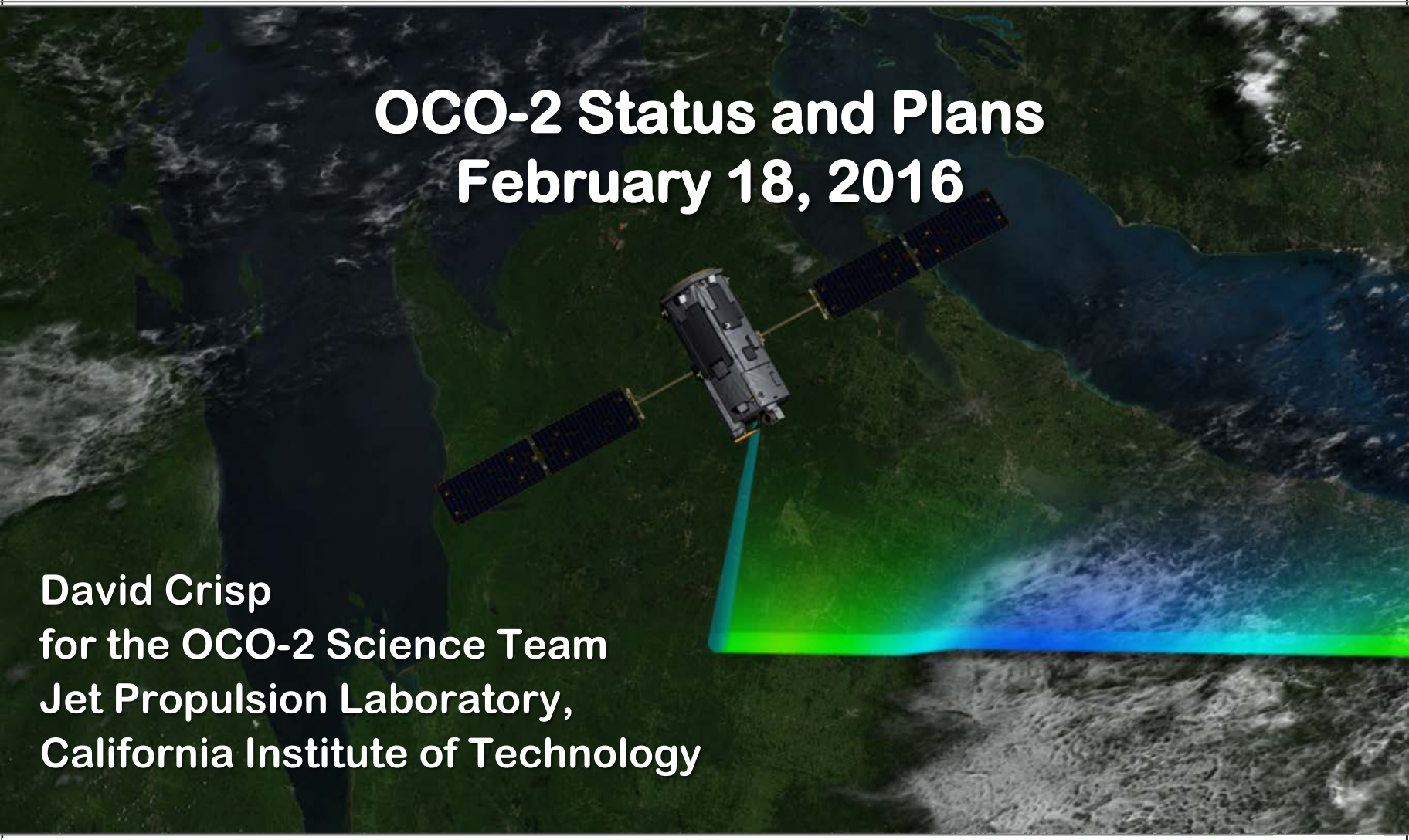
OCO-2 Status and Plans
February 18, 2016



David Crisp
for the OCO-2 Science Team
Jet Propulsion Laboratory,
California Institute of Technology

Copyright 2016 California Institute of Technology.
Government sponsorship acknowledged.

Topics Covered

- OCO-2 status update
  - Observatory Status
  - Instrument Status
- OCO-2 V7 data product delivery status
- Plans for processing GOSAT v201.201
- Upcoming Meetings
  - Science Team, EGU, JpGU, IWGGMS-12
- OCO-2 Vicarious Calibration At Railroad Valley

OCO-2 Observatory Status

- The OCO-2 spacecraft operations are "NOMINAL"
  - The last drag make-up maneuver, DMUM#10, executed on 11 February 2016 (in close coordination with CALIPSO DMUM)
  - The Navigation team has maintained ground track overlap within +/- 5 km of CALIPSO and CloudSat >95% of the time since 8/4/2015

- Upcoming Inclination Adjustment Maneuvers:
  - 10 Mar 2016 21:42:35
  - 17 Mar 2016 23:26:31
  - 07 Apr 2016 22:04:11
  - 26 Apr 2016 22:36:10

- The next instrument decontamination cycle is scheduled for early March 28 – April 3 2016. As in the past, that will preclude data acquisition for about one week

