

National Aeronautics and Space Administration



SAGE III /ISS

Stratospheric Aerosol and Gas Experiment

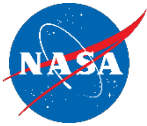
An Earth Science Mission on the International Space Station

SAGE III/ISS Validation Efforts

Mary Cate McKee and Carrie Roller

SAGE III/ISS Validation Team





Validation Efforts



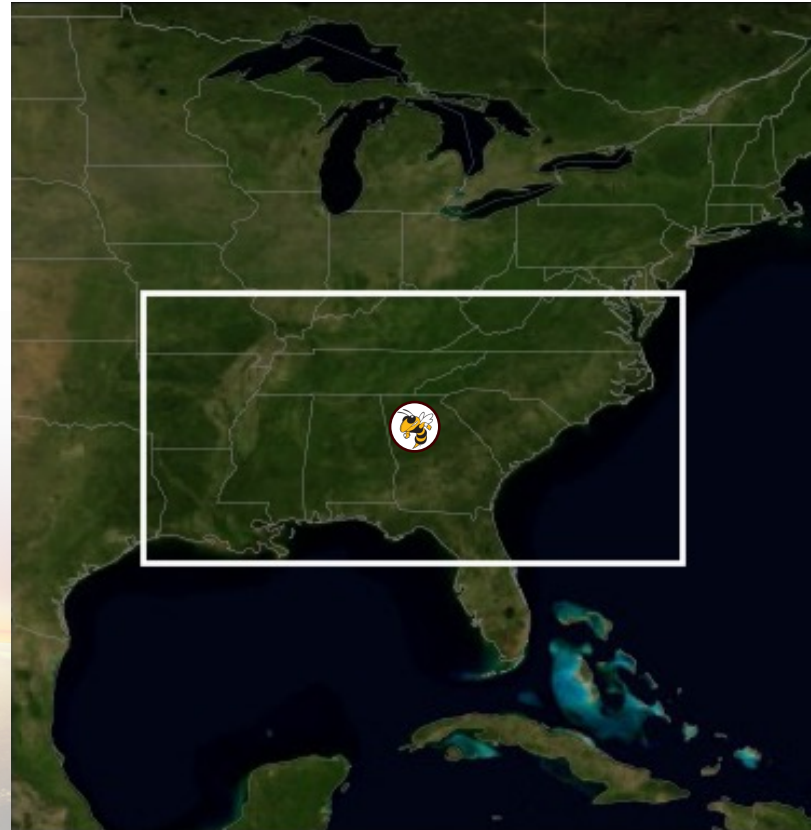
- **The validation team has continued efforts to validate the SAGE III/ISS data product against in-situ and satellite measurements collected via a variety of sources**
- **Ground-based measurements – lidar and sonde data**
 - Actively participating NDACC, SHADOZ, and WOUDC stations
 - NASA airborne campaigns and short-term measurement campaigns
- **Satellite based measurements**
 - Aura Microwave Limb Sounder (MLS) v5
 - Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS) v5.2
 - Ozone Mapping and Profiler Suite (OMPS) limb profiler (LP) v2.6

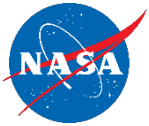


Validation Criteria

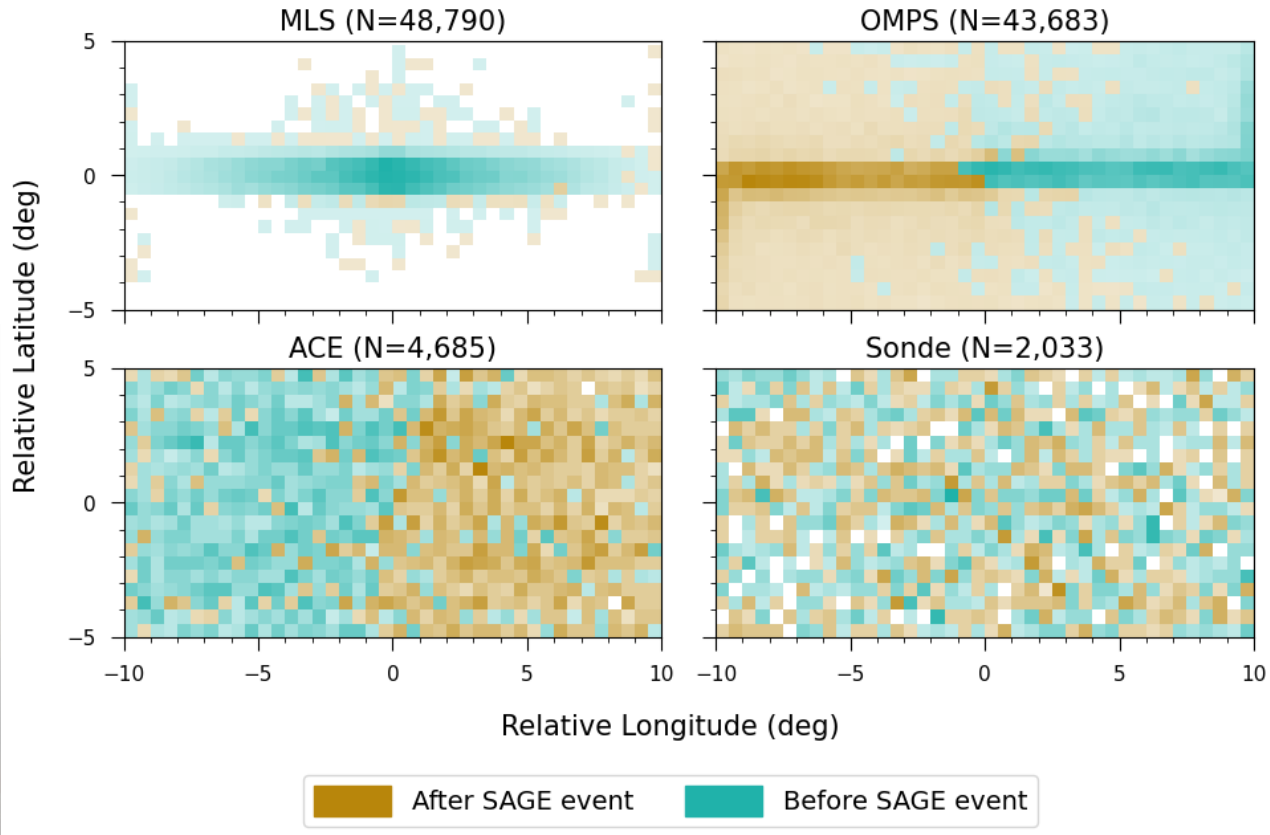


- **Species of interest:** ozone, water vapor
 - *Plan to include nitrogen dioxide and aerosol*
- **Coincidence criteria:**
 - \pm 24 hours
 - \pm 5 degrees latitude
 - \pm 10 degrees longitude
- **SAGE III/ISS event types:** solar occultation
 - *Plan to include lunar occultation events and limb events*





