

National Aeronautics and Space Administration



SAGE III
/SS

Stratospheric Aerosol and Gas Experiment

An Earth Science Mission on the International Space Station

Science Team Meeting 2018

NASA Langley Research Center

Oct 30, 2018





SAGE III
/SS

Stratospheric Aerosol and Gas Experiment

An Earth Science Mission on the International Space Station

Science Data Product Algorithm Validation

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Internal Algorithm Validation



- **Actively cooperate with NOAA and NIWA to collect coincidence measurements of Ozone, Water vapor (v5.1), and Aerosol (future goal) between balloon borne sondes and SAGE III overpasses**
- **Comparisons provide confidence in the algorithm (currently version 5.1)**
- **Aerosol sondes are in development at NOAA (expected to fly on balloons after the first of the year 2019)**
- **Current aerosol validation utilizes a conversion from extension values to backscatter values for comparison with NDACC aerosol LIDAR measurements.**
- **Additional comparisons using NDACC sonde measurements provide confidence that our measurements are within 20% above 20km**



SAGE III ISS v5.1 Validation



➤ Water Vapor Comparison: SAGE v5.1, MLS and NOAA Boulder FPH

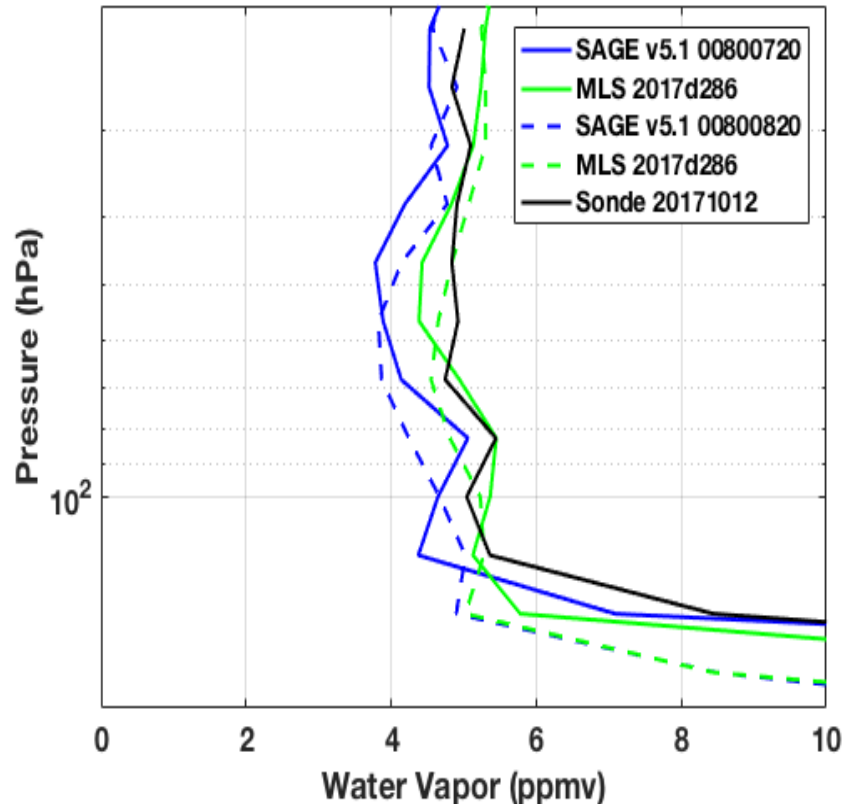
- Individual NOAA Events showing mixing ratio and % difference
 - Oct. 2017 – Feb. 2018
 - MLS data showing no matches for March and June 2018.
 - Difference Ranges: Latitude 5°, Longitude 10°, Time 24 hours
 - Use SAGE event numbers to note the Sunrise and Sunset events

➤ Ozone Comparison: SAGE v5.1 ozone aerosol product vs NIWA Lauder ozonesonde

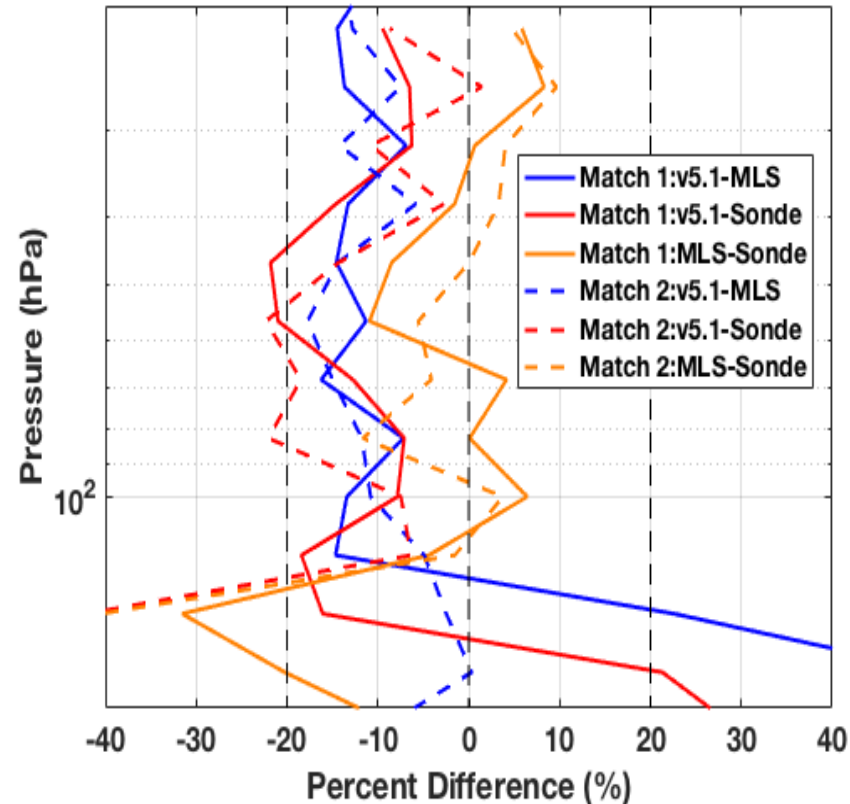
- All events with a SAGE overpass
 - June 2017 – May 2018
 - Difference Ranges: Latitude 5°, Longitude 10°, Time 24 hours
 - NIWA data retrieved from AVDC

