

# TC4 Science Objectives: Solar Spectral Irradiance

Instrument: **Solar Spectral Flux Radiometer (SSFR)**

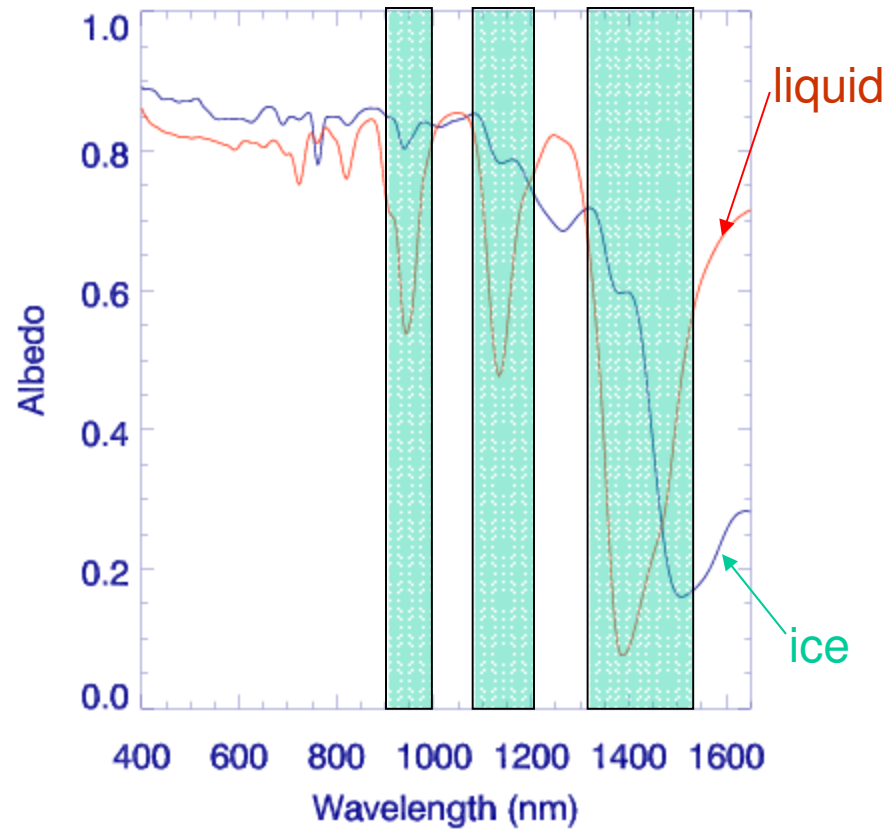
- 380 nm to 2100 nm
- 8-12 nm resolution
- Simultaneous zenith/nadir viewing
- $2\pi$  sr field-of-view [ $\text{W m}^{-2} \text{nm}^{-1}$ ]
- 1 Hz sampling
- 3-5% accuracy; 0.5% precision
- Deploy on DC-8 and ER-2 for TC4