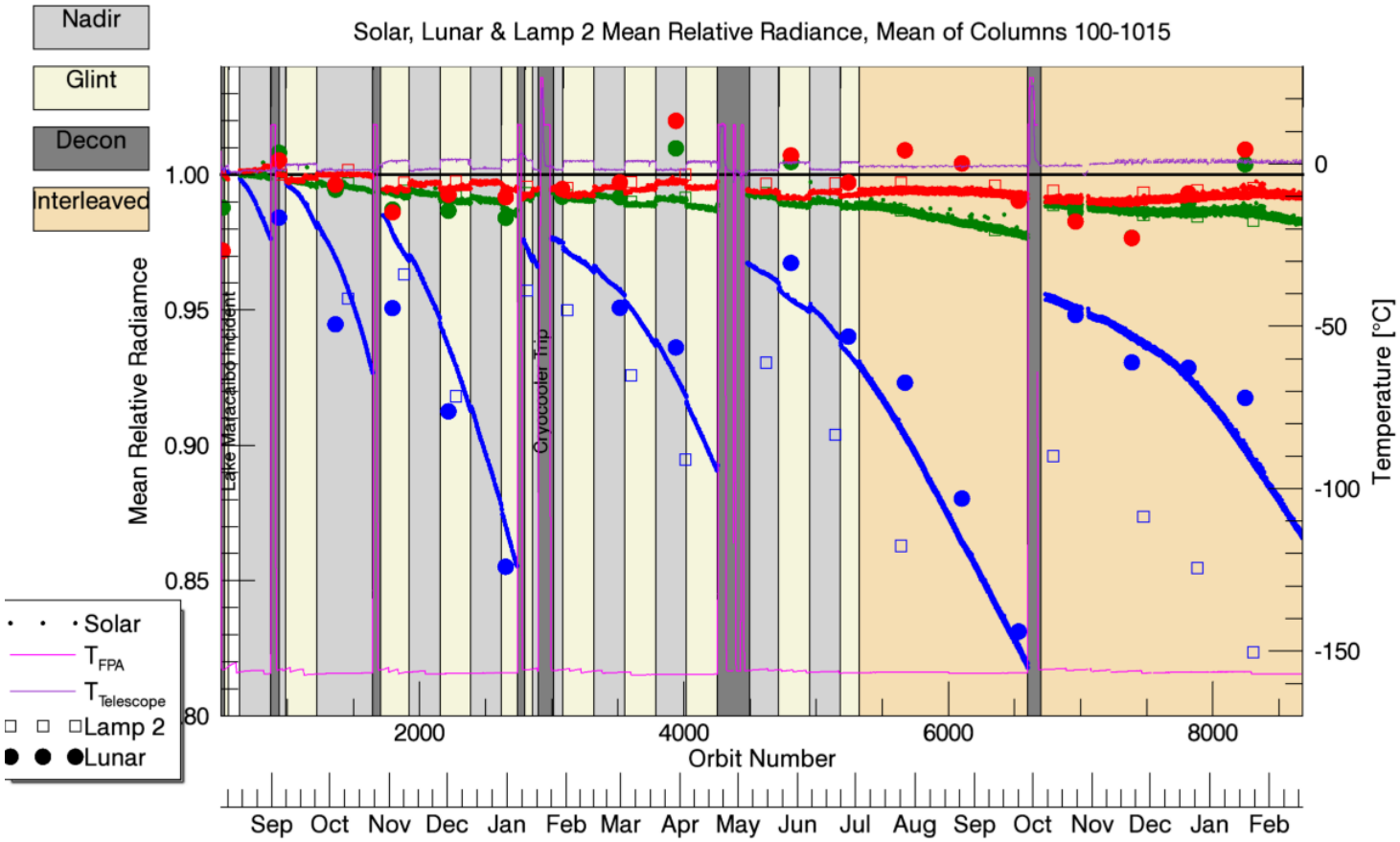
OCO-2 Instrument Status

- The instrument operations are nominal
  - Currently investigating possible changes in the ILS

- A-Band Sensitivity Variations
  - The sensitivity degradation has two separate components
    - A "fast degradation" that is reversed by decontamination cycles
    - A "slow degradation" that is monotonic
  - Both fast and slow degradation are corrected in the L1b product
  - 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
  - There is increasing evidence from Lunar Calibration that the "slow" degradation might be due to degradation of the lamp and solar diffusers

- Next decontamination cycle is scheduled for March 28, 2016

A-Band Sensitivity Degradation

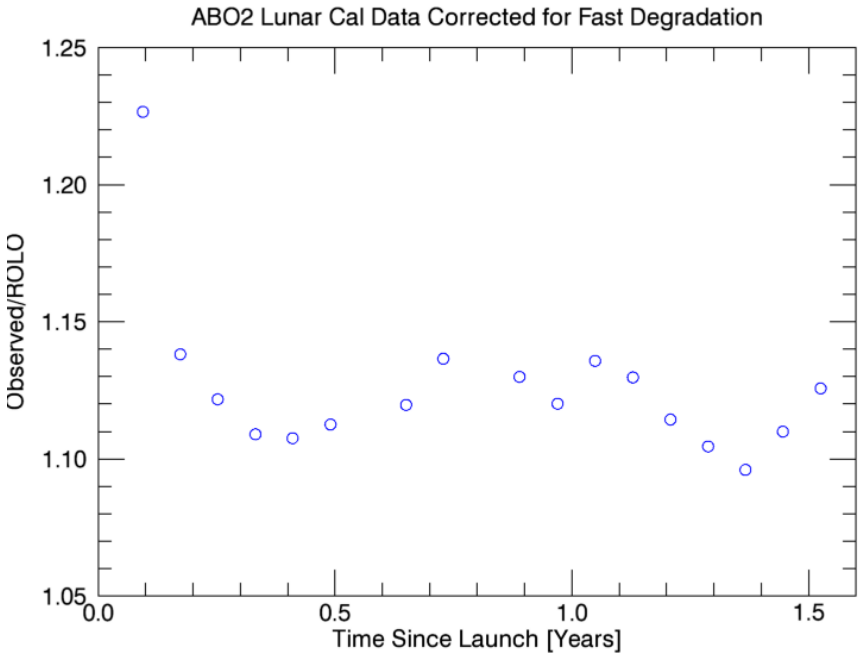


The rate of sensitivity loss in the ABO2 channel (blue) is decreasing with time, for both the “fast” (correctable) and “slow” (monotonic) components of the loss.

