CRYSTAL-FACE
Thin Cirrus Properties from Space using the MISR Multi-angle Research Aerosol Retrieval

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Two algorithm ideas for characterizing optically thin, uniform cirrus:

1. **Band-Difference-Angular-Signature (BDAS)** cloud detection algorithm (Wilson, DiGirolamo)
   - Uses multi-angle **blue and near-IR** MISR bands
   - **Detects scattering layers** high above most Rayleigh scattering
   - Might use BDAS detection as a *trigger* for the aerosol retrieval

2. Include a **cirrus component** in Standard aerosol retrieval algorithm (Kahn)
   - Uses multi-angle **red and near-IR** bands over dark water
     (4 bands over land)
   - Derives information about **aerosol amount and type**
GOALS:

- **Test both algorithms** against simultaneous in situ validation data

- **Quantify the sensitivity** to cirrus of each algorithm, under natural conditions
## MISR coverage for the CRYSTAL-FACE Campaign
### July 1 - July 31, 2002

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<th>Orbit</th>
<th>Path/Block</th>
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Flight tracks on 20020711 starting at 57600 UT (16:00)

ER-2
WB-57

Dots show aircraft location at start time
Crosses show locations at 5 minute intervals
Proteus altitude unknown; 18 km used only as representative value
MISR DF
70° Forward View
July 11, 2002
MAS: MODIS Airborne Simulator - ER-2
July 11, 2002
MISR AN Nadir View
July 29, 2002

FLORIDA_EAST: Orbit 13897, Path 14 Block 69-73
July 29, 2002
MISR Level 1B2 TERRAIN RGB AN

(27.50N, 80.36W) (27.39N, 76.66W)

(21.48N, 81.89W) (21.17N, 78.25W)
MAS: MODIS Airborne Simulator - ER-2

M. ODIS Airborne Simulator - ER-2

Flight #02-956 Track #2 of 16

29 Jul 2002

N. Patch
24.74-24.77 N lat
80.76-80.67 W ln

S. Patch
24.84-24.88 N lat
80.45-80.34 W ln

Cirrus
CRYSTAL_SW Site July 09, 2002 16:26 - 16:33 UTC
Path 18 Orbit 13606
paths over CRYSTAL_SW2, Local Mode Site #3021 (18.000, -86).

Path 018, Block 076
Orbit  X-Track  Of Time
#13606 104.7 km  16:26:
#13639 104.9 km  16:26:

Nearby L2 Sites
Flight tracks on 20020709 starting at 59400 UT (16:30)

- ER-2
- Proteus
- WB-57

Data show aircraft location at start time
Crosses show locations at 5 minute intervals
Proteus altitude unknown; 18 km used only as representative value
MISR AN
Nadir View
July 09, 2002
ER-2: 16:29 to 16:31 UTD; 20.70 to 20.48 N lat.; 86.45 to 86.51 W lon.; 20.39 to 24.45 km elev.

WB-57: 16:33:52 to 16:36:00 UTC [59632 to 59760]; 20.71 to 20.48 N lat.; 86.45 to 86.51 W lon.; 15.47 to 15.45 km elev.
CPL: Cloud Physics LIDAR - ER-2

Crystal 09Jul02 ER-2/CPL ABC-106

MISR Overflight

Cirrus
MISR BDAS: Band-Differenced Angular Signature (Forward C&D Cameras)
CAS: Cloud and Aerosol Spectrometer - WB-57

CRYSTAL Campaign, CAS - WB-57
July 09, 2002

Thin Cirrus

Particle Concentration

MISR Overpass
59165

16:40
60000

16:44
60250
An upper bound on the Ice Water Content for the period 59632 to 59760 is about 0.003 mg m\(^{-3}\).
CPI: Cloud Particle Imager - WB-57

July 09, 2002

One Particle Collected between 16:36 and 16:44 UTC
AOT\textsubscript{558} = 0.20; 50\% small spherical non-absorbing; 15\% dust; 35\% cirrus
## MISR - Nauru LIDAR Coincident Thin Cirrus Observations

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<tr>
<th>Date</th>
<th>DOY</th>
<th>MISR Time (UCT)</th>
<th>Orbit</th>
<th>Path</th>
<th>Cloud Base (km)</th>
<th>Cloud Top (km)</th>
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<td>5062</td>
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</table>
Where We’re At…

- The CRYSTAL-FACE data demonstrates we can coordinate aircraft and spacecraft to study thin cirrus.

- The July 09 analysis illustrates MISR’s ability to detect and retrieve cirrus AOT in the presence of aerosols.

- The Nauru data set will help us quantify MISR’s sensitivity to cirrus AOT.

- More data will be needed to assess MISR’s sensitivity to cirrus crystal habit.

- We would like to test a range of cirrus optical models in the MISR retrieval.
MISR BDAS: Band-Differenced Angular Signature (Aft C&D Cameras)