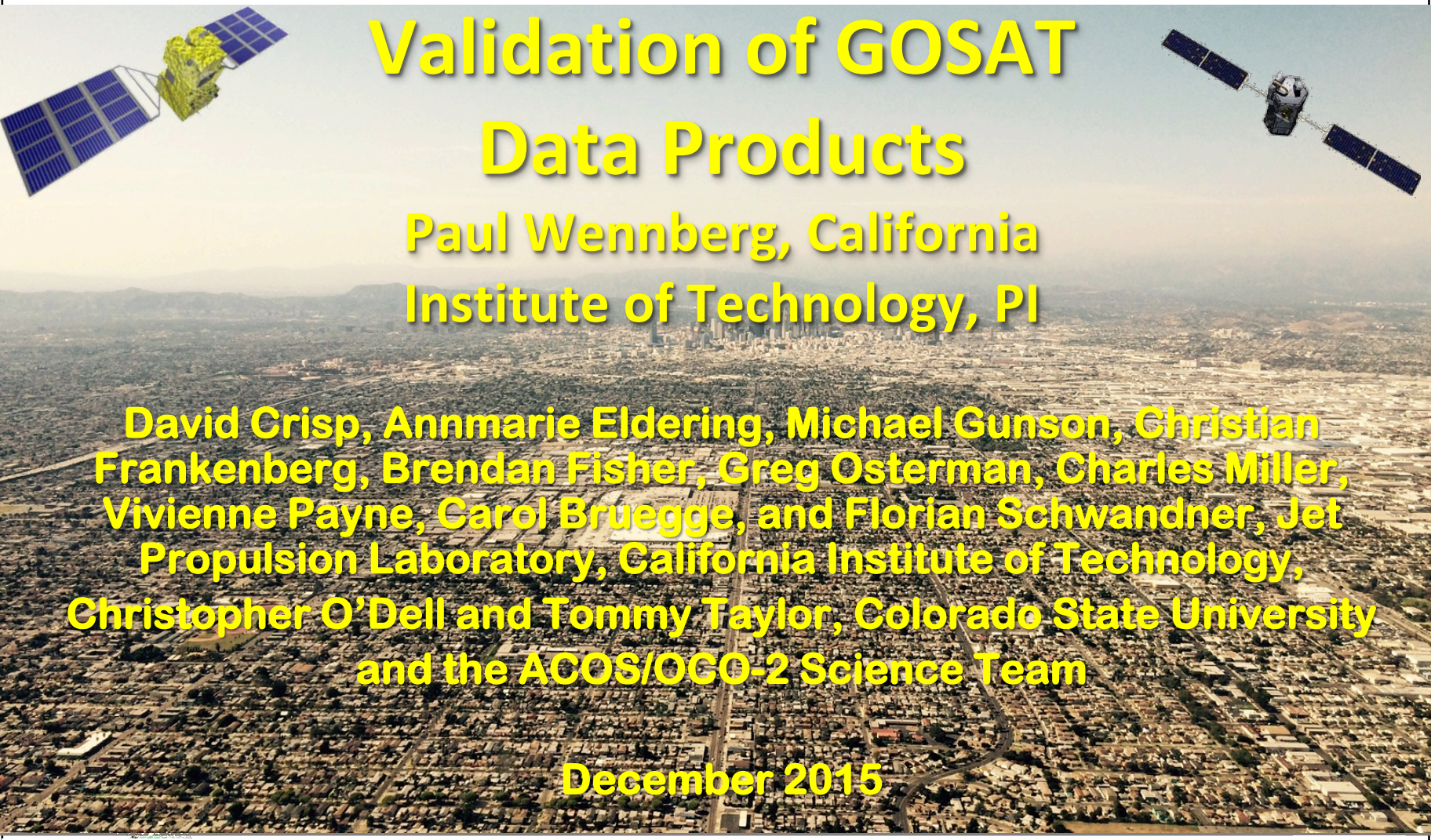

Validation of GOSAT Data Products

Paul Wennberg, California Institute of Technology, PI

David Crisp, Annmarie Eldering, Michael Gunson, Christian Frankenberg, Brendan Fisher, Greg Osterman, Charles Miller, Vivienne Payne, Carol Bruegge, and Florian Schwandner, Jet Propulsion Laboratory, California Institute of Technology, Christopher O'Dell and Tommy Taylor, Colorado State University and the ACOS/OCO-2 Science Team

December 2015

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Government sponsorship acknowledged.

Abstract

The Orbiting Carbon Observatory-2 (OCO-2) Team has continued working closely with the Greenhouse Gases Observing Satellite (GOSAT) team to (i) conduct vicarious calibration experiments in Railroad Valley, NV, U.S.A., (ii) retrieve estimates of X_{CO2} from OCO-2 and GOSAT TANSO-FTS data, and (iii) validate these products using internationally recognized standards. The OCO-2/GOSAT relationship was reinforced in March 2015 with the signing a new Memorandum of Understanding between NASA and the GOSAT and GOSAT-2 partners. Over the past year, while the GOSAT team has been finalizing the V201 product, the OCO-2 team has focused primarily on the delivery of the OCO-2 product, providing new opportunities for cross calibration of the OCO-2 and GOSAT instruments and cross validation of their products. These efforts are just now producing results. Members of the OCO-2 team have also continued the analysis of the GOSAT V161.161 data and the ACOS B3.5 products. Those efforts have produced 2 new refereed publications and several others in review. The OCO-2 now preparing to reprocess the entire GOSAT TANSO-FTS data record using the GOSAT V201 product and OCO-2 B7 algorithm to produce a 7-year, multi-satellite climate data record for X_{CO2}.

Contents of the Report

- Evolution of the ACOS/OCO-2 Team
- Summary of Collaborative Activities
- OCO-2 status update
  - Observatory Status
  - Instrument Status
- Introduction the OCO-2 Level 2 Products
- Preliminary OCO-2/GOSAT Cross Calibration and Cross Validation
- OCO-2 / ACOS Science Highlights
  - ACOS GOSAT B3.5 Highlights
- Summary of ACOS/GOSAT Publications
- OCO-2 plans for reprocessing GOSAT data

Evolution of the ACOS/OCO-2 Team

The ACOS/OCO-2 team has evolved somewhat over the past few years. The current active members are listed below.

Name	Affiliation	E-mail Address	Original Member	New Member
Paul Wennberg	California Institute of Technology	wennberg@caltech.edu	y	
David Baker	Colorado State University	baker@cira.colostate.edu	y	
Ralf Bennartz	Vanderbilt University	ralf.bennartz@vanderbilt.edu	y	
Hartmut Boesch	University of Leicester	hartmut.boesch@leicester.ac.uk	y	
Kevin Bowman	Jet Propulsion Laboratory	Kevin.W.Bowman@jpl.nasa.gov		y
Amy Braveman	Jet Propulsion Laboratory	Amy.Braverman@jpl.nasa.gov	y	
Linda Brown	Jet Propulsion Laboratory	linda.r.brown@jpl.nasa.gov	y	
Carol Bruegge	Jet Propulsion Laboratory	Carol.J.Bruegge@jpl.nasa.gov		y
Frederic Chevialliar	LSCE	frederic.chevallier@lsce.ipsl.fr	y	
David Crisp	Jet Propulsion Laboratory	david.crisp@jpl.nasa.gov	y	
Annmarie Eldering	Jet Propulsion Laboratory	Annmarie.Eldering@jpl.nasa.gov		y
Brendan Fisher	Jet Propulsion Laboratory	brendan.fisher@jpl.nasa.gov		y
Inez Fung	UC Berkeley	ifung@berkeley.edu	y	
Anna Michalak	Carniege Institute for Science	michalak@stanford.edu	y	
Charles Miller	Jet Propulsion Laboratory	charles.e.miller@jpl.nasa.gov	y	
Vijay Natraj	California Institute of Technology	Vijay.Natraj@jpl.nasa.gov	y	
Hai Nguyen	Jet Propulsion Laboratory	Hai.Nguyen@jpl.nasa.gov		y
Christopher O'Dell	Colorado State University	odell@atmos.colostate.edu		y
Gregory Osterman	Jet Propulsion Laboratory	Gregory.B.Osterman@jpl.nasa.gov		y
Vivienne Payne	Jet Propulsion Laboratory	Vivienne.H.Payne@jpl.nasa.gov		y
Randy Pollock	Jet Propulsion Laboratory	Randy.Pollock@jpl.nasa.gov		y
Stanley Sander	Jet Propulsion Laboratory	Stanley.P.Sander@jpl.nasa.gov	y	
Florian Schwandner	Jet Propulsion Laboratory	Florian.Schwandner@jpl.nasa.gov		y
Tommy Taylor	Colorado State University	tommy@atmos.colostate.edu		y
Debra Wunch	California Institute of Technology	dwunch@caltech.edu		y
Yuk Yung	California Institute of Technology	yly@gps.caltech.edu	y	

Summary of Collaborative Activities

Highlights of Collaborative Activities

- New Memorandum of Understanding (MoU) between NASA and the GOSAT Partners (JAXA, NIES, MoE) for GOSAT, OCO-2, and GOSAT-2 was signed in March 2015

- The California Institute of Technology Linde Center for Global Environmental Science and the OCO-2 Team co-hosted
  - RA PI Meeting: 15 June 2015
  - IWGGMS-11: 16-18 June 2015

- 7th Annual Railroad Valley Vicarious Calibration Campaign

- Participated in OCO-2 / GOSAT Technical Interface Meeting (TIM) at JpGU and AGU

