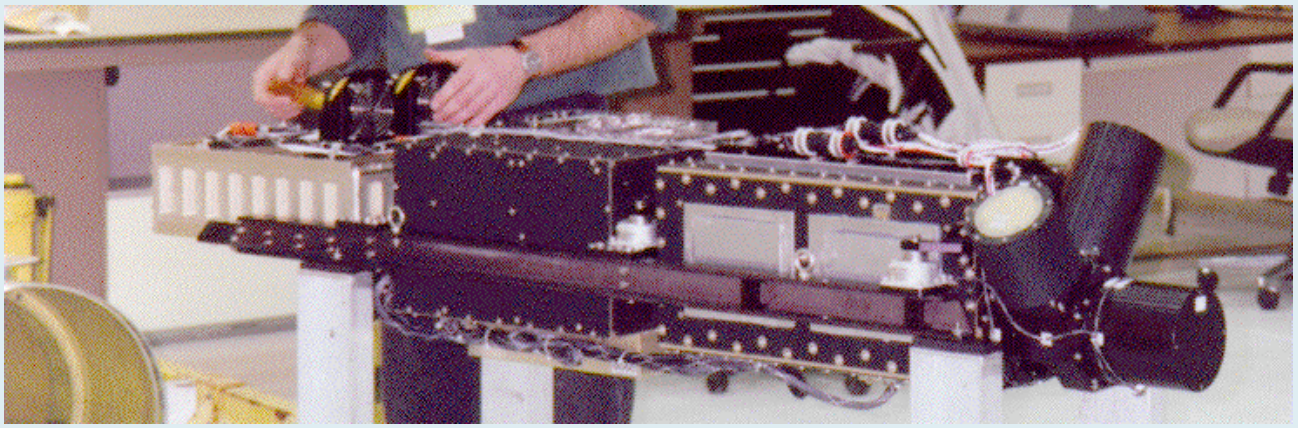
EOS Validation: SAFARI 2000

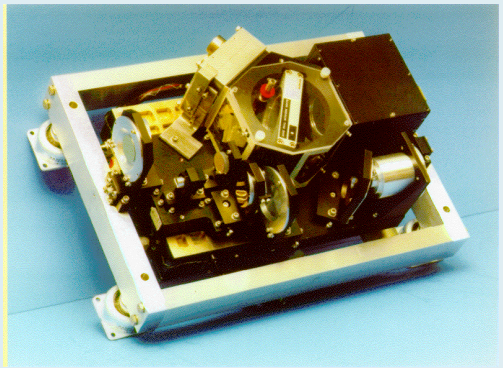
Hank Revercomb
University of Wisconsin - Madison
AIRS Science Team Meeting 19-21 June 2001

Topics:

- Scanning-HIS airborne FTIR (ER-2 and DC-8)
- South African Fires
- Smoke haze
- CO detection
- Land surface emissivity

Scanning-HIS: Aircraft interferometer for NASA ER-2 and DC-8



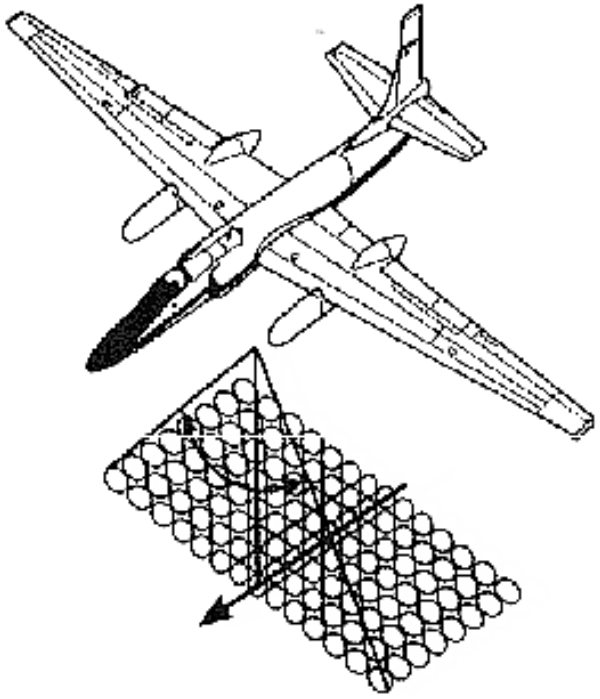


Hank Revercomb
University of Wisconsin, Space Science and Engineering Center

Scanning HIS: ER2 Centerline Pod

(HIS= High-resolution Interferometer Sounder)

Roots:
- U. of Wisconsin HIS Program, 1978-present
- 1st U2/ER2 HIS, 1985-present
- NAST-I, close cousin, for NPOESS testbed (Wingpod)
- First ER-2 Mission: Wintex, 1999

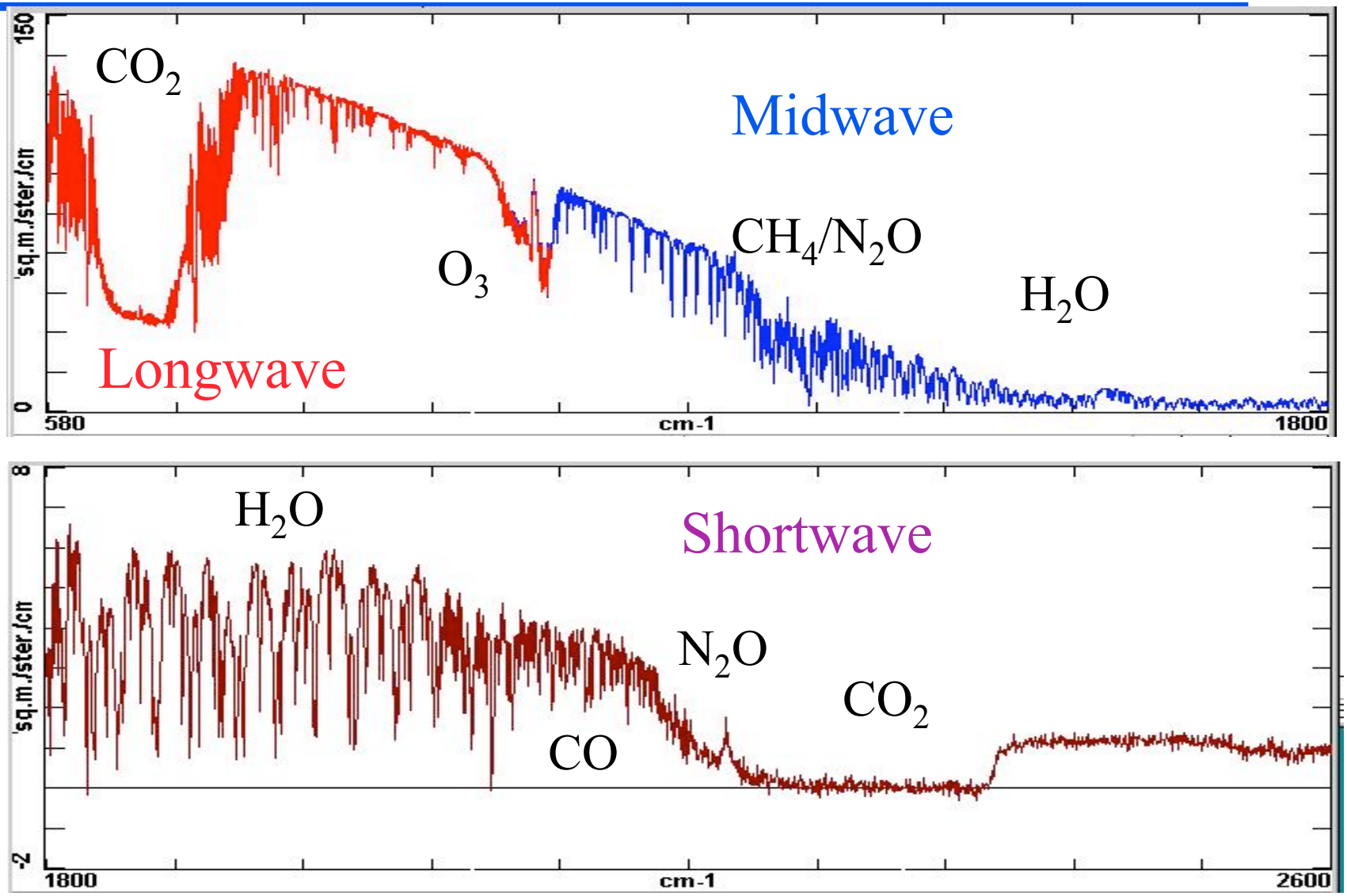


Characteristics:

Spectral Coverage:	3-17 microns
Spectral Resolution:	0.5 cm^{-1}
Resolving power:	1000-6000
Footprint Diameter:	2 km
Cross-Track pattern:	Programmable
SAFARI Swath width:	30 km or Nadir only

Scanning HIS Radiances-24 August 2000

SAFARI Terra Overpass-Clear Water



SHIS Goals for SAFARI

- IR Spectral Characteristics of Smoke/Haze
- CO Detection -- MOPITT comparisons
- Surface Emissivity Variations over wide range of surface types
- Cloud Radiative Properties associated with burning
- Terra/MODIS Validation

Scanning-HIS SAFARI Summary (1)

Hank Revercomb & Robert Knuteson, U of Wisc, 5-30-01

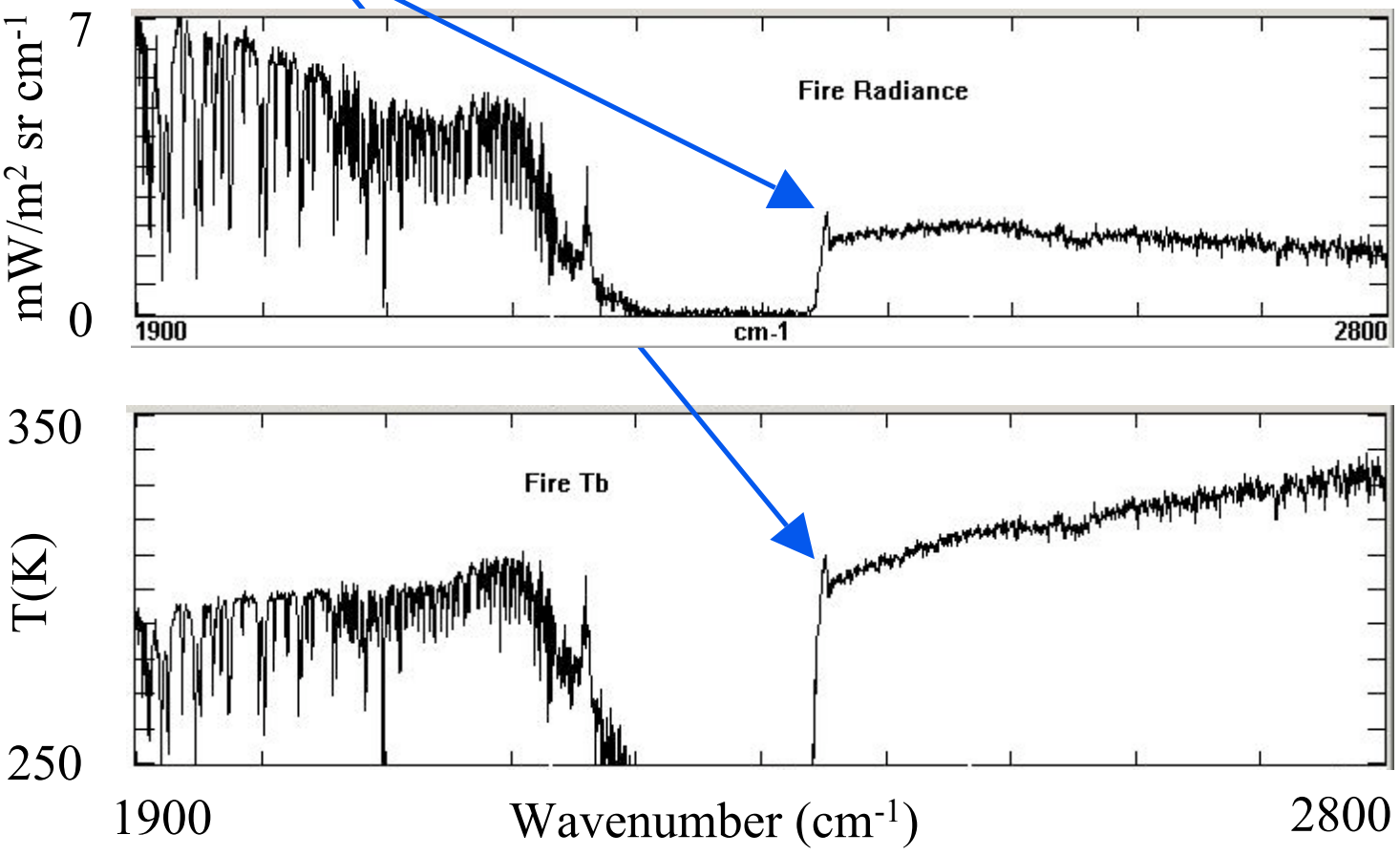
- **Data Collection and Analysis Schedule:**
  - 90 hours of radiance data collected during 14 ER-2 flights
  - Preliminary processing conducted in the field
  - Final radiance processing on 4 of 14 flights (20 hours) complete
  - Radiance processing to be completed by September 2001
  - Early results on CO and surface emissivity planned for AMS Satellite Conference, 15-18 October 2001
  - Smoke/Cloud results by early 2002

- **Current Analysis Status (May 2001):**
  - Identified infrared spectral signature of burning fires (1, 7 Sept 2000)
  - Detected elevated CO concentration associated with burning fires
  - Estimated land surface emissivity in 8-12 micron window for a variety of surface types
  - Started analyses of cloud/smoke/haze (cirrus & haze examples)