Spatial Distribution of Matches

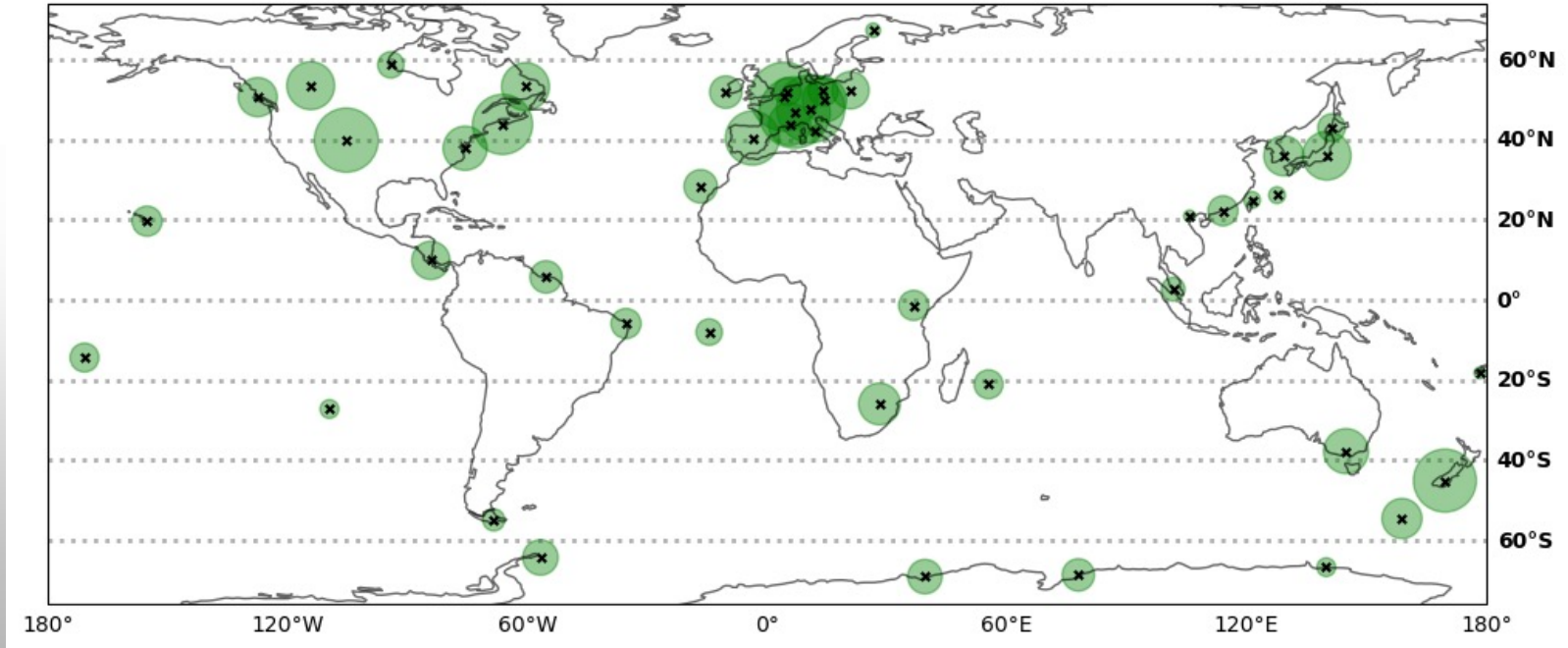




Ozonesonde Stations

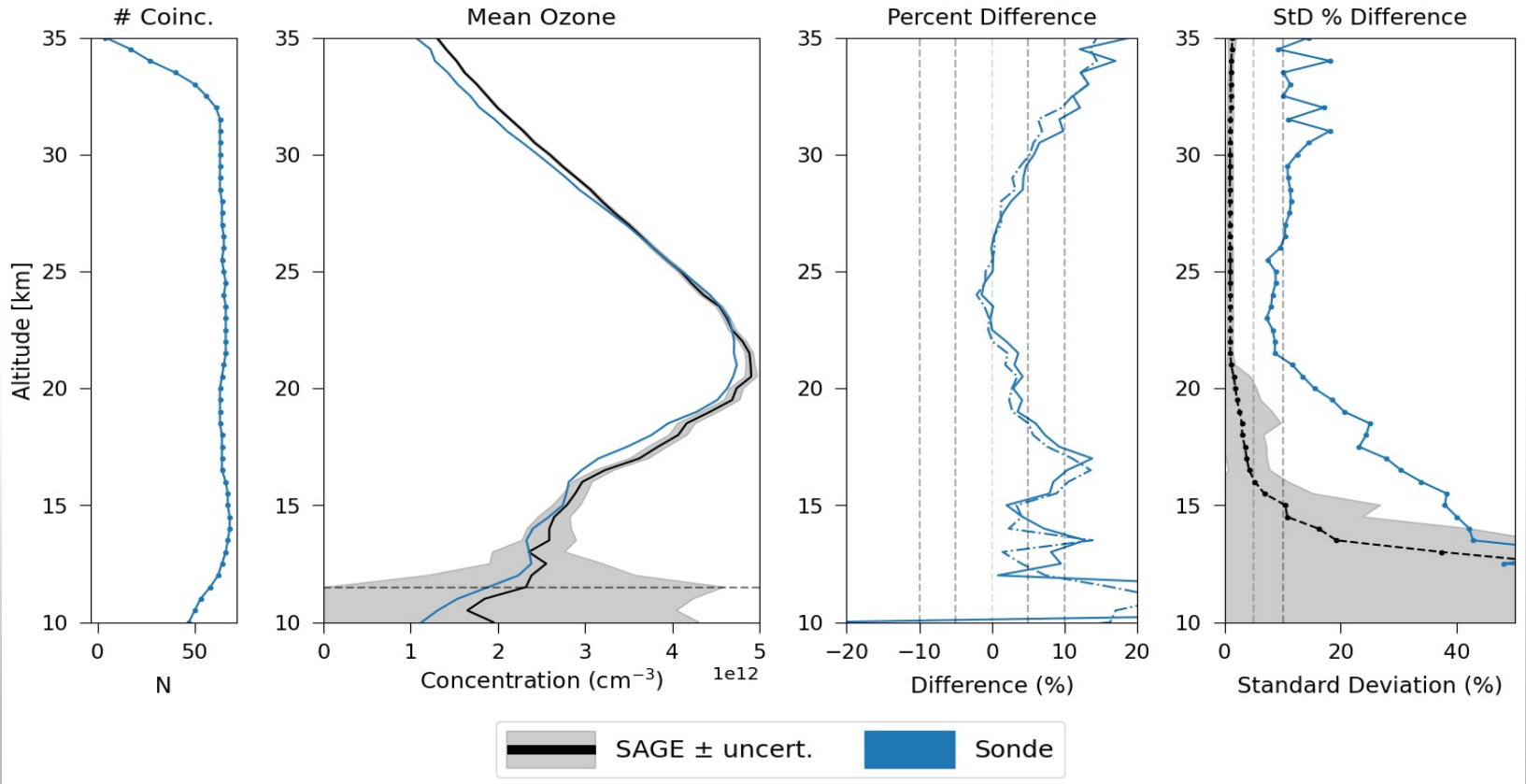


- 48 Stations across NDACC, WOUDC, SHADOZ
- 1,032 matches / 11,133 profiles (9.3%)