- GOSAT/OCO-2 Outreach Activities

NASA/JAXA/NIES/MoE MOU for GOSAT, OCO-2, and GOSAT-2

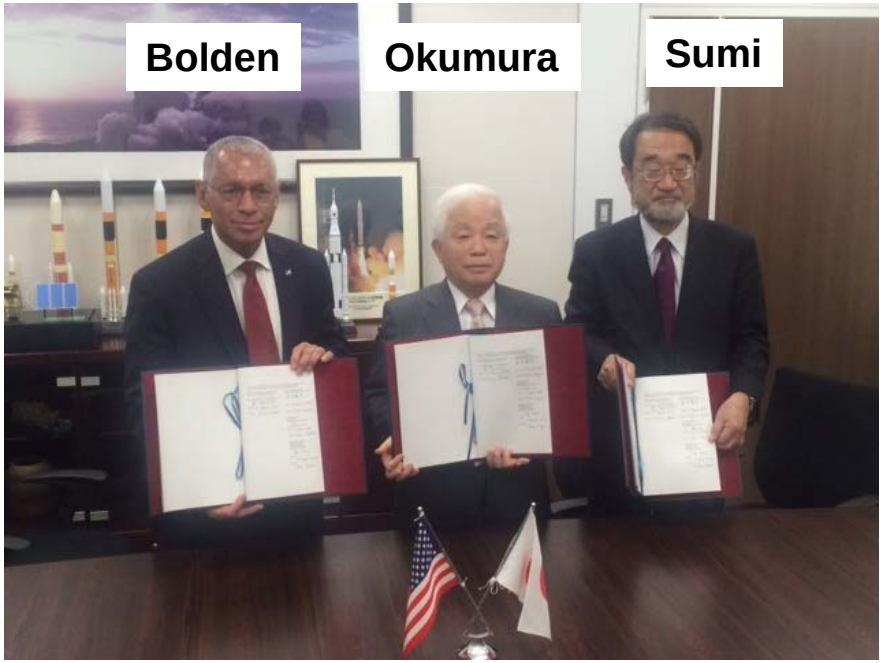
In March 2015, NASA and the GOSAT/GOSAT-2 partners (JAXA, NIES, MoE) signed a new Memorandum of Understanding (MOU) for the GOSAT, OCO-2, and GOSAT-2 missions.

- Pre-launch cross calibration
- On-orbit calibration
- Conduct annual technical interface meetings
- Implement a common validation approach
- Establish a joint mission science team

GOSAT

OCO-2

GOSAT-2



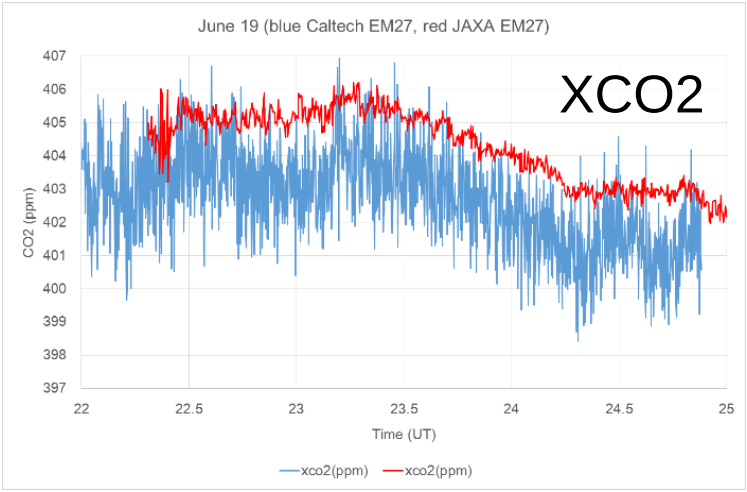
IWGGMS-11 Summary

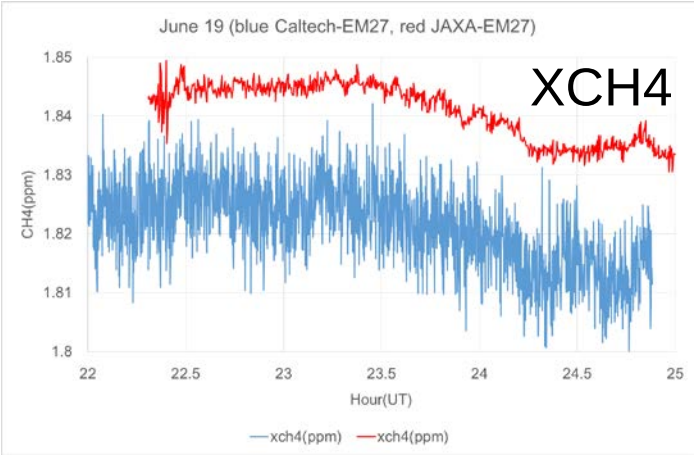
- The OCO-2 team and the Caltech Linde Center for Global Environmental Science hosted the 11th International Workshop on Greenhouse Gas Measurements from Space (IWGGMS-11) on the Caltech campus on 16-18 June
- The meeting was attended by >150 scientists from around the world, who presented 54 oral talks and 90 posters

EM-27 Cross Calibration

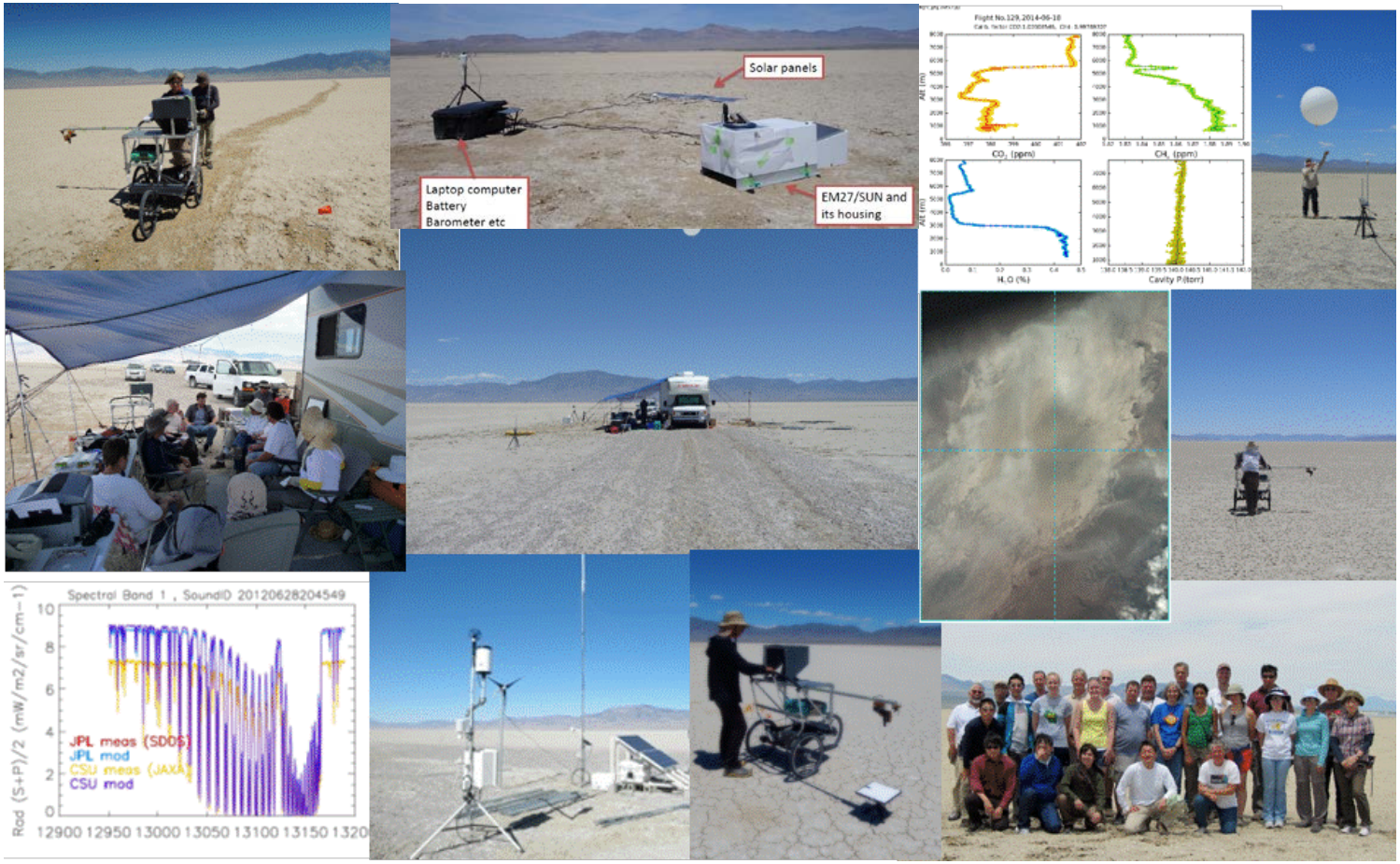
Side by side comparison of Caltech EM27 and JAXA EM-27 June 19, 2015, at Caltech, in Pasadena

- Both data sets are processed with the same algorithm
- Larger fluctuations in Caltech EM27 are probably due its wider spectral range
- ILS must be calibrated and modeled well to reduce biases.
- P, T, RH are same.