➤ Aerosol Extinction conversion to Backscatter measurements

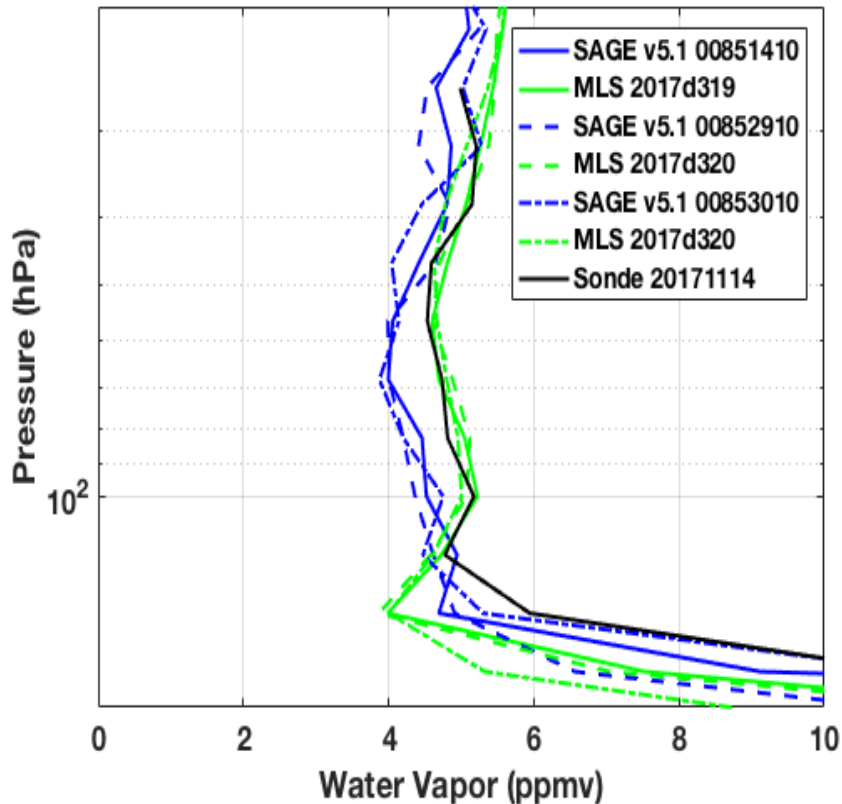
Water Vapor Comparison 20171012



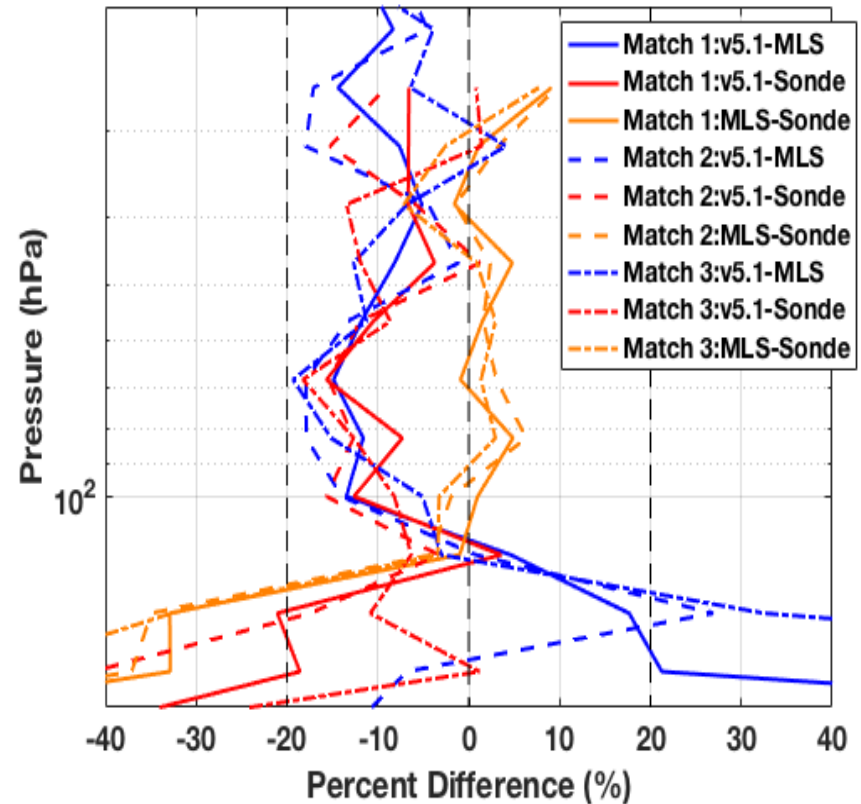
Percent Difference (H2O1-H2O2)/H2O2*100 20171012



