

National Aeronautics and  
Space Administration



**EARTH  
SYSTEM**  
OBSERVATORY

# Overview of the Earth System Observatory—Atmosphere Observing System (AOS)

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## Current concept achieves Aerosol and CCP science

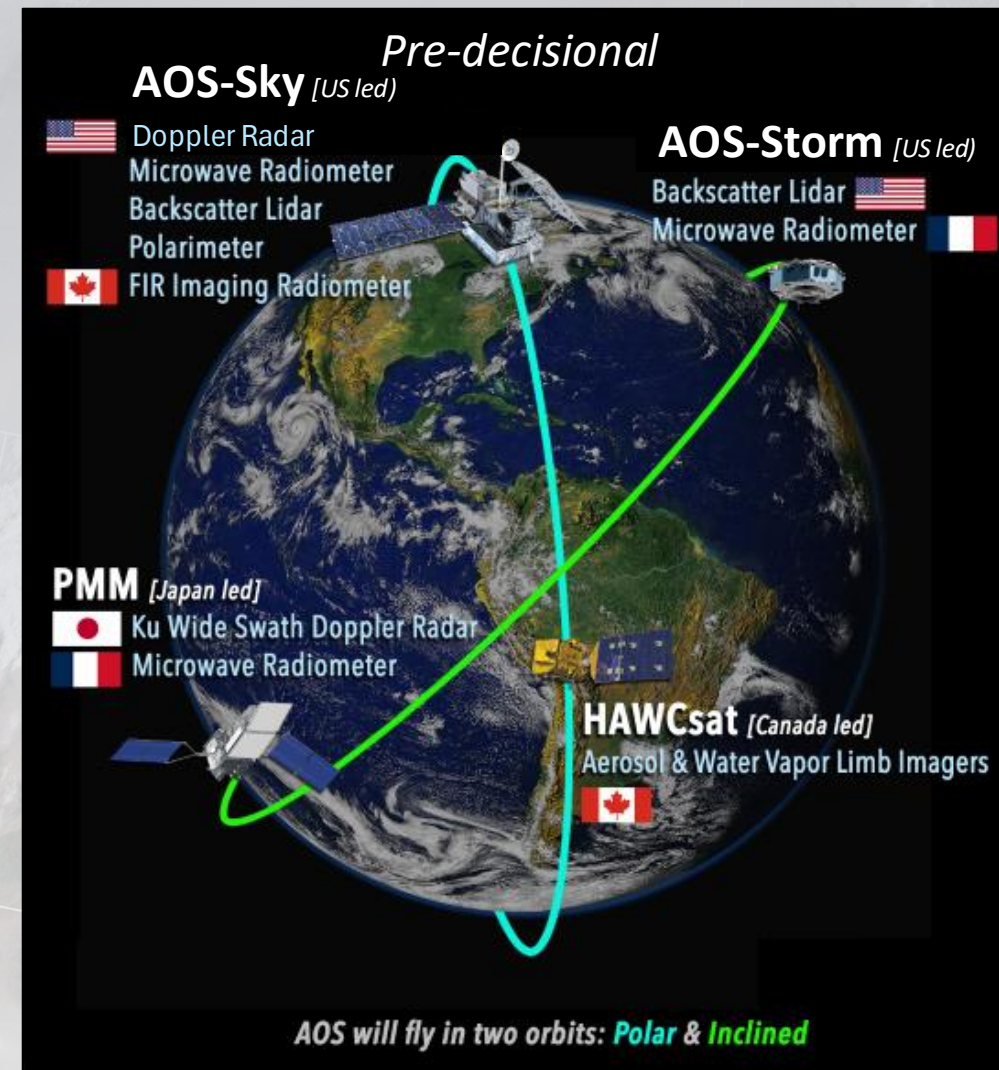
- Delivers globally distributed measurements over a range of temporal scales
- Complemented by sub-orbital element (e.g., science & cal/val)

## AOS-Sky satellite represents Decadal Survey Minimum candidate architecture

- Conducting Pre-formulation study with ASI on a lidar separate from AOS-Sky
- CSA HAWCsat adds information on aerosol and moisture profiles

