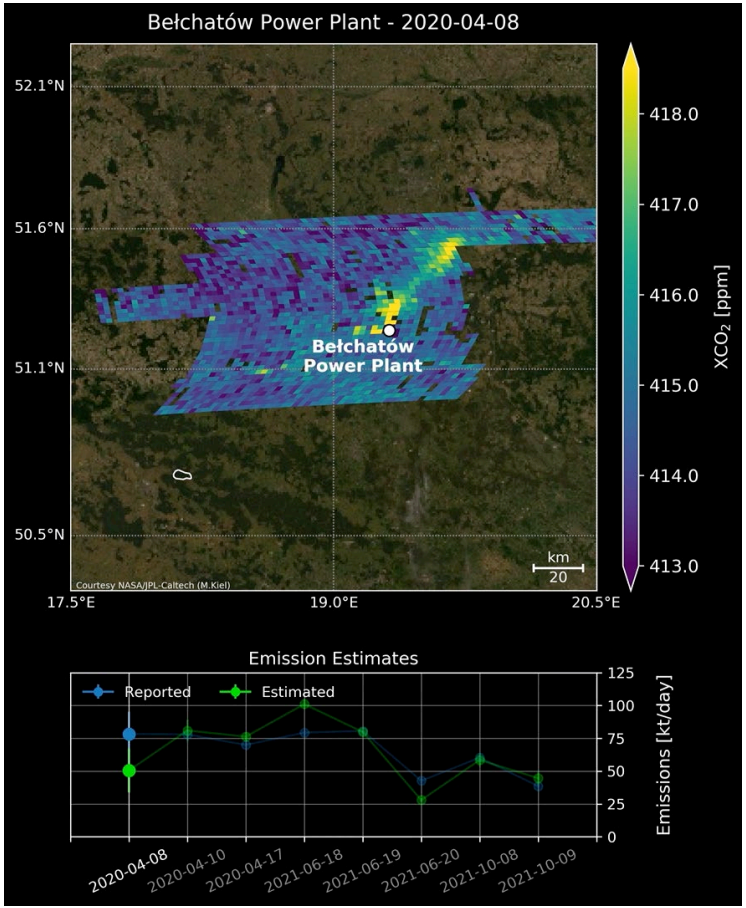
Also see Posters 5-P01 Roten, 6-P04 Wu, Talk 5-7 Danjou

Quantifying and monitoring power plant emissions

- Ongoing work by Pandey, Wu, et al.
- GBP (Govind Ballabh Pant) lake region in India is surrounded by multiple mega power plants
- Bayesian inversion of OCO-3 SAMs using STILT runs to constrain emissions from individual power plants



Quantifying and monitoring power plant emissions



- Another example of how OCO-3 SAMs can be used to quantify emissions from power plants by continuous and localized monitoring
- Belchatów power plant in Poland is the largest thermal (coal-fired) power station in Europe and one of the world's most carbon polluting
- Along with the observations made in Target mode from OCO-2 and OCO-3, the SAM mode observations are enabling continuous monitoring of emissions
- Re: Previous talk by Ray

Contribution to EO Dashboard local-urban story

Released last week from https://eodashboard.org/
Planning to add OCO-3 SAM results with wider and higher spatial resolution map

2018-06-30

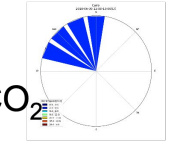
Negative enhacementCO_2
Wind from North
Nile delta Farmland

2019-02-01

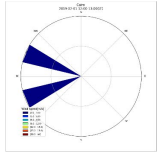
CO_2 Enhancement
Wind from East
Nile delta Strong SIF