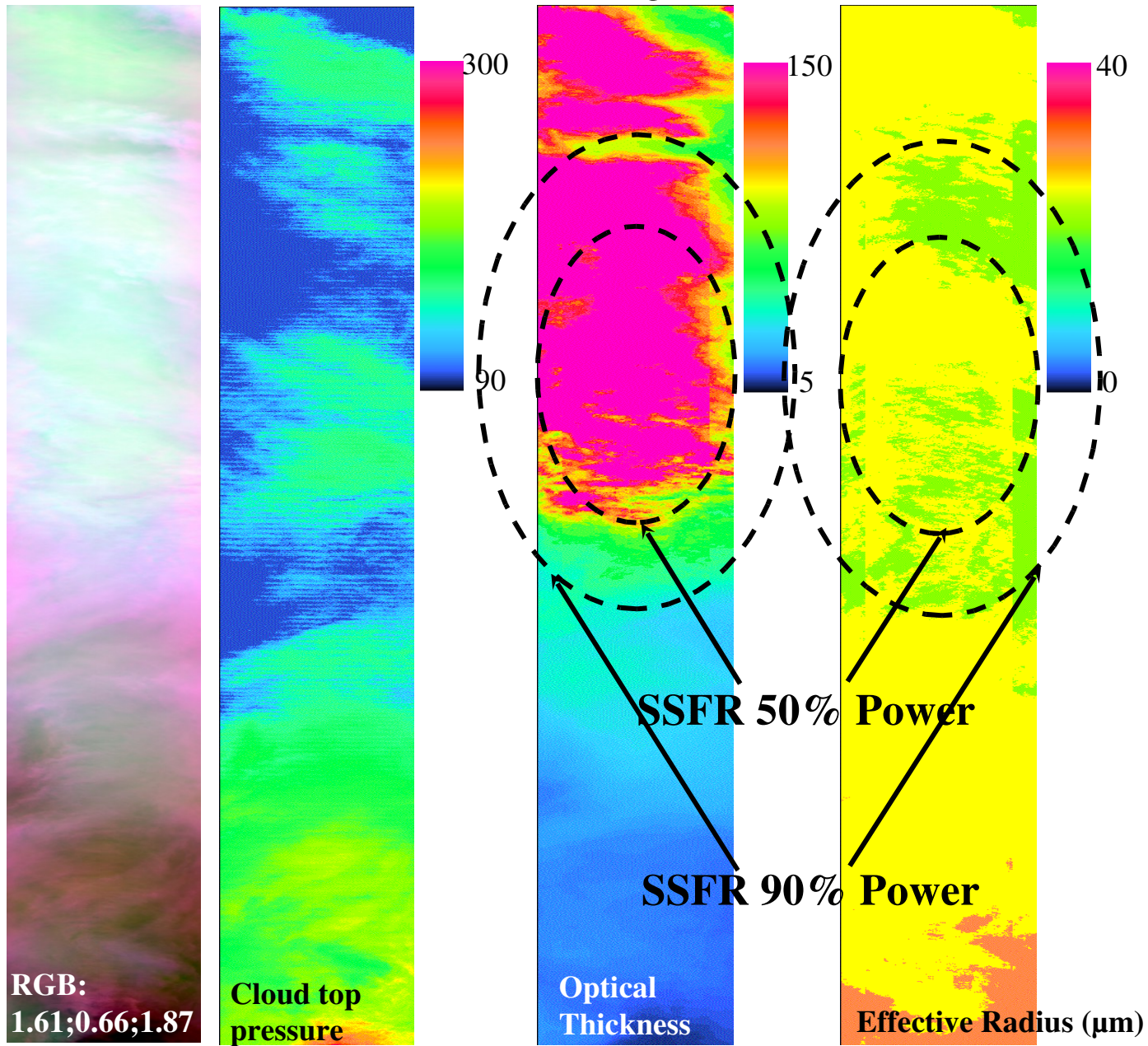
## Objectives

- Characterize radiation fields/budgets over the experimental regime.
  - Cloud and cloud-free
- Retrievals of cloud water phase, crystal/droplet radius effective radius, optical depth, and liquid water path.
- Test/validation/comparison with satellite/simulator cloud retrievals (MAS and MODIS) and in situ microphysical measurements.
- 3-D cloud radiation/cloud generator simulations.
- Examine 3-D influence on retrieved parameters.
- Examine aerosol influence on retrieved parameters.
- Characterize land/sea surface spectral albedo.