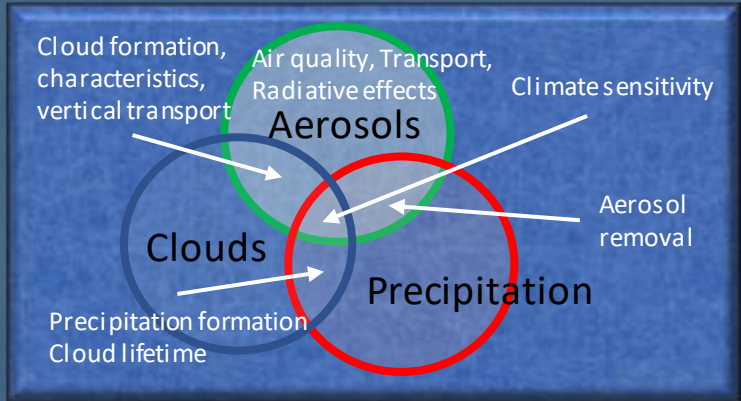
## Generous contributions from JAXA and CNES enable critical science over varying times of day

- Addresses DS stated importance of diurnally varying measurements for CCP
- Provides continuity with TRMM/GPM with Doppler capability and new time-differenced radiometer measurements
- U.S. backscatter lidar adds aerosol and cloud detection as well as PBL height information



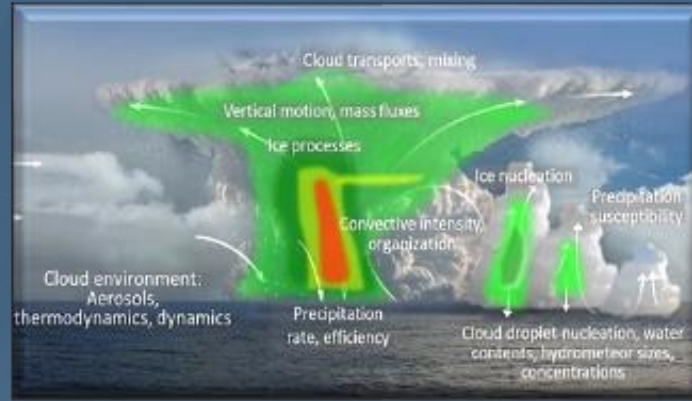
Graphic reflects initial architecture concept directed at KDP-A. Additional direction was provided to study architecture changes, which are still on-going.

# AOS's Focus on Three DS Themes



**1. CLIMATE:** How can we improve our ability to predict local and regional climate response to natural and anthropogenic forcings and reduce the uncertainty in global climate sensitivity?

Requires global coverage, particularly of rapidly changing polar regions → necessitates polar sun-synchronous orbit



**2. CONVECTION:** Why do convective storms, heavy precipitation, and clouds occur exactly when and where they do? How do microphysical properties relate to storm dynamics?