Fire Radiometric Signature

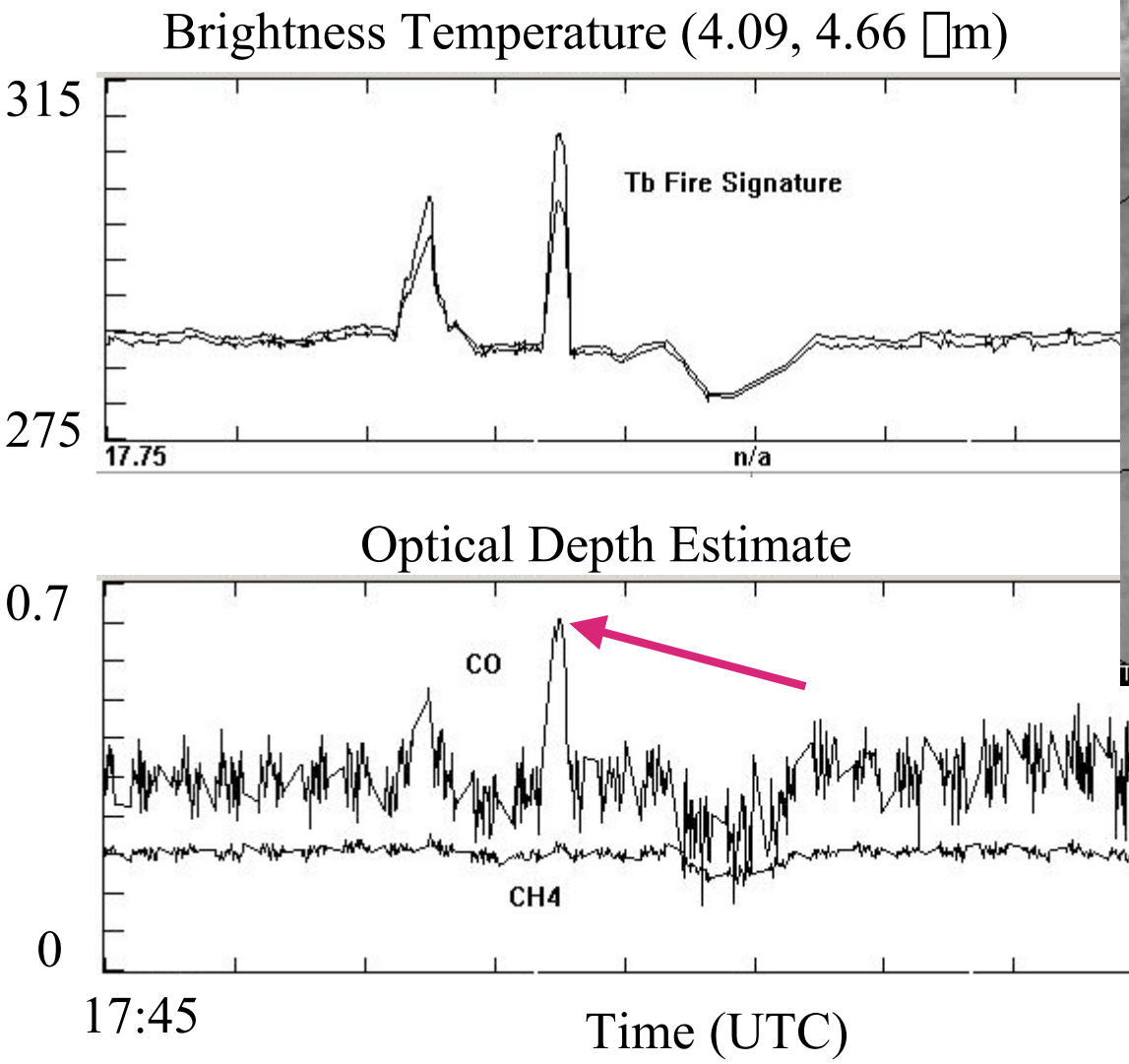
(1 Sept Night Flight, 7 Sept Controlled Burn)

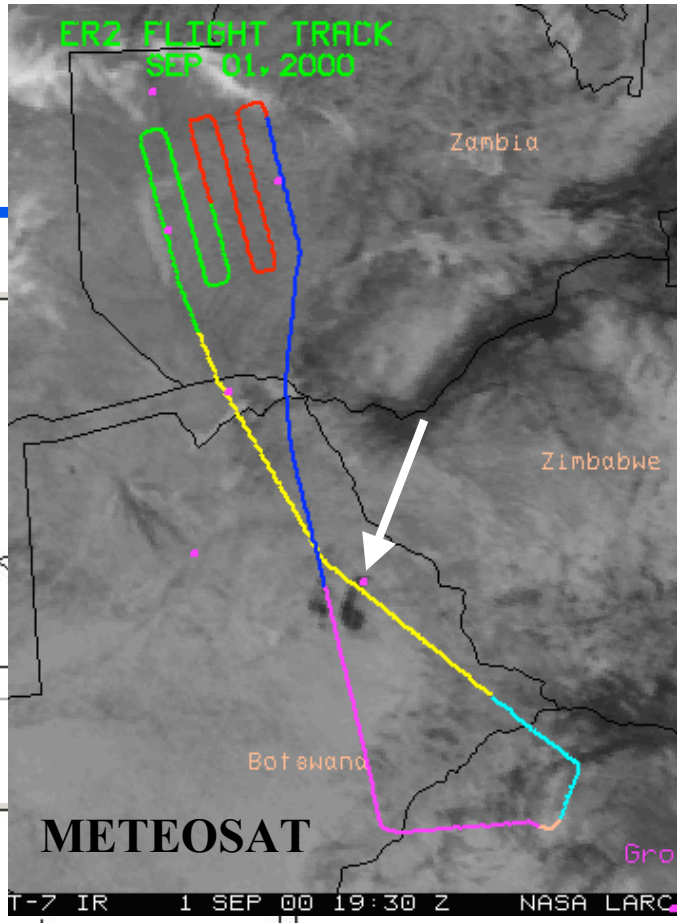
- High temperature and enhanced CO_2 provide a unique "**blue Spike**" signature in high resolution spectra



MAS

CO Detection over Fire
(1 Sept Night Flight)