# Cloud phase

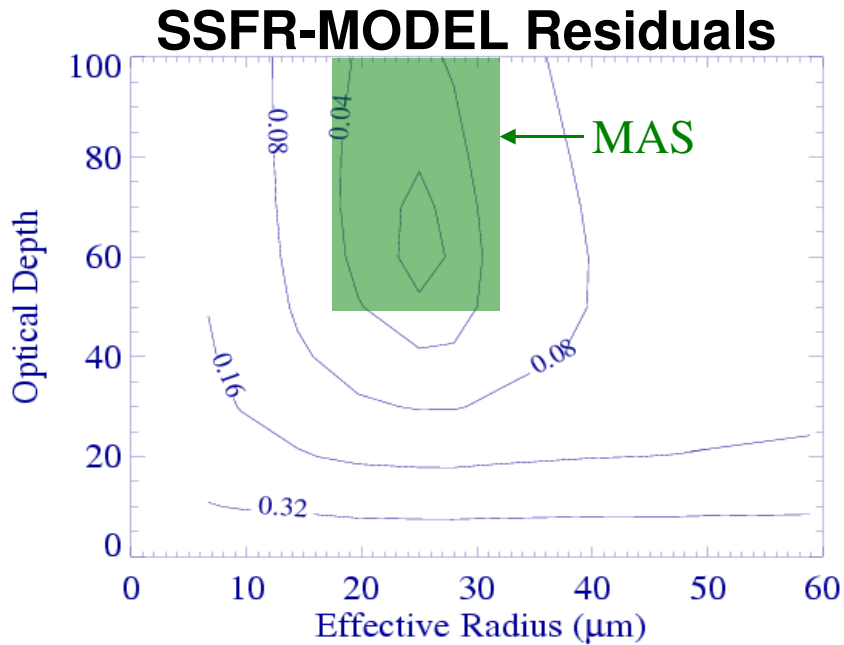


2002.07.09 flight 02948, track 6, scanlines 0-5780

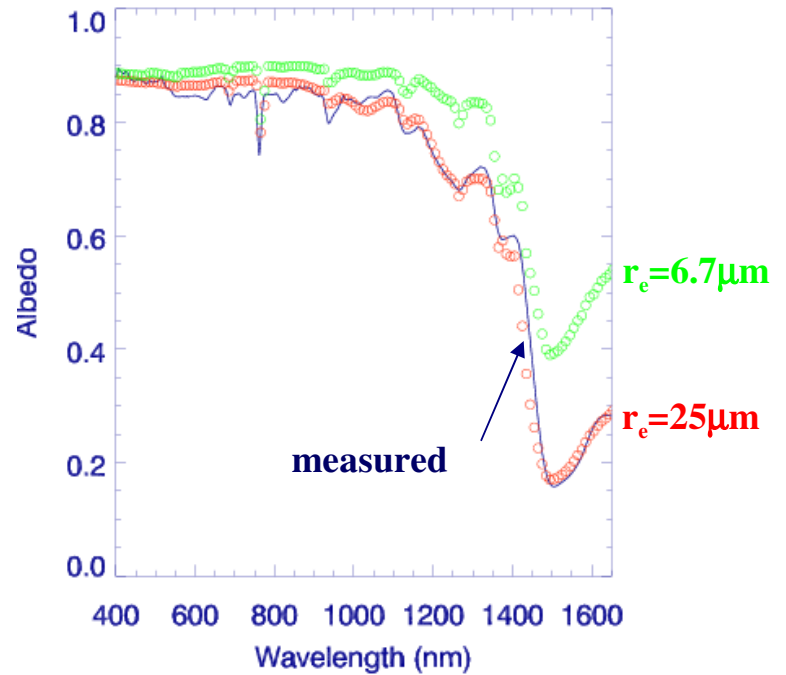


*Platnick and Wind,  
2003*

