National Aeronautics and Space Administration

Stratospheric Aerosol and Gas Experiment
SAGE III on ISS

SAGE-III Aerosol and Ozone Products: Using NDACC Lidar Data as Validation Toolset

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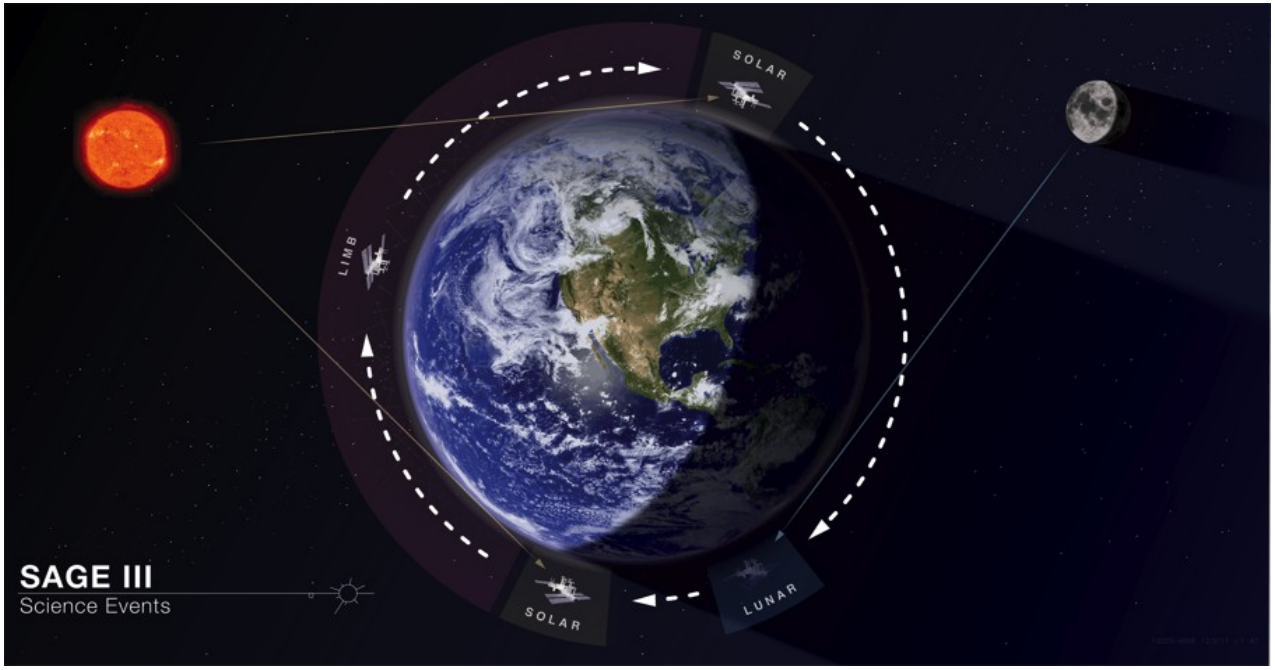
The SAGE-III/ISS Breakdown

Data collection began:
- 2017-06-07

Detector:
- 809x10 pixel CCD
- 280 – 1040 nm
- 1550 (±15) nm

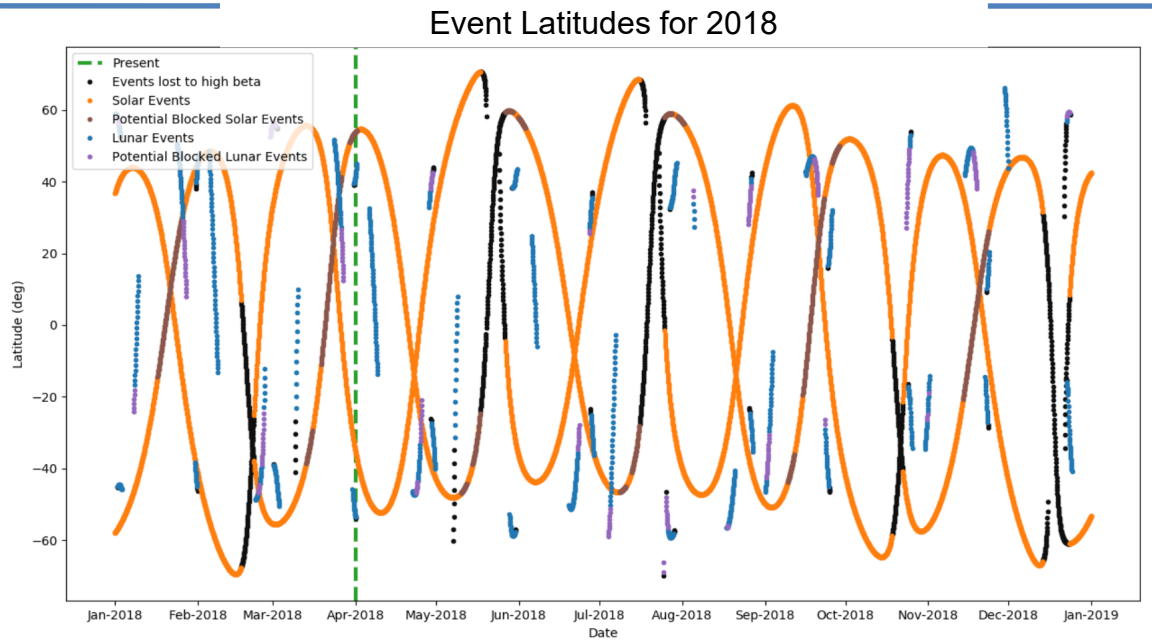
Operational Modes:
- Solar Occultation (SO)
- Lunar Occultation (LO)
- Limb Scatter (LS)