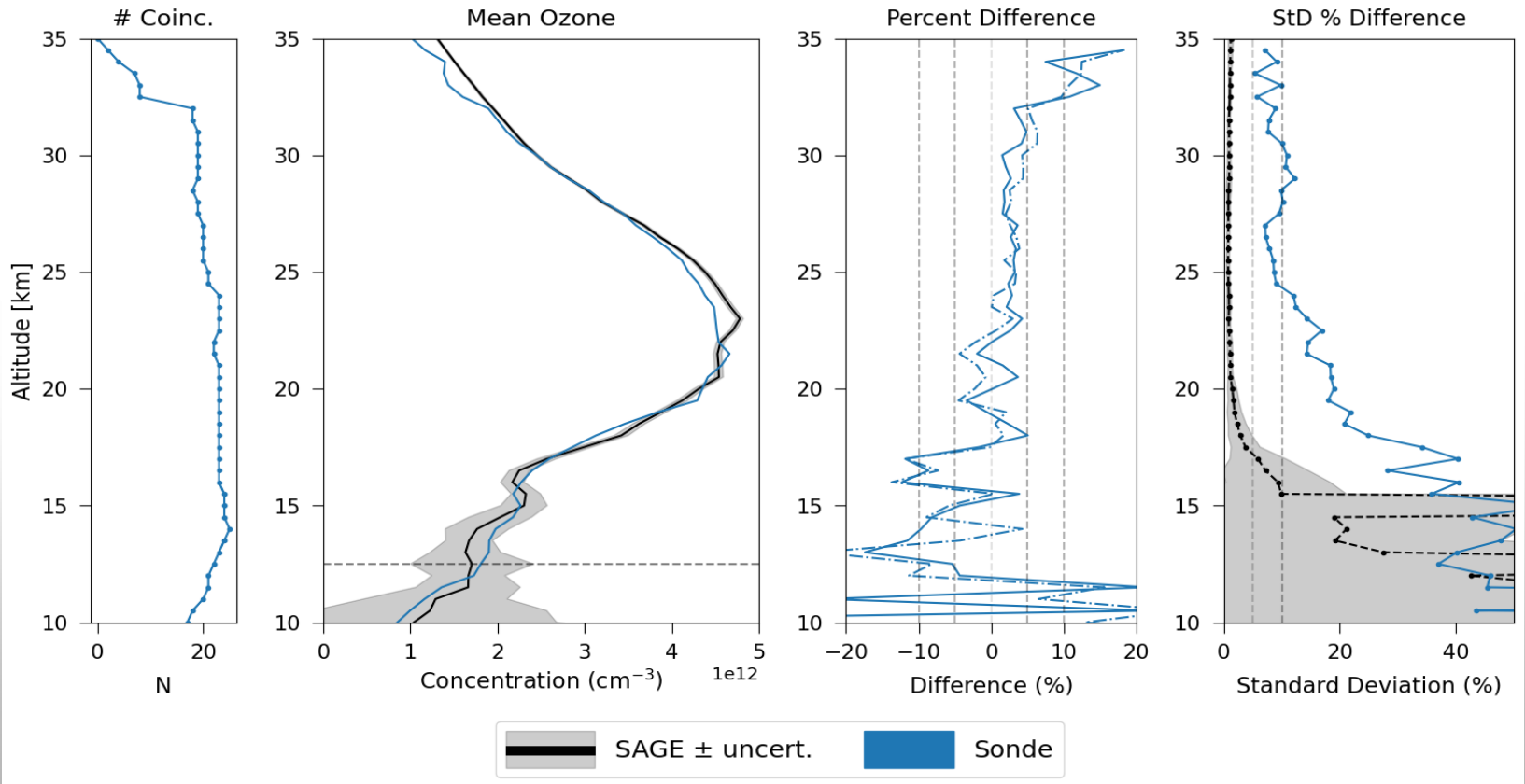


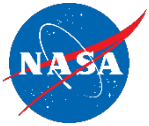
Uccle Ozonesonde



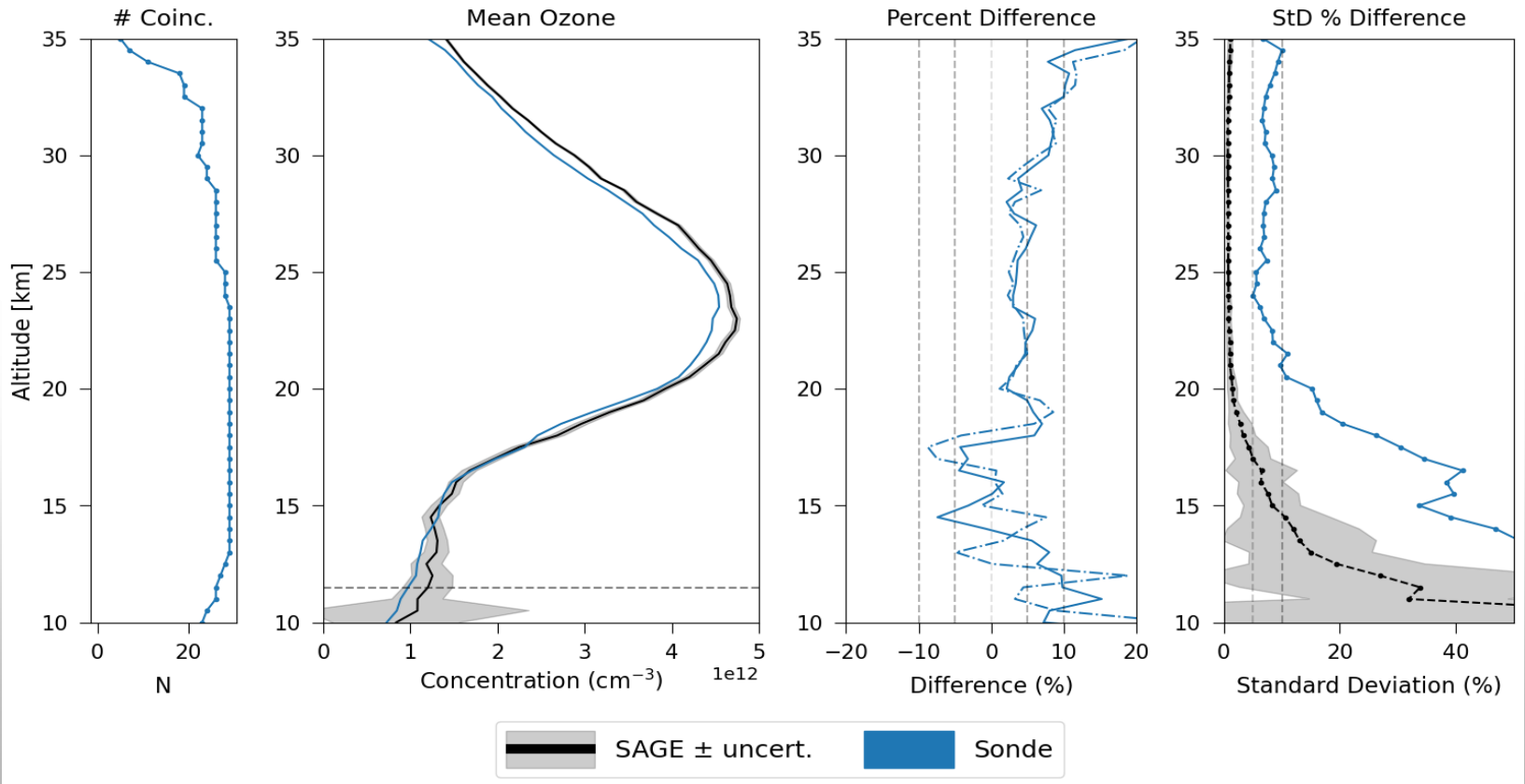


Haute-Provence Ozonesonde



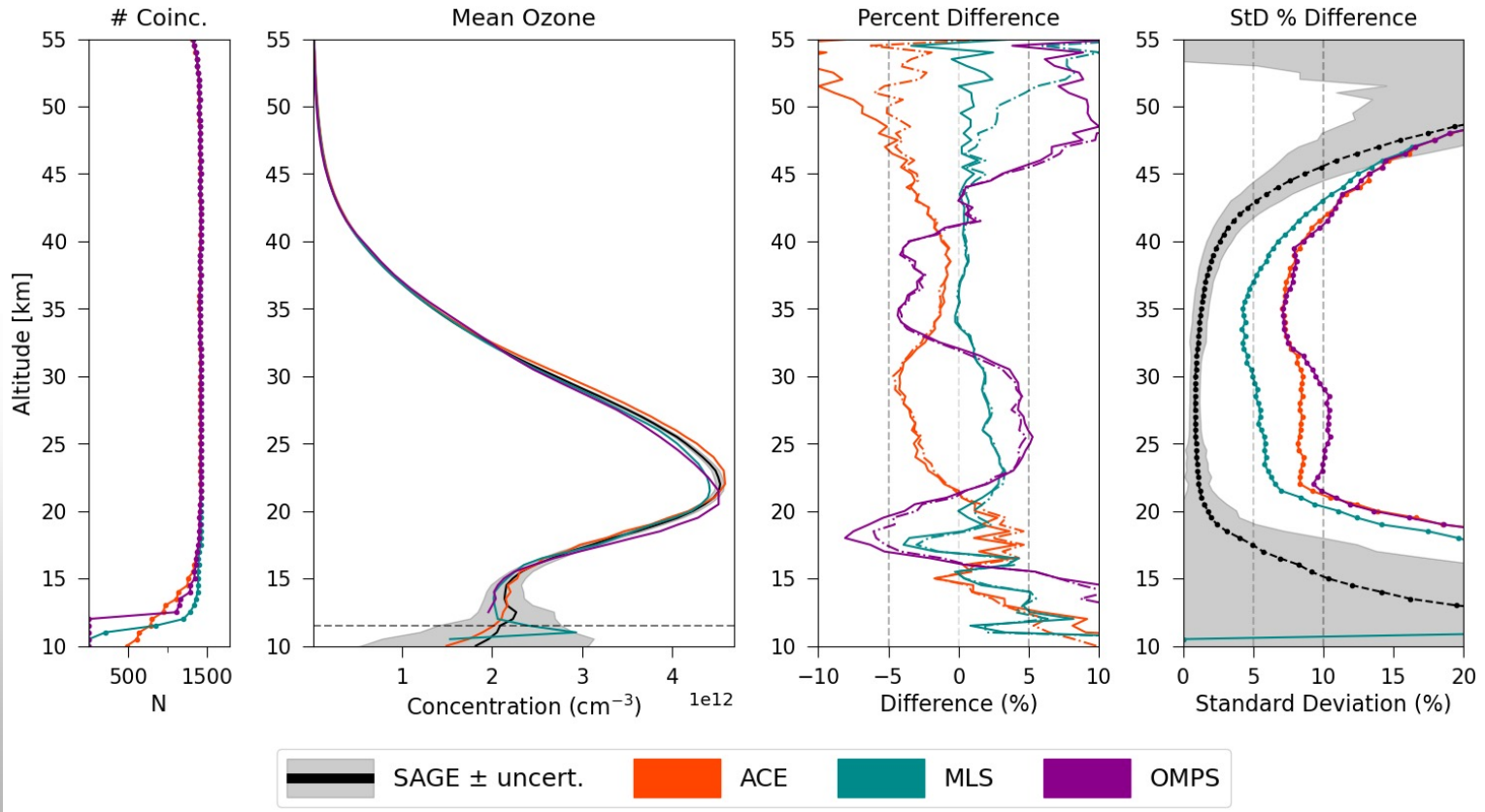


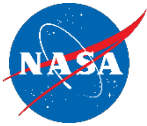
Broadmeadows Ozonesonde