Water Vapor Comparison 20171114

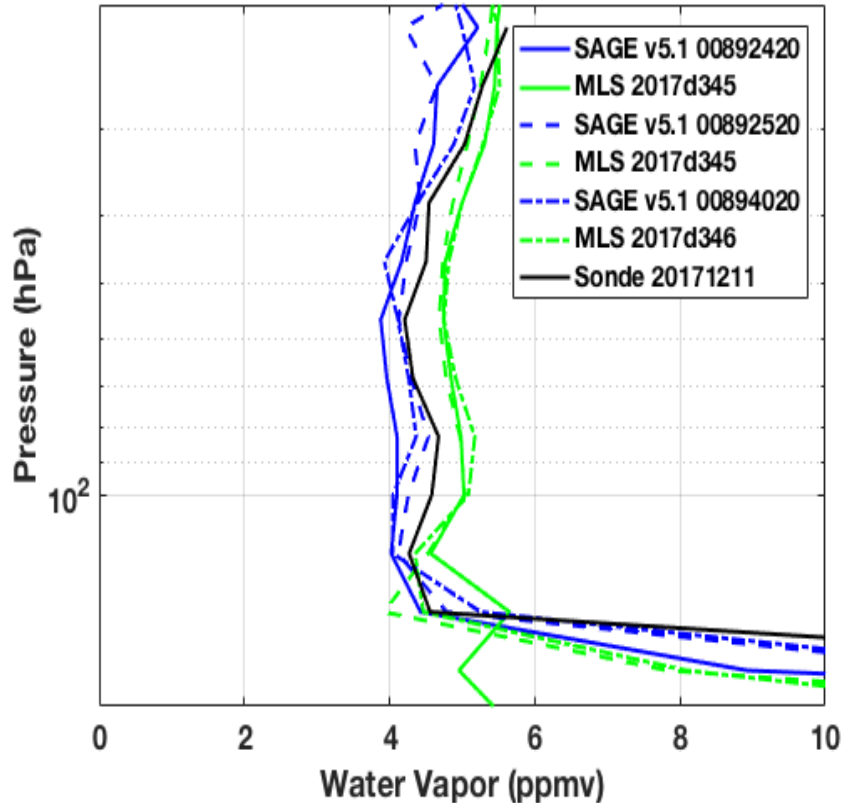


Percent Difference (H2O1-H2O2)/H2O2*100 20171114

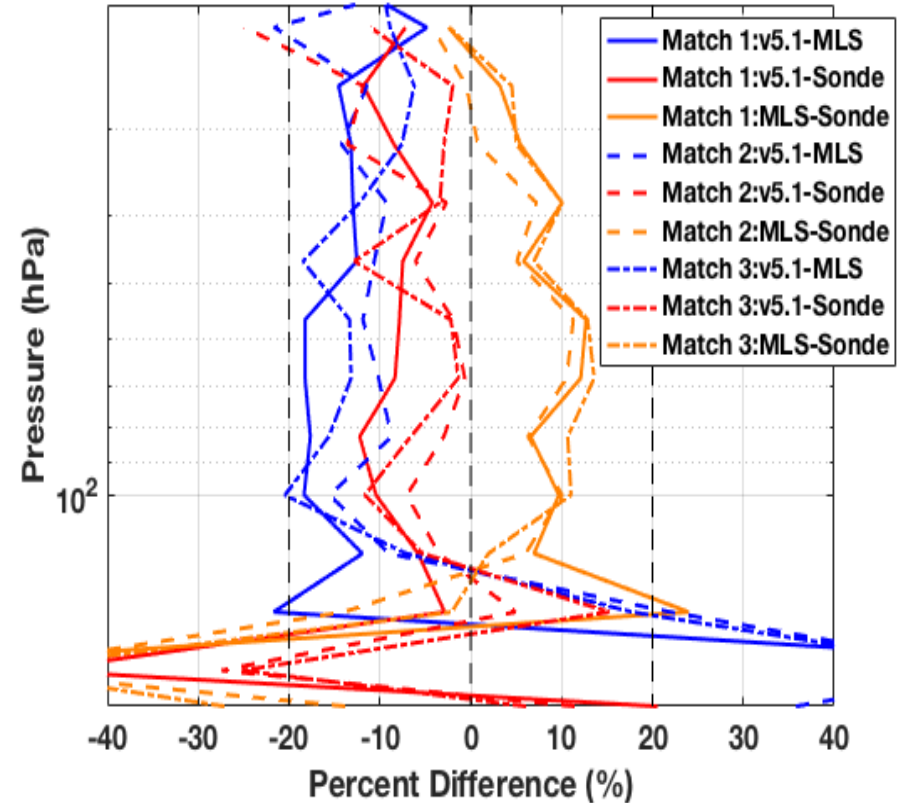


SAGE III/ISS v5.1 Water vapor Dec 11, 2017

Water Vapor Comparison 20171211

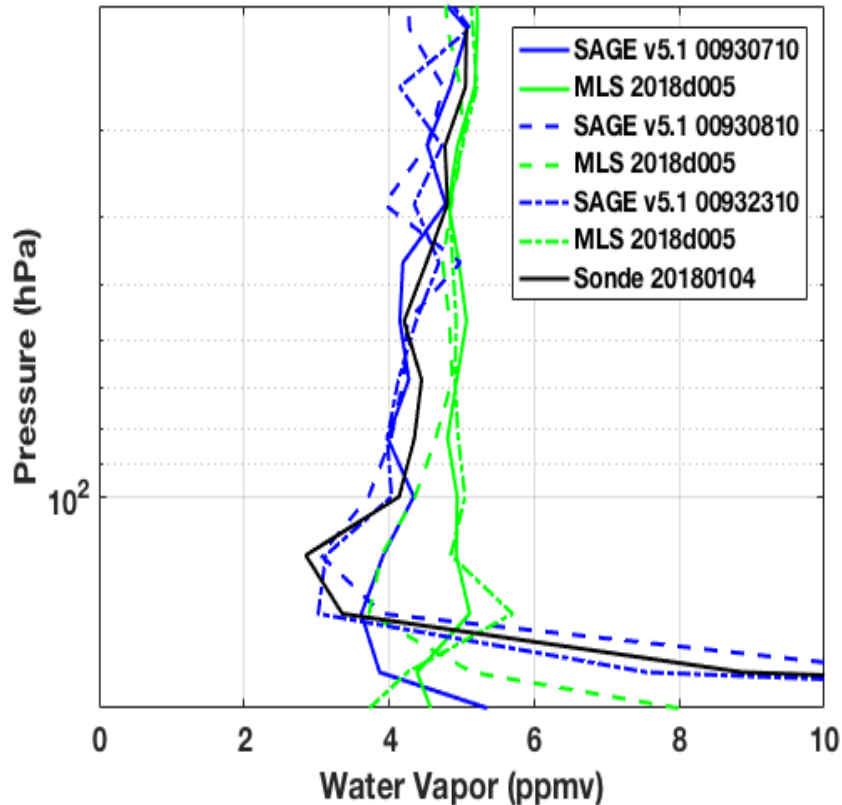


Percent Difference (H2O1-H2O2)/H2O2*100 20171211

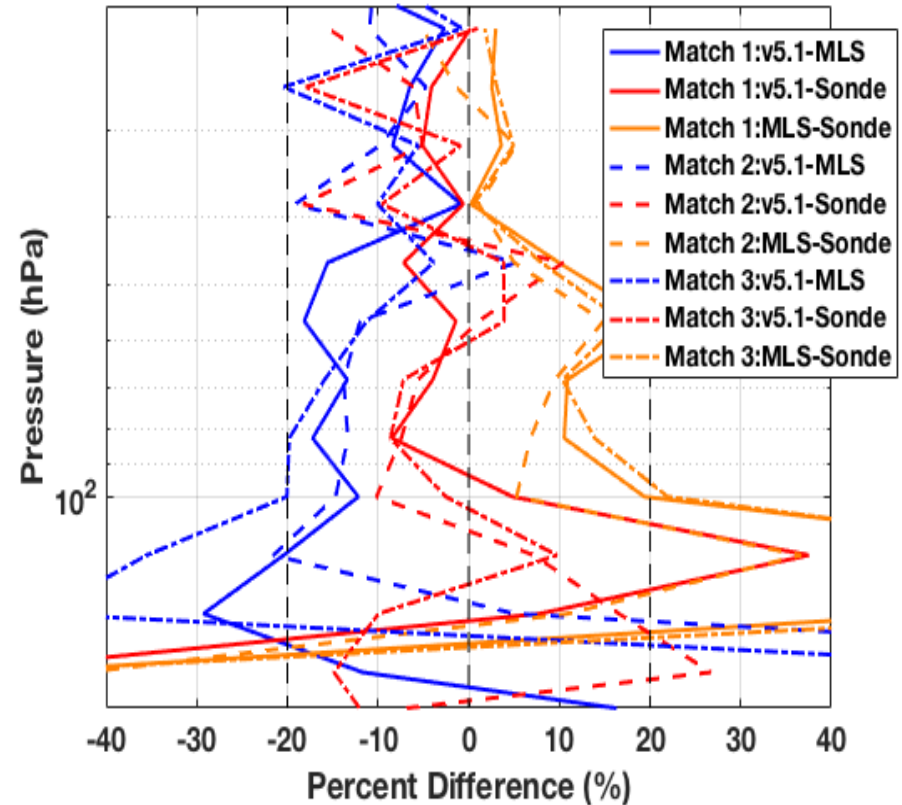