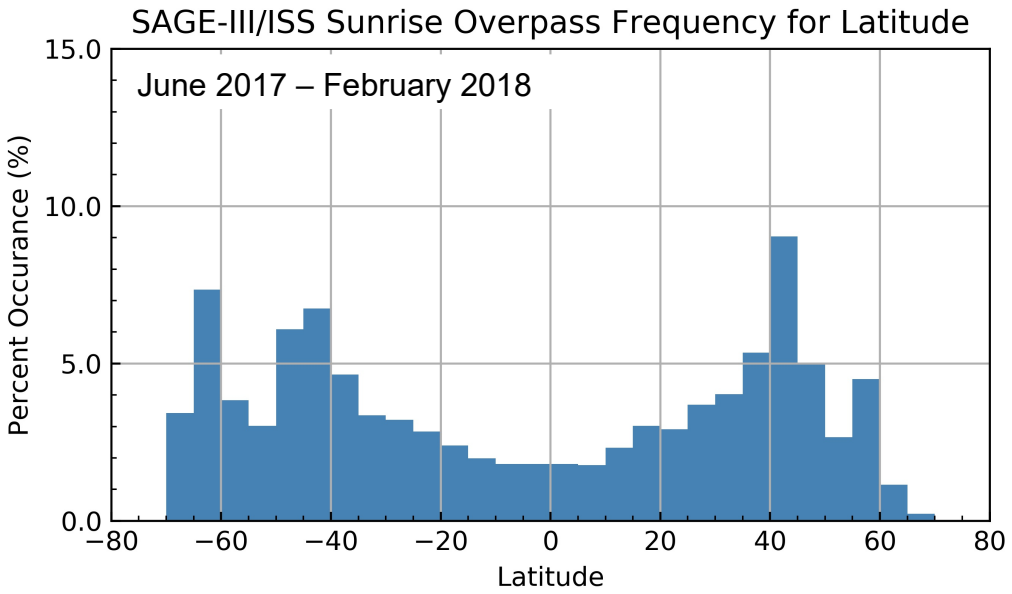


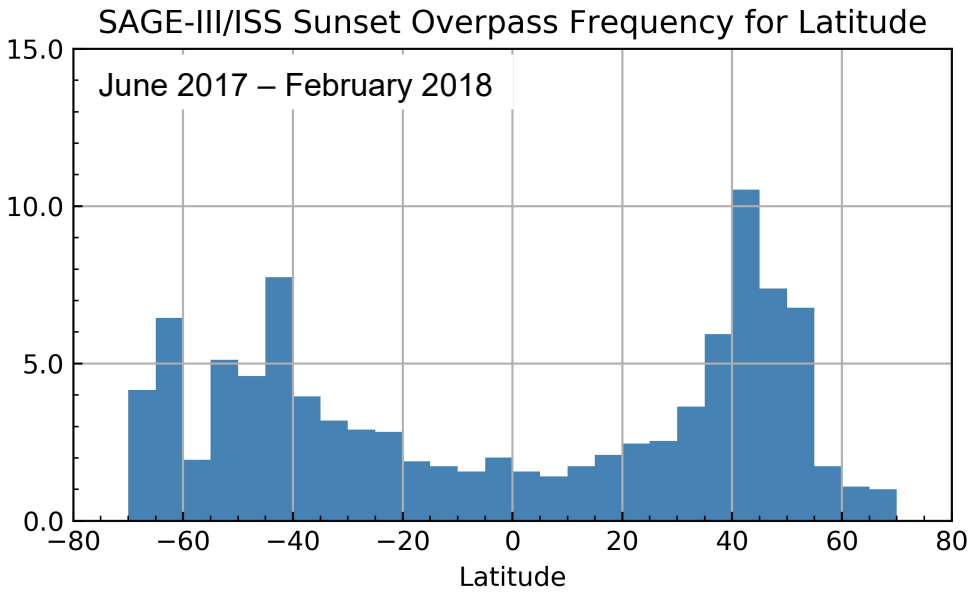
Occultation data collections dictated by orbital mechanics
- Sunrise/Sunset – local time
- Moonrise/Moonset –nighttime species

LS observations will be made on a regular basis
- When/where has a degree of flexibility