SAGE / ACE / MLS / OMPS Ozone

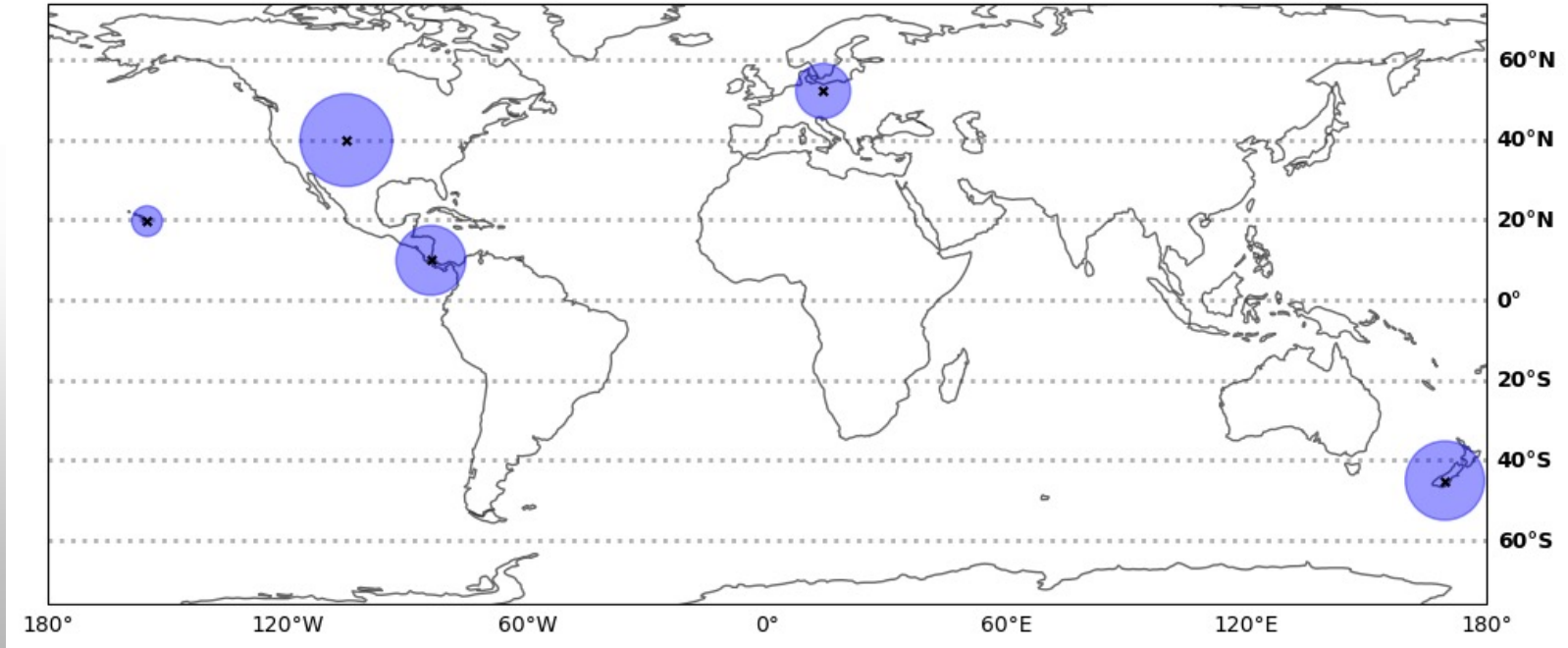




Water Vapor Sonde Stations

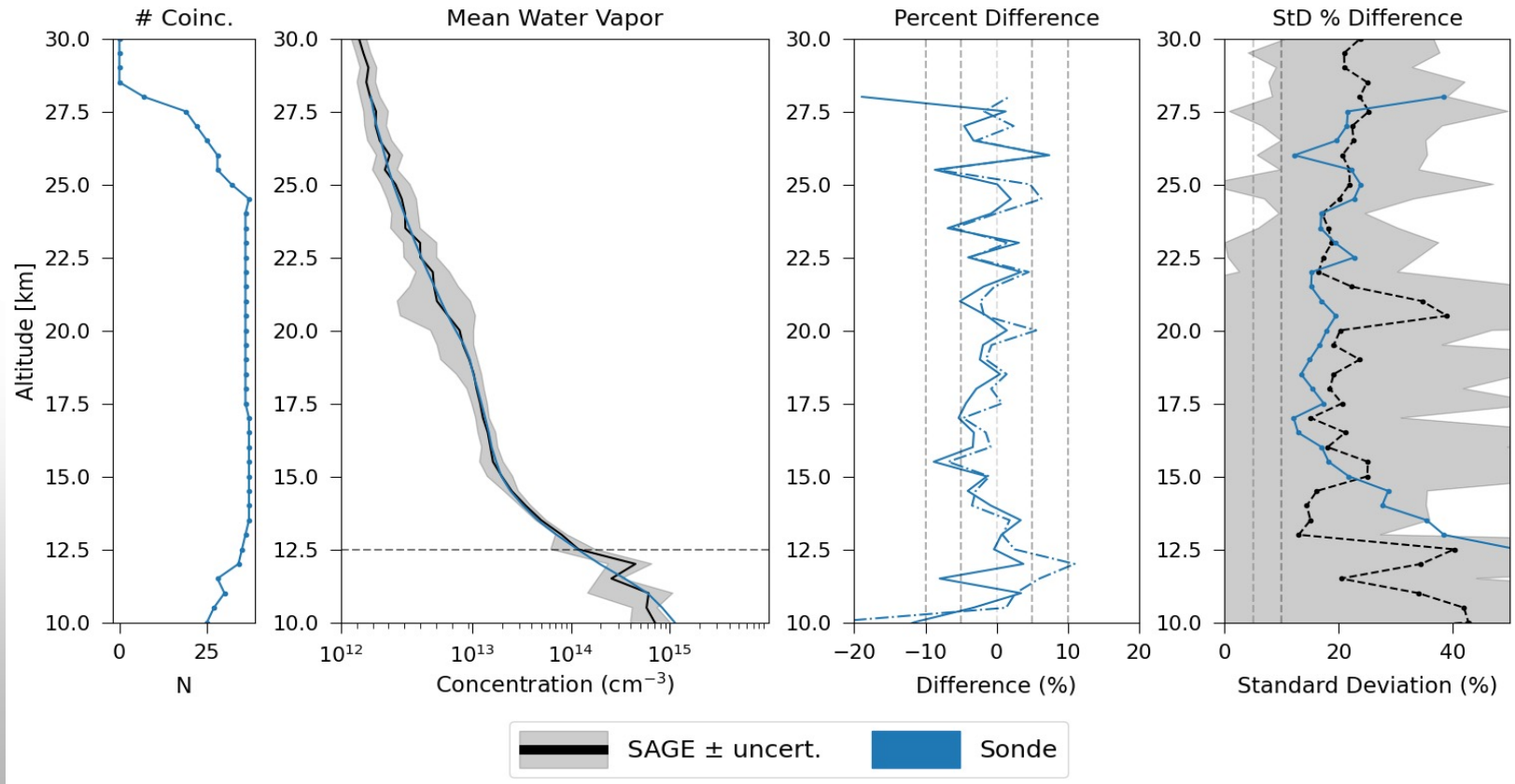


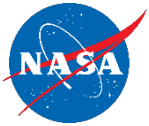
- 5 NDACC stations (Boulder, Costa Rica, Hilo, Lauder, Lindenberg)
- 102 matches / 403 profiles (25.3%)