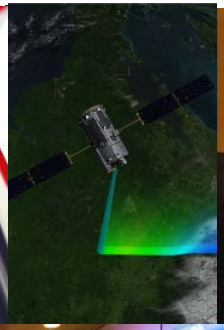


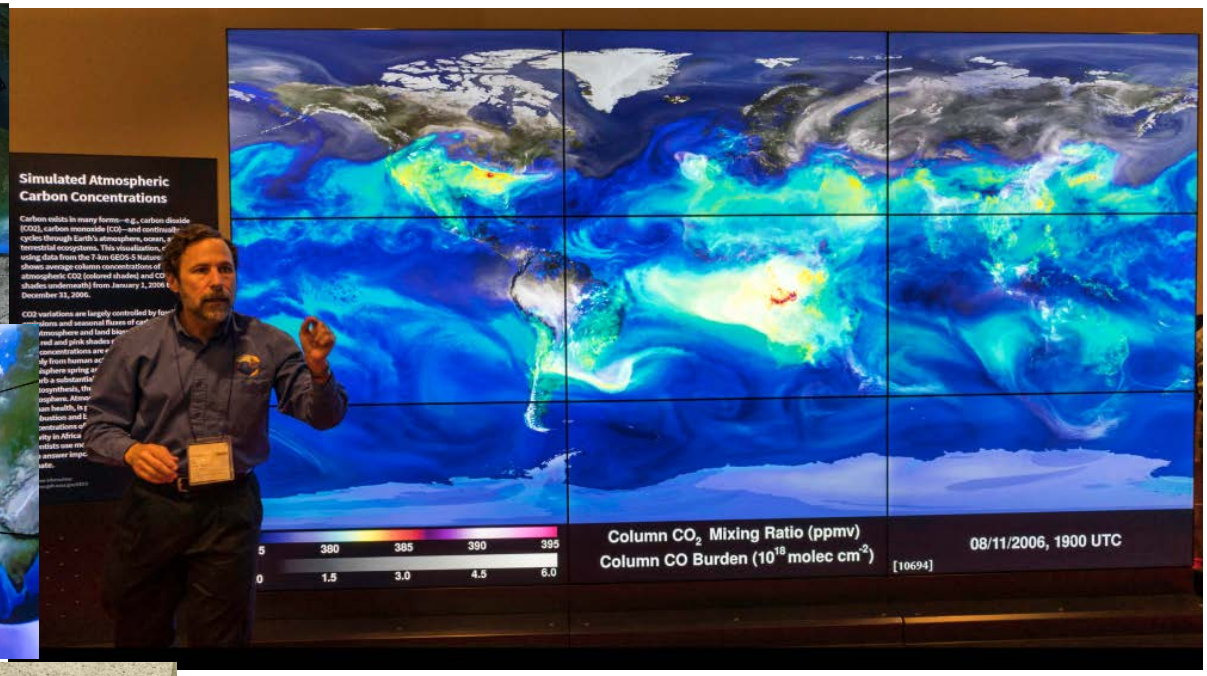
Vicarious Calibration

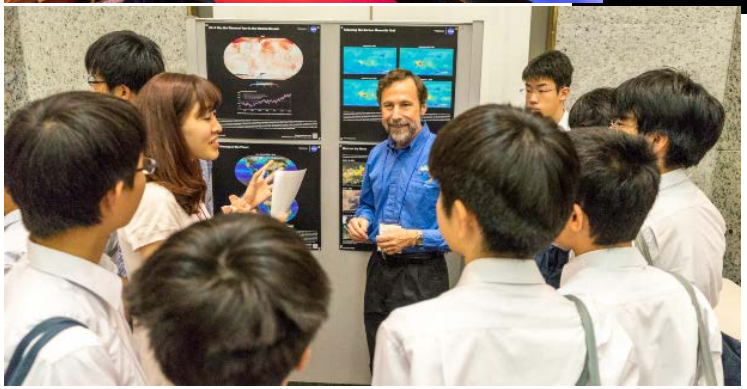


Vicarious Calibration Campaigns in Railroad Valley have continued to play a critical role in GOSAT inflight calibration, and now play a similar role for OCO-2.

OCO-2 and GOSAT Outreach







The GOSAT and OCO-2 stories continue to be strongly linked in our outreach activities, such as those associated with the 2015 JpGU.

OCO-2 Observatory Status

OCO-2 Observatory Status

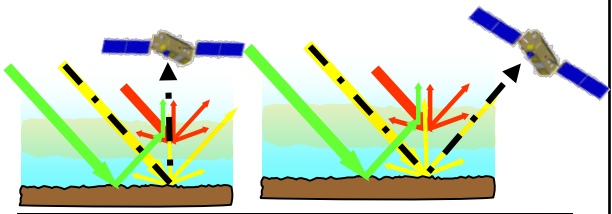
- The OCO-2 spacecraft operations are "NOMINAL"
  - OCO-2 was successfully launched on 2 July 2014, entered the A-Train on 3 August 2014, and has been returning science observations since 6 September 2014
  - The spacecraft has operated flawlessly since that time with outages due to
    - Drag make-up maneuvers
    - Risk mitigation maneuvers (e.g. avoiding space junk)
    - Instrument decontamination cycles
    - Two instrument-related safing events
  - The glint/nadir observing strategy has been modified to
    - Mitigate impact polarization dependence of the instrument
    - optimize the coverage of oceans and high latitude continents

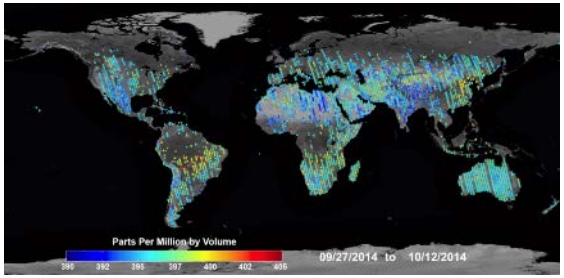
- Data are being delivered through the NASA GES DISC

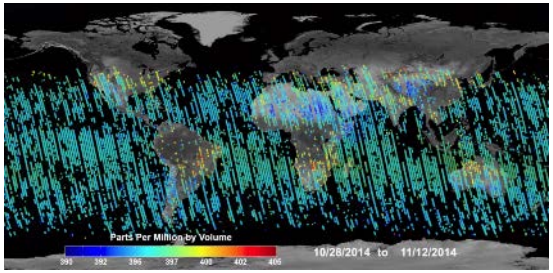
  http://disc.sci.gsfc.nasa.gov/OCO-2

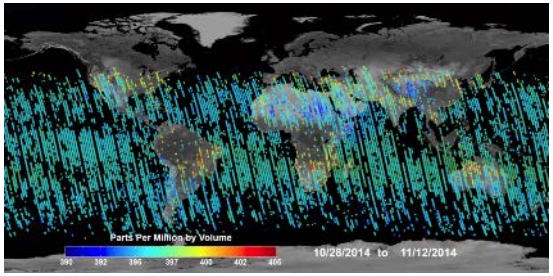
Evolution of the OCO-2 Observing Strategy

- OCO-2 collects science measurements while pointing the instrument to
  - Nadir: along ground track at local nadir
    - more useful data over high latitude land
  - Glint: toward the "glint spot," where sunlight is specularly reflected by surfaces
    - better S/N over ocean
- Initially, Nadir and Glint observations were collected observations on successive, 16-day ground repeat cycles
  - Leaves 16-day gaps over oceans
- July 2: Began collecting Nadir and Glint data on alternating orbits
- On November 11th, the strategy was refined further to always collect glint data on predominately ocean orbit tracks









OCO-2 Instrument Status

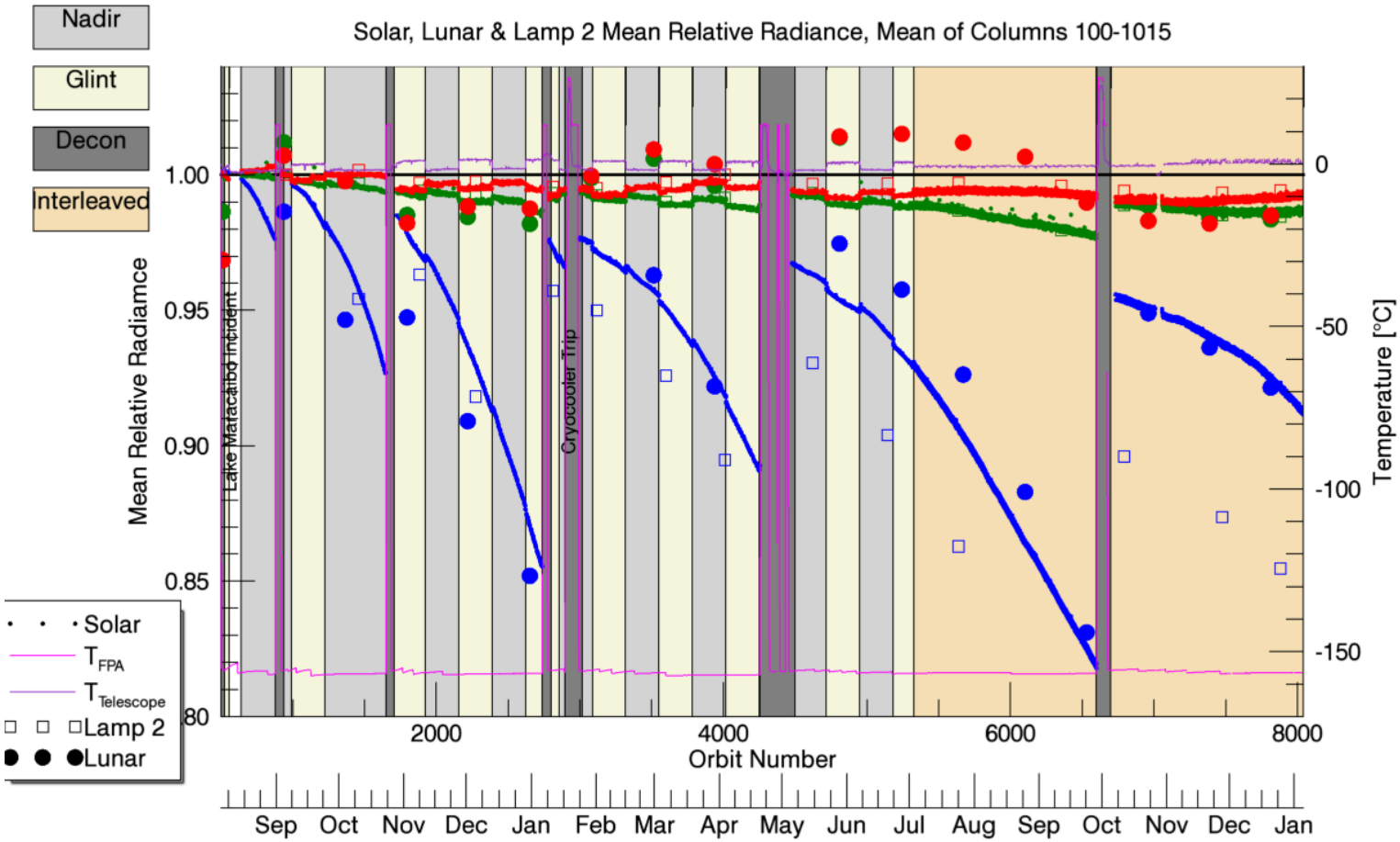
OCO-2 Instrument Status

- The instrument status is NOMINAL
  - Routine instrument operations are interrupted for drag make-up and risk mitigation maneuvers, and decontamination cycles
- Changes in orientation of spectrometer slits
  - Prior to November 11, 2011, nadir observations were collected with the instrument's slits oriented perpendicular to the principal plane while glint observations were collected with the slits rotated 30 degrees (counter-clockwise from above) about the center of the field of view from this orientation
  - Since 11 November 2011, both glint and nadir observations are collected with the instrument slits rotated 30 degrees (counter clockwise from above) about the center of the field of view from the perpendicular to the principle plane
- Routine (orbit by orbit) and special (lunar, solar Doppler, and vicarious calibration) activities are ongoing