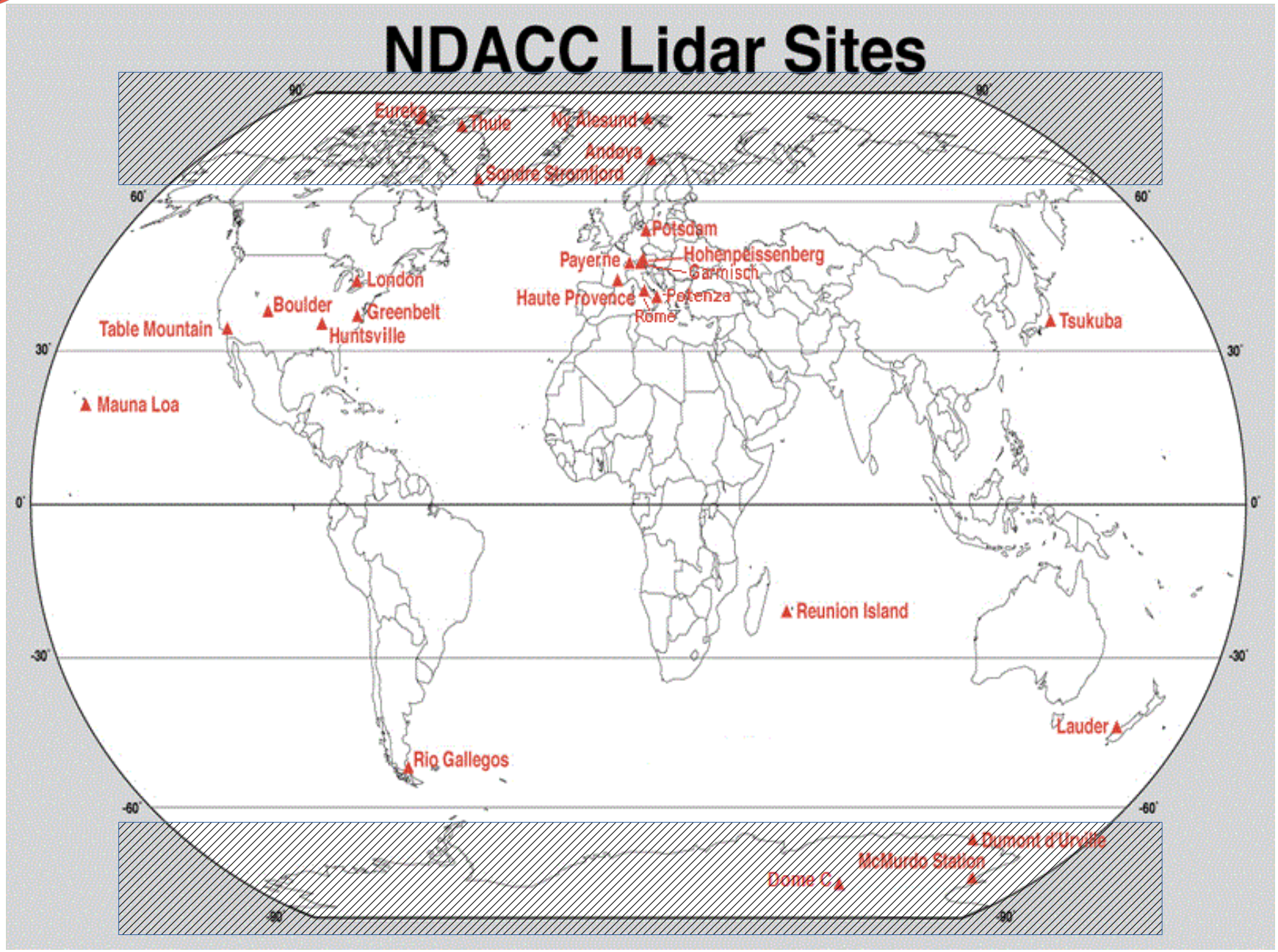
ISS Orbit & Overpass Frequency







NDACC LIDAR Site Map



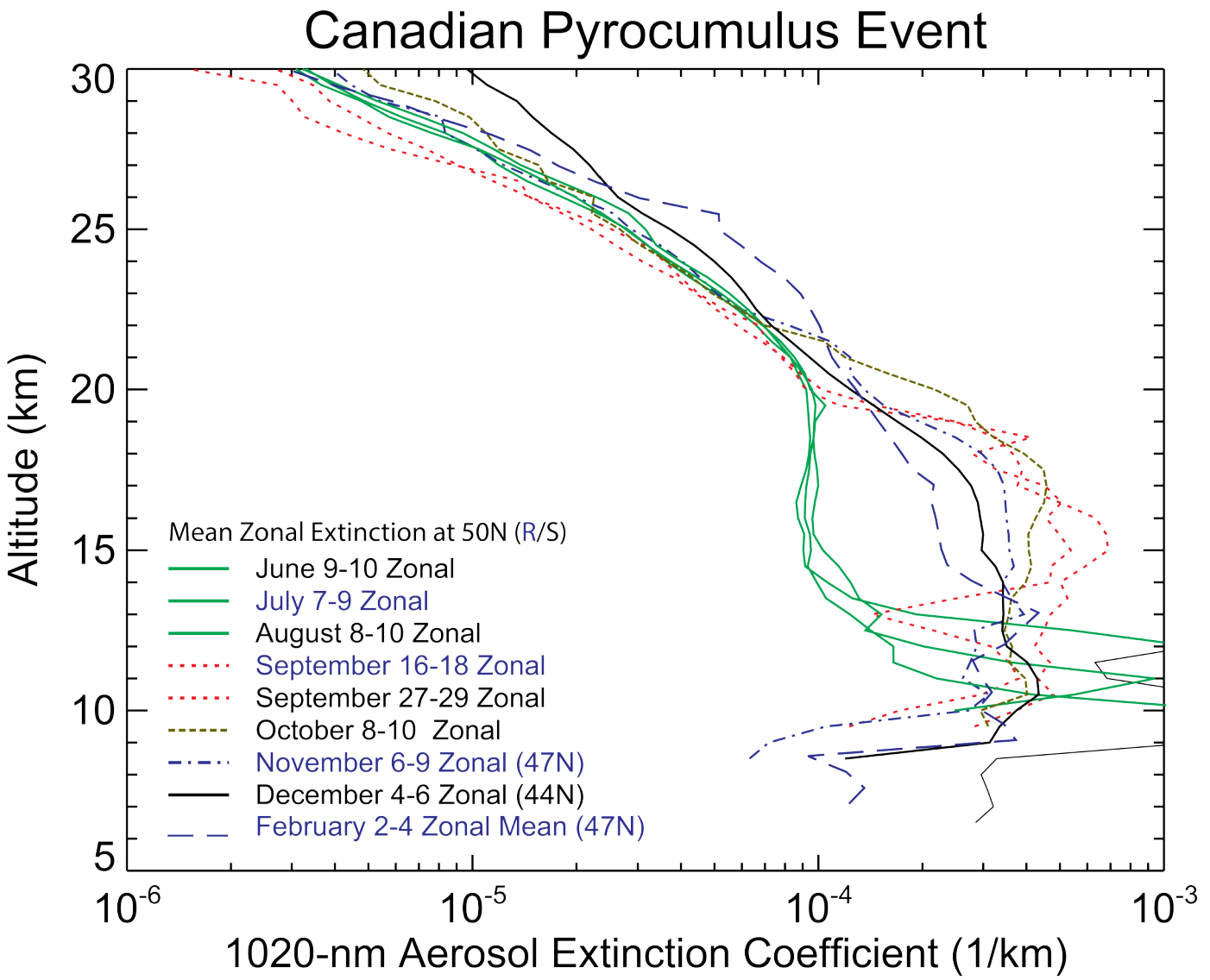
Standard Data Products

Product	Event Type	Vertical Range & Resolution [km]	Precision [%]	Wavelengths (nm)
Spectral Transmission	Solar	0* – 100, 0.75	0.1	280-1040, 1550
Aerosol Ext./Optical Depth	Solar	0* – 40, 0.75	5	384, 447-450, 520, 601, 676, 756, 869, 1018-1023, 1550
Ozone [cm^{-3}]	Solar	0* – 50, 0.75	5	282-294, 562-595, 608-621
Water Vapor [cm^{-3}]	Solar	5* – 45, 0.75	10	920-971
Nitrogen Dioxide [cm^{-3}]	Solar	TP+2 – 45, 0.75	10	433-450
Ozone [cm^{-3}]	Lunar	15* - 45, 1.5	5	378-679
Nitrogen Dioxide [cm^{-3}]	Lunar	20 – 45, 1.5	10	378-679
Nitrogen Trioxide [cm^{-3}]	Lunar	25 – 45, 1.5	15	378-679

* Or cloud-top; ** at 600 nm

Mother of Pyrocbs

We see her too!



Validation Criteria

Collocation criteria:

- Latitude: ±5° (site dependent)
- Longitude: ±10°
- Time: ±24 h
- Locations: global

Resolution requirements:

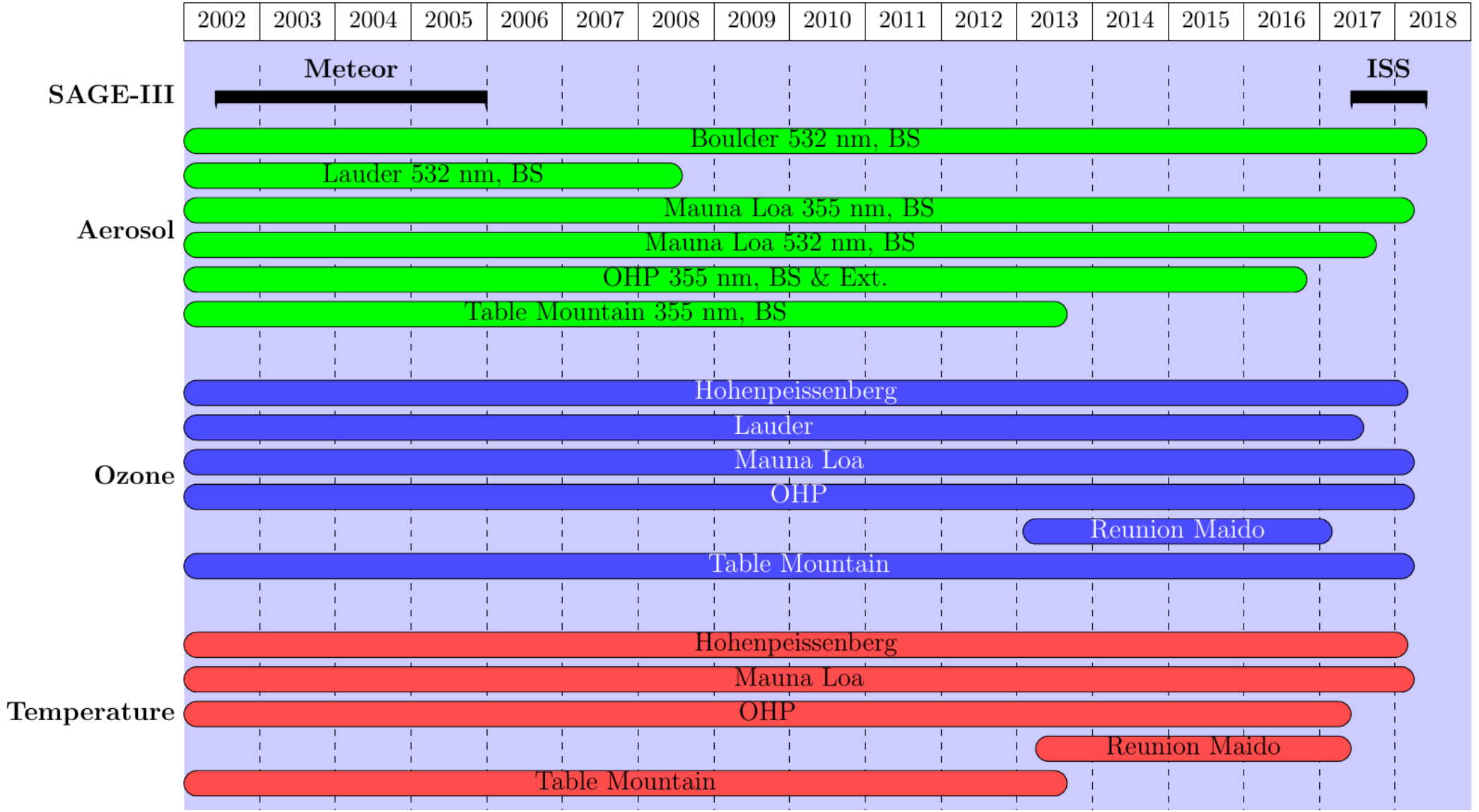
- Time: ideally 4-6 h (10-12 acceptable)
- Vertical: ideally < 0.5 km

Science products (UTLS and up):