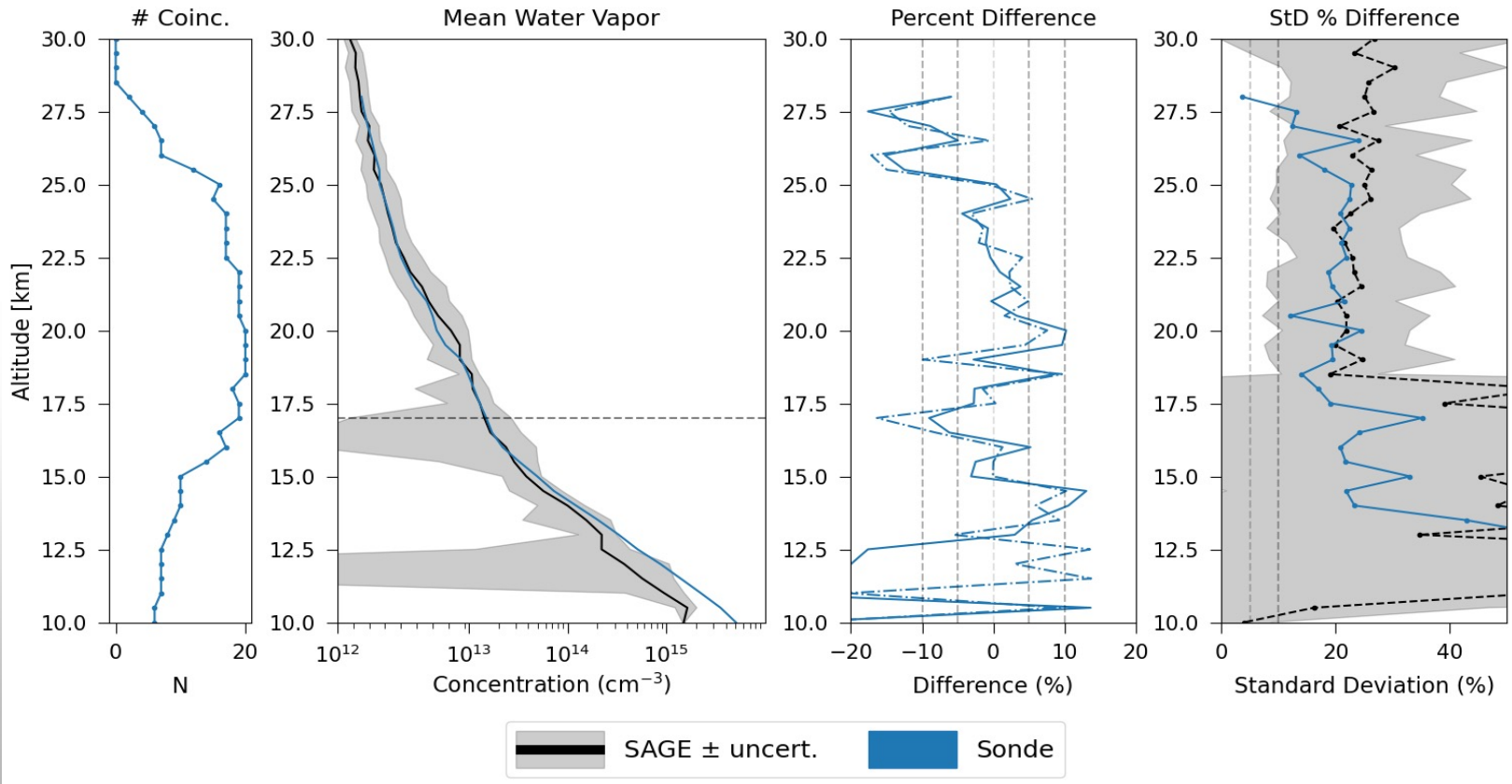


Boulder Water Vapor Sonde



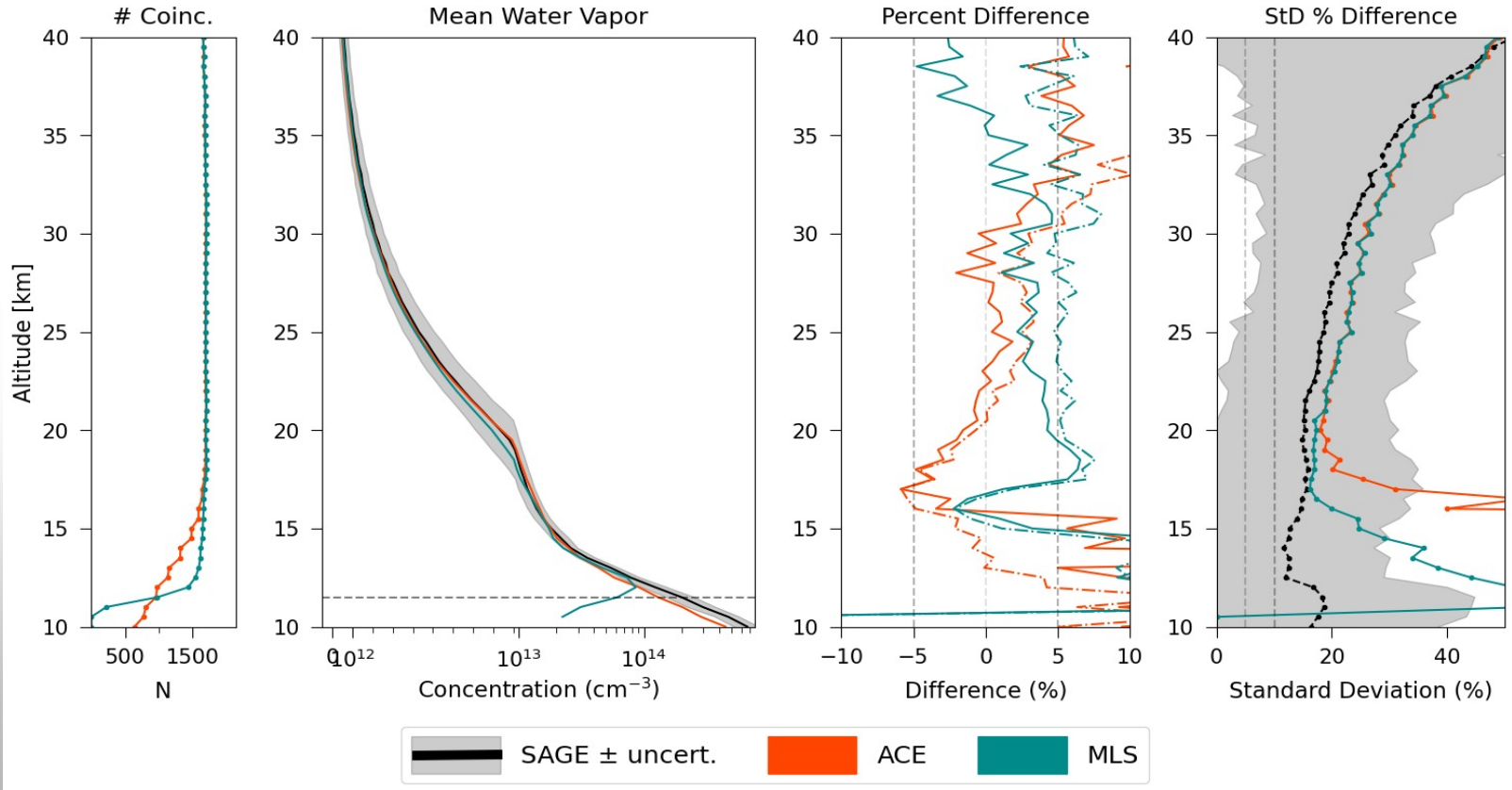


Costa Rica Water Vapor Sonde





SAGE / ACE / MLS Water Vapor





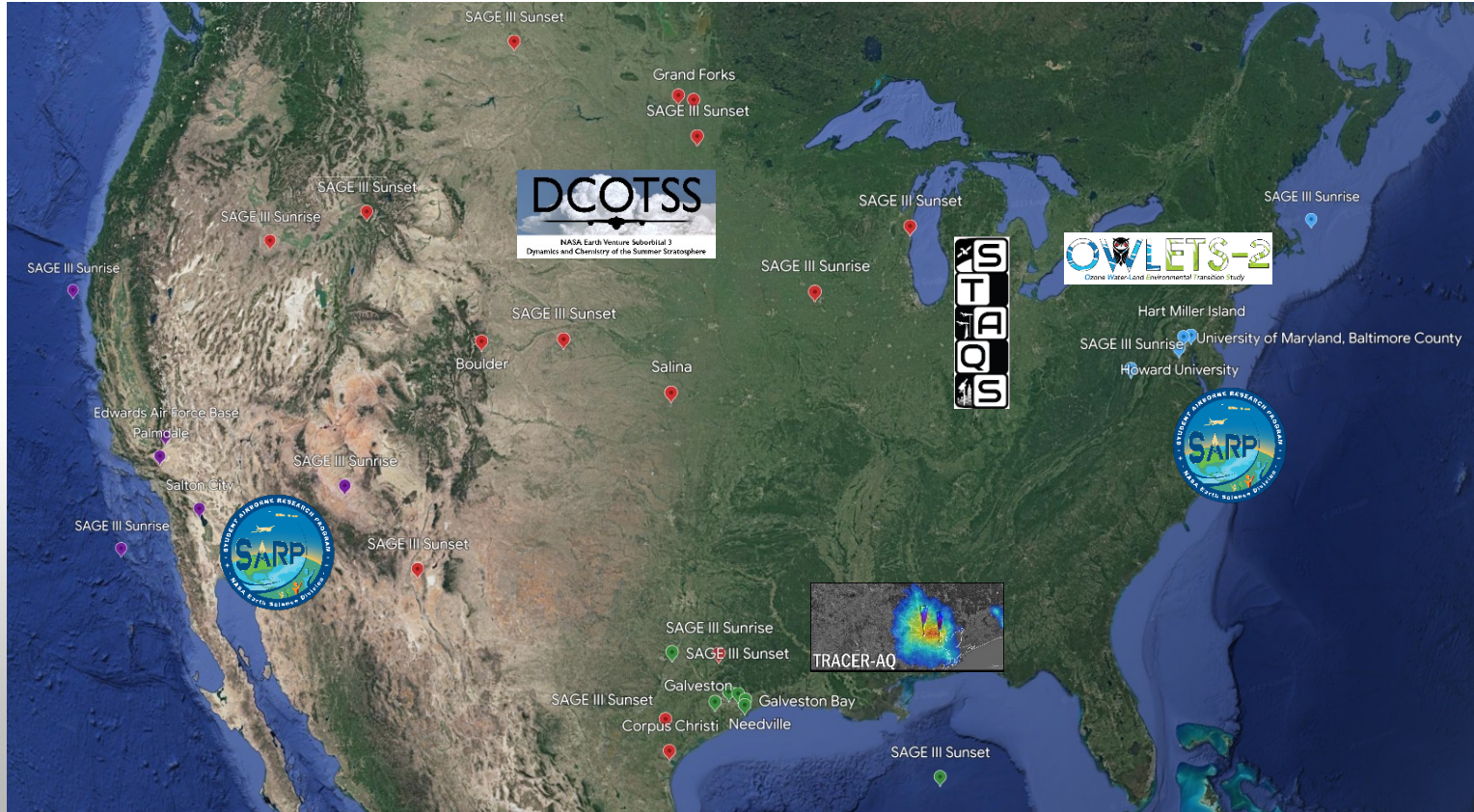
Airborne Science Campaigns

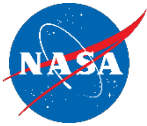


- **The NASA Airborne Science program relies on the use of aircraft systems that collect targeted sub-orbital measurements.**
 - This is often done through organized field campaigns that utilize a fleet of aircraft to collect data during short duration measurement studies.