Cause of the Slow Degradation

The slow degradation may be the result of degradation in the Lamp and Solar calibration systems rather than the instrument

- The slow degradation is seen in the lamp and solar calibration records
- There is no evidence of the slow degradation in the Lunar Calibration data
- No sign of the slow degradation is seen in any of the L2 data, but fast degradation is seen
- If the slow degradation is only in the lamp and solar calibrators, we are currently over-correcting the ABO2 radiances by ~4%



Lunar Calibration data, once the fast degradation is removed [Lars Chapsky]

OCO-2 B7r Standard Production Calendar

as of 2/16/2016 Build 7.n.00 L2 XCO2 Production & Delivery Status - Retrospective Calibration

	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
July																															
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
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	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	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-16																															
February																															

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

Production and Deliveries of B7r are now complete through the month of December 2015

OCO-2 B7r Lite Production Calendar

as of 2/16/2016 Build 7.n.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
July																															
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
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	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-16																															
February																															

Warm

Cold, unstable

Cold, stable

Completely without Science

B7r processing

complete

- incomplete

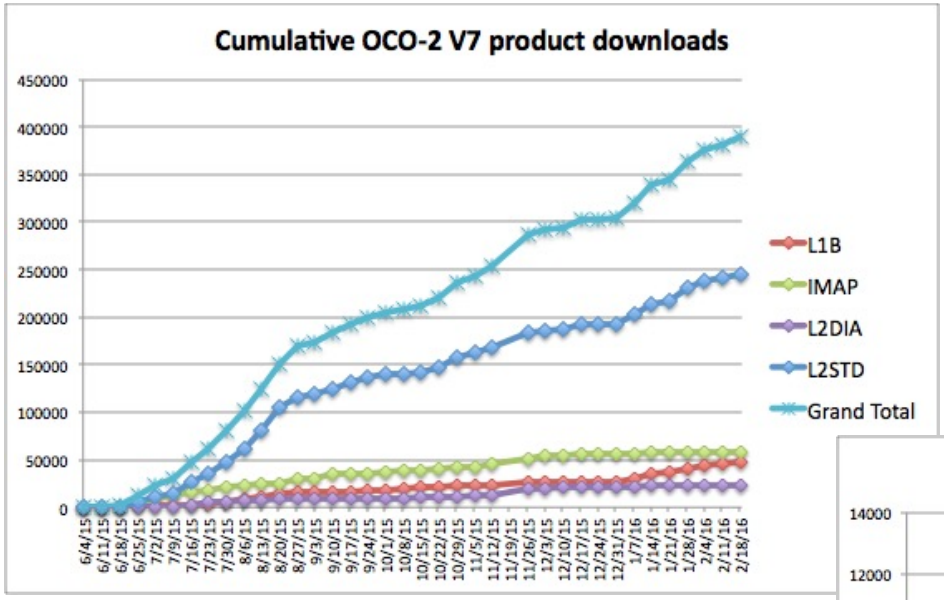
not begun

Days delivered to GES DISC

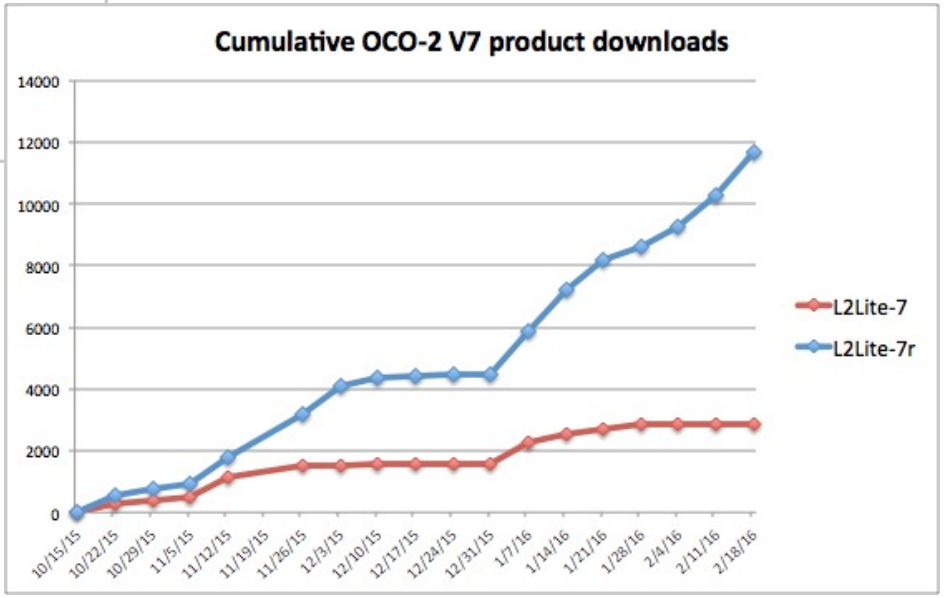
D all orbits delivered

Production and deliveries of B7r Lite files are also complete through the month of December 2015.