SAGE III/ISS v5.1 Water vapor Jan 4, 2018

Water Vapor Comparison 20180104

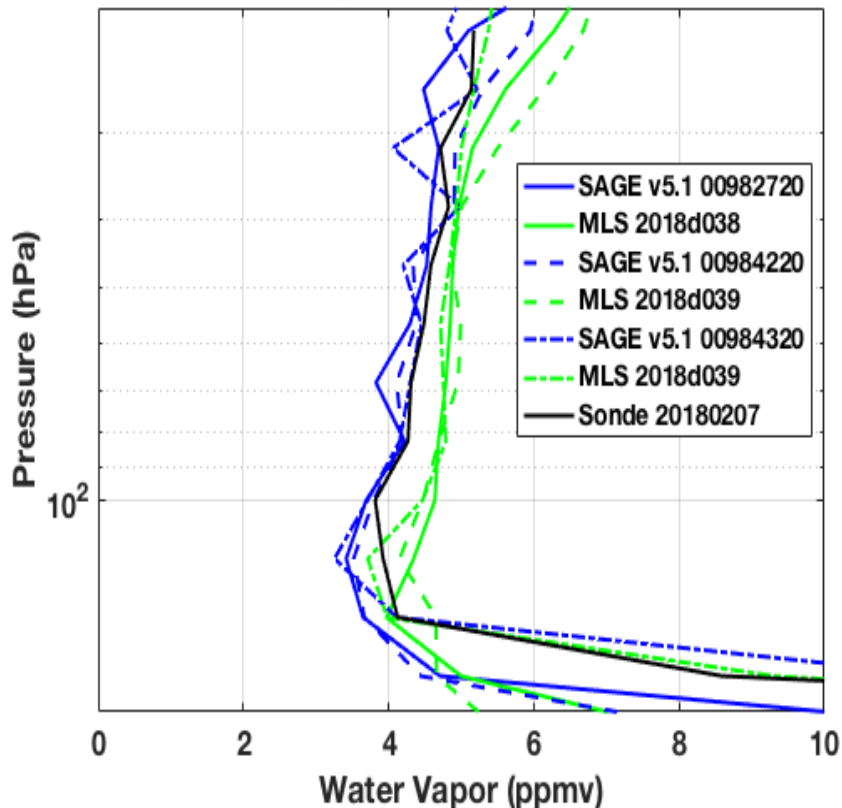


Percent Difference (H2O1-H2O2)/H2O2*100 20180104

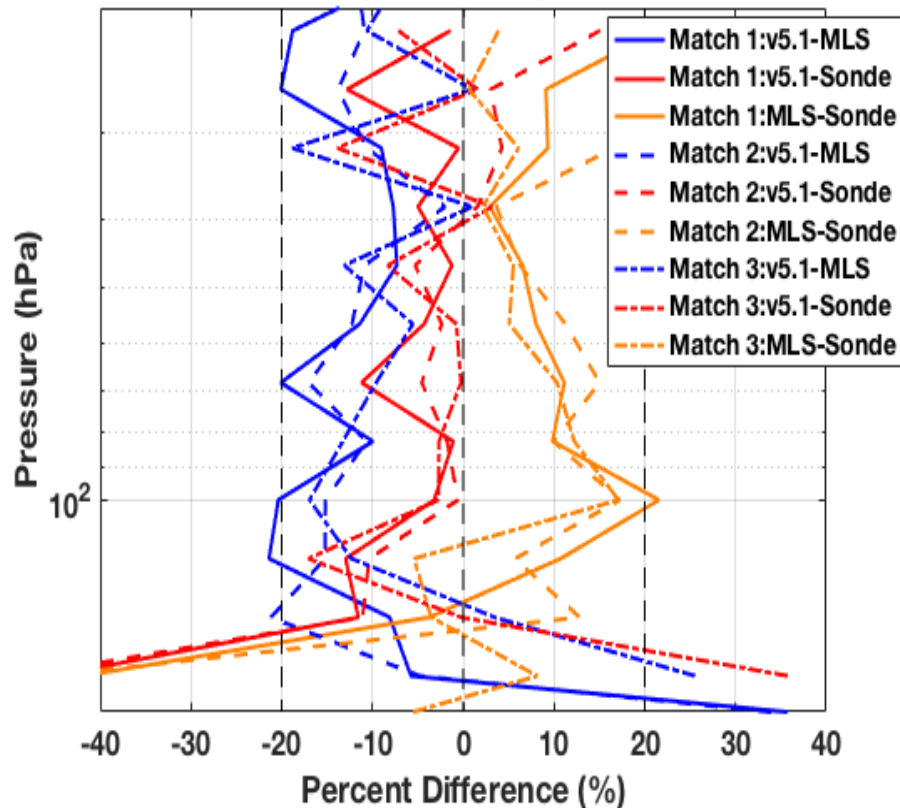


SAGE III/ISS v5.1 Water vapor Feb 7, 2018

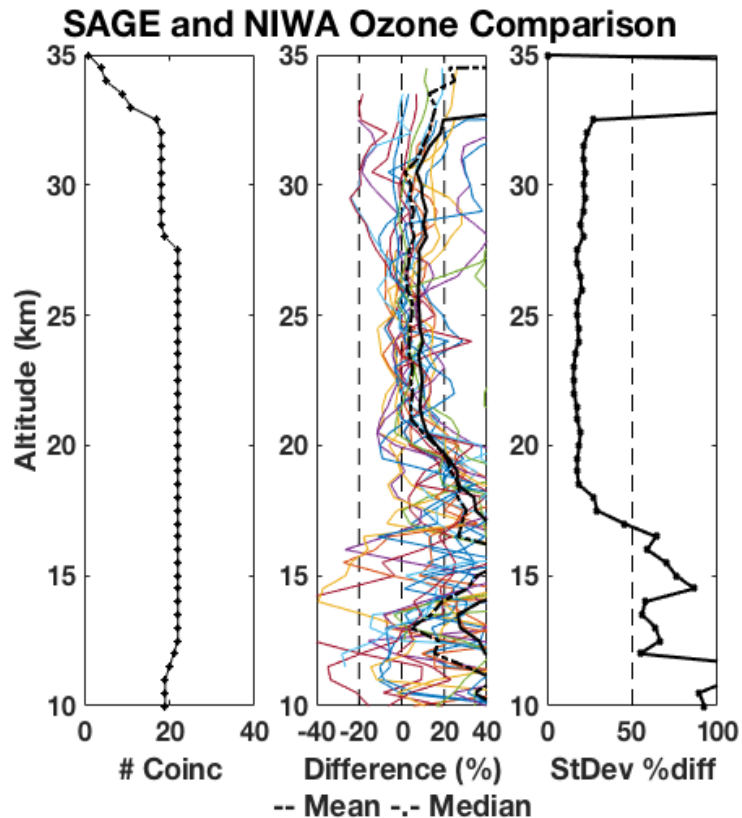
Water Vapor Comparison 20180207



Percent Difference (H2O1-H2O2)/H2O2*100 20180207