# CRYSTAL-FACE 9 July 2002

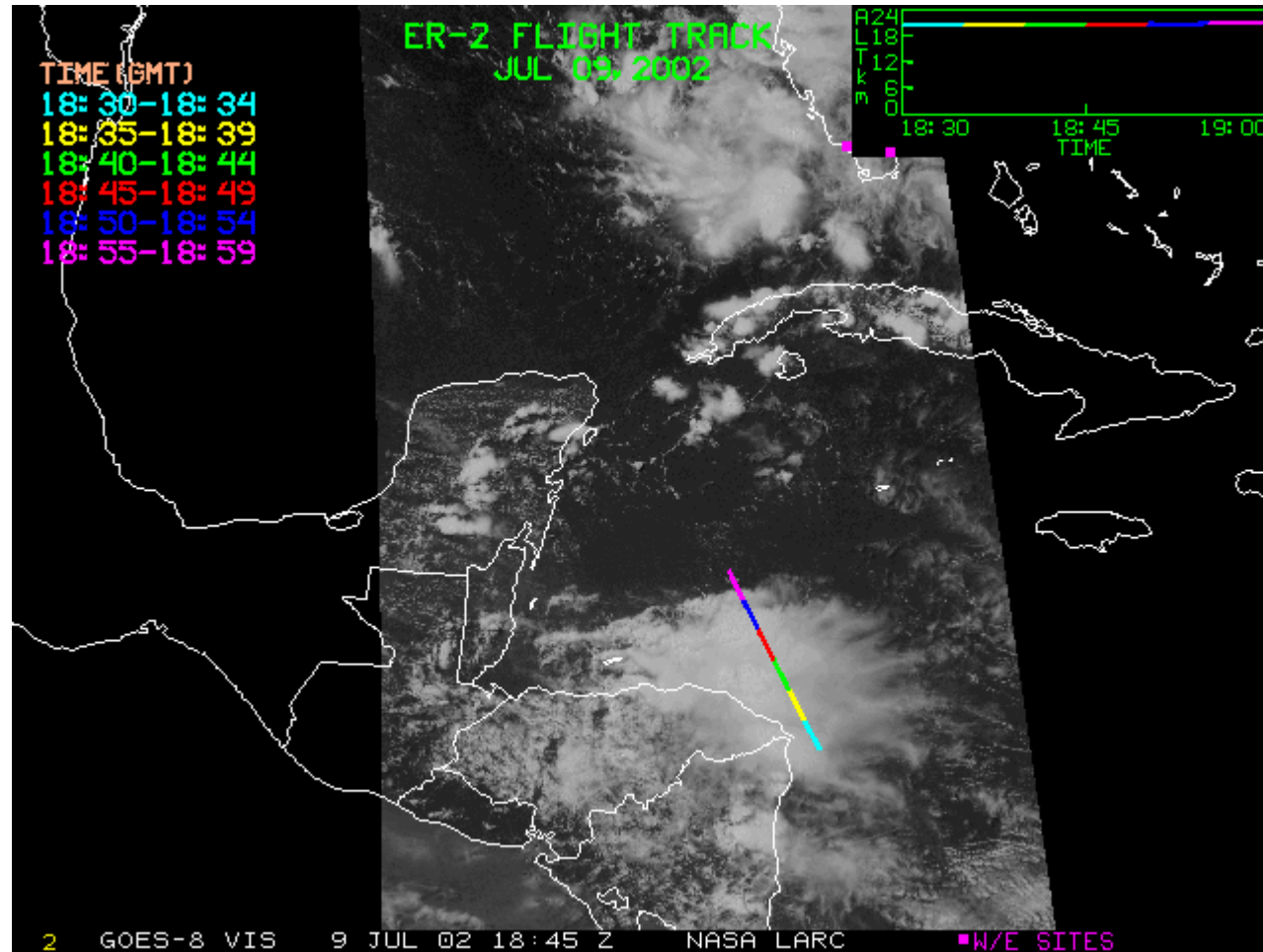


*Pilewskie et al., 2004, 2006*



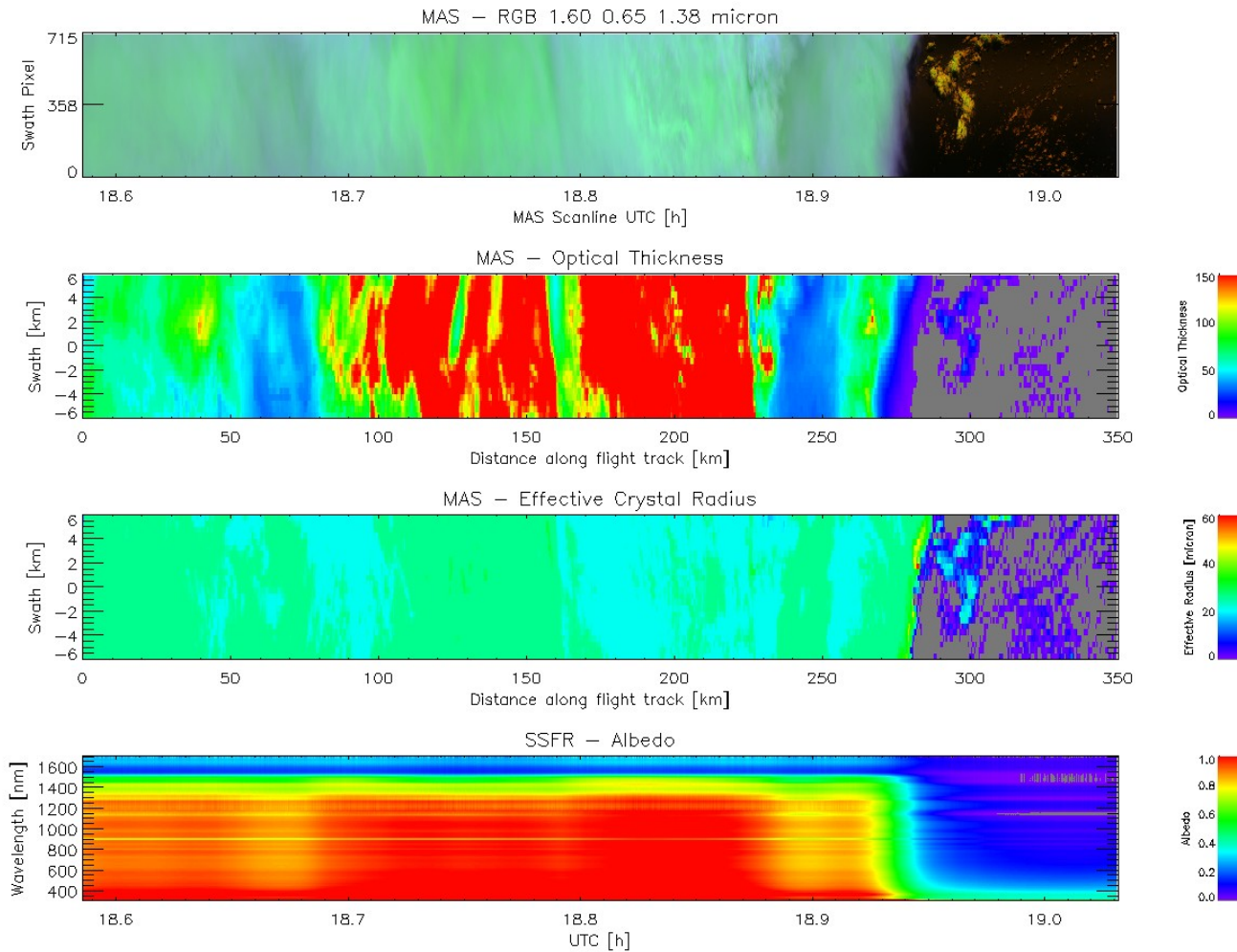
# TC4 Science Objectives: Solar Spectral Irradiance