Download Statistics (2/18/2016)



OCO-2 Data product downloads continue at a rapid pace [Charley Avis]



Plans for Processing the GOSAT v201201 Product

- The OCO-2 Science Data Operations System (SDOS) team is preparing to reprocess the v201 product
- Substantial progress has been made in understanding the differences between the v161.161 and v201.201 product, but there are still a few questions
  - Current question – How do we compute noise for v201.201?
    - For earlier versions, we used out-of-band radiances, but there is little or no out-of-band radiance in the Best Estimated radiance files
    - What is the best way to do this now?
- Testing program will commence next week
- Schedule for processing is contingent on test results

Upcoming Meetings

- 21-23 March 2016: OCO-2 Science Team Meeting, Caltech
  - REGISTER! https://sites.google.com/site/oco2stmmar2016/
- 17-22 April 2016: EGU, Vienna
- 17-22 April 2016: International Radiation Symposium, Auckland, New Zealand
- 9-13 May 2016: ESA Living Planet Symposium, Prague
- 17-18 May 2016: NOAA ESRL GMD Annual Meeting, Boulder
- 22-26 May 2016: JpGU, Makuhari Messe, Japan
  - Two abstracts just submitted
- 6-7.5 June, 2016: GOSAT RA PI Meeting, Kyoto
- 7.5-9 June, 2016: IWGGMS-12, Kyoto
- 10 June, 2016 OCO-2/GOSAT TIM, Nara

OCO-2 Vicarious Calibration At Railroad Valley

12Feb2016 RDF update

Carol Bruegge

Radiometric equation

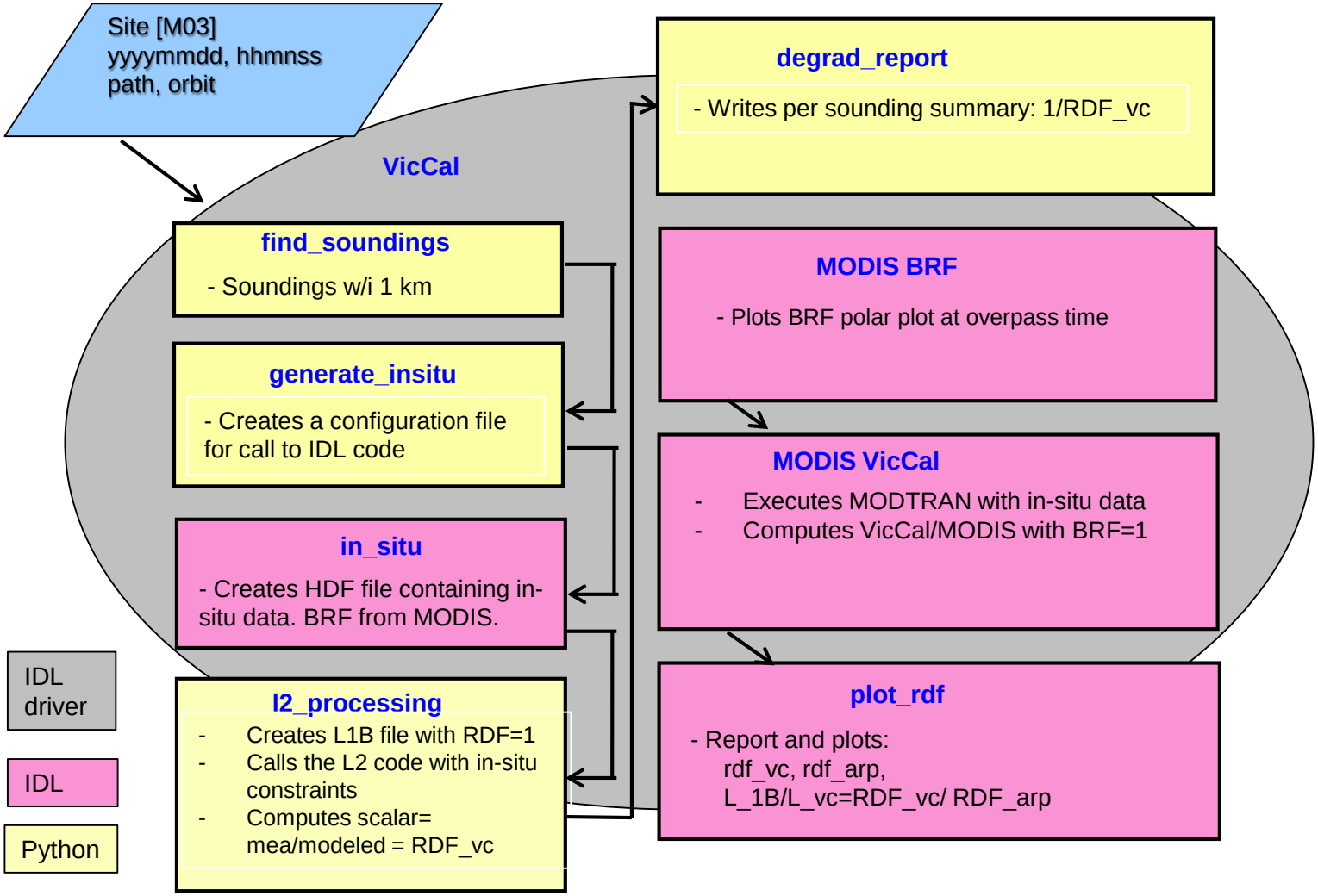
Radiance is computed from the digitized signal via:

$$L(\lambda_j) = [1/RDF] \sum_{i=1}^{3} g_{i,j} \left(DN_j - DN_{j,\mathrm{dark}}\right)^i$$