SAGE III/ISS v5.1 Ozone Aerosol



- SAGE v5.1 Ozone Aerosol Product
- Data Range June 2017 – May 2018
- NIWA data retrieved from AVDC



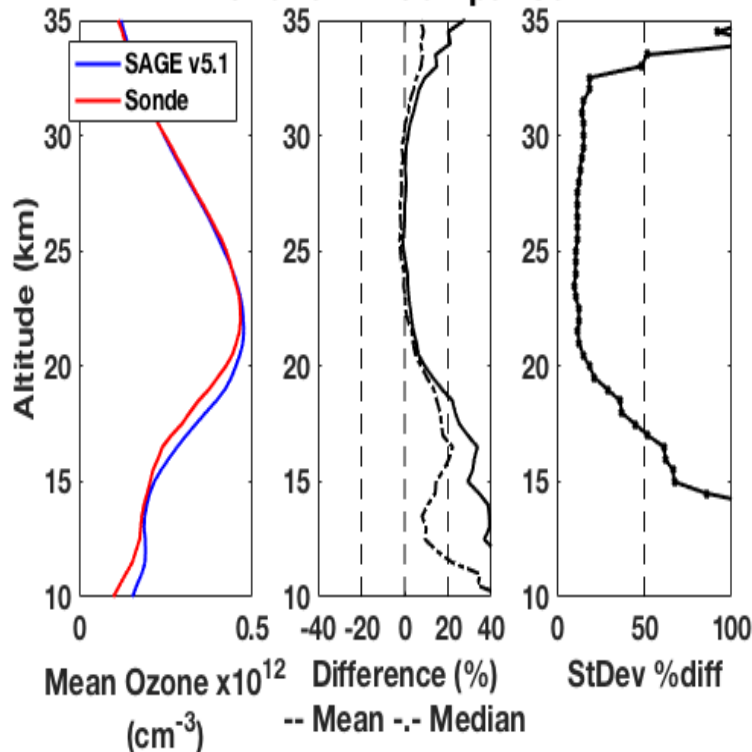


SAGE v5.1 Ozone Aerosol Product

Data Range June 2017 – May 2018 (255 coincidence)



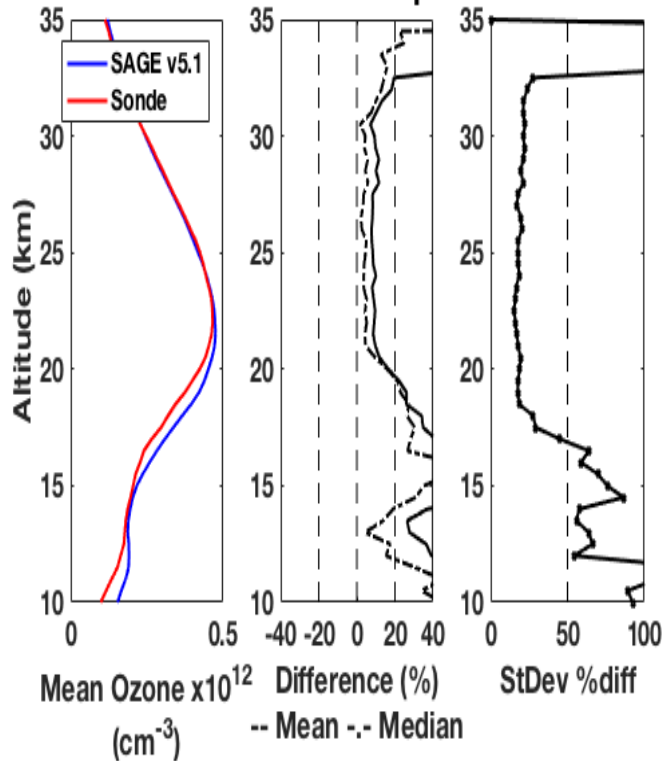
SAGE and AVDC Sondes Ozone ND Comparison