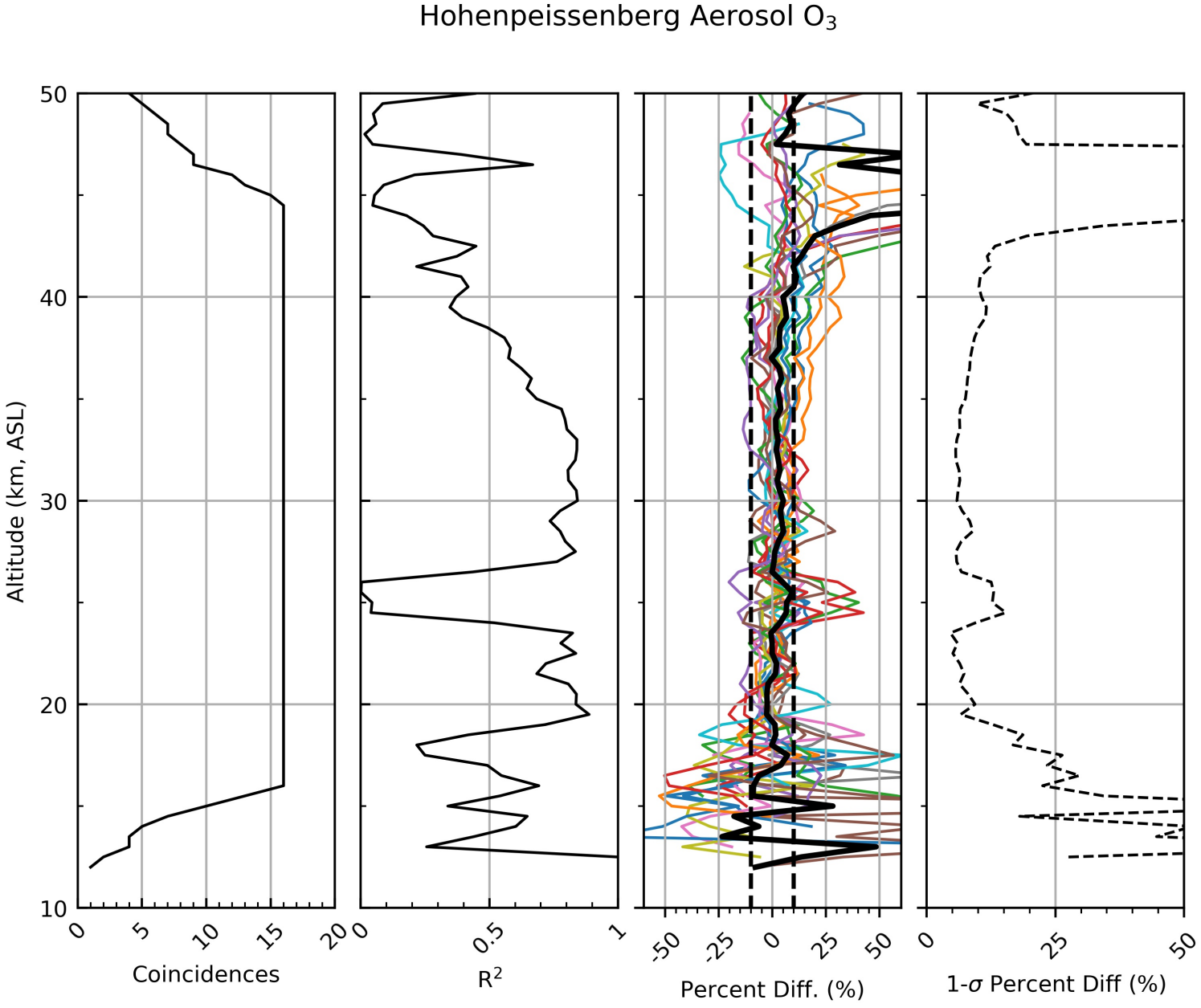
- Aerosol backscatter (ideally extinction)
- Ozone number density
- Water vapor (operational, released in next version)
- Temperature profile (research product)