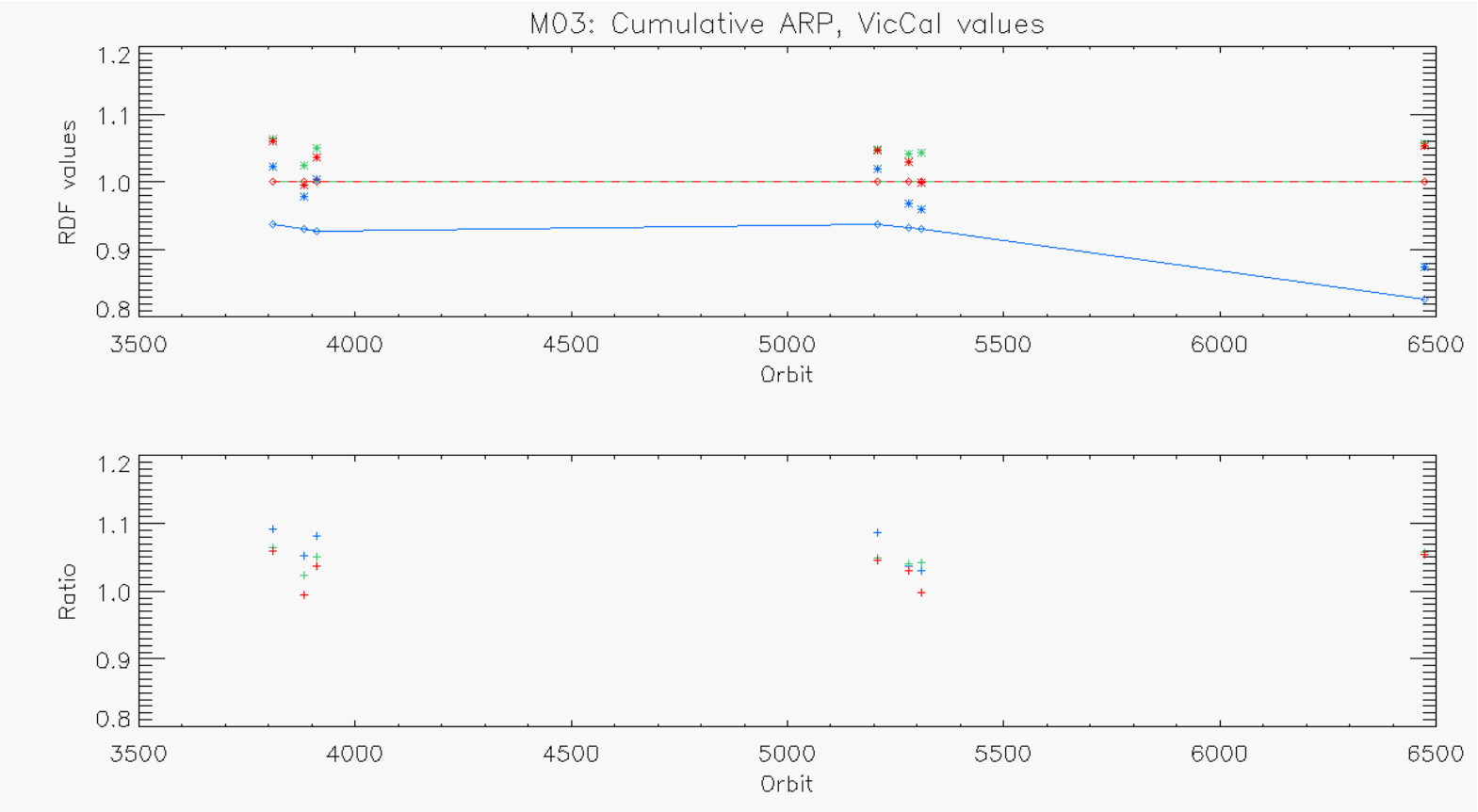
where

- RDF is the radiometric degradation factor; the change in response compared to preflight response
- g are the preflight determined gain coefficient, reported for each of 8 spatial footprints and 1016 spectral samples
- DN_{dark} is computed as a function of temperature.
- Note if RDF decreases in time then the DN will decrease, for a given incident radiance, as compared to an earlier response.