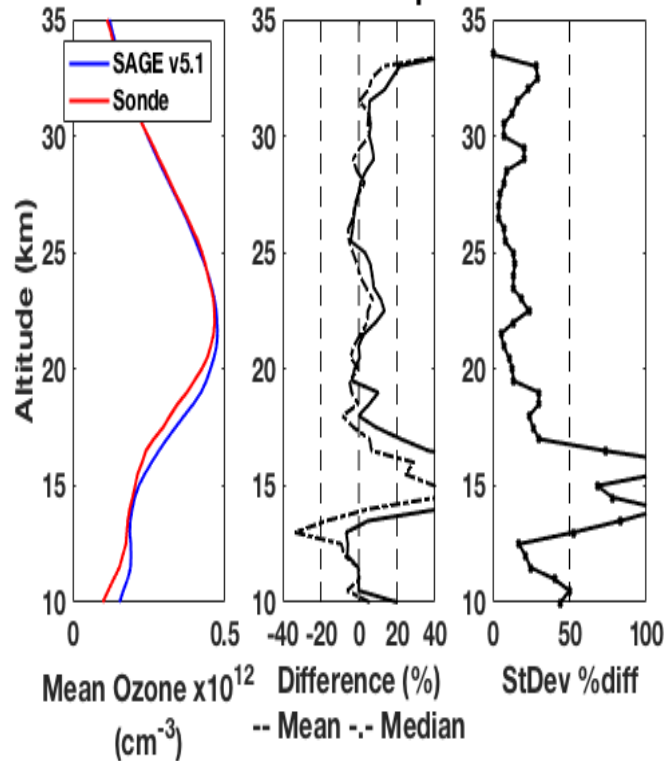
- Broadwell
 - Macquerie Island
 - Neumayer
 - Praha
 - Dumont d'Uville
 - OHP
 - Scoresbysund
 - Hohenpeissenberg
 - Marambio
 - Legionowo
 - Naha
 - Syowa
 - Tsukuba
 - De Bilt
 - Parambio
 - Payerne
 - Lauder
 - Boulder
 - Hilo
 - Huntsville
 - Pago Pago
 - Suva
 - Trinidad Head CA
 - Ushu
- ABM
- JMA
- KNMI
- NOAA

SAGE v5.1 Ozone Aerosol Product

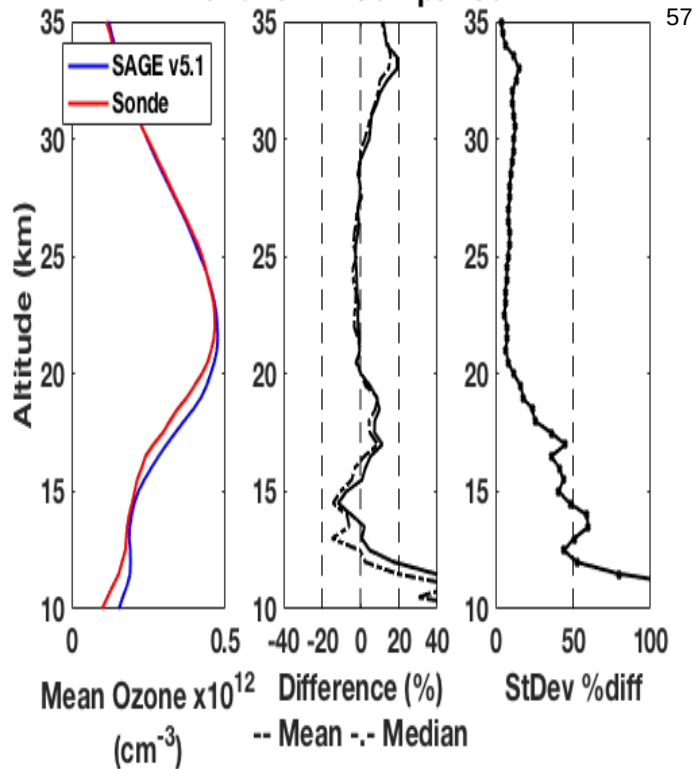
**SAGE and Lauder Sondes
Ozone ND Comparison**



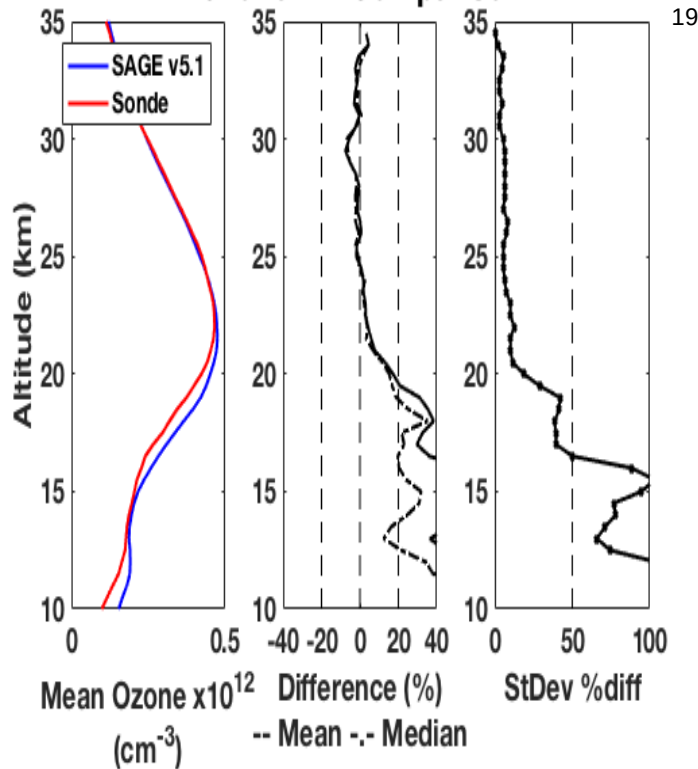
**SAGE and OHP Sondes
Ozone ND Comparison**