A-Band Channel Sensitivity Variations

- The most significant instrument calibration issue involves reductions in the sensitivity of the A-Band channel (next slide)
  - Sensitivity variations are much smaller in the CO_2 channels
- The A-Band sensitivity degradation has two components
  - A "fast degradation" that is reversed by decontamination cycles
  - A "slow degradation" that is monotonic
- A plausible root cause for the "fast" sensitivity degradation has been identified -- ice on the focal plane and cold filter degrades efficiency of the anti-reflection coating
- The root cause for the slow degradation is still under investigation
- Both fast and slow degradation are corrected in the L1b product
- Rate of fast and slow sensitivity loss is decreasing with time
- Next decontamination cycle some time in March 2016

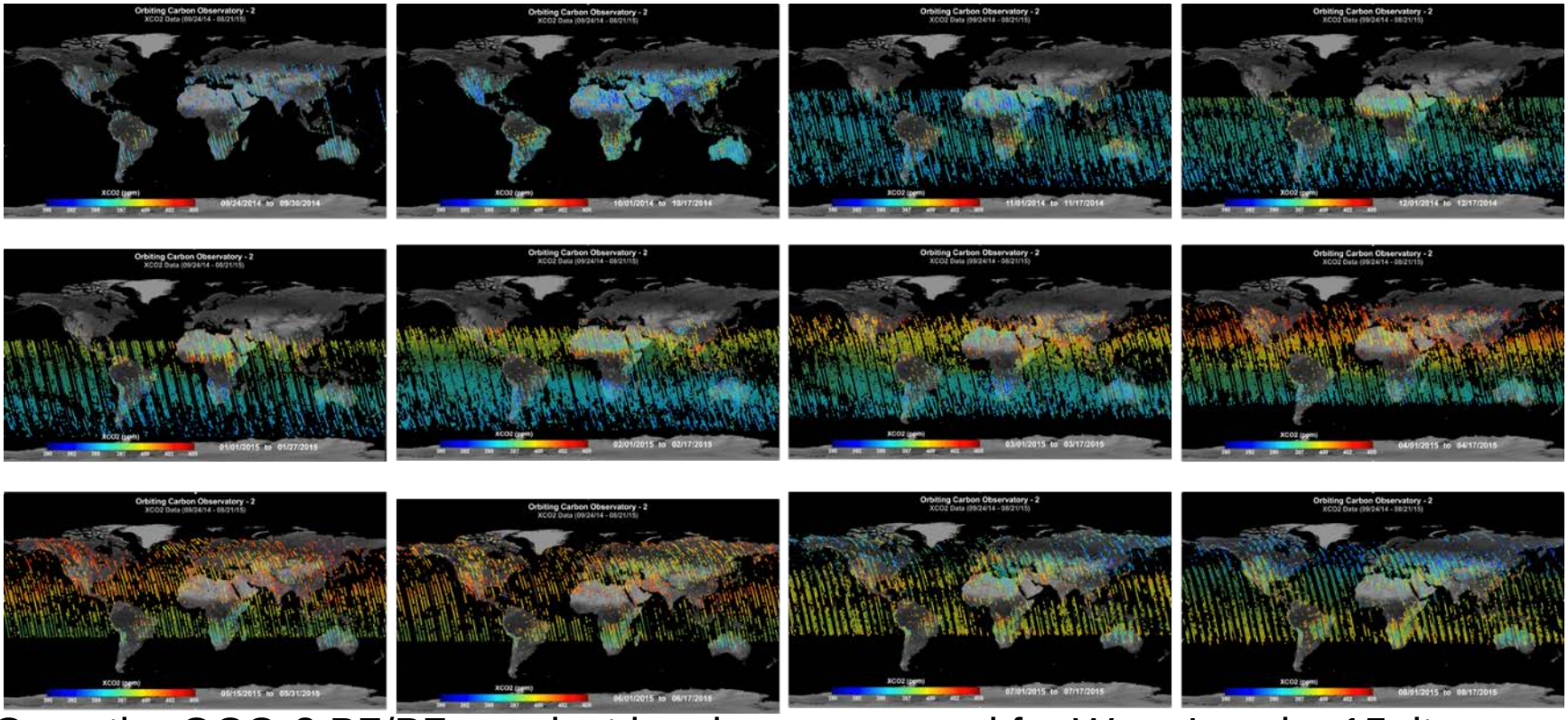
A-Band Sensitivity Degradation



The rate of sensitivity loss in the ABO2 channel (blue) is decreasing with time, for both the “fast” (correctable) and “slow” (monotonic) components of the loss.

Introduction the OCO-2 Level 2 Products

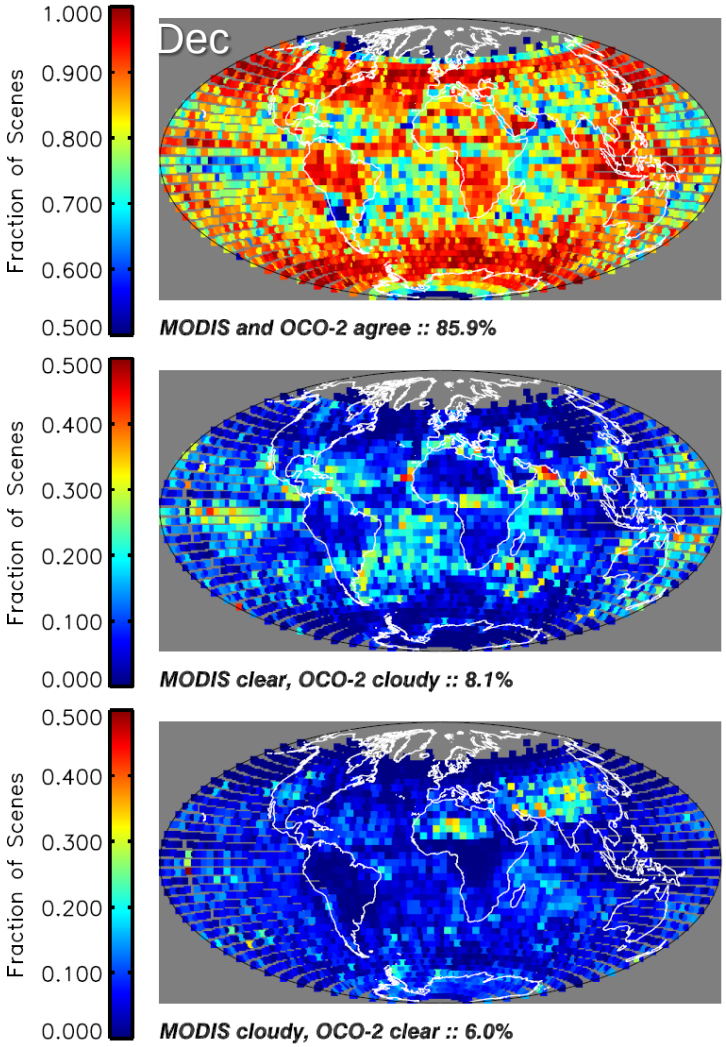
The Screened B7/B7r Product



Once the OCO-2 B7/B7r product has been screened for Warn Level < 15, it meets the OCO-2 “threshold” (minimum mission) accuracy requirements but not the coverage requirements (80% of the range of latitudes on the Sunlit Hemisphere at monthly intervals).

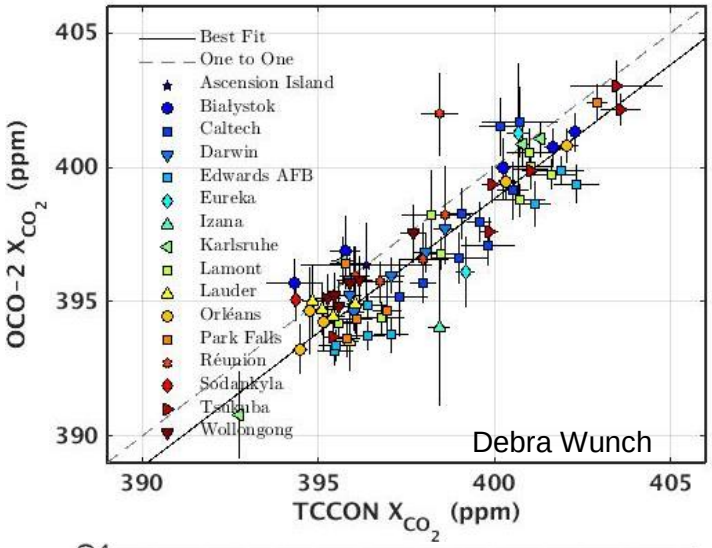
Prescreening: Cloud Screening
(Taylor et al.)