Software flow diagram



2015 RRV Viccal summary

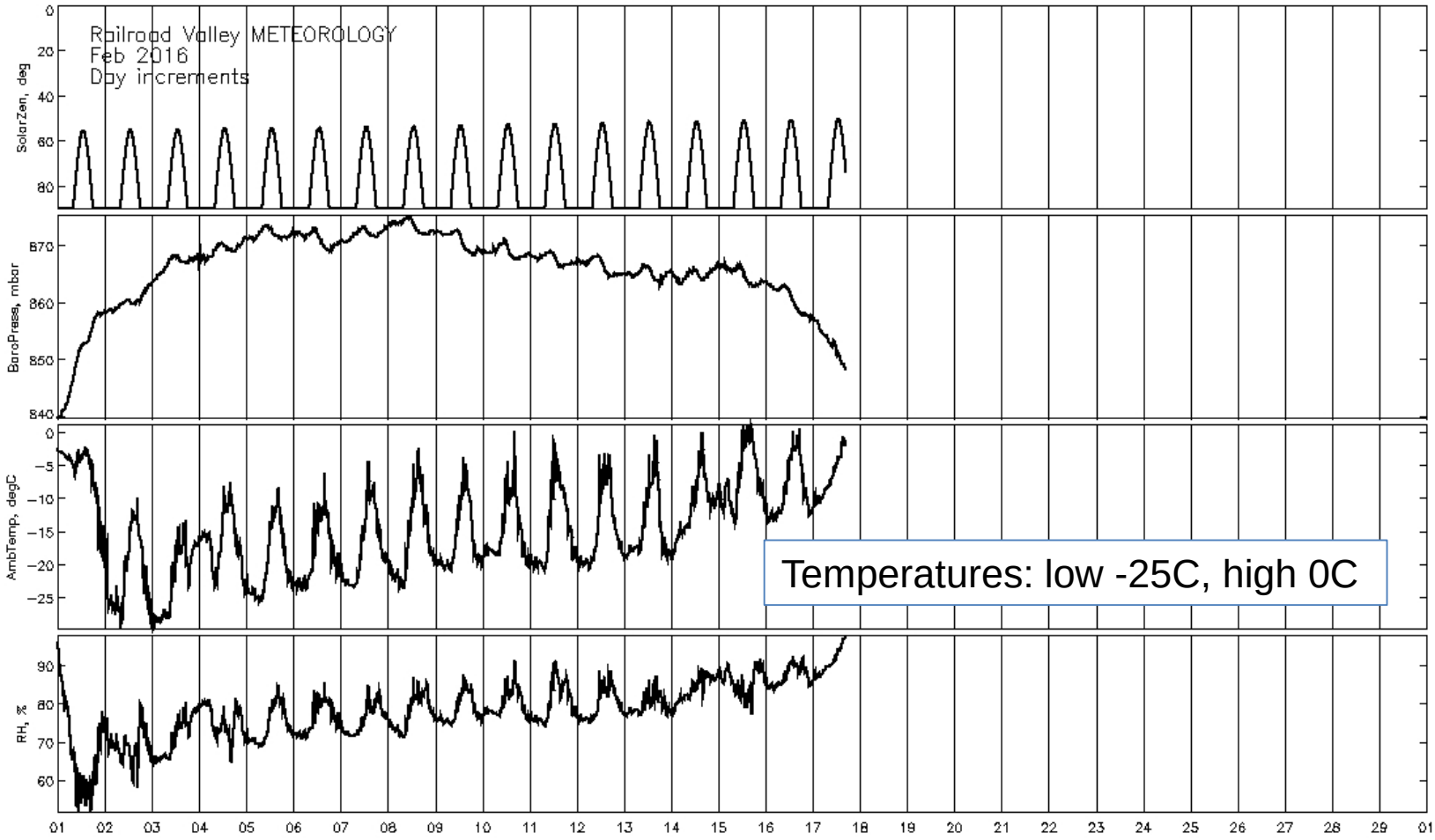


Top: RDF for RRV Viccal (points) and OCO L1B coefficients (points with line).
Bottom: Radiance ratio OCO2/RRV Viccal averages are 6%, 5%, and 3% high for ABO2, WCO2, and SCO2 bands. (OCO L1B radiances too high.)