SAGE and Hohenpeissenberg Sondes
Ozone ND Comparison

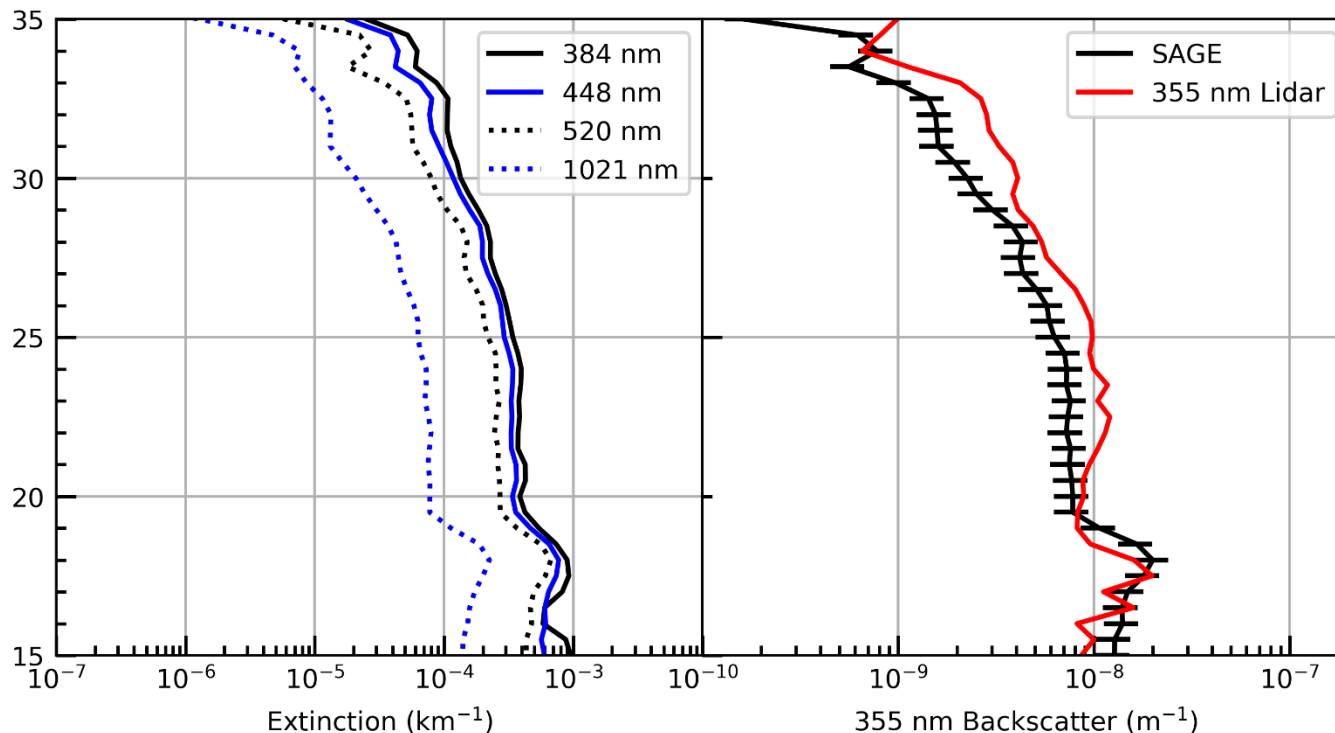


SAGE and Boulder Sondes
Ozone ND Comparison



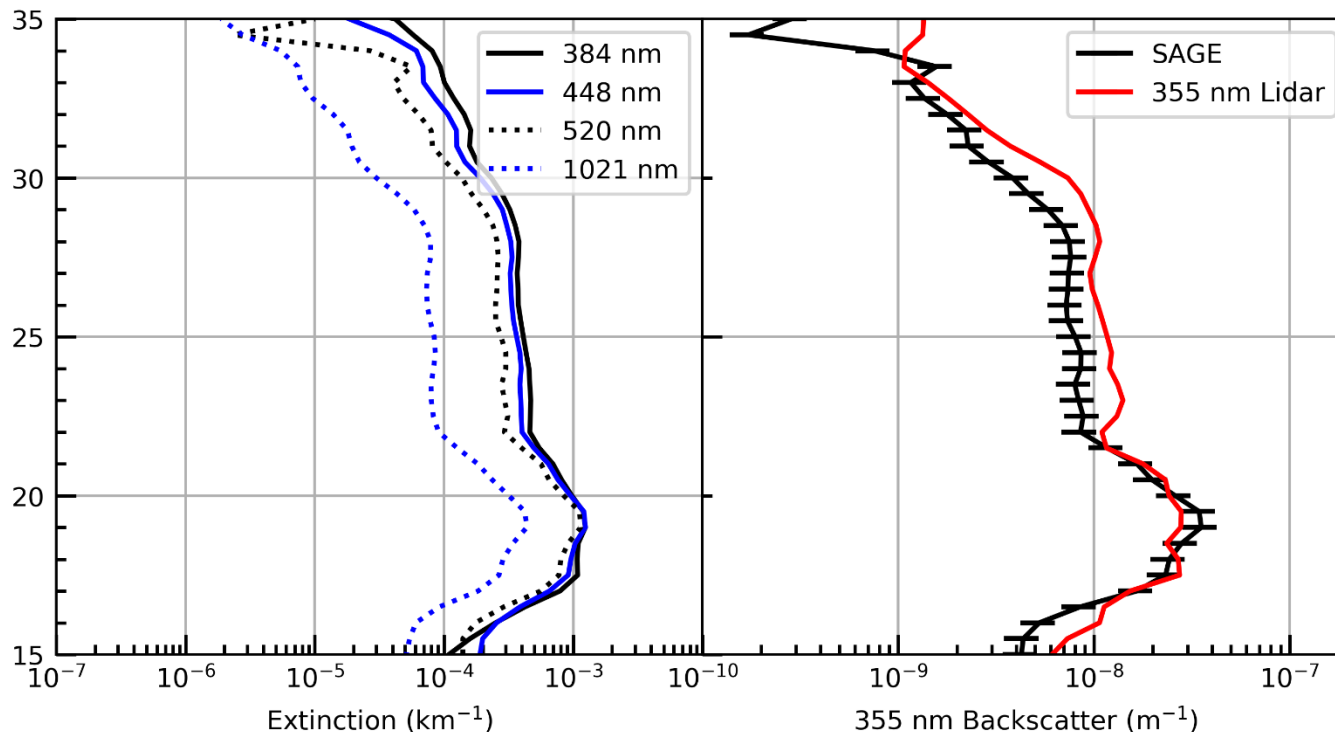
Aerosol Extinction conversion to Backscatter Sept 23, 2017

Table Mountain Sunset 2017-09-23 16:49
Overpass Relative to Ground Station: 14.3 H, 96.0 km N, 528.0 km W,