Known Overlap with ISS

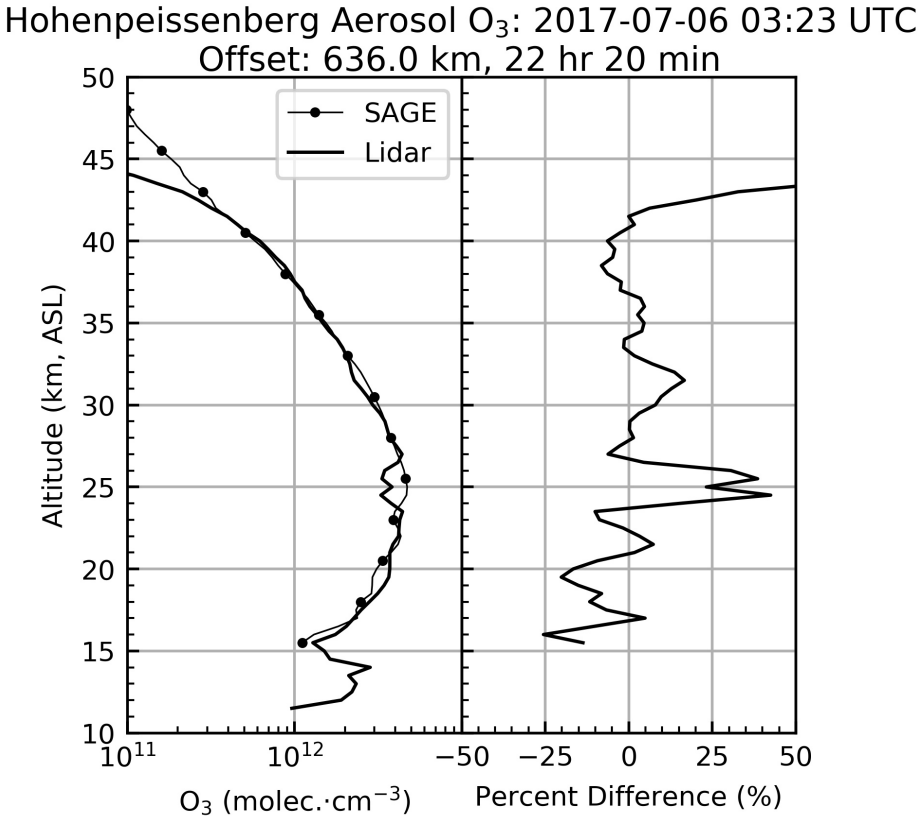
as of April 2018



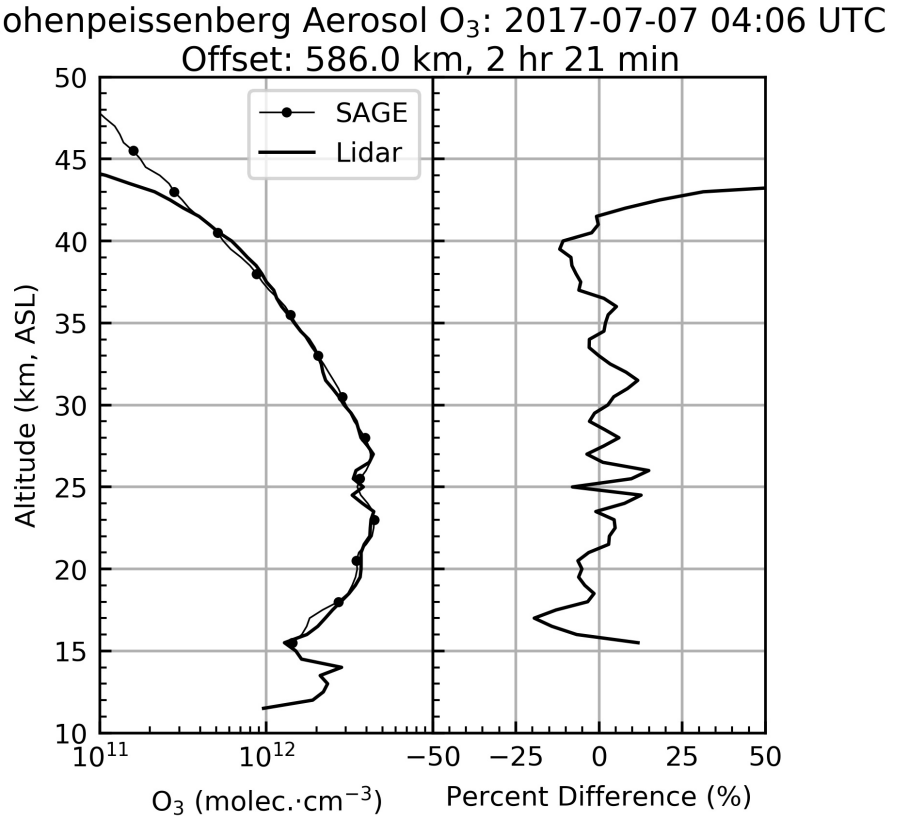
Using LWG Data: Hohenpeissenberg



Location Matters

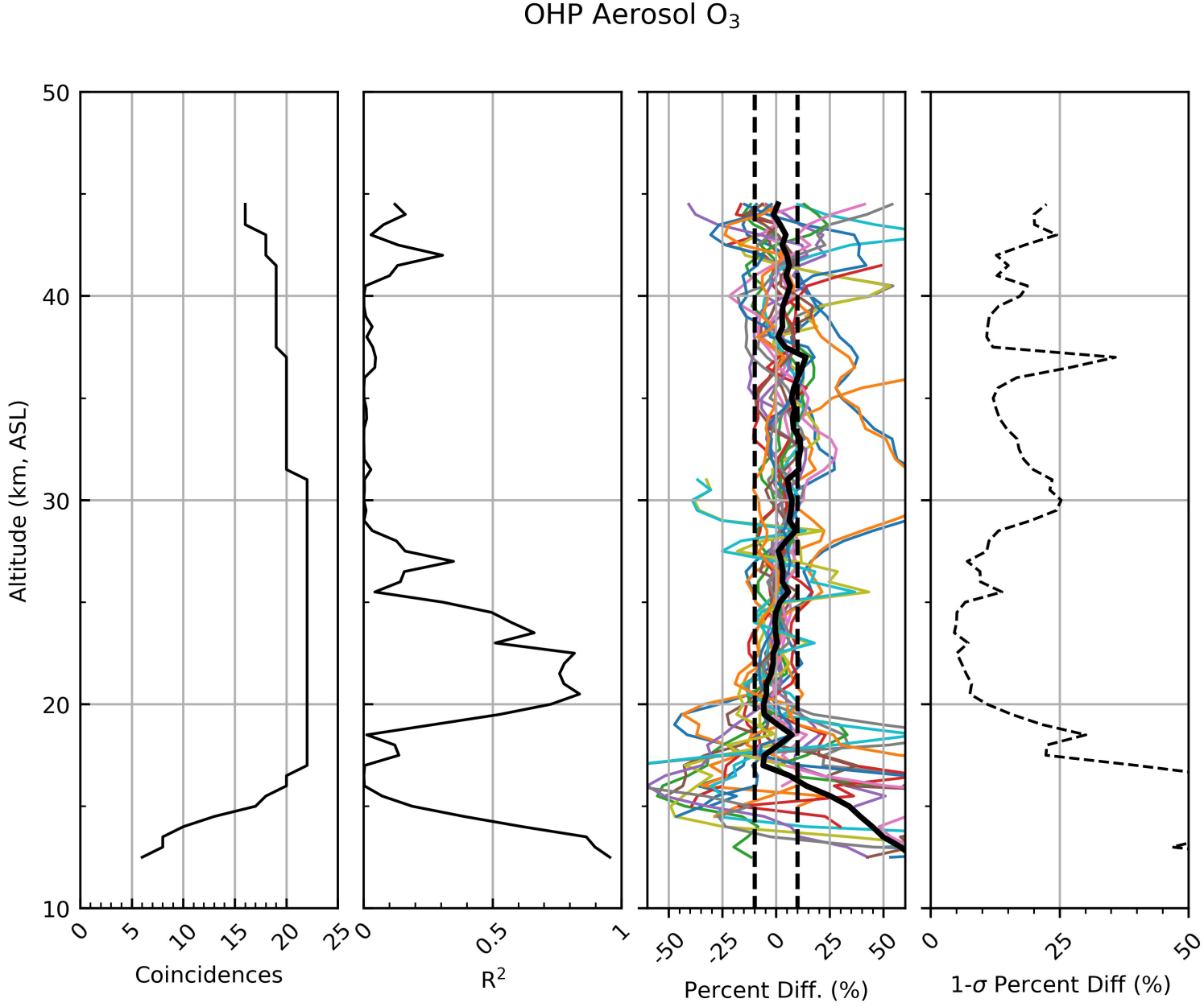


400 km south

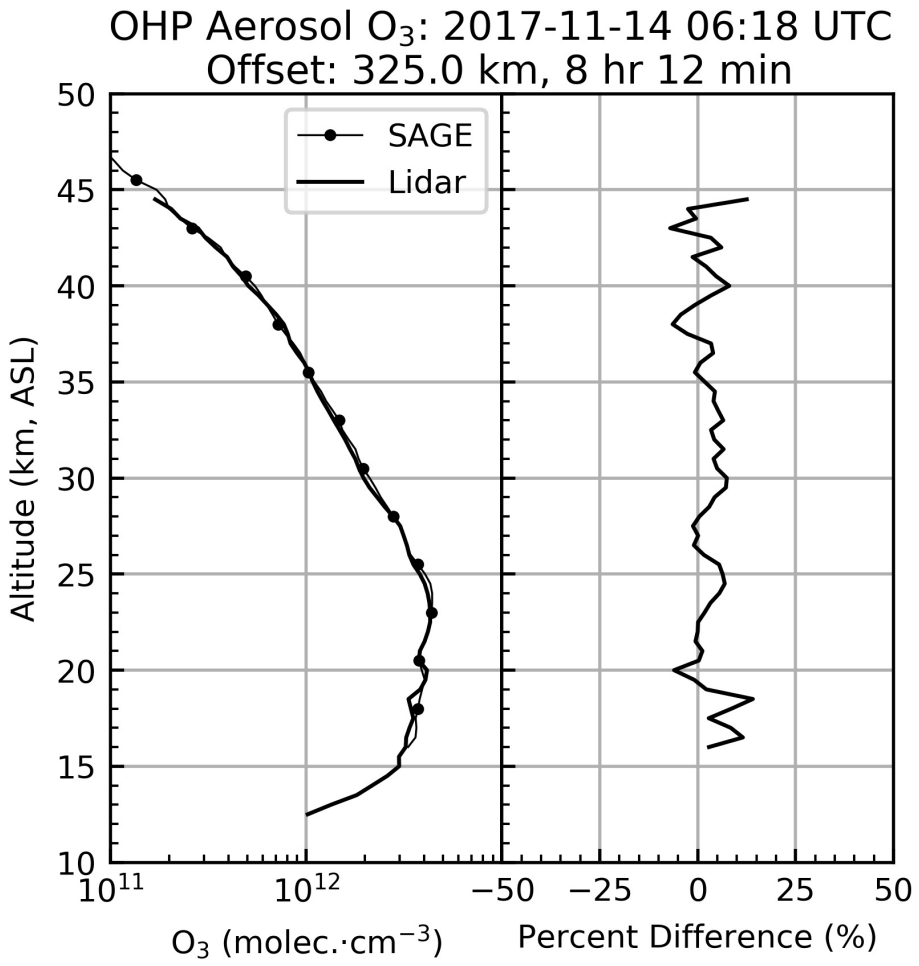


580 km east

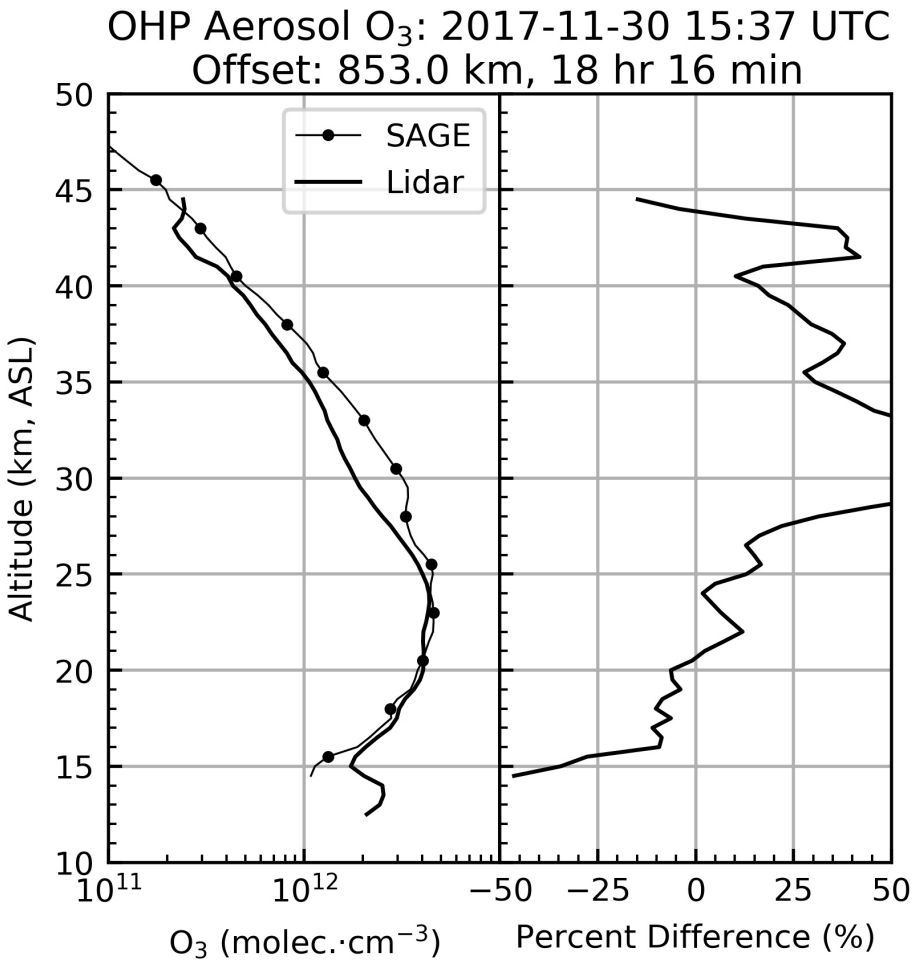
Initial Usage, OHP



Location Matters



200 km south



500 km south

LWG helps inform latitude tolerance

How can you help?

Validation Measurement Locator

https://sage.nasa.gov/validation/