- **The main focus of field campaigns is data collected via aircraft sensors and operations, though many campaigns also collect sonde data in addition to aircraft data as part of their data product suites.**
- **The in-situ data collected during these campaigns provide an additional validation outlet for SAGE III/ISS and allows for unique inter-agency comparisons.**



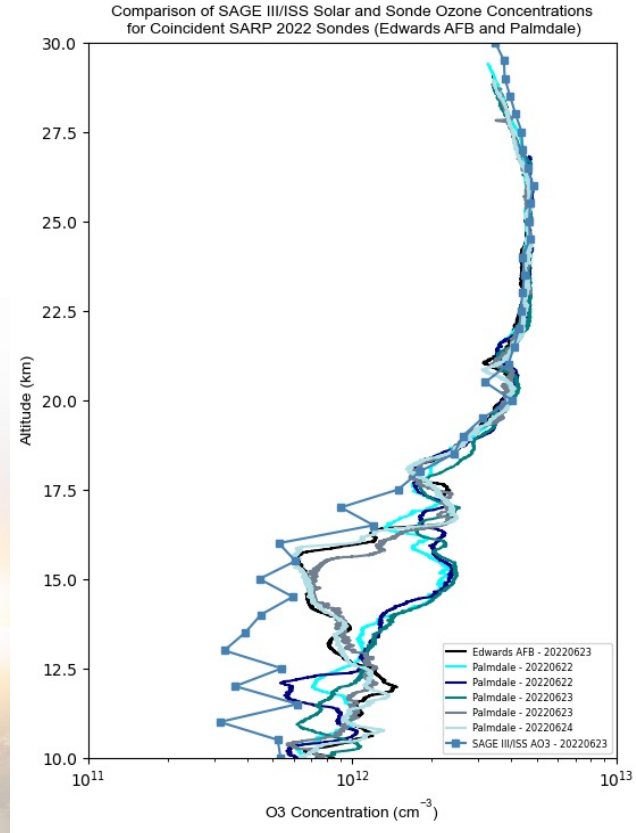
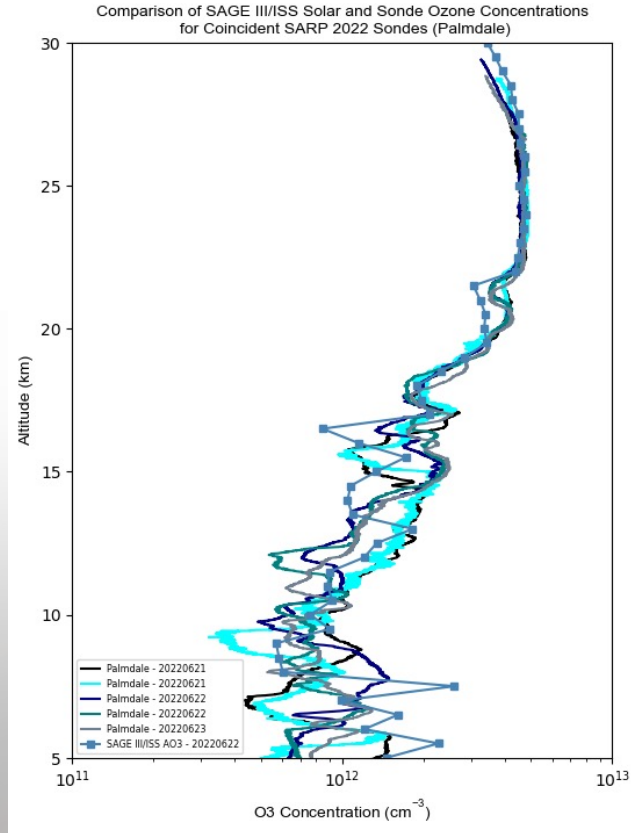
Airborne Campaign Coverage