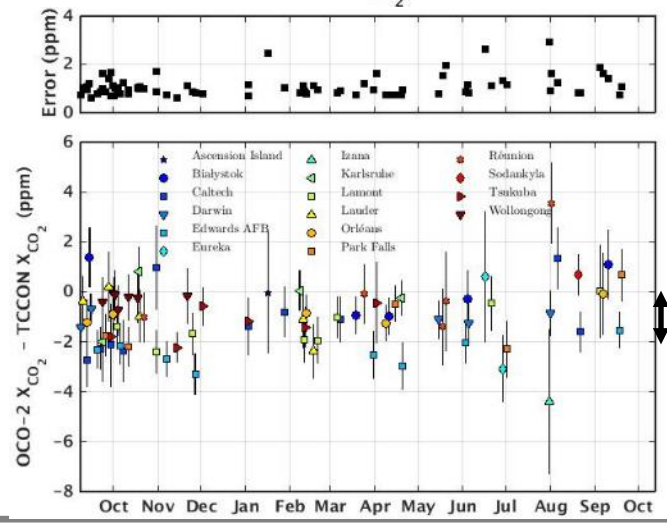
- The OCO-2 cloud screening approach includes 2 fast algorithms:
  - O_2 A-band Preprocessor (ABP)
    - Rayleigh scattering + O_2 absorption
    - Most sensitive to high clouds
  - IMAP DOAS Preprocessor (IDP)
    - Gas absorption, no scattering
    - Applied to CO_2 channels
    - Most sensitive to low clouds
- OCO-2 cloud screening results have been validated against MODIS-Aqua cloud mask product
  - ~85% agreement in global average
  - Disagreements due to co-location errors, thin aerosols and other factors



Filtered and Bias-Corrected OCO-2 vs TCCON

- OCO-2 made 179 target observations since August 2014
  - 80-90 are of good enough quality for comparisons to TCCON data Now making 8-10 target observations each month
  - Top figure: Relationship between OCO-2 target mode data and TCCON data recorded during the target observation
  - Bottom figure: Time series of OCO-2 comparisons to TCCON
    - no drift in comparisons over the first year
- OCO-2 data source: "Lite" products
  - removed the small offset between the satellite and TCCON observations
  - screening with OCO-2 "Warn Levels"





OCO-2 B7r Standard Production Calendar

as of 12/30/2015 Build 7.0.00 L2 XCO2 Production & Delivery Status - Retrospective Calibrat

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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August																															
September						D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
October	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D				D	D	D	D	D
November	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
December	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
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March	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
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June	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
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October							D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D				D	D
November	D																														
December																															

Warm

Cold, unstable

Cold, stable

Completely without Science

B7 processing
complete

incomplete

not begun

B7r processing
complete

incomplete

not begun

Facility
cluster

Pleiades

Amazon

Days delivered to GES DISC
D all orbits delivered

OCO-2 B7r Lite Production Calendar

as of 12/30/2015 Build 7.0.00 Lite XCO2 Production & Delivery Status - Retrospective Calibra

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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October	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D					D	D	D	D
November	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
December	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
January-15	D	D	D	D	D	D				D	D	D	D	D	D	D	D								D	D	D	D	D	D	D
February	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D			
March	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
April	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D											
May							D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
June	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
July	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
August	D		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
September	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D			
October							D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D				D	D
November																															
December																															

Warm

Cold, unstable

Cold, stable

Completely without Science

B7 processing
complete

incomplete

not begun

B7r processing
complete

incomplete

not begun

Facility
cluster

Pleiades

Amazon

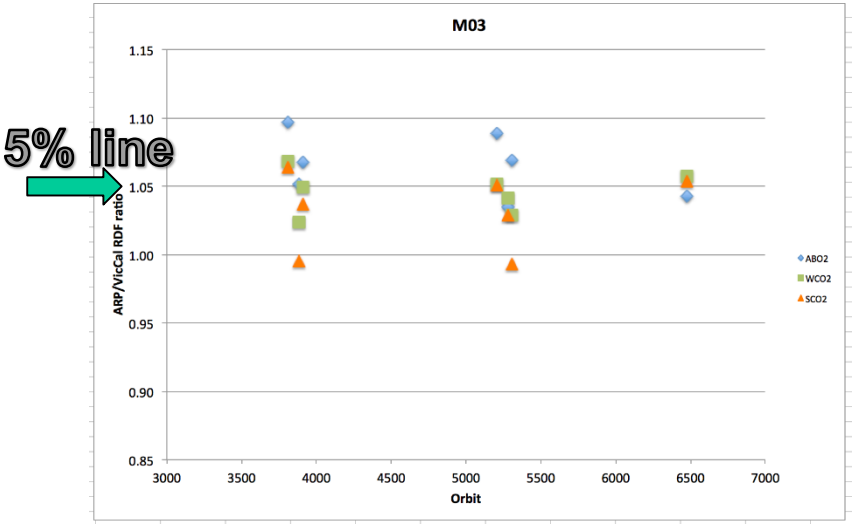
Days delivered to GES DISC
D all orbits delivered

The B7r Lite file deliveries are currently lagging the B7r Standard file deliveries by about one month.

Preliminary OCO-2/GOSAT Cross Calibration and Cross Validation

Absolute Radiometric Calibration: Level 1B vs Vicarious Calibration

- **Measurements over Railroad Valley (RRV) suggest that the reported OCO-2 Level 1B radiances may be 5% high compared to Vicarious Calibration (VC) estimates.**
  - **Radiometric scale is established by trending the response degradation in lamp, solar, and lunar calibration data, relative to preflight tests.**
  - **Vicarious Calibration is the best validated in-flight methodology that can establish an absolute radiometric scale.**
  - **L2 code is used for VC analysis, thus many errors, such as solar irradiance uncertainties, cancel in the forward (calibration)/ reverse (retrieval) process.**

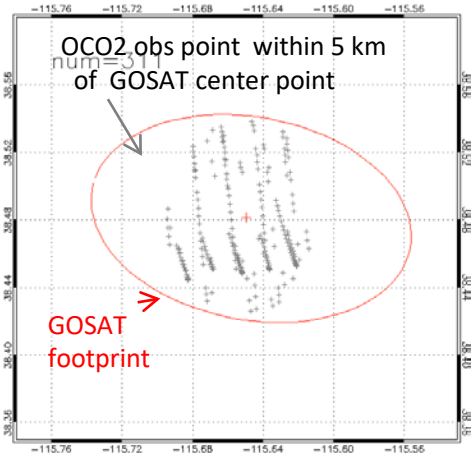


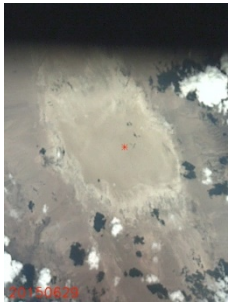
- Cross-comparisons show an OCO-2/ VC radiance ratio of 1.05, 1.07, and 0.99 for ABO2, WCO2, and SCO2, with a standard deviation of 1% over 3 comparisons.
- GOSAT also uses RRV VC to define its radiometric scale, so OCO-2 is also biased 5% high relative to GOSAT
- Lunar Calibration data are being analyzed to see if it supports this 5% high bias

OCO2- GOSAT Spectra Comparisons over Railroad Valley, NV, 29 June 2015

oco2_L1bScTG_05280a_150629_B7000_150630182925.h5
GOSATTFTS20150629211603702 42_1BSPOD161161.01

OCO2: path139 (looking from West)
GOSAT: path37 (looking from West)

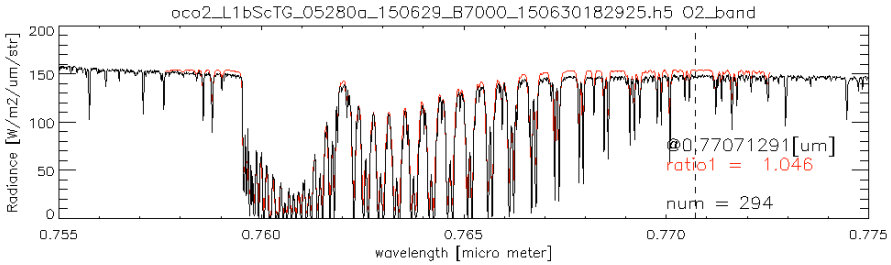


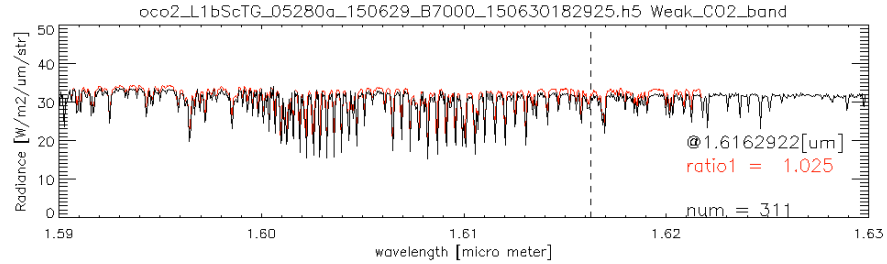


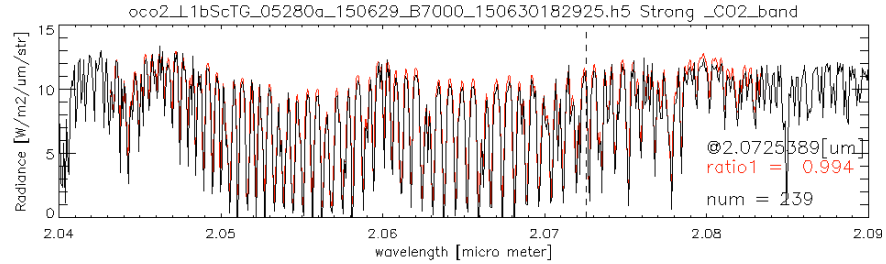
Comparisons between OCO-2 and GOSAT also indicate that The OCO-2 ABO2 and WCO2 bands have a ~5% radiometric bias.