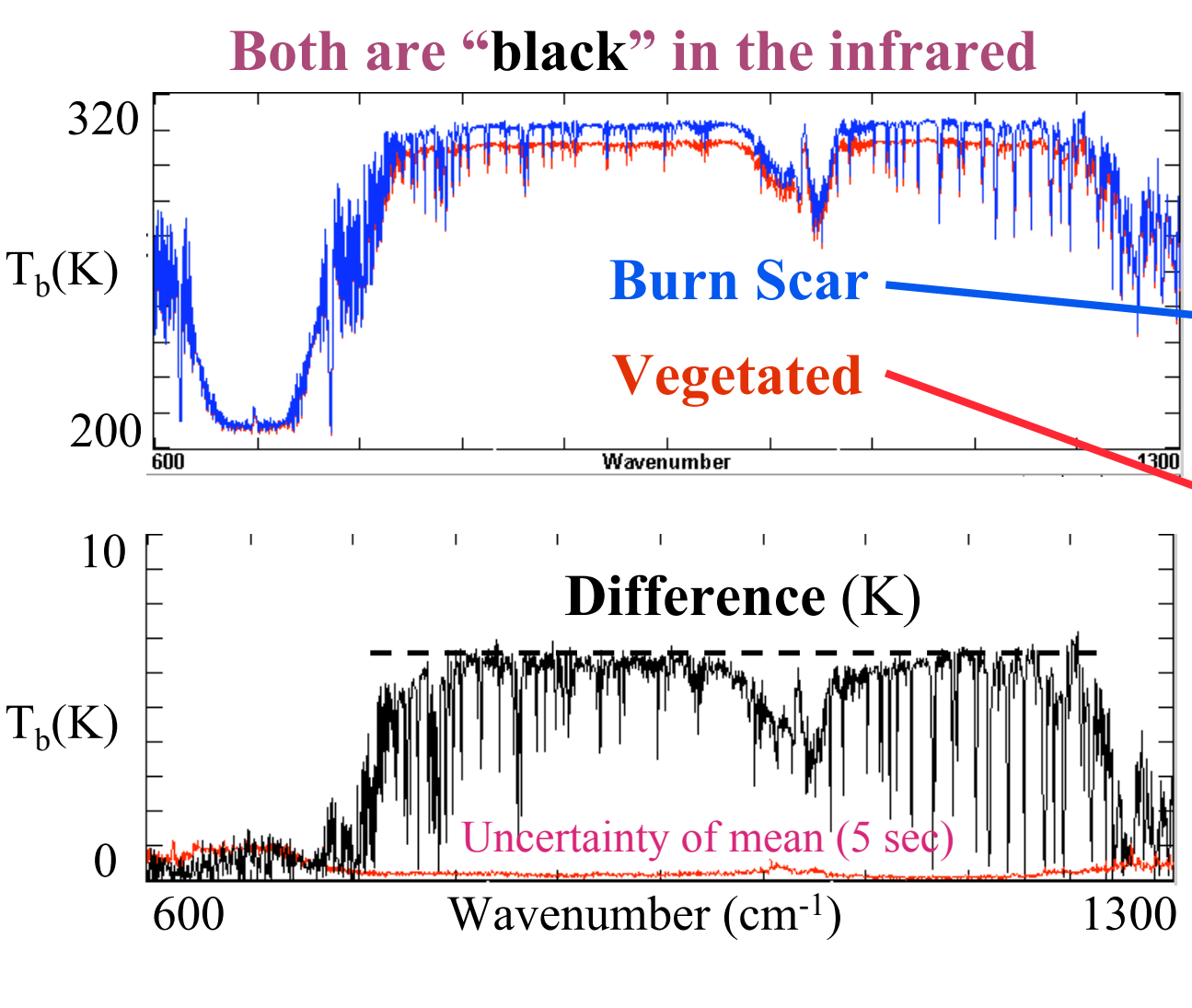




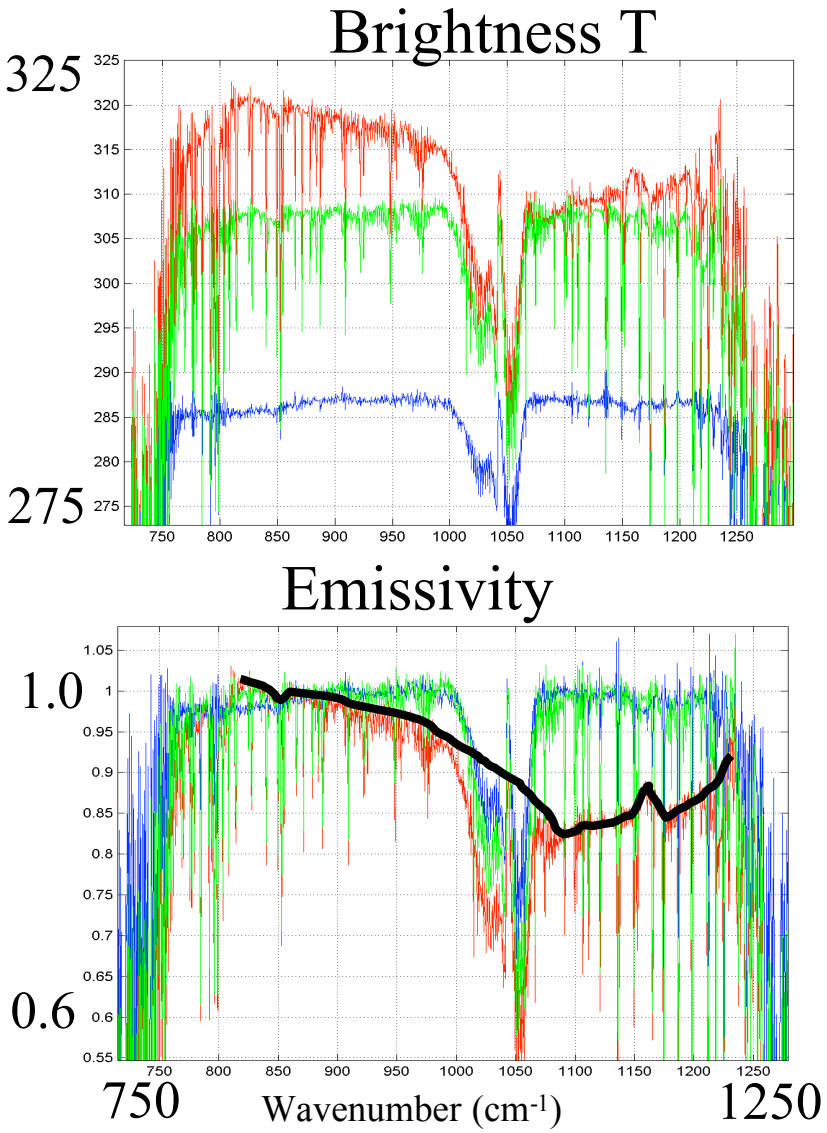
Column CO doubles over the fire

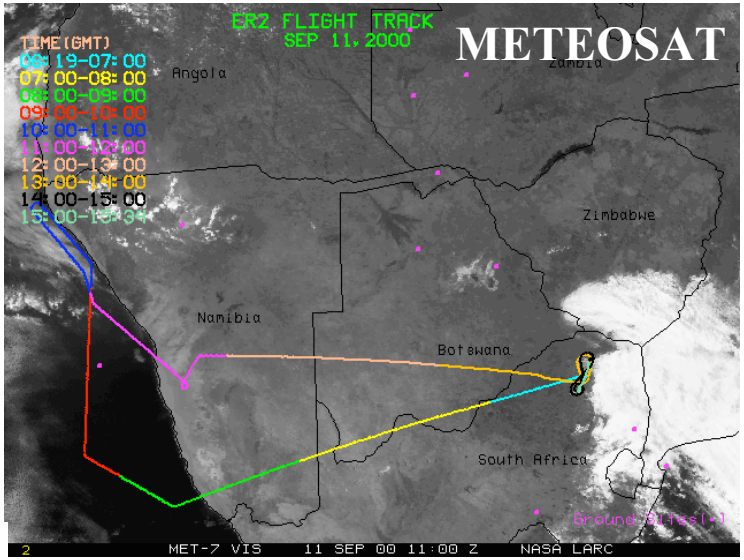
Burn Scar Surface Characteristics

(7 September Controlled Burn)



Namibian Land Surface Emissivity
(11 September 2000)