SARP 2022

*Student Airborne Research Program



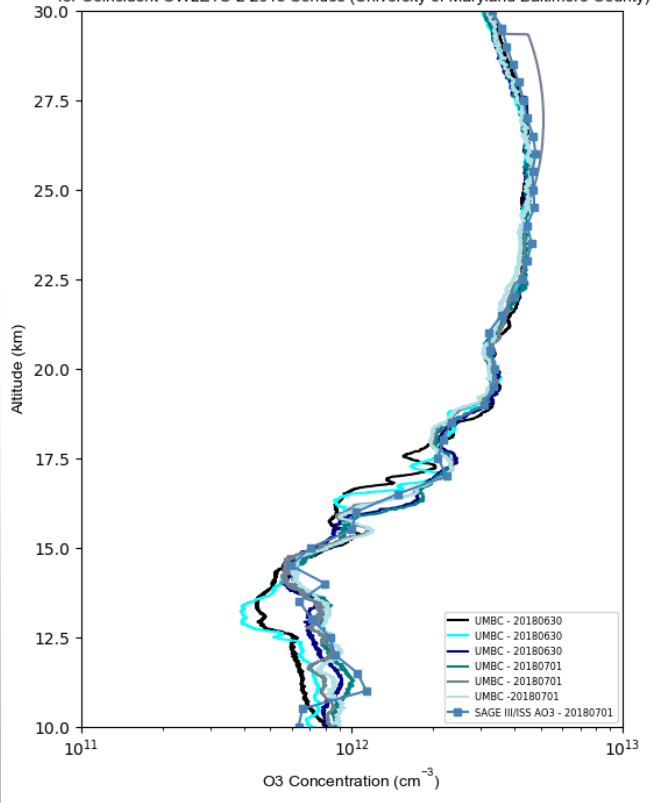


OWLETS-2 2018

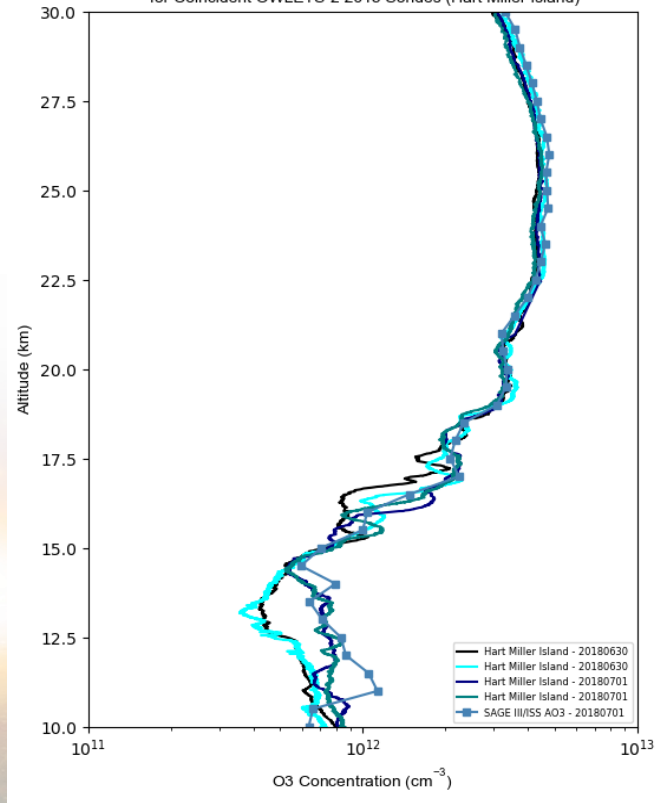
*Ozone Water-Land Environmental Transition Study -2



Comparison of SAGE III/ISS Solar and Sonde Ozone Concentrations for Coincident OWLETS-2 2018 Sondes (University of Maryland Baltimore County)



Comparison of SAGE III/ISS Solar and Sonde Ozone Concentrations for Coincident OWLETS-2 2018 Sondes (Hart Miller Island)



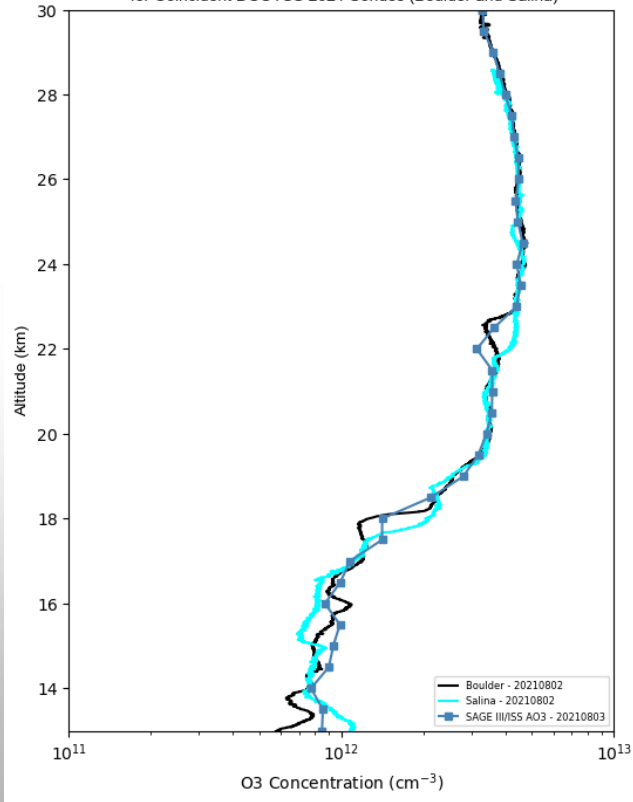


DCOTSS 2021 and 2022

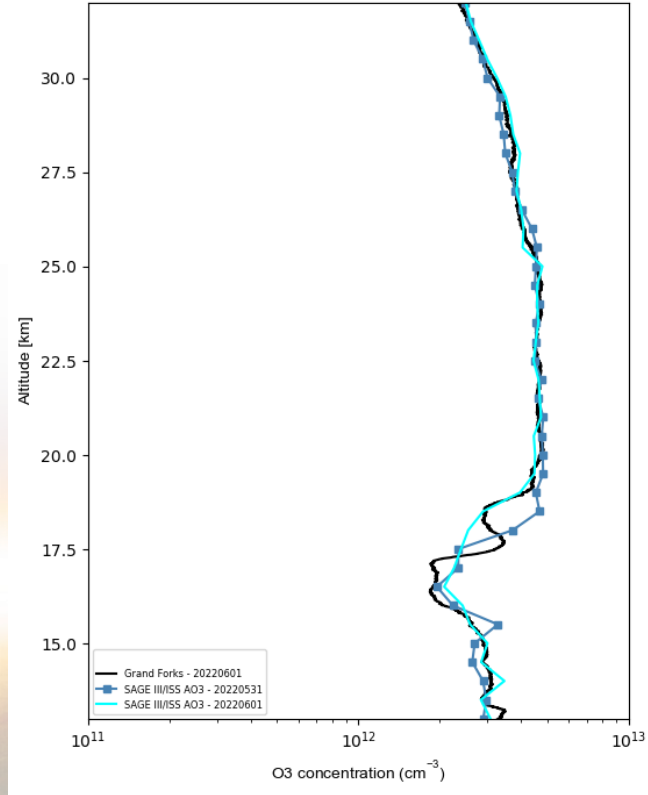
*Dynamics and Chemistry of the Summer Stratosphere