GOSAT Rad
OCO2 average Rad within 5km of GOSAT cnt point X 2

ratio1 = OCO2/GOSAT



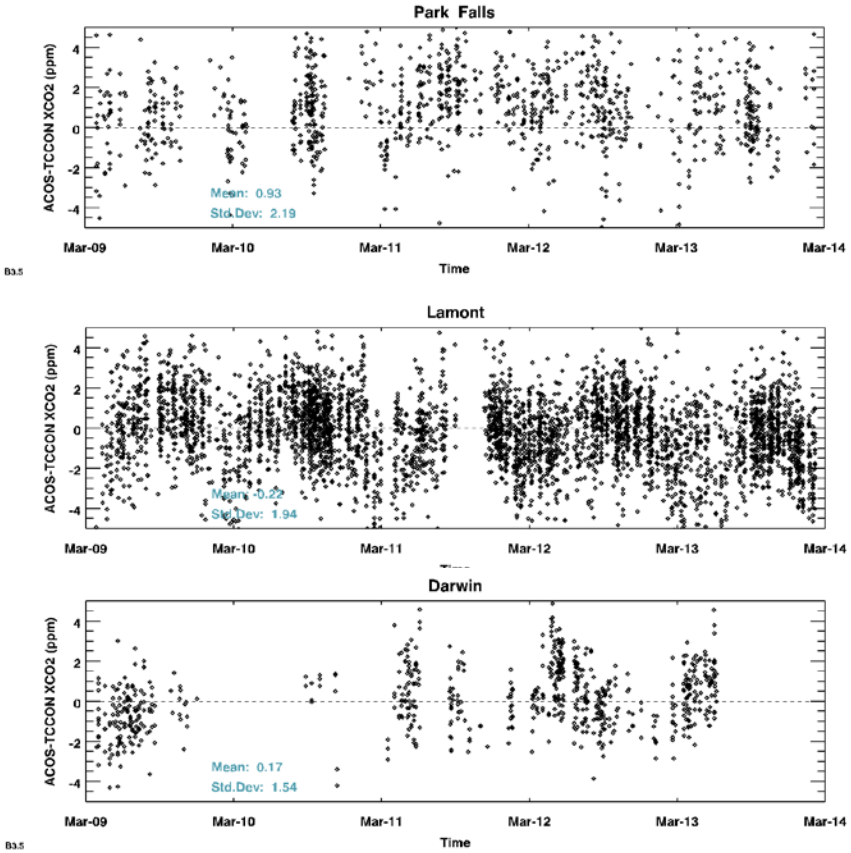


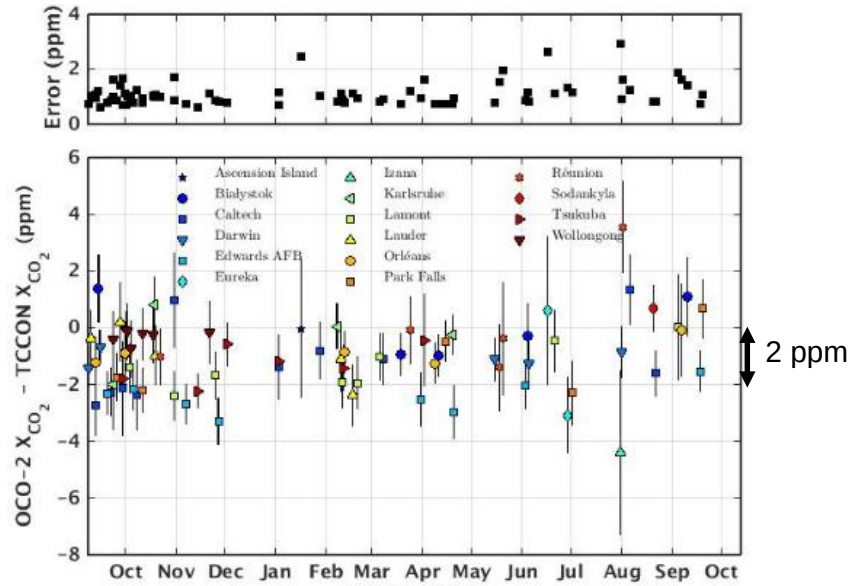


A. Kuze et al. 2015 OCO-2/GOSAT TIM

GOSAT/OCO-2 Validation: Comparison of OCO-2 X_{CO2} Products with ACOS/GOSAT B3.5

There are currently no near-simultaneous OCO-2 and ACOS/GOSAT X_{CO2} products. However, both the OCO-2 B7 and ACOS/GOSAT B3.5 products were validated against TCCON, providing a basis for comparison.





Differences between ACOS/GOSAT B3.7 and TCCON X_{CO2} estimates for Park Falls (top left), Lamont (middle left) and Darwin (bottom left) are similar to differences between OCO-2 and TCCON X_{CO2} estimates for the first year of operations.

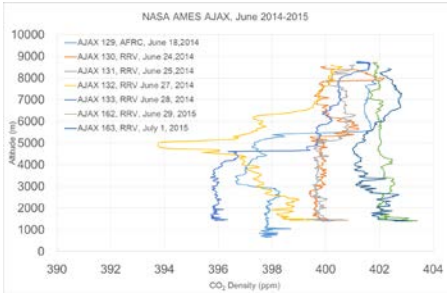
Other OCO-2/GOSAT XCO2 Validation Opportunities – RRV 2015

OCO-2 and GOSAT X_{CO2} retrieved during the 2015 RRV vicarious calibration campaign have been compared with each other and with in situ results from the AJAX aircraft.

GOSAT data acquisition time	GOSAT NIES Level 2 with min χ^2 out of 4 soundings from GOSAT Level 1 V161				OCO-2 Level-2 lite Coincident Footprint average (6/29 : 1481data7/1 : 353data			Basecamp weather station	RRV Aeronet	AJAX airplane	
	P_{surf} (hPa)	AOD (500nm)	XCO_2 (ppm)	XCH_4 (ppm)	P_{surf} (hPa)	AOD	XCO_2 (ppm)	P_{surf} (hPa)	AOT (500nm)	XCO_2 (ppm)	XCH_4 (ppm)
2014/06/24 20:46:35	851.1	0.035	401.9	1.810	N/A	N/A	N/A	851.099	0.0927	398.5	1.811
2014/06/25 21:18:56	844.5	0.024	402.3	1.812	N/A	N/A	N/A	849.223	0.0756	398.7	1.808
2014/06/27 20:46:37	849.1	0.025	400.5	1.803	N/A	N/A	N/A	851.711	0.0645	397.6	1.807
2014/06/28 21:18:54	846.0	0.018	400.4	1.807	N/A	N/A	N/A	851.512	0.0347	397.5	1.809
2015/06/29 21:17:20	853.3	0.068	406.2	1.806	861.1	0.246	401.1	856.889	0.1187	401.3	1.784
2015/07/01 20:44:54	847.3	0.095	402.7	1.799	855.6	0.122	400.0	856.326	0.1026	401.2	1.784

2015/7/1 thin cirrus cloud, AOT 2015 is thicker. AJAX: Courtesy of L. Iraci, T. Tanaka of NASA AMES, NIES L2: T. Yokota

OCO2 L2_LITE
Footprint average(6/29:
1481data7/1:353data
AOD, NIES, CIMEL @500nm



OCO-2 and GOSAT results for 29 June and 7 July 2015 are compared to AJAX profiles (Left) over Railroad Valley, Nevada (RRV)

Kuze et al. 2015 OCO-2/GOSAT TIM

OCO-2 / ACOS Science Highlights

ACOS GOSAT B3.5 Highlights

C. O'Dell, H. Lindqvist, ACOS/GOSAT Team

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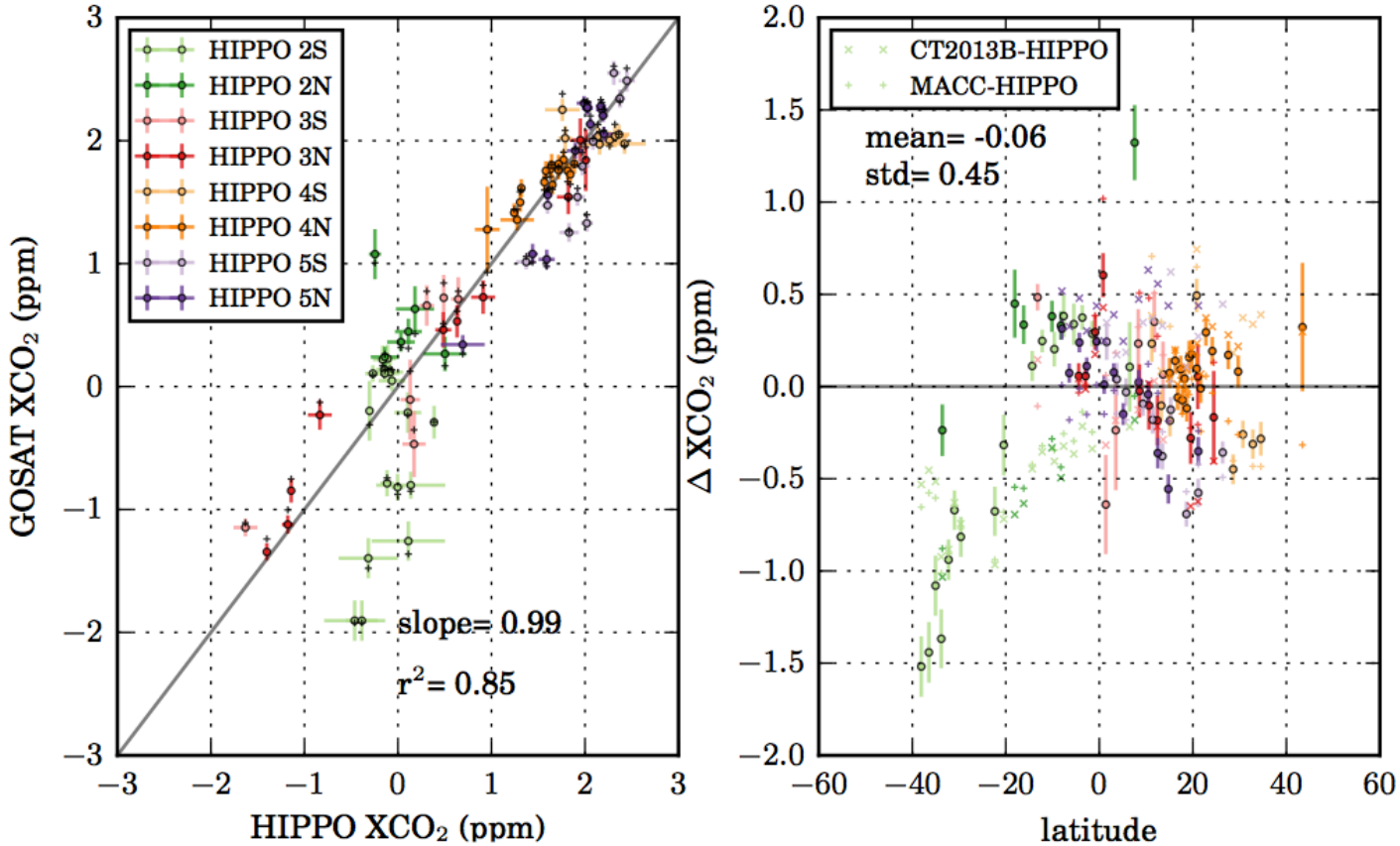
Government sponsorship acknowledged.