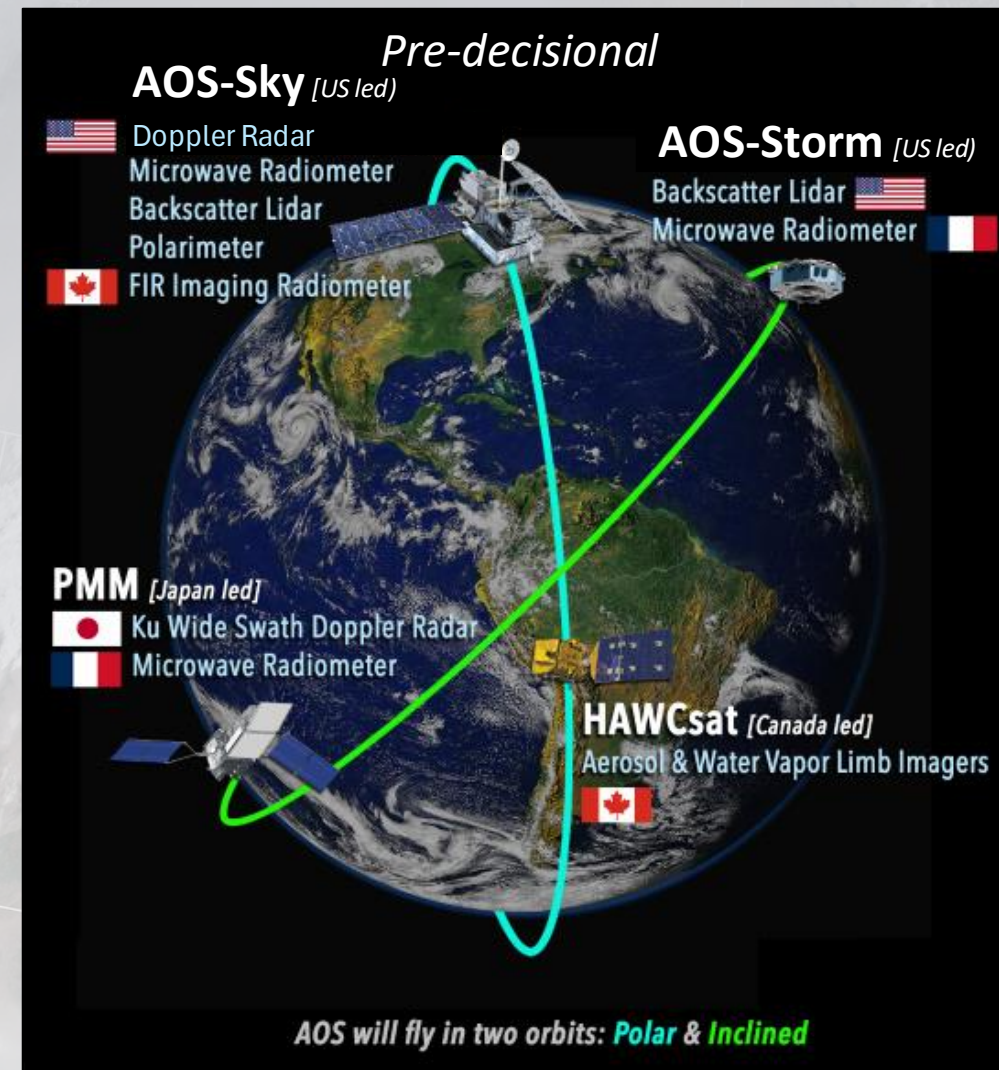
Requires sampling at varying times of day for convection → necessitates an inclined precessing orbit



**3. AEROSOLS:** What processes determine the spatio-temporal structure of important air pollutants and their concomitant adverse impacts on human health, agriculture, and ecosystems?

Emphasis on global observations but can benefit from varying-time-of-day measurements

- AOS-Storm expected to proceed toward System Requirements Review in May 2024
  - Includes JAXA PMM radar, CNES tandem radiometers, NASA ALICAT backscatter lidar
- AOS-Sky trade studies
  - Industry radar and polarimeter study concept development
  - Potential partnership with Italian Space Agency for lidar
  - Spacecraft trades
  - Outcome of trades to inform path forward by Spring 2024



Key elements of the Earth-observing system of satellites related to atmospheric measurements are **coming to an end in the very near future.**