Table summary

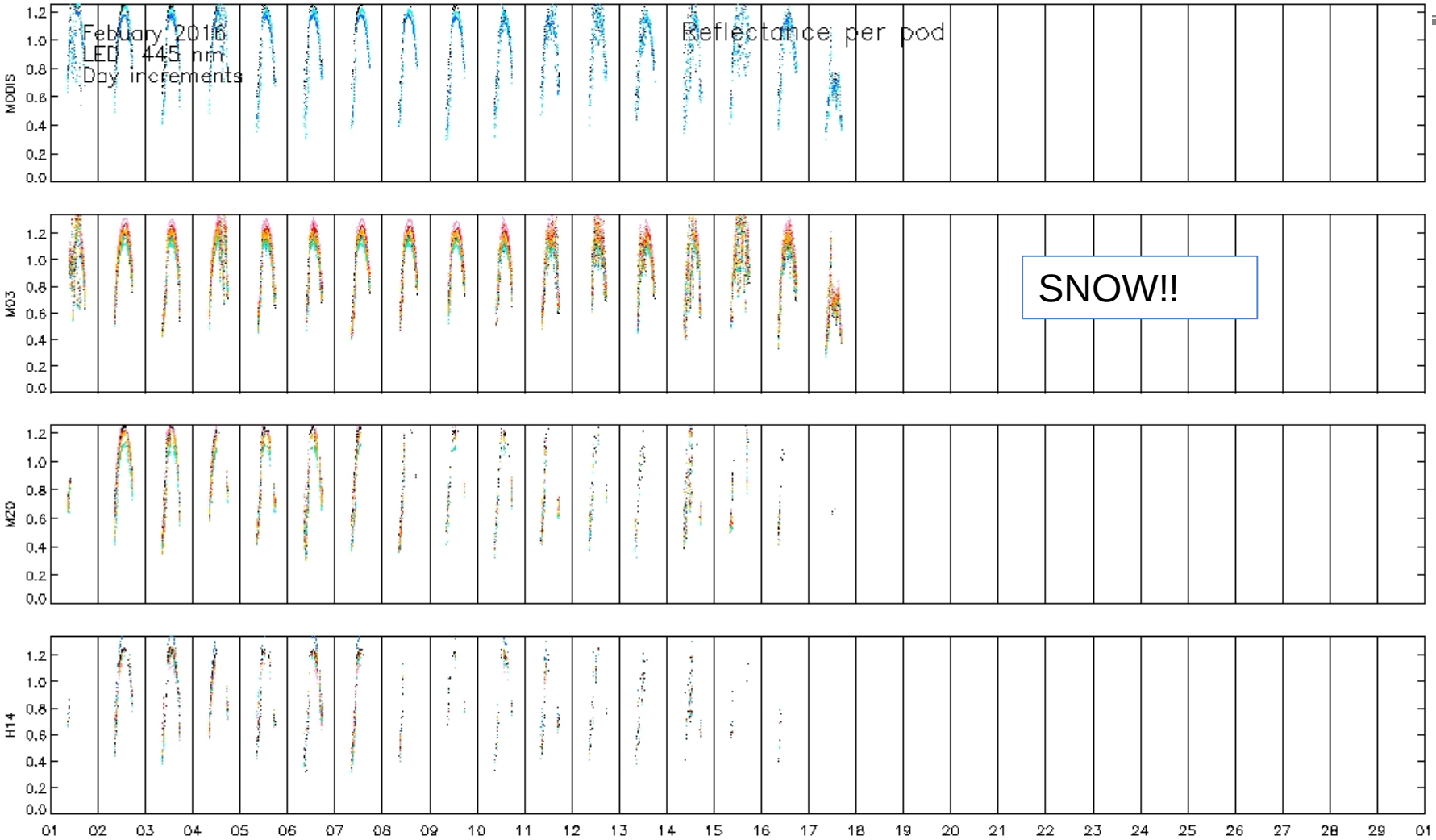
		Radiance ratio=RDF_vc/RDF_arp					
	Orbit	Path	nBRF	ABO2	WCO2	SCO2	
20150320	3809	136	0.98	1.09	1.06	1.06	
20150325	3882	139	1.03	1.05	1.02	1.00	Outlier
20150327	3911	137	1.00	1.08	1.05	1.04	
20150624	5207	136	1.05	1.04	1.04	1.03	Consistent results with large range in view angles and nBRF correction
20150629	5280	139	0.96	1.04	1.04	1.03	
20150701	5309	137	0.93	1.03	1.04	1.00	
20150919	6474	137	0.98	1.06	1.06	1.05	
Average				1.06	1.05	1.03	
Median				1.05	1.04	1.03	Final
Stdev, %				2.2	1.2	2.4	