ACOS/GOSAT Version 3.5

- Nearly identical to operational OCO-2 XCO2 retrieval algorithm

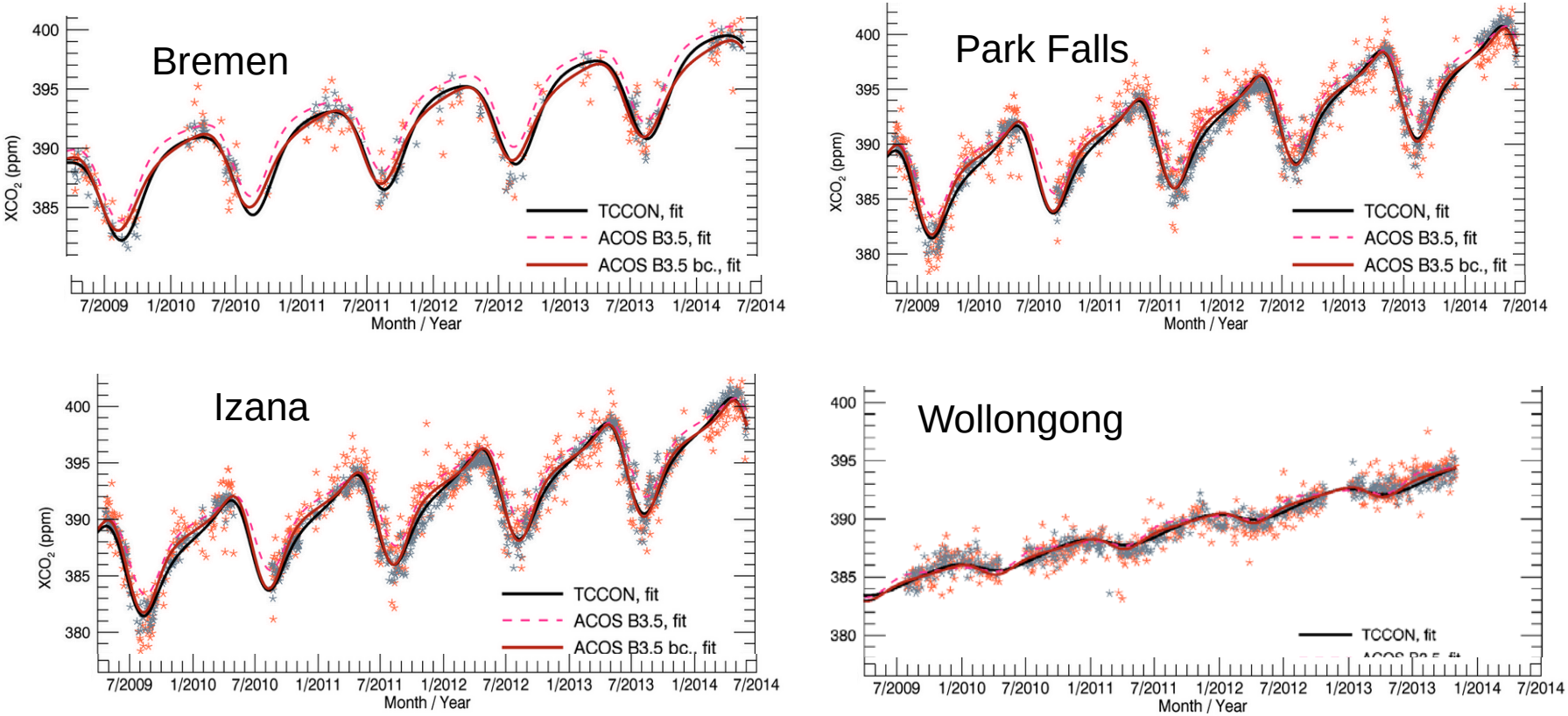
- Many papers published with these data:
  - Schwander et al 2015 : Volcanoes
  - Frankenberg et al 2015: vs. HIPPO
  - Lindqvist et al 2015: Seasonal cycle
  - Kulawik et al 2015: Multi-satellite validation
  - Chevallier et al 2015: Statistical Optimality of Inversions
  - Chevallier & O'Dell 2015: Global Inversion
  - Zhou et al 2015: Validation of Ocean Glint
  - Plus many v3.4-based papers!

ACOS vs. HIPPO



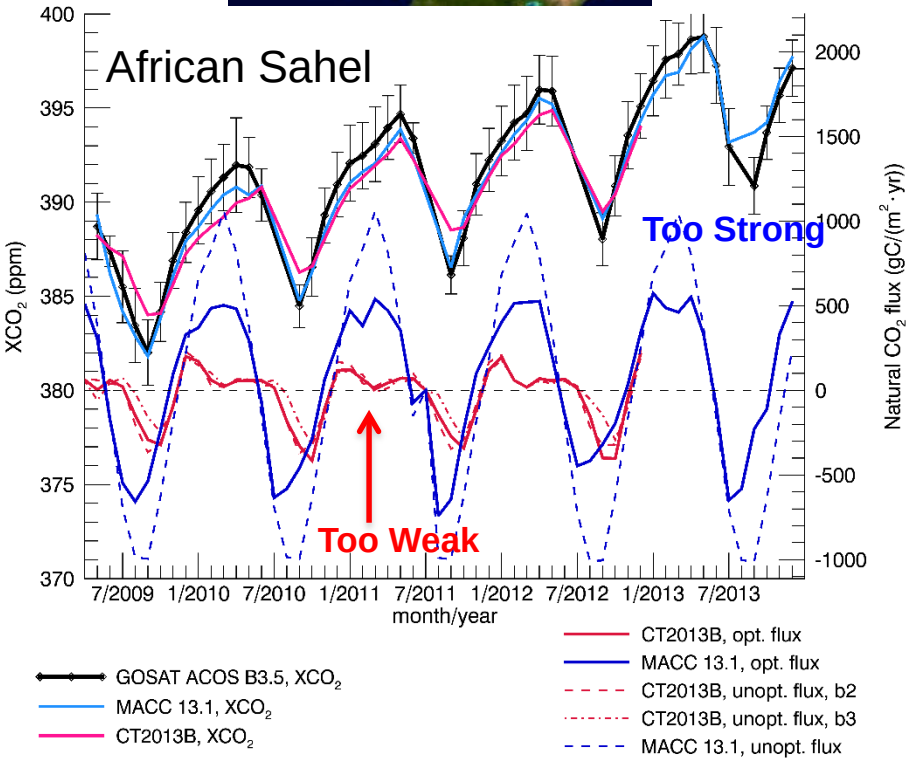
Frankenberg et al., 2015: Using airborne HIAPER Pole-to-Pole Observations (HIPPO) to evaluate Model and remote sensing estimates of atmospheric carbon dioxide. *Atmos Chem. Phys. Discuss.*

Seasonal Cycle Validation



Lindqvist, H., O'Dell, C. W., Basu, S., Boesch, H., Chevallier, F., Deutscher, N., Feng, L., Fisher, B., Hase, F., Inoue, M., Kivi, R., Morino, I., Palmer, P. I., Parker, R., Schneider, M., Sussmann, R., and Yoshida, Y.: ***Does GOSAT capture the true seasonal cycle of carbon dioxide?***, *Atmos. Chem. Phys.*, 15, 13023-13040, doi:10.5194/acp-15-13023-2015, 2015.

Evaluating Models with GOSAT?

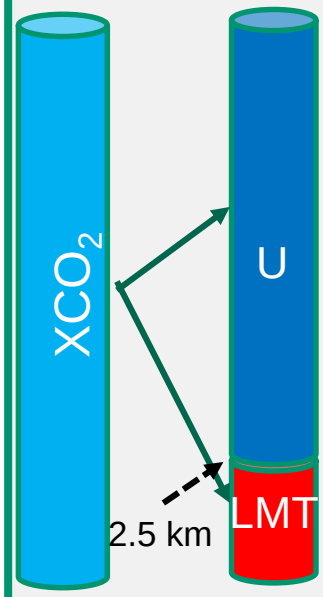


THE QUESTION:

Can we learn something about underlying CO_2 fluxes by making direct comparisons of GOSAT and model XCO_2?

