

The Science that Could be Done with Ground-based Infrared Spectrometers

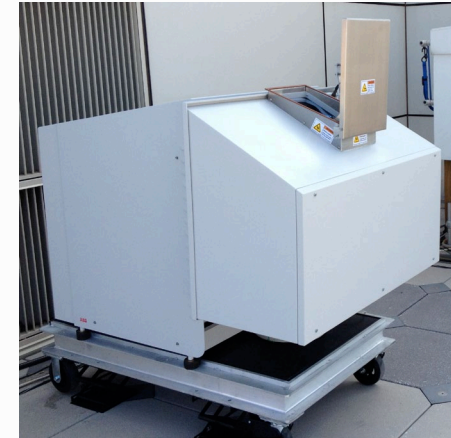
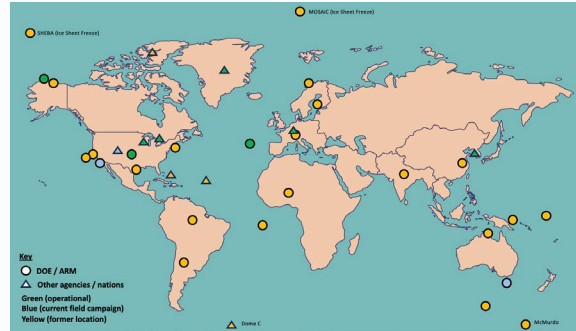
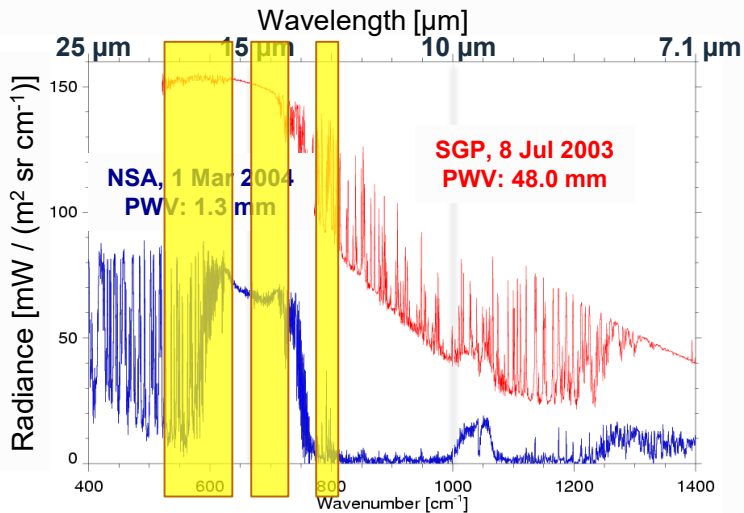


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Infrared Spectrometers



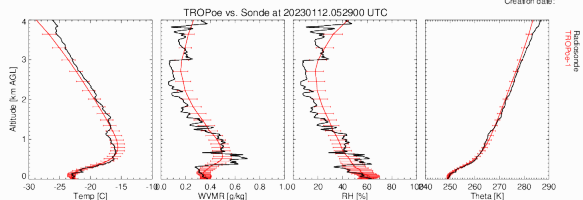
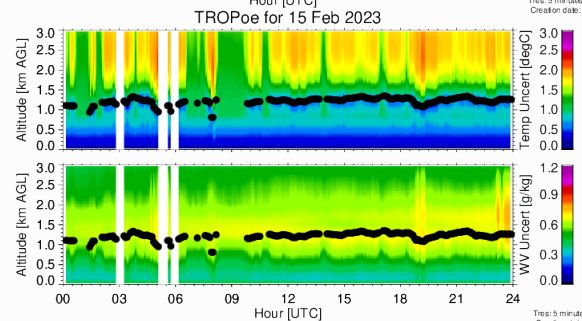
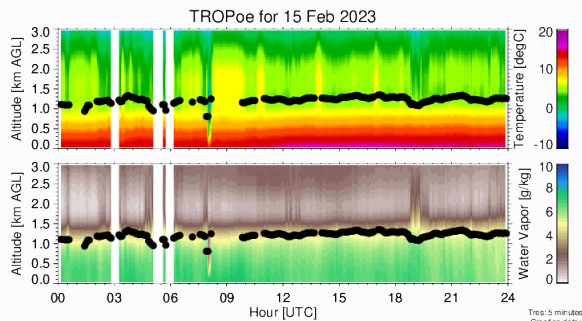
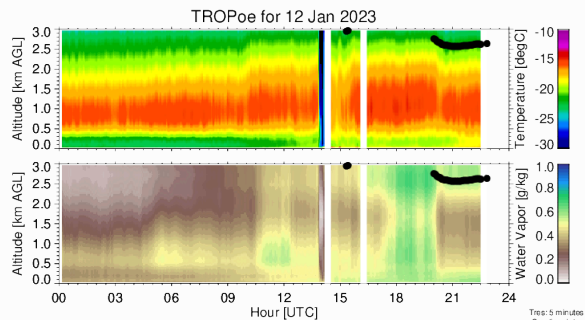
- Measures downwelling IR spectra emitted by the atmosphere at high temporal and spectral resolution (30 s, 1 cm^{-1})
- Initial prototype in 1993 (at UW-Madison), matured as part of DOE ARM
- Hardened, automated instrument; self-calibrating
- Commercially available
- Deployed around the world