**Polar**

**CloudSat/CALIPSO**

MCR KDP-A

**earthcare**

Possible extended mission

**AOS-Sky + HAWCsat**

Possible extended mission

**Inclined**

**GPM**

End of GPM station keeping fuel

**INCUS**

**PMM**

Possible extended mission

**AOS-Storm**

Possible extended mission

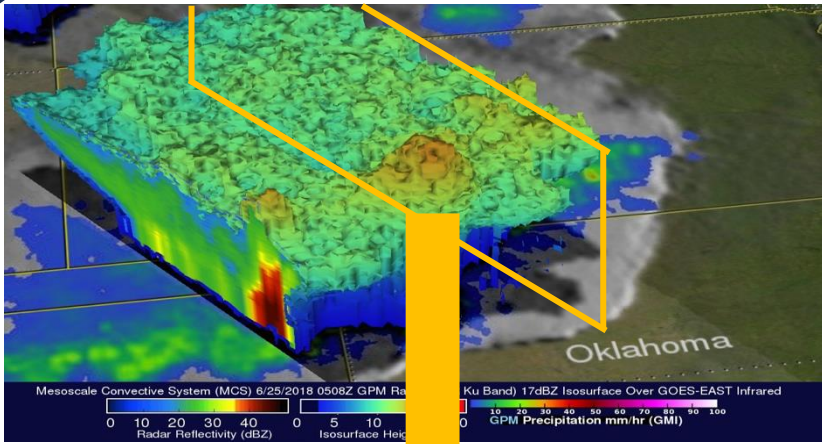
CSA

JAXA CNES

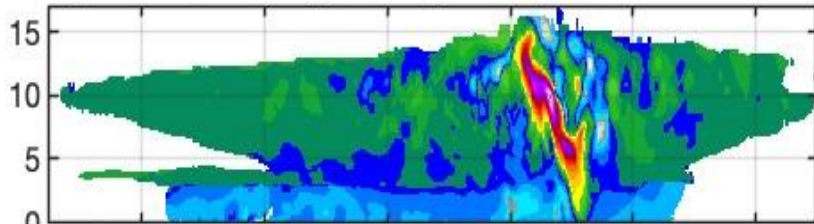
# Back up slides

# A Visual View of AOS-Inclined Measurements

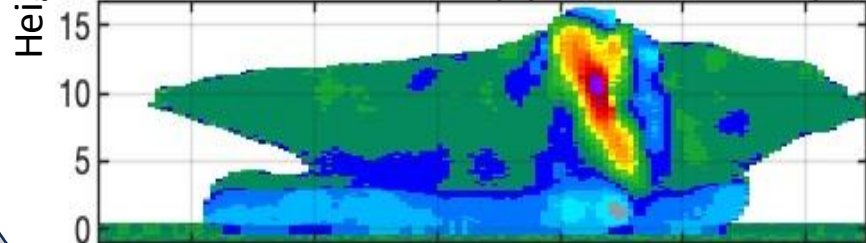
## JAXA Wide Swath Ku Doppler Radar



Model "Truth"

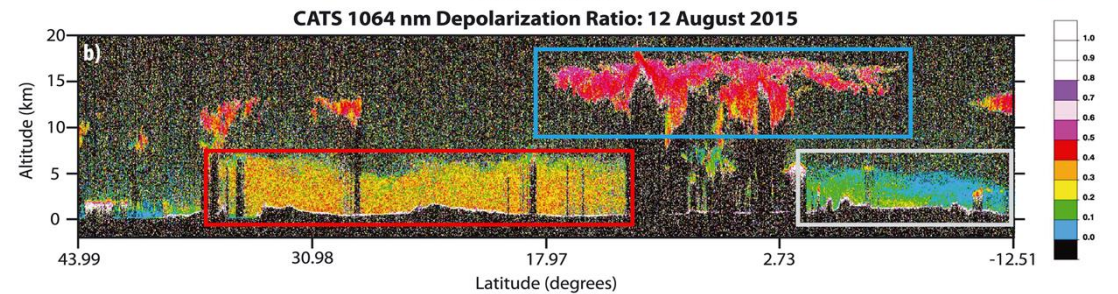
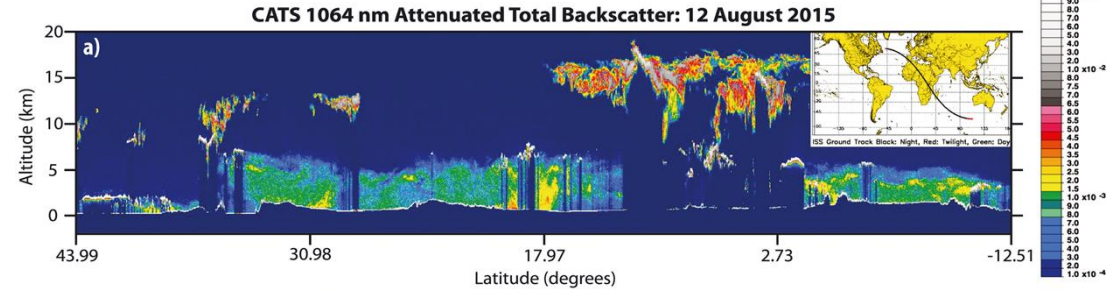