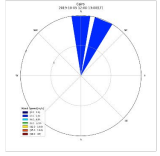
2019-10-05

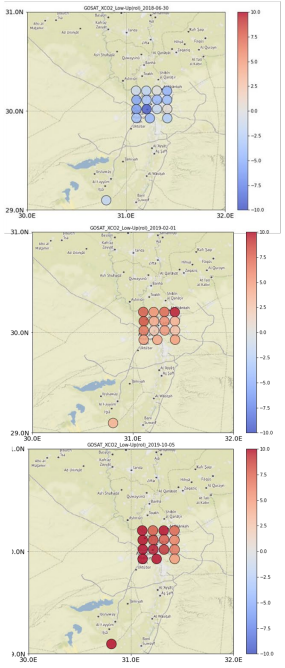
CO_2 Enhancement
Wind Weak SIF

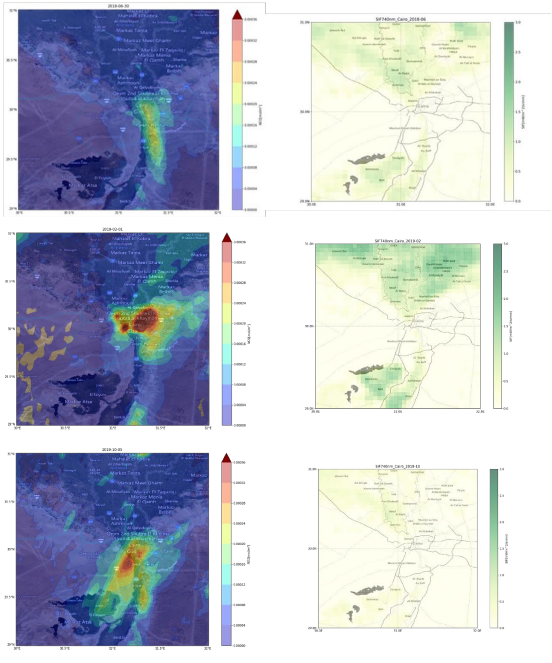


Airport wind at GOSAT overpass







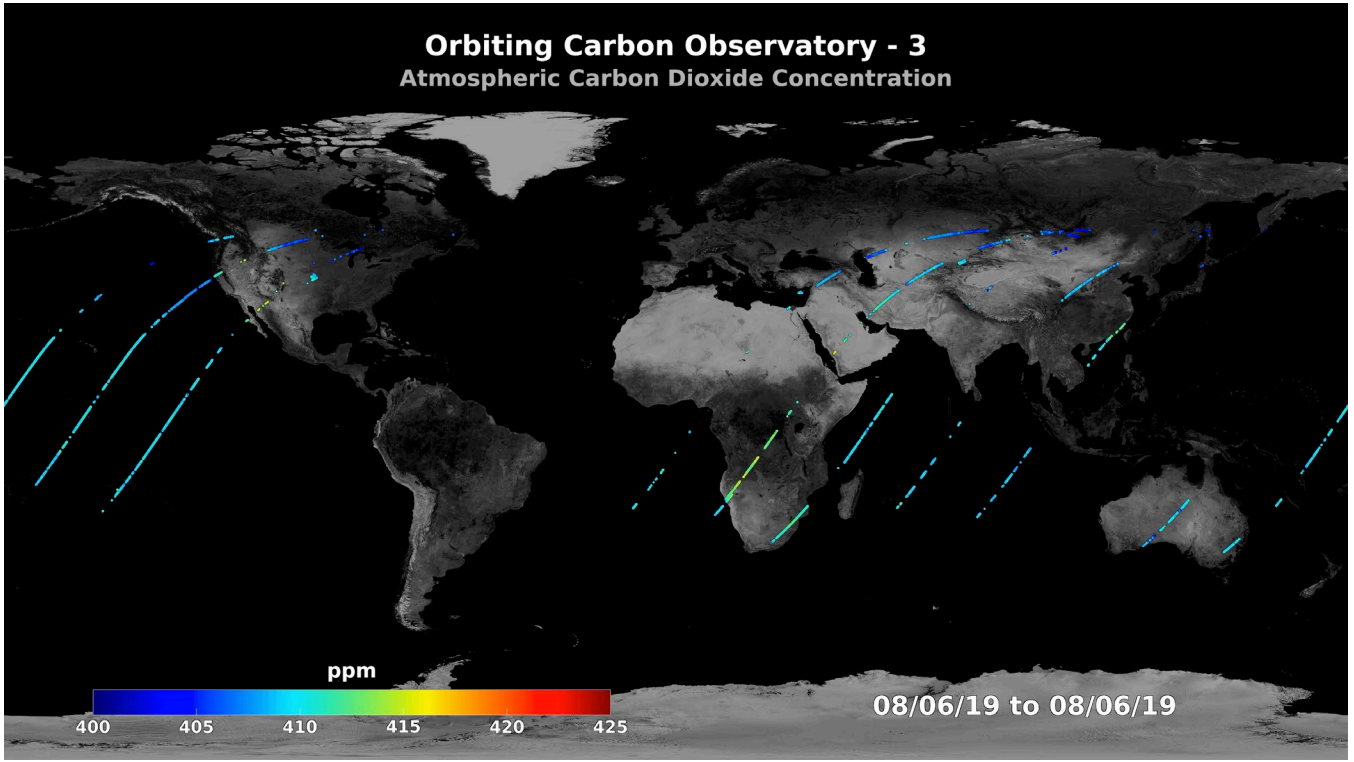


GOSAT partial column from SWIR and TIR XCO_2^{LT}-XCO_2^{UT} average Daily TROPOMI NO_2 Monthly TROPOMI SIF

Slide Courtesy: A. Kuze (JAXA)

Summary & Future plans

- Snapshot Area Mapping (SAM) mode measurements, which are unique to OCO-3, provide an innovative map-like dataset for constraining emissions at sub-regional, urban and local scales - scales that are relevant to decision making and policy implementations
- Benefit of SAM mode measurements for monitoring anthropogenic emissions are incomparable, especially over hotspots like power plants & cities / urban regions with limited ground-based monitoring capabilities
- OCO-3 is scheduled to be decommissioned in January 2023
  - B11 data delivery, covering August 2019 – January 2023, to the science community
  - anticipated data gap between OCO-3 and future wide-swath missions with similar global anthropogenic emission monitoring capabilities will unfortunately happen → implications for tracking city- and country-level progress towards meeting CO_2 emission reduction goals



THANK YOU

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Jet Propulsion Laboratory
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