LSpec meteorological data, Feb. 2016

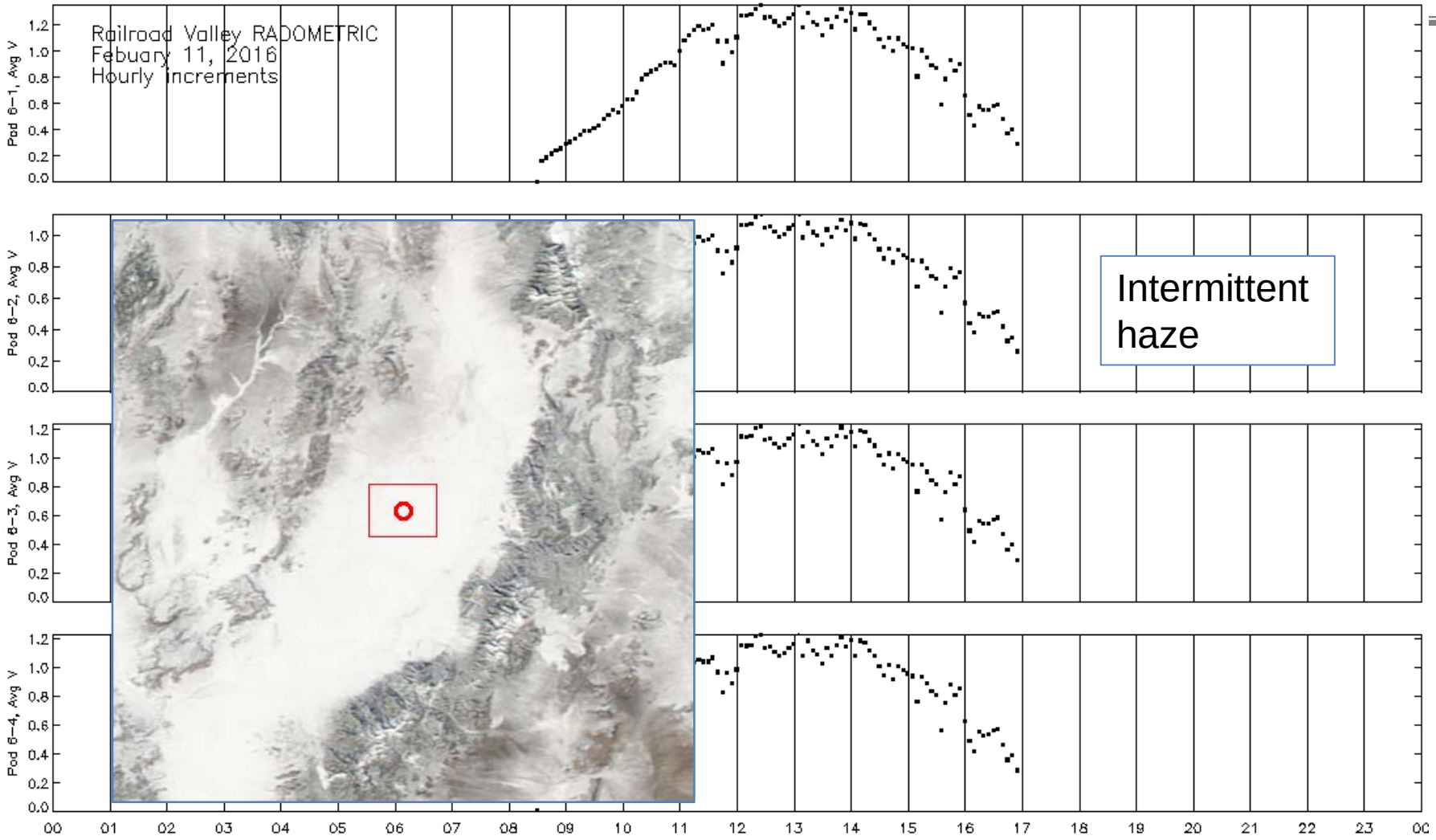


Temperatures: low -25C, high 0C

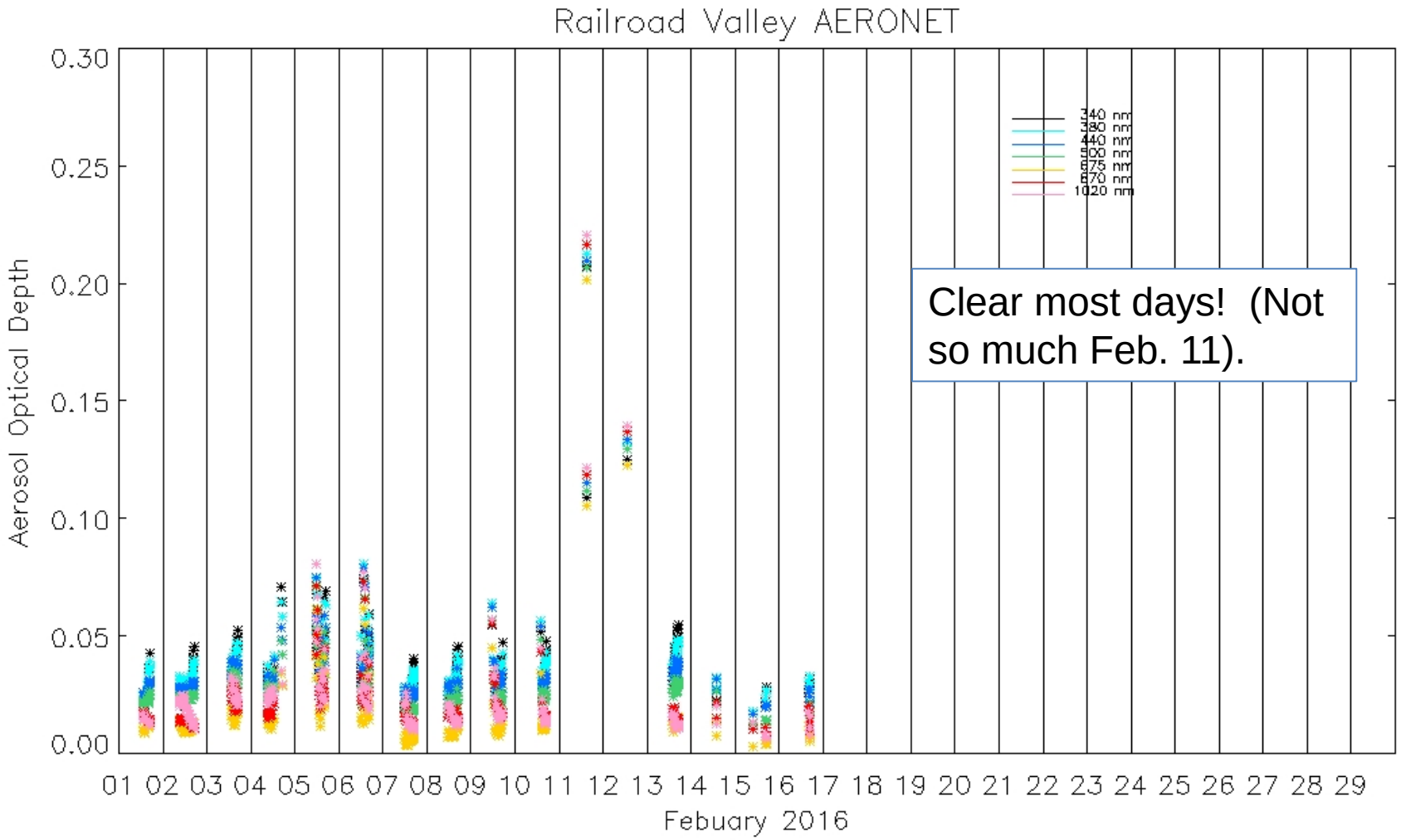
LSpec reflectance data, Feb. 2016



LSpec voltage data, 11Feb2016



LSpec aeronet, Feb. 2016



Clear most days! (Not so much Feb. 11).

RRV preparations 2016

Student summer intern:

Henry Steiner, 2nd year mechanical engineering major; competitive swimmer, has hiked through Death Valley, swam 25 km across SF Bay at 55F, lifeguard.

Knows telescopes/optics, UAVs. Python and C proficient.

Also, we would like to introduce Peter Lawson (JPL), a new member of the OCO-2 / OCO-3 Calibration Team.