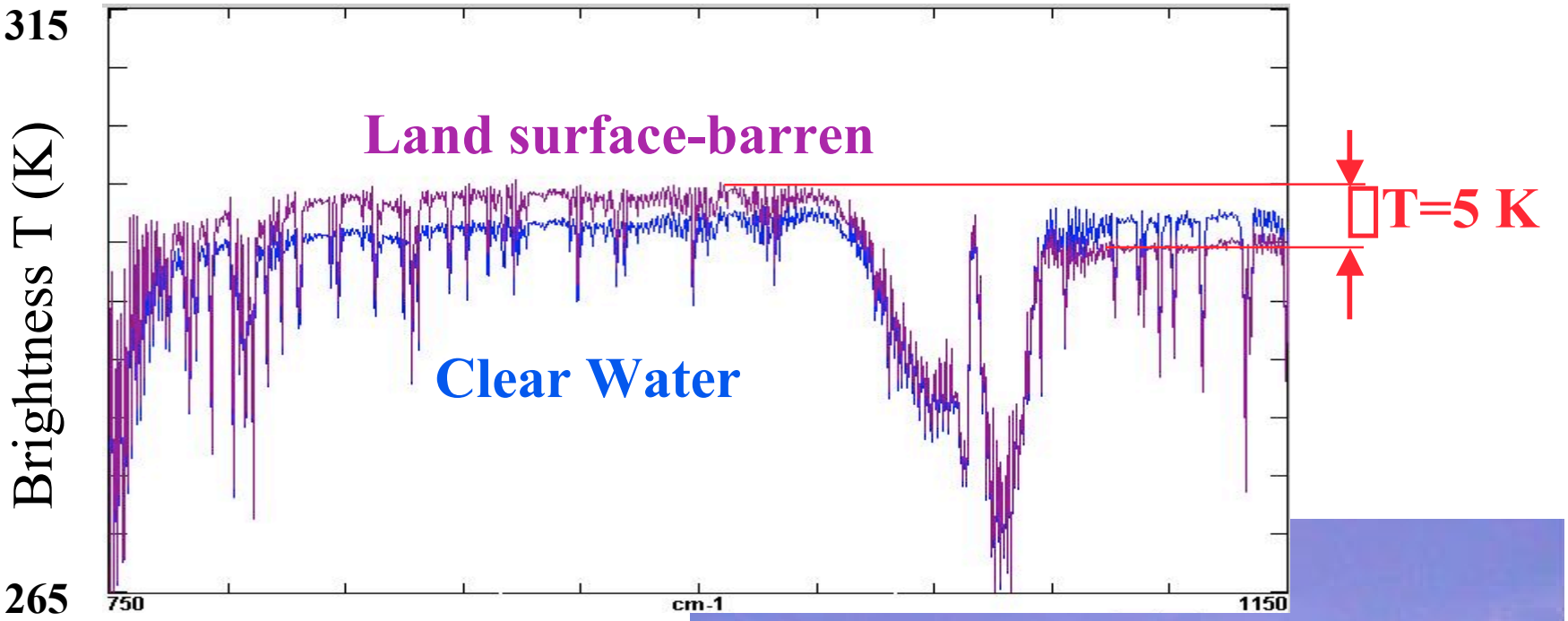




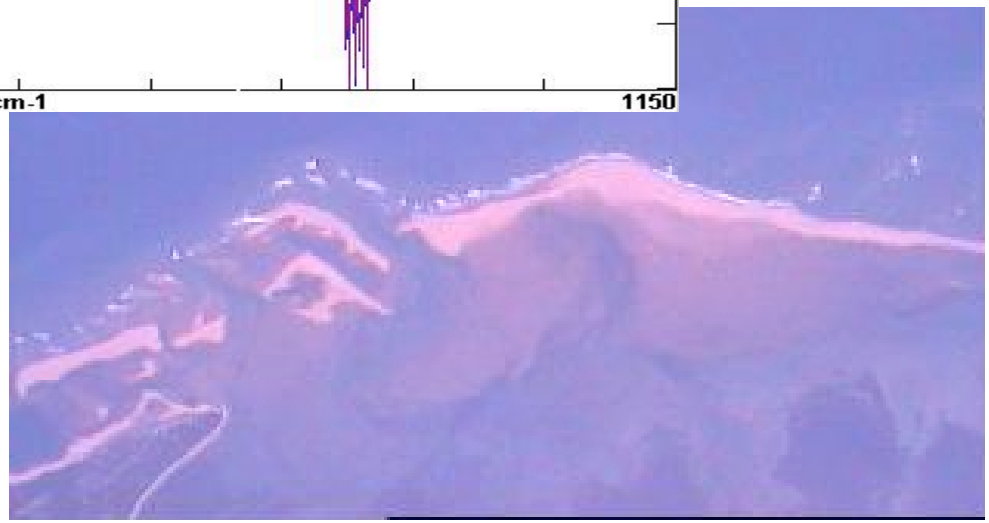
Namibian Coast

- Kuiseb River Canyon
  [Dunes (left)Desert pavement]
- Kalahari Desert (Vegetated)
- Ocean

Inhaco Island Surface Emissivity
(24 August 2000)



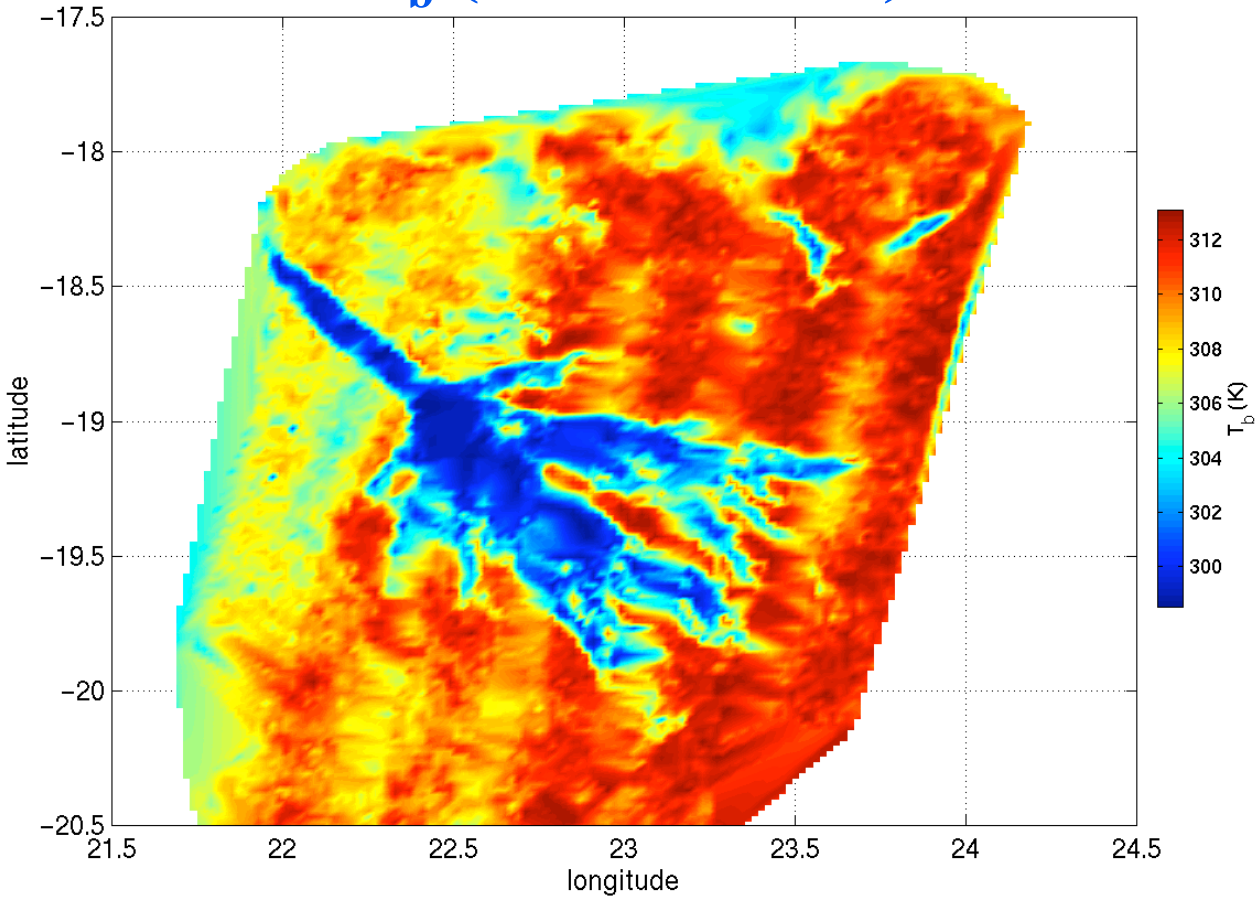
MOPITT-A Video



Okavanga Delta Mapping
(27 August 2000)