Simulated Ku Doppler Velocity

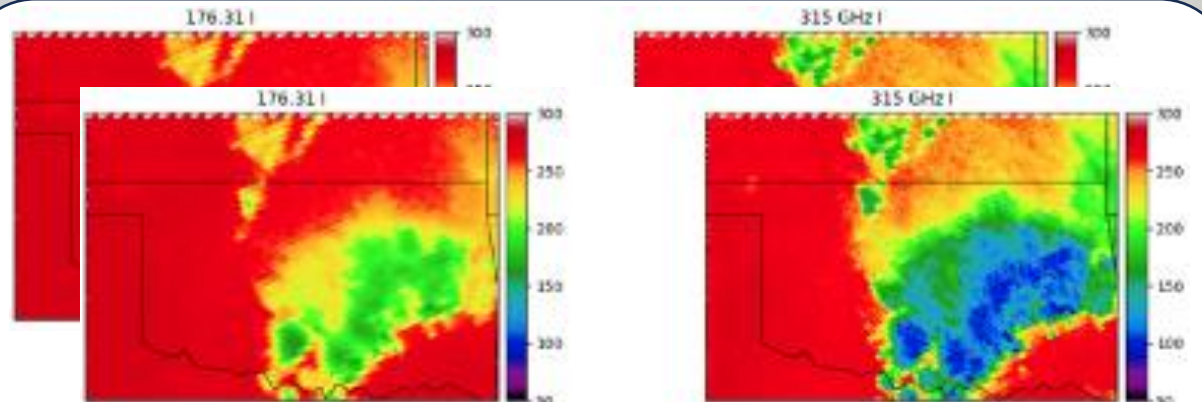


Courtesy Pavlos Kollias

## 532-, 1064-nm Backscatter Lidar



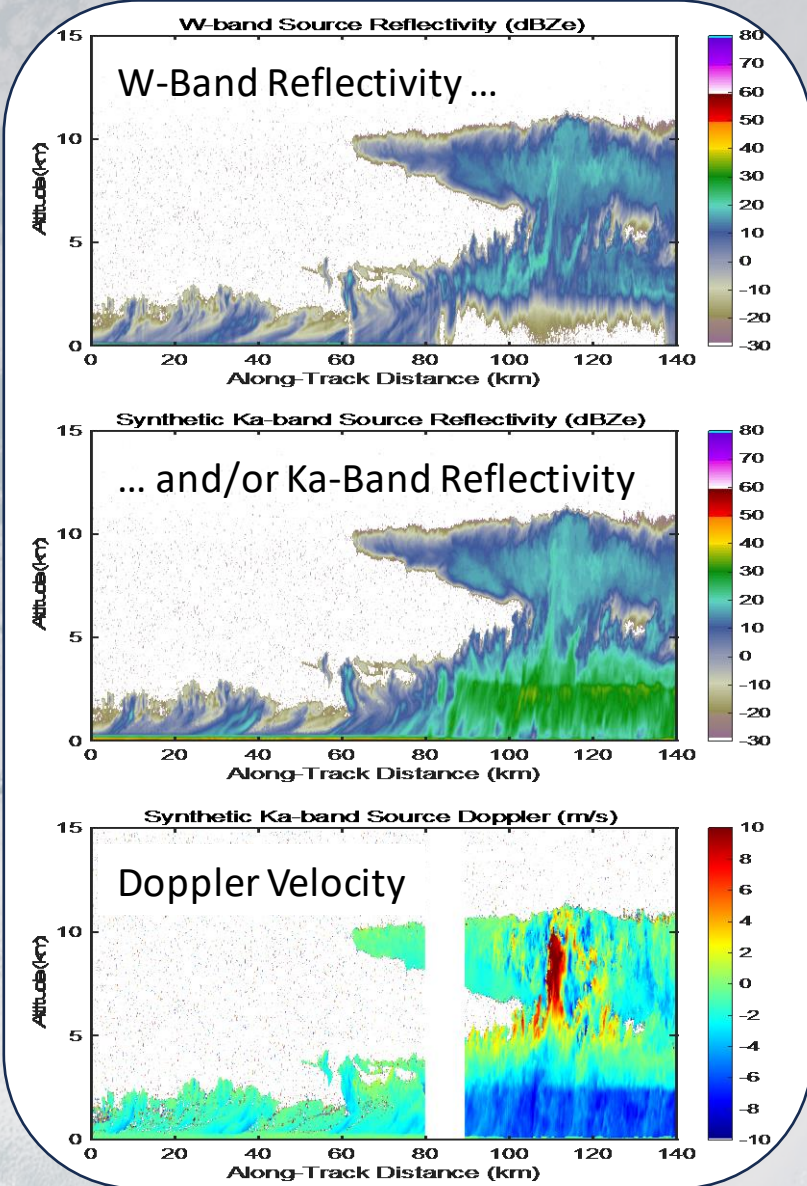
## CNES Microwave Radiometers (89, 183, 325 GHz)