The SAGE III/ISS Validation Measurement Locator is a web application intended to assist the correlative and validation measurement community for pre-mission field campaign planning activities

- Up to three weeks of advanced measurement predictions provided
  - Predictions change due to reboost events, so recheck as overpass approaches

- Web application provides temporal and geospatial search criteria

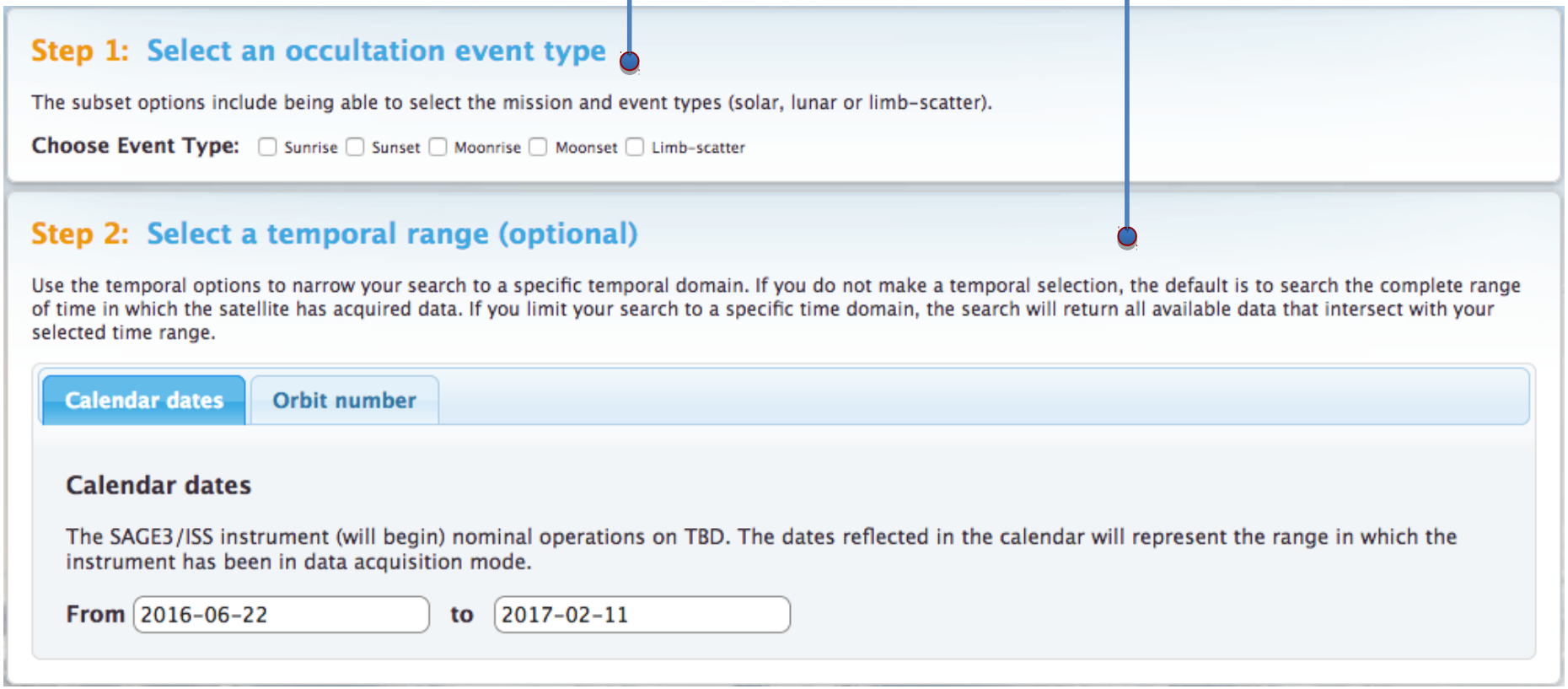
- A downloadable report for import into other applications is available