*Result from CRYSTAL-FACE – Thick cloud case*



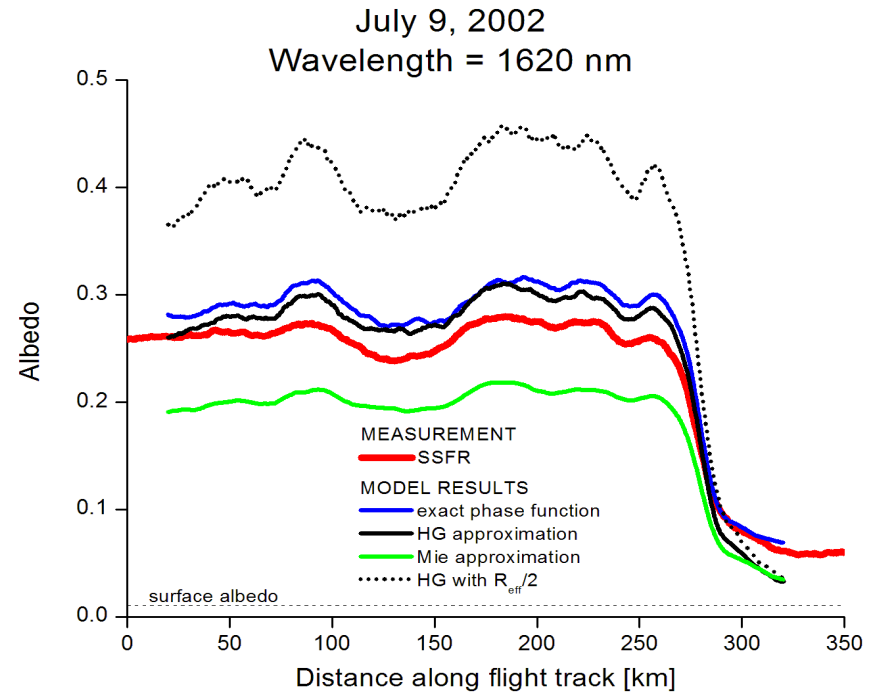
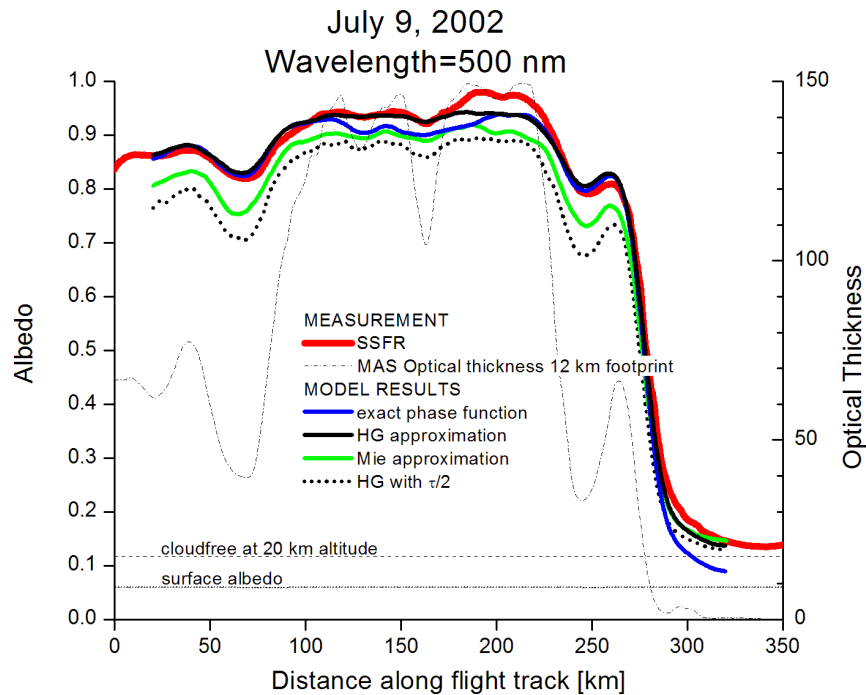
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## Result from *CRYSTAL-FACE* – Thick cloud case