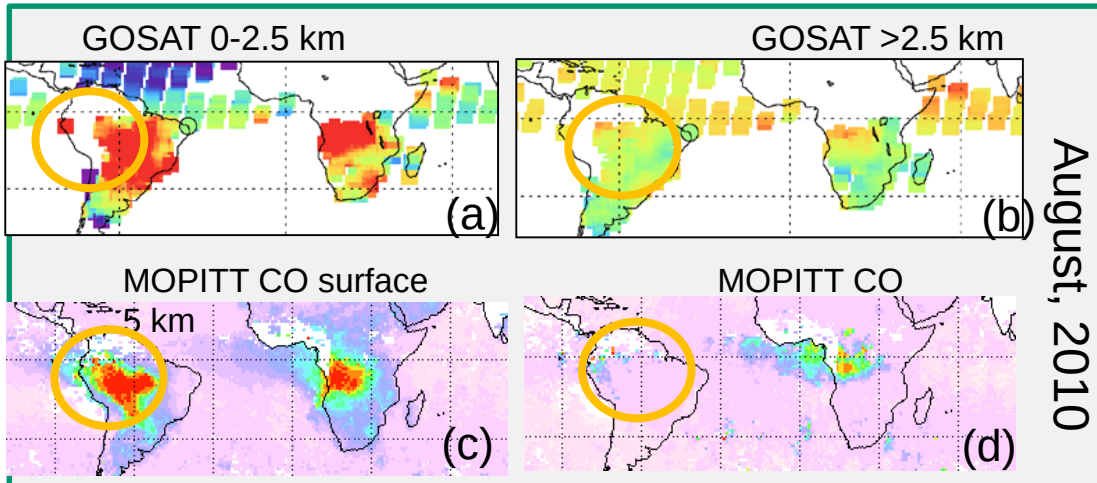
Lindqvist et al., 2016, in prep.

Lower tropospheric CO_2: a new dimension from GOSAT



Two partial columns, LMT and U, are created from the ACOS-GOSAT profiles, with ACOS-type bias correction. The same process should apply to OCO-2

Kulawik et al, 2016, in prep.

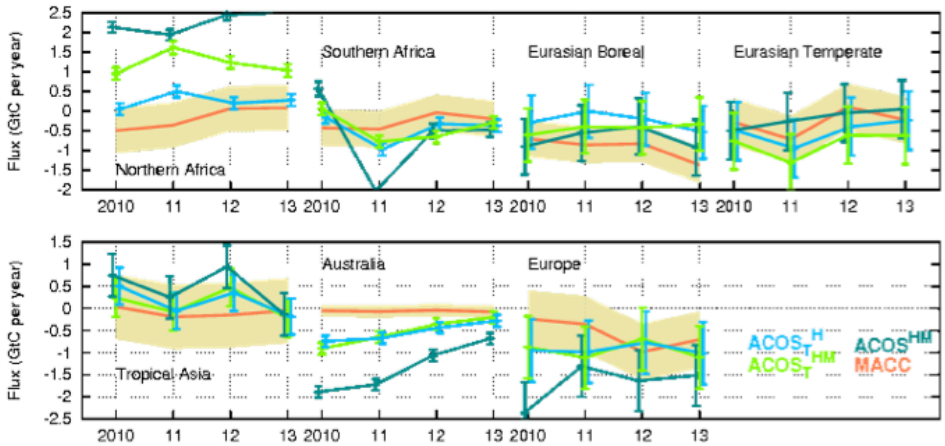


MOPITT multi-spectral CO is used to validate the partitioning between LMT-XCO2 and U-XCO2 in the tropics where the GOSAT prior is vertically and spatially flat. In the burning season, high values are seen *only* at the surface in South America for GOSAT LMT-XCO_2 (a) and MOPITT (c) but not in the mid-troposphere (b, d). Outflow is seen in the mid-trop. for both satellites in subsequent months (not shown).

Tailored inversions with GOSAT using optimized constraints

- The CO_2 retrieval constraints are much weaker than that of inversion models.
- Would like to change these post-retrieval.
- We derived a methodology to accomplish this.
- Applied to 5 years GOSAT data in MACC inversion system.

Chevallier & O'Dell, 2015, JGR under review.



Results more consistent with air-sample inversion!

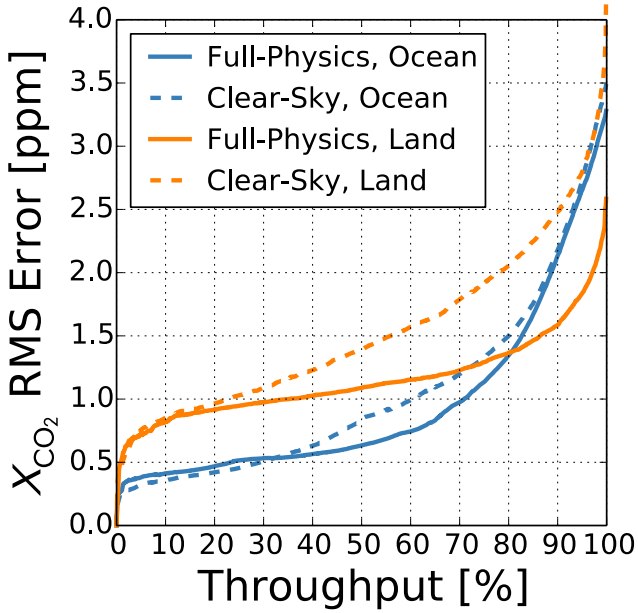
2010-2013 Mean Natural Land Fluxes (GtC/yr)

	In-situ	ACOS	ACOS Tailored*
NH	-2.7	-4.0	-2.9
Tropics	-0.4	-2.3	-0.2
SH	-0.3	-1.5	-0.6

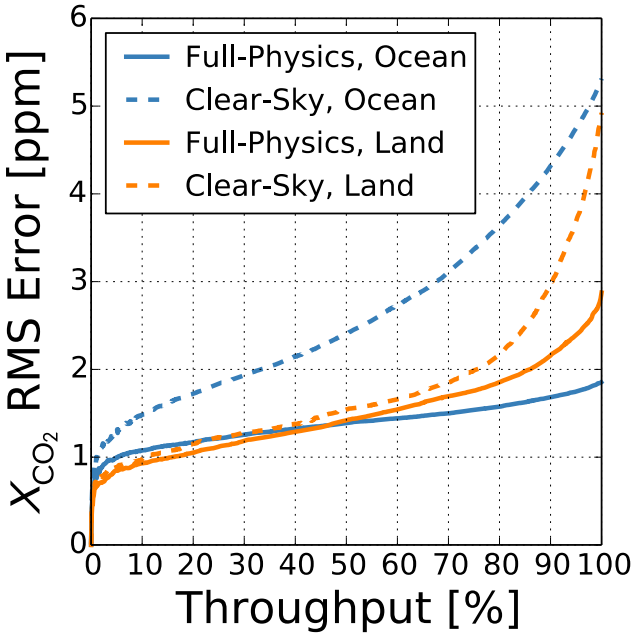
** Excludes M-gain*

The Potential of Clear-Sky Carbon Dioxide Satellite Retrievals

- Clear-sky OCO-2 simulations
  - Filtered using Lukas's genetic algorithm
  - Similar RMS errors to full-physics!



OCO-2 simulations



GOSAT measurements

- Clear-sky GOSAT retrievals
  - Similar over land, 30-60% worse over ocean
  - Errors still relatively small! (< 2 ppm)
  - See Nelson et al., 2015 (AMTD) for more info.

Summary of ACOS/GOSAT Publications

2015 OCO-2/GOSAT Publications

- Lindqvist, H., O'Dell, C. W., Basu, S., Boesch, H., Chevallier, F., Deutscher, N., Feng, L., Fisher, B., Hase, F., Inoue, M., Kivi, R., Morino, I., Palmer, P. I., Parker, R., Schneider, M., Sussmann, R., and Yoshida, Y.: *Does GOSAT capture the true seasonal cycle of carbon dioxide?*, *Atmos. Chem. Phys.*, 15, 13023-13040, doi:10.5194/acp-15-13023-2015, 2015.

- R. R. Nelson, C. W. O'Dell, T. E. Taylor, L. Mandrake, and M. Smyth. The potential of clear-sky carbon dioxide satellite retrievals, *Atmos. Meas. Tech. Discuss.*, 8, 13039-13072, doi:10.5194/amtd-8-13039-2015, 2015.

2015 OCO-2/GOSAT Publications in Press

- C. Frankenberg, S. S. Kulawik, S. Wofsy, F. Chevallier, B. Daube, E. A. Kort, C. O'Dell, E. T. Olsen, and G. Osterman, Using airborne HIAPER Pole-to-Pole Observations (HIPPO) to evaluate model and remote sensing estimates of atmospheric carbon dioxide. *Atmos. Chem. Phys.*, in press, 2015.

- F. Chevallier and C. W. O'Dell. Multiyear global CO_2 atmospheric inversion from tailored CO2 satellite retrievals, *Geophys. Res. Lett.*, in press, 2015.

- S. Kulawik, D. Wunch, C. O'Dell, C. Frankenberg, A. R. Jacobson, M. Reuter, T. Oda, F. Chevallier, V. Sherlock, M. Buchwitz, G. Osterman, Charles Miller, Consistent evaluation of GOSAT, SCIAMACHY, CarbonTracker, and MACC through comparisons to TCCON, *Atmos. Chem. Phys.*, in press, 2015.

GOSAT v201201 Processing Plans

Future Plans: Processing the GOSAT v201201 Product

- There is a strong consensus among the OCO-2 Science Team that a uniform, 6+year GOSAT product processed through the same algorithm as the OCO-2 product would be valuable for several investigations.

- The OCO-2 Science Data Operations System (SDOS) team is preparing to reprocess the v201 product
  - Updated documentation on the differences between this product and the v160160 product has been obtained
  - Some questions remain to be answered.

- A testing program is currently under development

- The timing of the reprocessing effort is currently under discussion, and will be modified pending the outcome of the tests