Validation Measurement Locator

https://sage.nasa.gov/validation/

Temporal selector

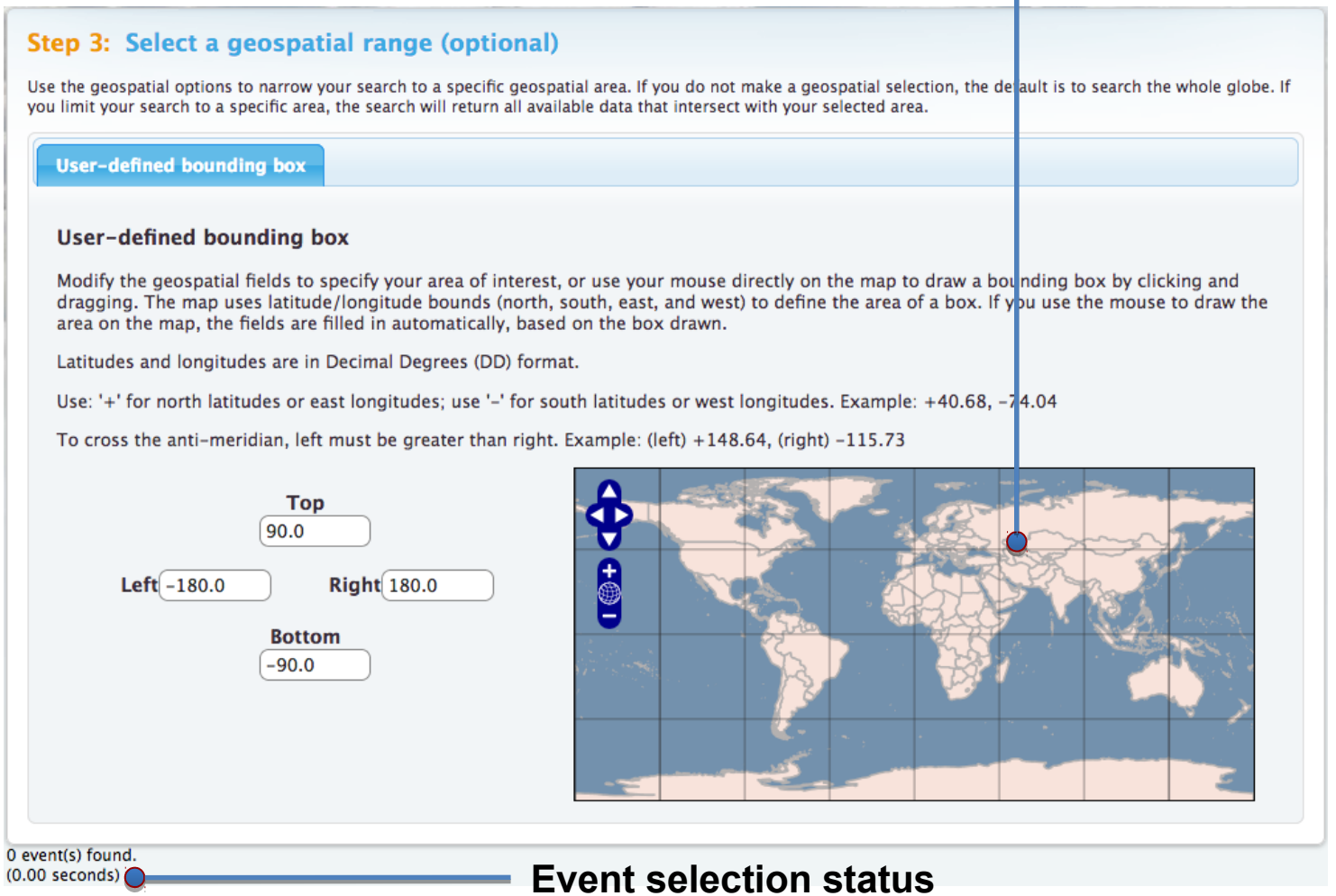
Event-type selection



Validation Measurement Locator

https://sage.nasa.gov/validation/

Geospatial selector

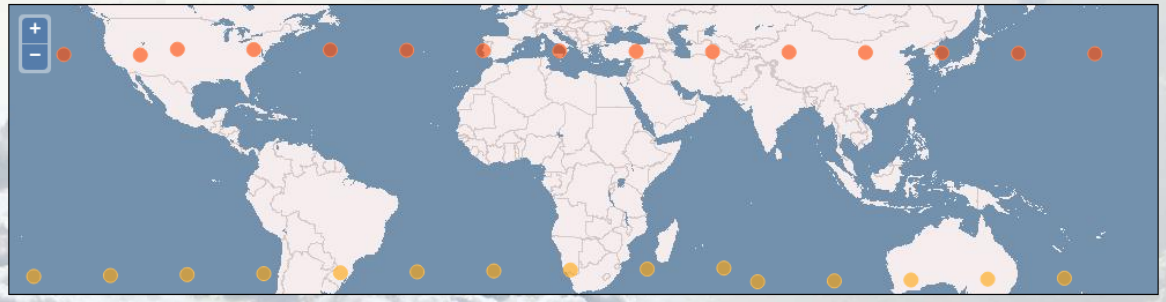


Event selection status

Validation Measurement Locator

https://sage.nasa.gov/validation/

Occultation Type	Temporal constraints	Spatial constraints
Sunrise Sunset	2017-11-30T00:00:00.000000Z to 2017-11-30T23:59:59.999999Z	Global (no constraints)



Display 30 events Search:

Event ID	Cycle ID	Event Date	Occult type	Az	El	Lat	Lon	Solar Beta	Lunar Beta	LPhase	SZA	Altitude	ISS Orbit
875410	20171126	2017-11-30 00:46:44	Sunrise	17.89	-19.49	-26.95	63.83	16.83	-48.46	130.15	90.00	404.46	8754
875420	20171126	2017-11-30 00:10:57	Sunset	162.04	-19.46	37.93	-113.60	16.90	-48.52	129.83	90.00	399.05	8754
875510	20171126	2017-11-30 02:19:24	Sunrise	17.65	-19.49	-27.24	40.51	16.61	-48.22	130.98	90.00	404.49	8755
875520	20171126	2017-11-30 01:43:36	Sunset	162.28	-19.46	38.06	-136.86	16.68	-48.29	130.66	90.00	399.03	8755
875610	20171126	2017-11-30 03:52:04	Sunrise	17.42	-19.49	-27.52	17.20	16.39	-47.95	131.81	90.00	404.51	8756
875620	20171126	2017-11-30 03:16:16	Sunset	162.51	-19.46	38.18	-160.11	16.46	-48.03	131.49	90.00	399.01	8756
875710	20171126	2017-11-30 05:24:45	Sunrise	17.19	-19.50	-27.81	-6.11	16.17	-47.65	132.63	90.00	404.53	8757
875720	20171126	2017-11-30 04:48:55	Sunset	162.74	-19.46	38.31	176.64	16.24	-47.74	132.31	90.00	398.98	8757
875810	20171126	2017-11-30 06:57:25	Sunrise	16.95	-19.50	-28.09	-29.43	15.95	-47.32	133.47	90.00	404.56	8758
875820	20171126	2017-11-30 06:21:35	Sunset	162.98	-19.46	38.43	153.39	16.02	-47.42	133.15	90.00	398.96	8758
875910	20171126	2017-11-30 08:30:05	Sunrise	16.71	-19.50	-28.37	-52.74	15.73	-46.96	134.30	90.00	404.58	8759
875920	20171126	2017-11-30 07:54:14	Sunset	163.22	-19.47	38.55	130.13	15.80	-47.08	133.98	90.00	398.94	8759
876010	20171126	2017-11-30 10:02:45	Sunrise	16.48	-19.51	-28.65	-76.06	15.51	-46.58	135.14	90.00	404.60	8760
876020	20171126	2017-11-30 09:26:54	Sunset	163.46	-19.47	38.67	106.88	15.57	-46.71	134.81	90.00	398.91	8760
876110	20171126	2017-11-30 11:35:25	Sunrise	16.24	-19.51	-28.92	-99.37	15.28	-46.17	135.97	90.00	404.62	8761
876120	20171126	2017-11-30 10:59:33	Sunset	163.69	-19.47	38.79	83.63	15.35	-46.31	135.65	90.00	398.89	8761
876210	20171126	2017-11-30 13:08:05	Sunrise	16.00	-19.51	-29.20	-122.69	15.06	-45.74	136.81	90.00	404.64	8762
876220	20171126	2017-11-30 12:32:12	Sunset	163.93	-19.47	38.91	60.39	15.12	-45.89	136.49	90.00	398.87	8762
876310	20171126	2017-11-30 14:40:45	Sunrise	15.75	-19.51	-29.47	-146.00	14.83	-45.28	137.65	90.00	404.66	8763
876320	20171126	2017-11-30 14:04:52	Sunset	164.18	-19.47	39.02	37.14	14.90	-45.44	137.33	90.00	398.85	8763

Starting the Conversation

https://sage.nasa.gov/validation/

SAGE-III science team already selected via ROSES:

- have variety of focus areas

If you are collecting data already…

- can operation be shifted by hours or a day
  - does this flexibility exist?