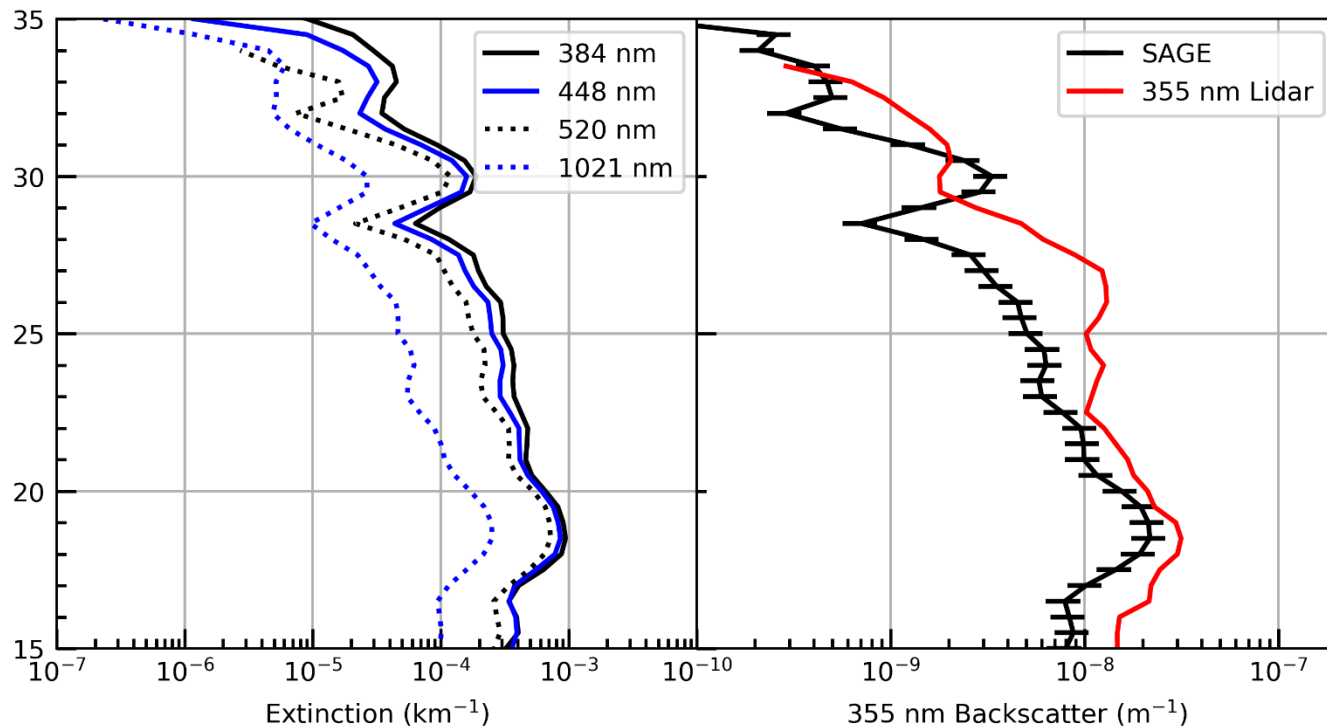
Aerosol Extinction conversion to Backscatter Oct 29, 2017

Table Mountain Sunset 2017-10-29 16:30
Overpass Relative to Ground Station: 9.3 H, 96.0 km N, 528.0 km W,



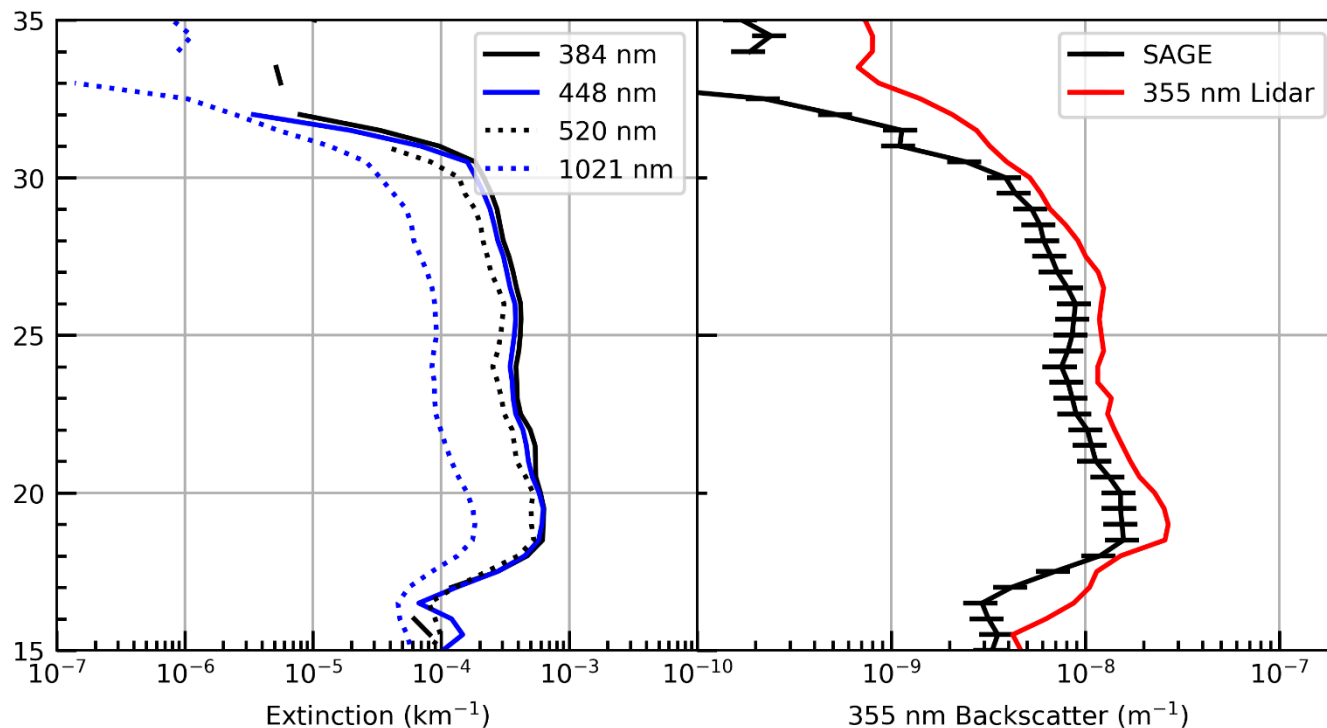
Aerosol Extinction conversion to Backscatter Dec 16, 2017

Table Mountain Sunset 2017-12-16 03:52
Overpass Relative to Ground Station: 2.6 H, 96.0 km N, 528.0 km W,



Aerosol Extinction conversion to Backscatter Jan 18, 2018

Table Mountain Sunset 2018-01-18 17:24
Overpass Relative to Ground Station: 12.9 H, 96.0 km N, 528.0 km W,





Conclusions



- **Algorithm version 5.1 shows good agreement with coincident sonde measurements (<20% above 20km)**
- **Future aerosol validation will require validated aerosol sondes (POPS) currently in development**
- **Conversion of aerosol extinction to backscatter measurements allows comparisons with CALIPSO CALIOP aerosol measurements as well as NDACC LIDAR measurements**
- **Continued refinements in this comparison process and 16 total coincident balloon borne launches scheduled in FY19 along with available NDACC comparisons will continue to provide validation of the algorithm versions.**