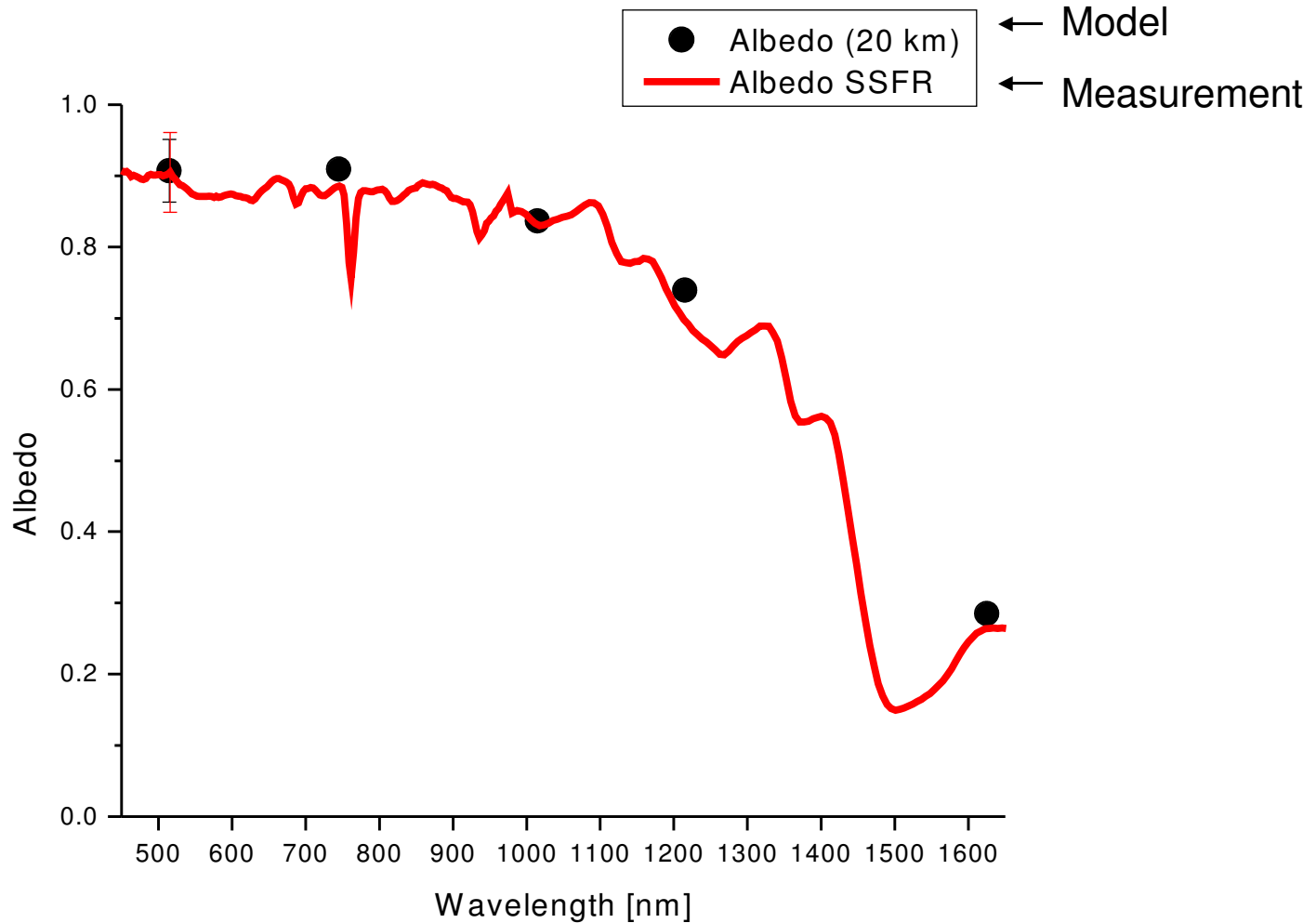
# TC4 Science Objectives: Solar Spectral Irradiance