What do you need from us to schedule operation during overpass?

- weekly e-mail/bulletin for your site?
- SAGE-III data available: https://eosweb.larc.nasa.gov/project/sageiii-iss/sageiii-iss_table

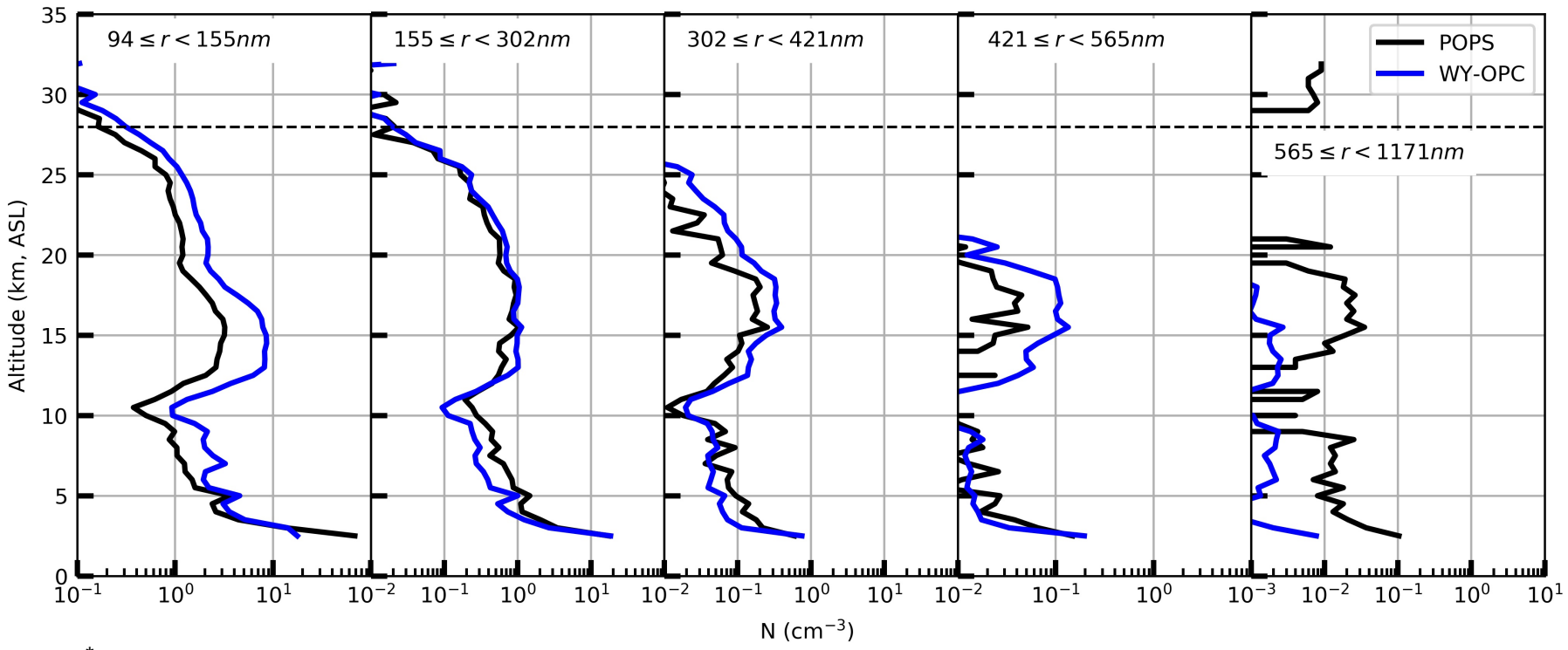
What would we like?

- quick release data products (within a month)
- coincident data collection

Aerosol Validation

A Particular Challenge...

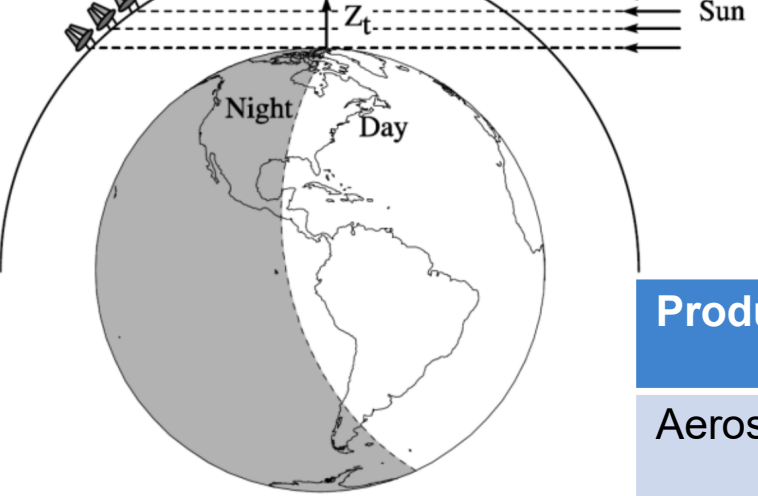
POPS* and Wyoming OPC Profiles (0.5 km vertical resolution) 2017-11-09



* Printed Optical Particle Spectrometer

Data courtesy of Terry Deshler (University of Wyoming and Troy Thornberry (NOAA)

Questions



Product	Event Type	Wavelengths (nm)
Aerosol Ext./Optical Depth	Solar	384, 447-450, 520, 601, 676, 756, 869, 1018-1023, 1550
Aerosol Ext./Optical Depth	Lunar	NA
Ozone	Solar	282-294, 562-595, 608-621
Ozone	Lunar	378-679
Nitrogen Dioxide	Solar	433-450
Nitrogen Dioxide	Lunar	378-679
Water Vapor	Solar	920-971
Water Vapor	Lunar	NA

Product	Event Type	Vertical Range & Resolution [km]	Precision [%]	Accuracy Goal [%]	Wavelengths (nm)
Spectral Transmission	Solar	0* – 100, 0.75	0.1	0.1***	
Aerosol Ext./Optical Depth	Solar	0* – 40, 0.75	5	5	384, 447-450, 520, 601, 676, 756, 869, 1018-1023, 1550
Ozone#	Solar	0* – 50, 0.75	5	5	282-294, 562-595, 608-621
Water Vapor#	Solar	5* – 45, 0.75	10	10	920-971
Nitrogen Dioxide#	Solar	TP+2 – 45, 0.75	10	10	433-450
Ozone#	Lunar	15* - 45, 1.5	5	6	378-679
Nitrogen Dioxide#	Lunar	20 – 45, 1.5	10	10	378-679
Nitrogen Trioxide#	Lunar	25 – 45, 1.5	15	10	378-679