Scanning HIS: 2 km footprints

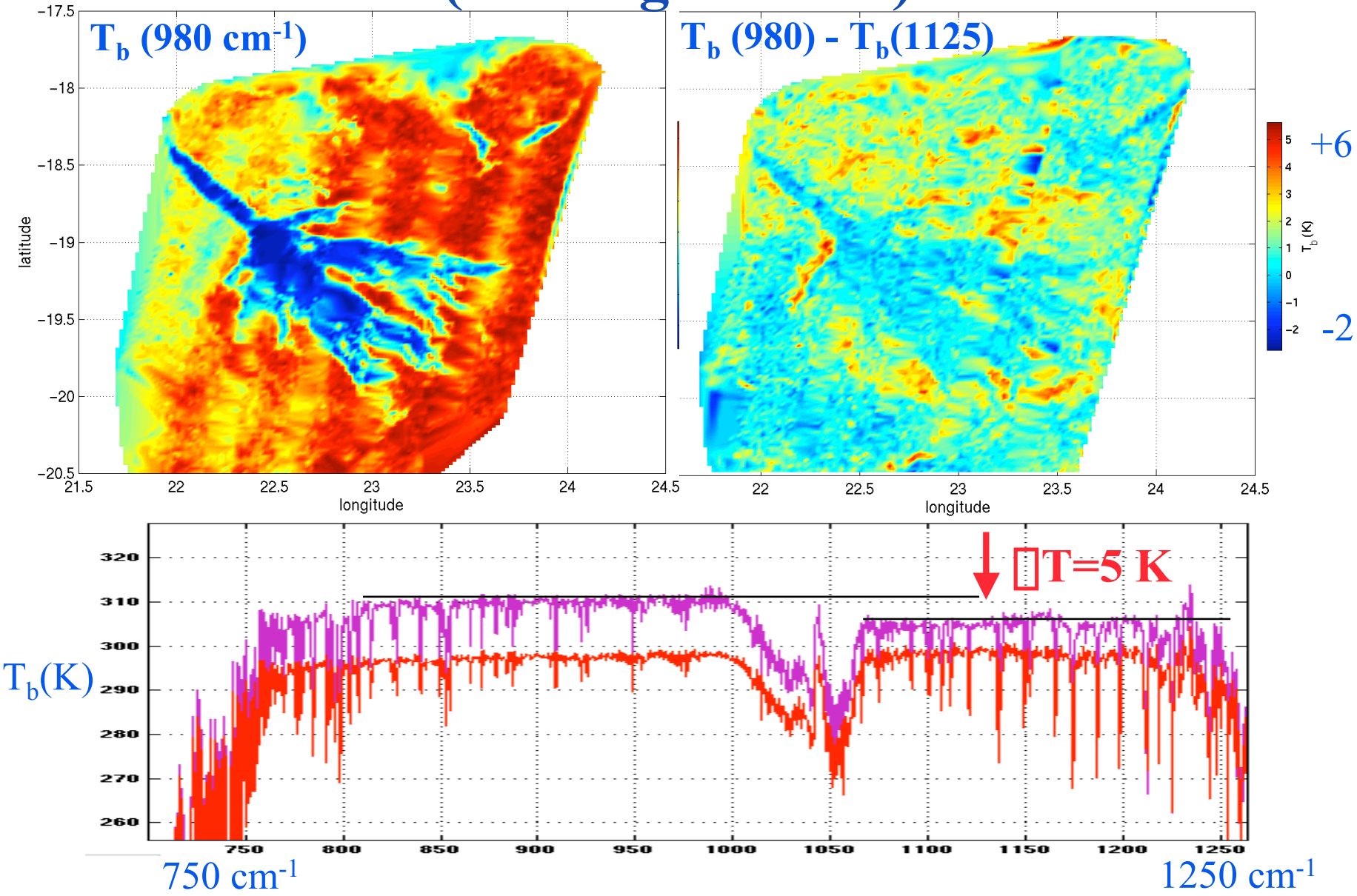
T_b (980-985 cm^{-1})



MODIS: 0.25 km

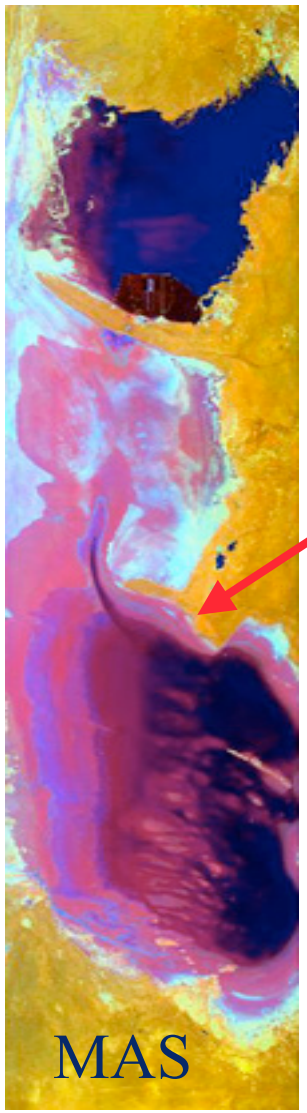
0.65 □m

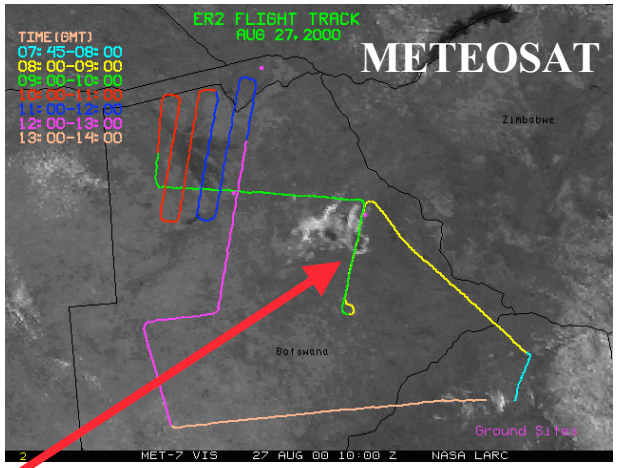
Okavanga Delta Surface Emissivity
(27 August 2000)

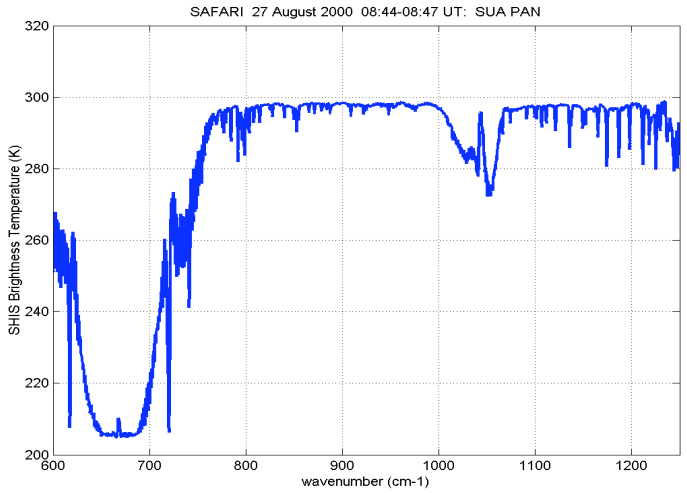


Sua Pan Land Surface Emissivity

(27 August 2000)