## Result from *CRYSTAL-FACE* – Thick cloud case



# 3-d irradiance simulation

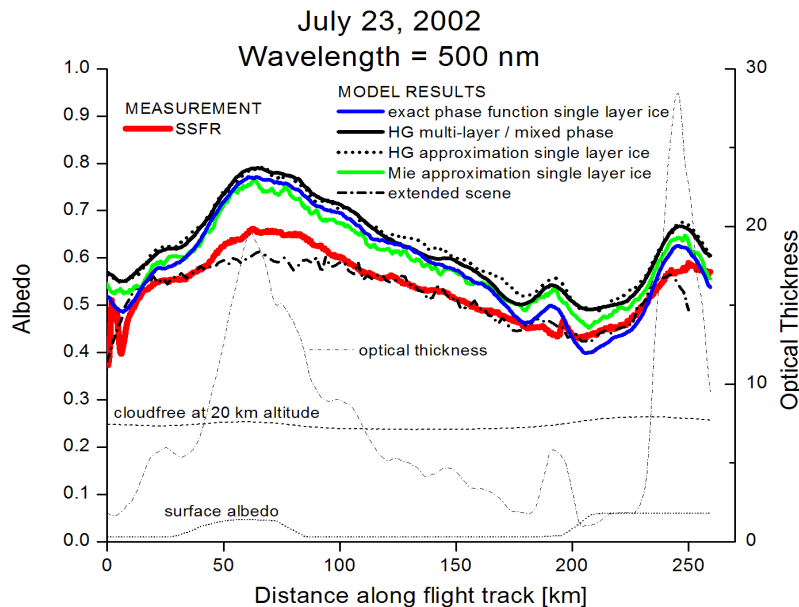
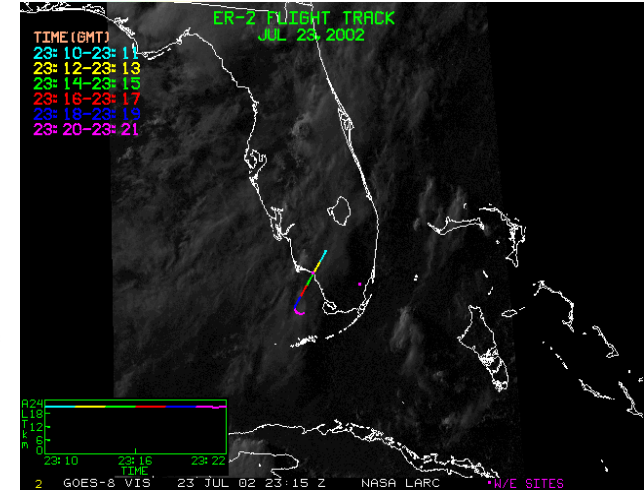
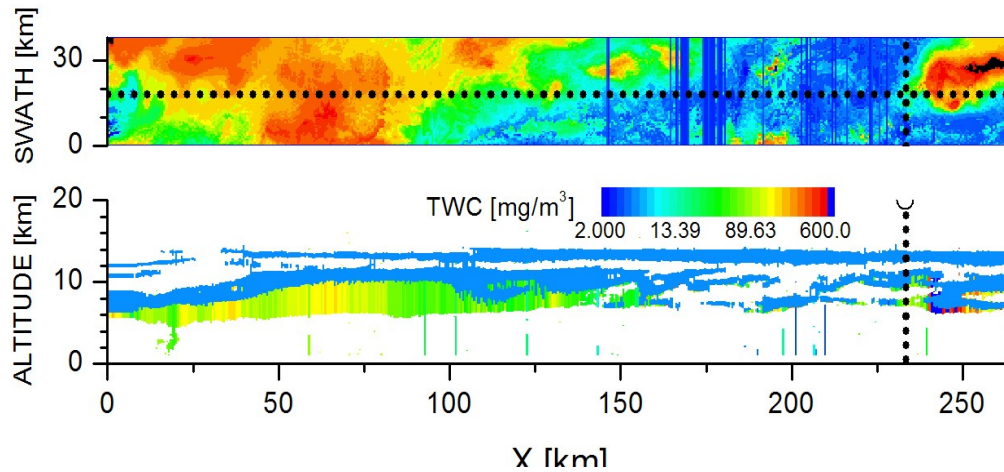
*Domain averaged spectral albedo*