Comparison of SAGE III/ISS Solar and Sonde Ozone Concentrations for Coincident DCOTSS 2021 Sondes (Boulder and Salina)



Comparison of SAGE III/ISS Solar and Sonde Ozone Concentrations for Coincident DCOTSS 2022 Sonde (Grand Forks)

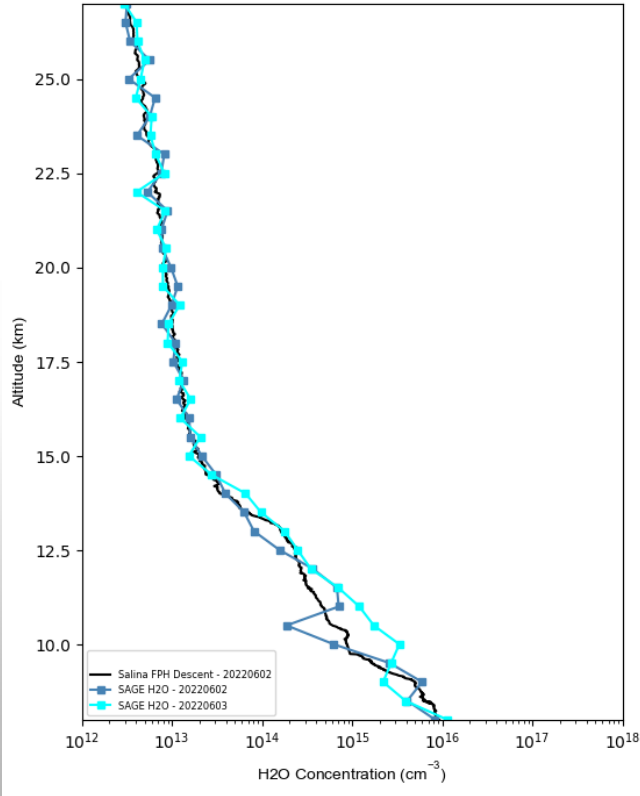




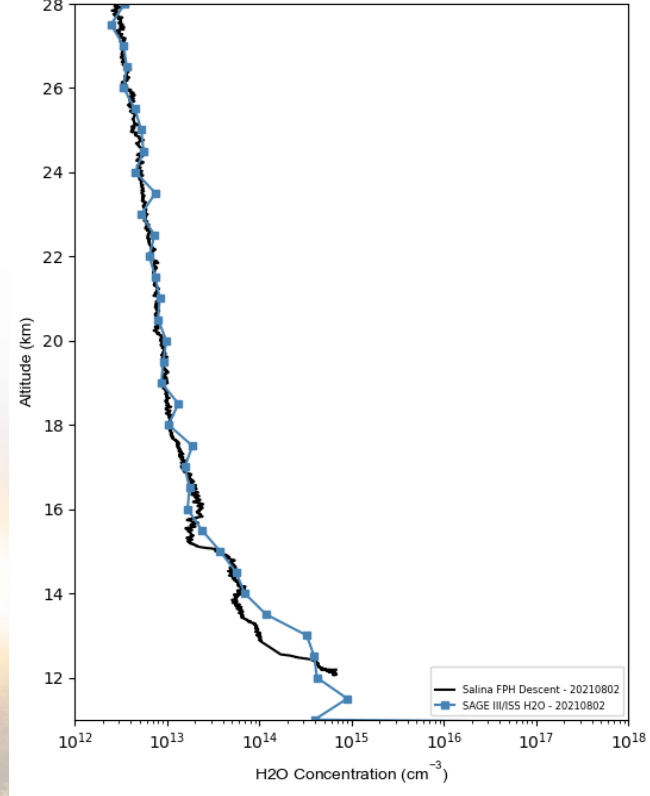
DCOTSS Water Vapor – FPH Sondes



Comparison of SAGE III/ISS Solar and Sonde Water Vapor Concentrations for Coincident DCOTSS 2022 Sonde on Descent (Salina)



Comparison of SAGE III/ISS Solar and Sonde Water Vapor Concentrations for Coincident DCOTSS 2021 Sonde on Descent (Salina)

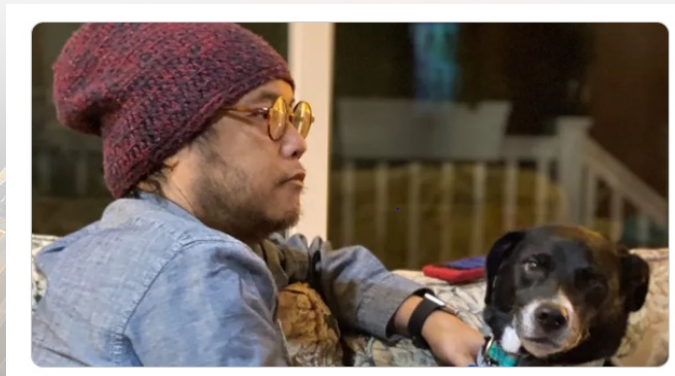




SAGE III/ISS Validation Website



- **SAGE III/ISS has a public facing validation website that allows users to input coordinates and timeframes to view any SAGE III/ISS events that match the selected criteria.**
- **The SAGE III/ISS validation website is:**
 - <https://sage.nasa.gov/validation/>
- **Validation website curators: SAGE III/ISS Ground Systems (Jim Farmer, Rick Farmer)**



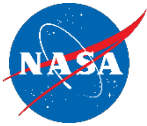
*In memory of Danny
Mangosing
1965 - 2023*



How can YOU participate in the validation efforts?



- **Interested in participating in the SAGE III/ISS validation efforts but don't have the time to delve into the validation website to plan for coincident events?**
 - The validation team can bring weekly updates to YOU!
- **Each participating station or PI receives weekly emails detailing all upcoming SAGE III/ISS events that will coincide with their location and meet the validation criteria.**
- **Coincident events included in these weekly emails include SAGE III/ISS events that are approximately 3 weeks out.**
 - This time frame is used to ensure the accuracy of the SAGE III/ISS event predictions and allows stations to have advance planning for possible coincident measurements.
- **Events included in the weekly emails also take into account the dynamic ISS calendar, the SAGE III/ISS activity calendar, and potential blockages that may affect science data collection.**
- **The SAGE III/ISS team is always looking to add to new participants to this list!**
 - If you are interested in signing up for this weekly mailing list, please email me at:
carrie.roller@nasa.gov



Long Term Event Predictions



- In addition to short term event predictions, long term event predictions are also available on the SAGE validation website and monthly via email to stations or PIs that request them.
- Long term events are ~ 6 months out in time and are not guaranteed as they are highly likely to vary in time and space due to reboosts, schedule changes, etc that may occur within the coming months.
- These predictions are useful for long range planning with the caveat in mind that they are likely to change.
 - If you are interested in signing up for long term event emails, please email me at: carrie.roller@nasa.gov



ISS Reboost



- **Periodically, the ISS needs to complete a reboost (or deboost) for altitude maintenance.**
- **Following an ISS reboost, it takes approximately 2–4 days for the ISS orbit parameters (Two-line elements, TLEs) to fully settle into the new changes in the ISS orbit.**
 - During this time, predictions may be slightly skewed in time and longitude.
- **Reboost details are included in weekly emails, as applicable, and there is a warning banner on the validation website.**
- **Once the orbit changes have settled out, all events are re-checked for accuracy to ensure that they still meet the constraints for validation.**



Blockage



- **There are times when visiting vehicles, solar panels, or modules can obstruct the view of SAGE III/ISS.**
- **Expected blockage information can be found on the SAGE III/ISS Validation website**
 - Levels are: none, low, medium, high, and extreme
- **Depending on the severity of the blockage, events may still acquire successfully.**
- **Events sent to validation partners have blockage levels of medium or lower to ensure event success.**
 - High and extreme levels of blockage may still acquire but are not guaranteed. These events are not sent to validation partners.



Contact Information



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- Carrie Roller: carrie.roller@nasa.gov





Questions?