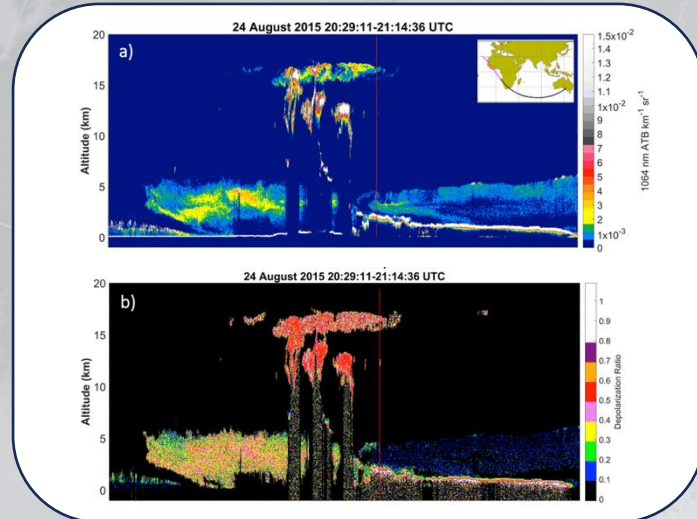
# A Visual View of AOS-Polar Measurements



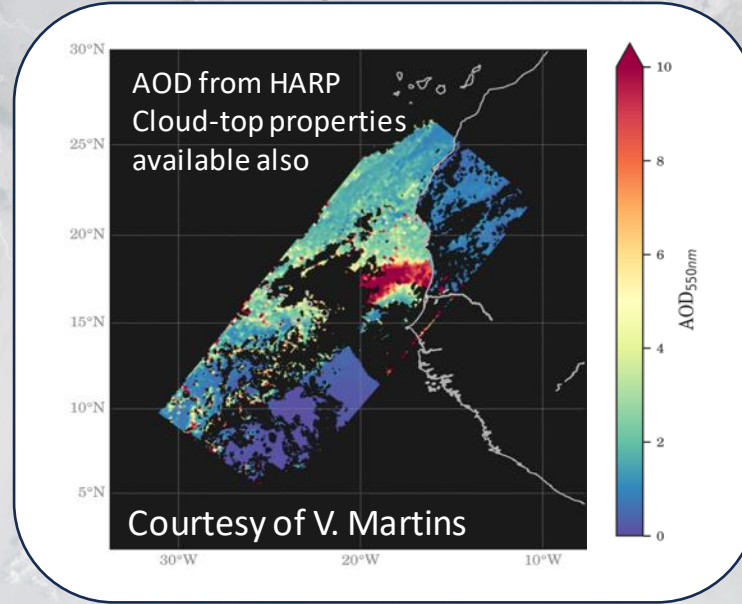
## Single-Frequency Doppler Radar



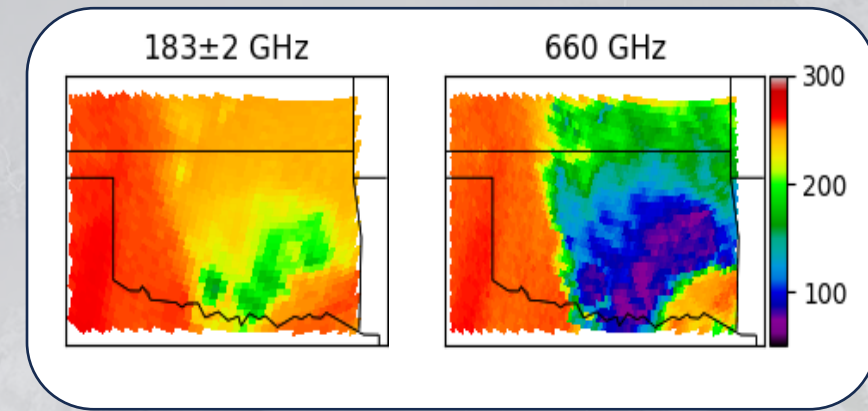
## 532-, 1064-nm Backscatter Lidar



## Multi-angle Polarimeter



## Microwave Radiometer: 89-700 GHz



## CSA LWIR-FIR Radiometer (4-73 μm), Aerosol/Moisture Limb Sounding

