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

Dave Turner
NOAA / Global Systems Laboratory
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

Very cold/dry polar atmosphere

A cloud-topped marine PBL

A fair-Wx continental PBL
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\textsubscript{low}, mixing diagrams)
- Sensitivity to clouds
  - Liquid water path and effective radius (for clouds with LWP < 50 g/m\textsuperscript{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