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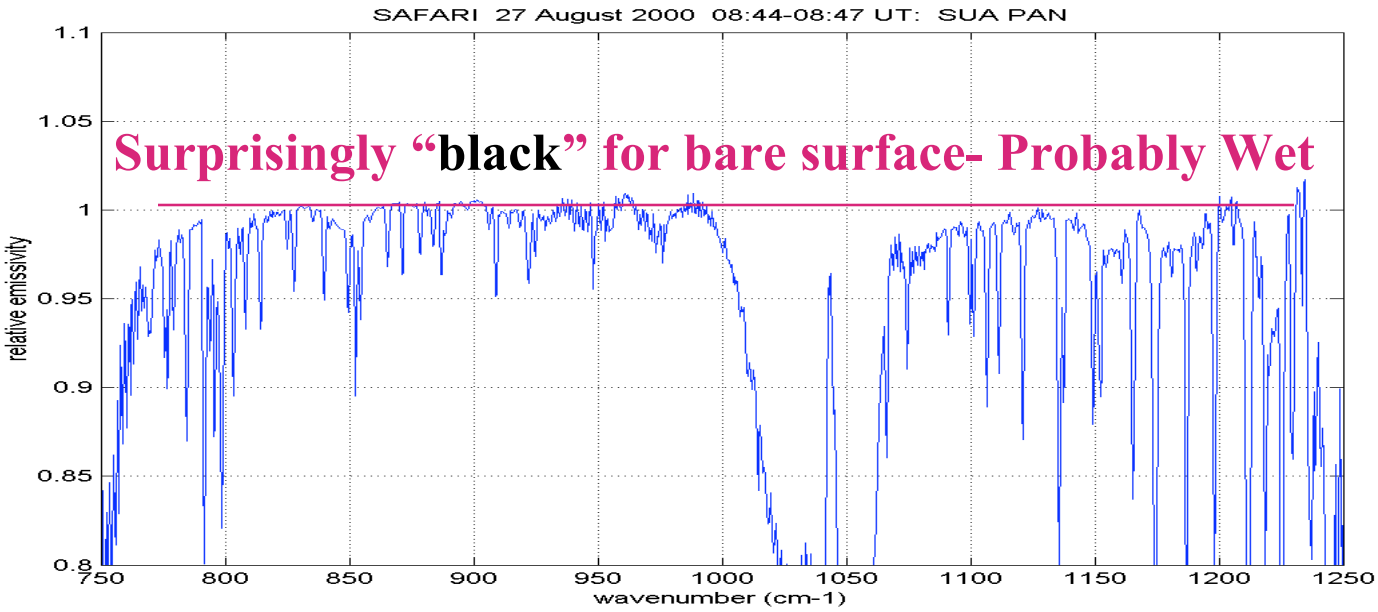
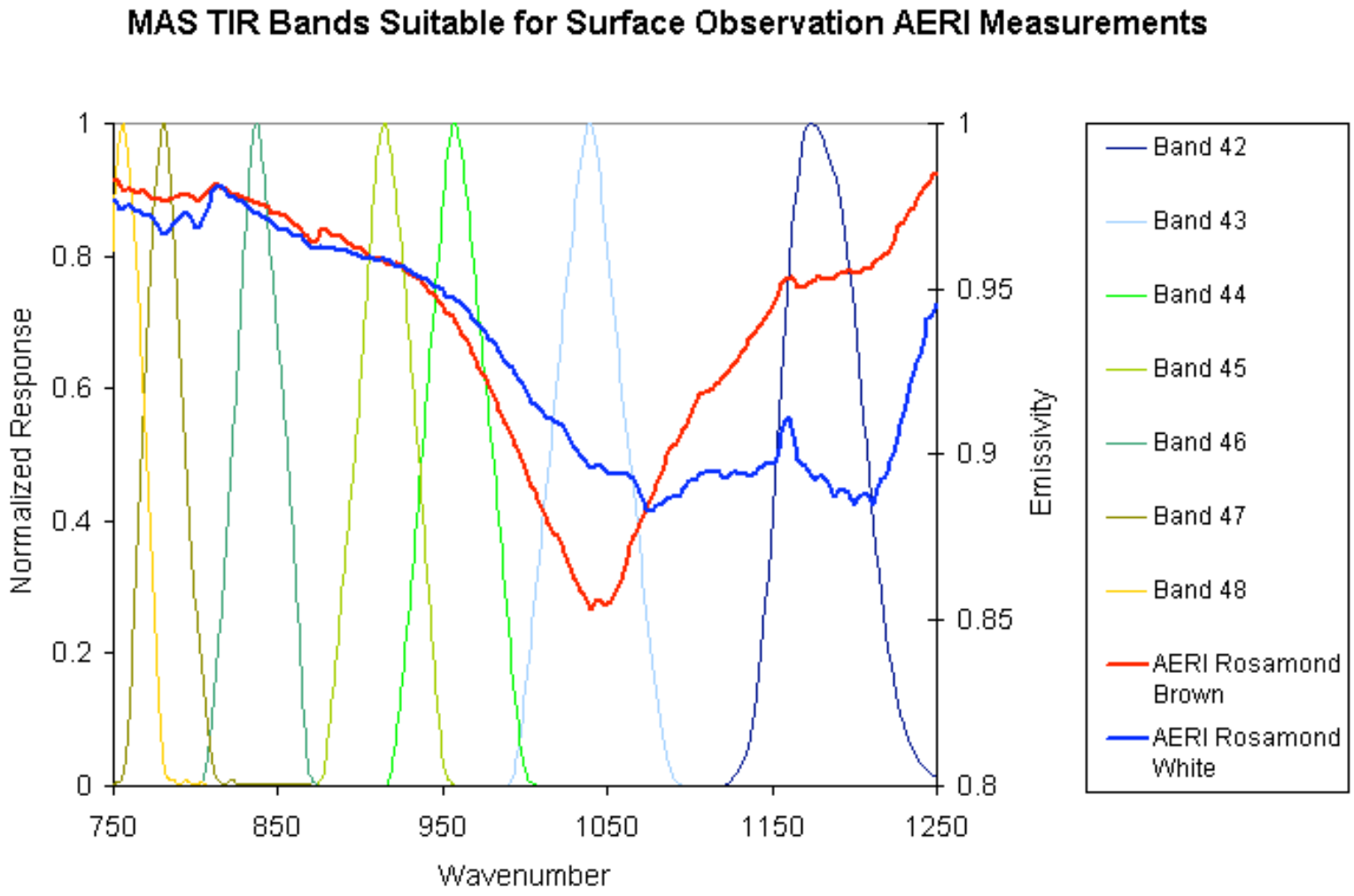
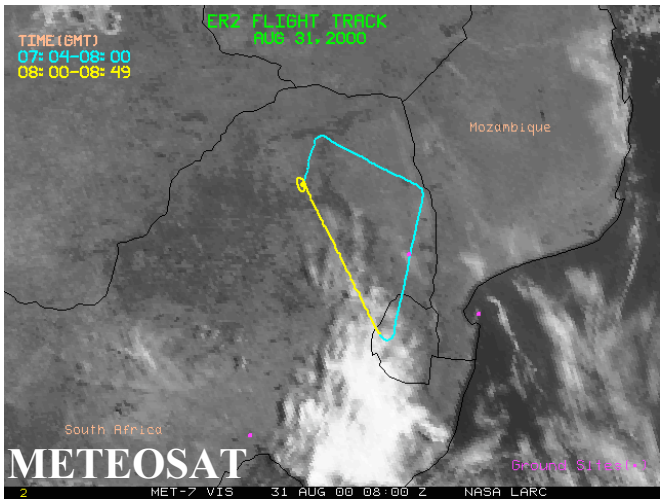