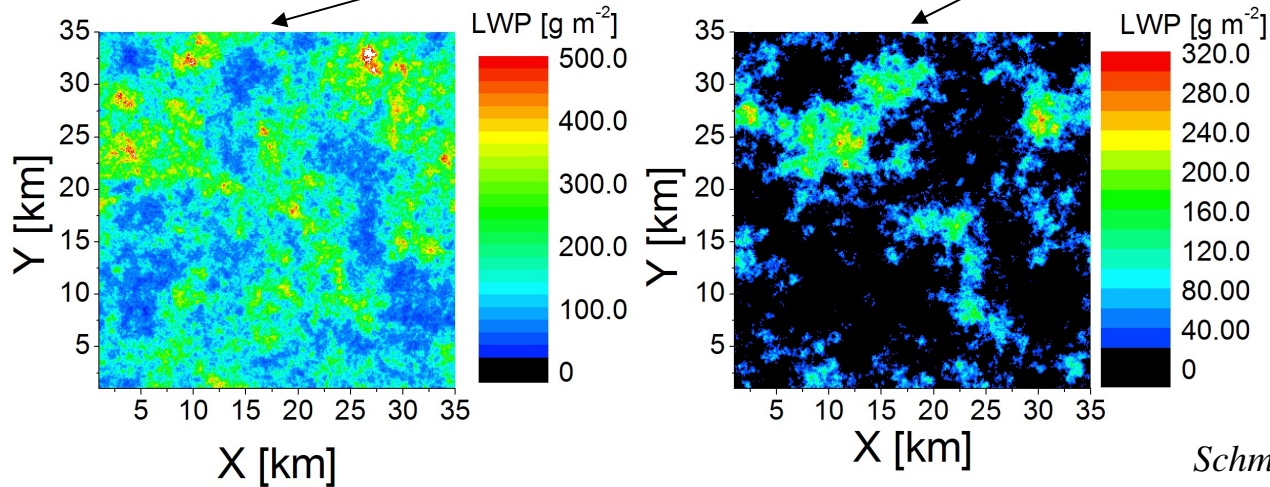


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## Result from *CRYSTAL-FACE* – thin cloud case



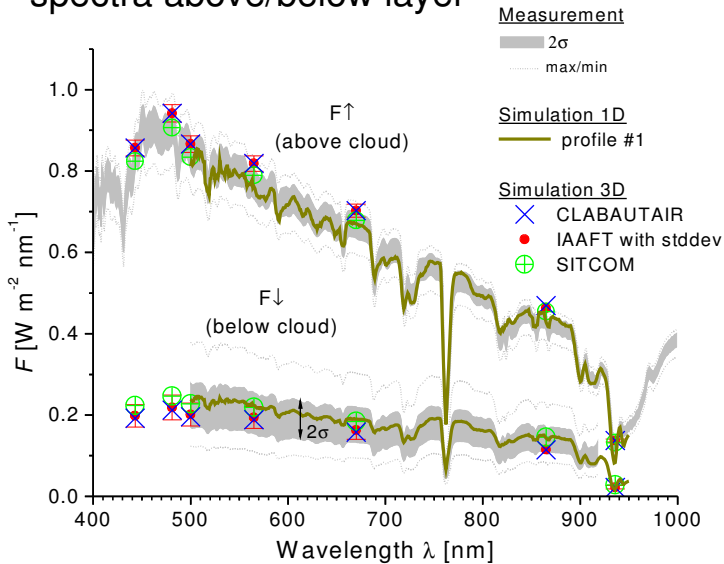
# Cloud generator: overcast St and broken Cu



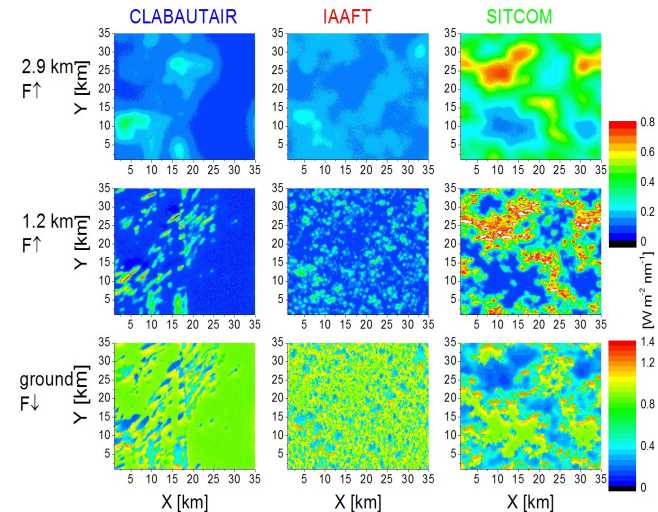
*Schmidt et al., 2006*

overcast St – domain averaged spectra above/below layer

## 3-D Modeled irradiance



broken Cu – horizontal structure of modeled irradiance



# TC4 Science Objectives: Solar Spectral Irradiance

## *Suggested Flight patterns / aircraft / satellite coordination*

- **Budget:** ER-2 (above layer) / DC-8 (below layer) flying along same ground track – straight legs
- **Retrievals:** ER-2 or DC-8 above cloud layer
- **3D clouds / RTM:** preferably additional in situ microphysical measurements from WB-57 (a: straight leg within cloud near cloud top; b: full cloud vertical profile)
- **Aerosol influence on cloud retrievals:** DC-8 and ER-2 (WB-57?)
- **Characterize land/sea surface spectral albedo:** Preferably “low” legs with DC-8, CLEAR conditions (if we ever get them)

Under all circumstances, we'd prefer to have a MODIS overpass while flying.