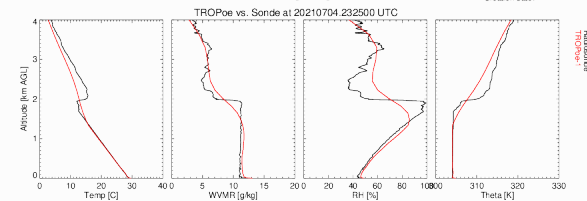
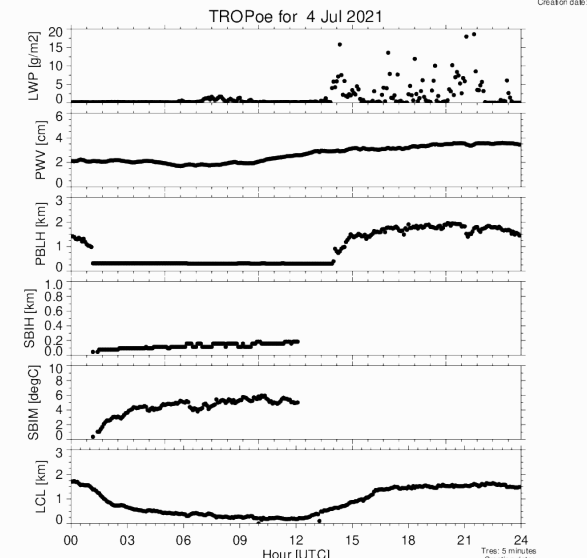
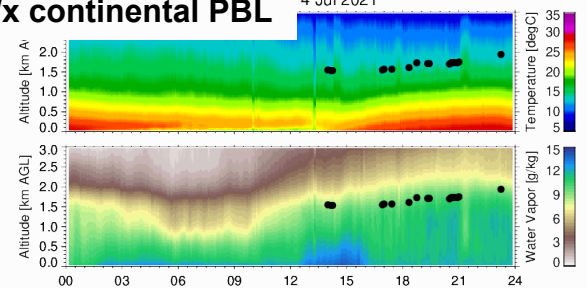
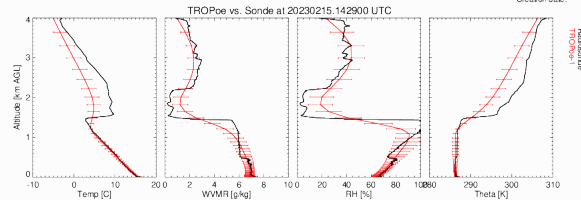
Thermodynamic profiling

A fair- Wx continental PBL 4 Jul 2021

A cloud-topped marine PBL



Very cold/dry polar atmosphere



Other geophysical variables that can be derived/retrieved



- Precipitable water vapor (PWV)
- PBL height
- Surface-based inversion properties (strength, height)
- Convective indices (surface-based and mixed-layer CAPE, CIN, LCL)
- Land-atmosphere interactions (e.g., CTP- HI_{low} , mixing diagrams)
- Sensitivity to clouds
 - Liquid water path and effective radius (for clouds with $LWP < 50 \text{ g/m}^2$)
 - Fog studies (thermodynamics in optically thin fog, microphysical properties)
 - Ice water path and effective radius, some info on ice habit (for clouds with $0.5 < \tau < 6$)
 - Mixed-phase clouds (for total optical depths < 6)
- Dust studies
 - Radiometric dust composition (e.g., clays vs calcium carbonates vs quartz)
- Trace gas studies
 - Carbon dioxide, ozone, carbon monoxide, methane, nitrous oxide
 - Some signals on CFCs too