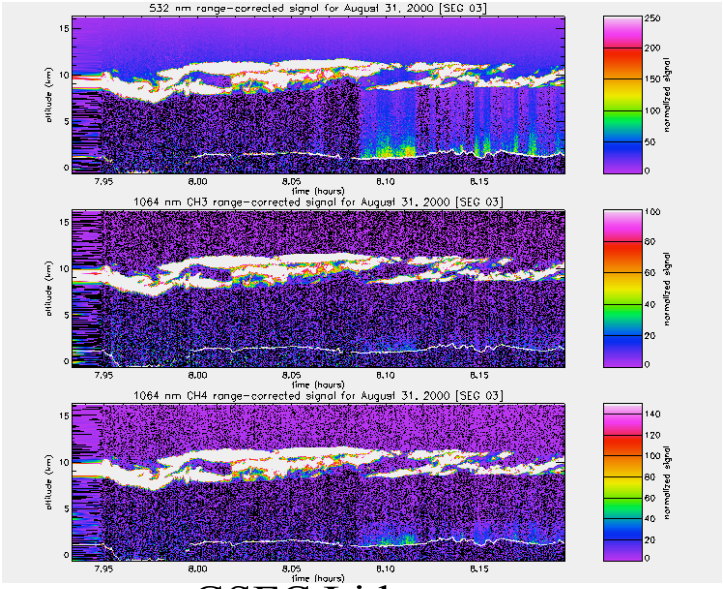
PLAYA CHARACTERIZATION 2. - LAKE Rosamond, Dryden



Cirrus Cloud Radiative Properties

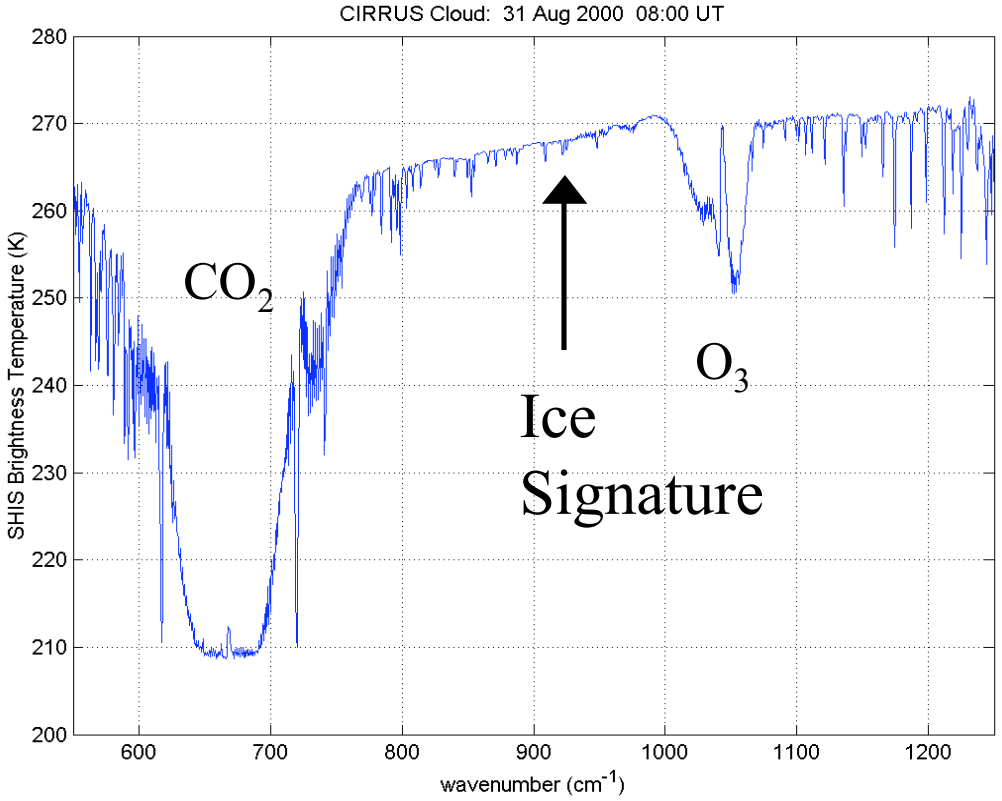
(31 August 2000)



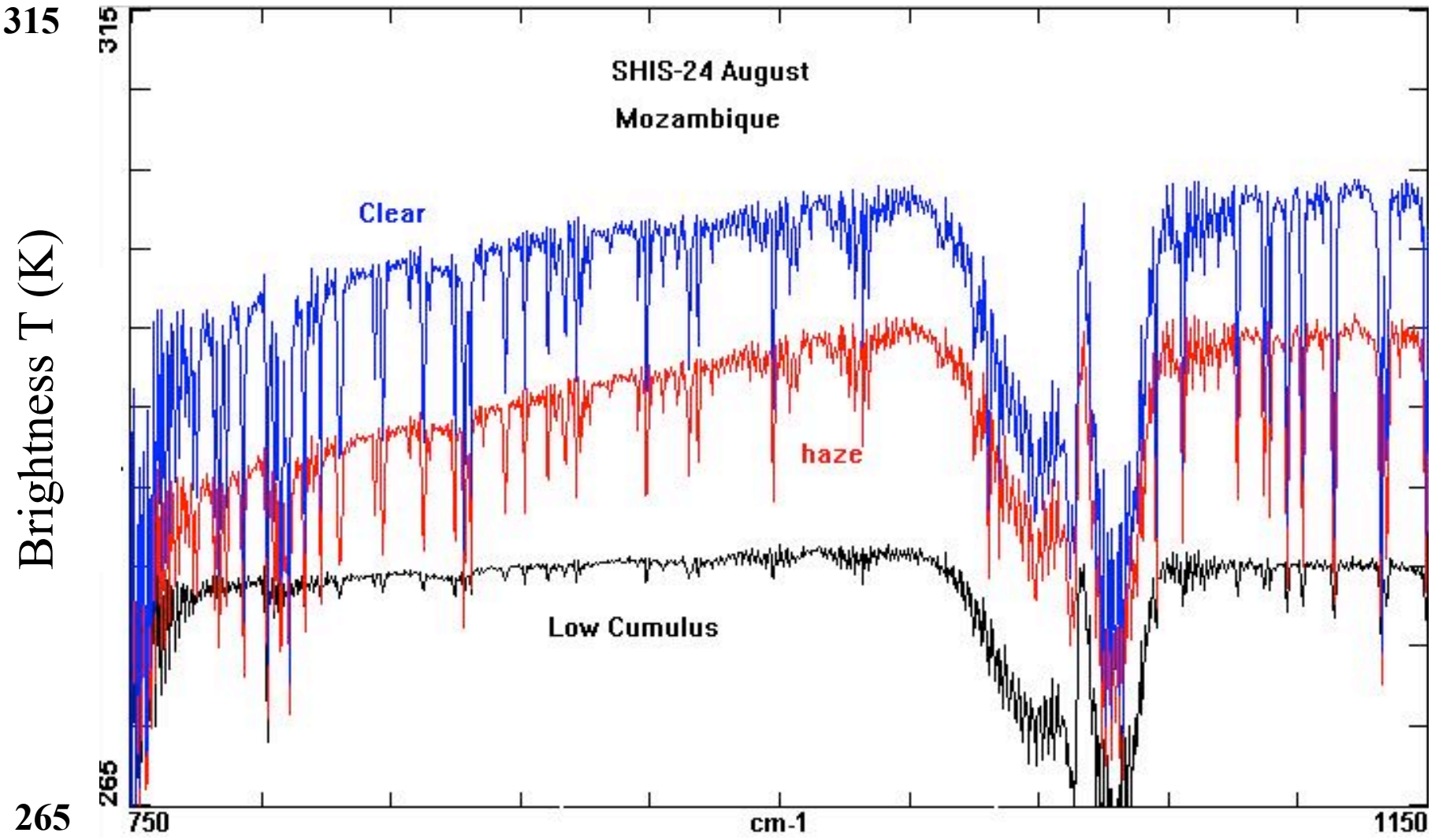


GSFC Lidar

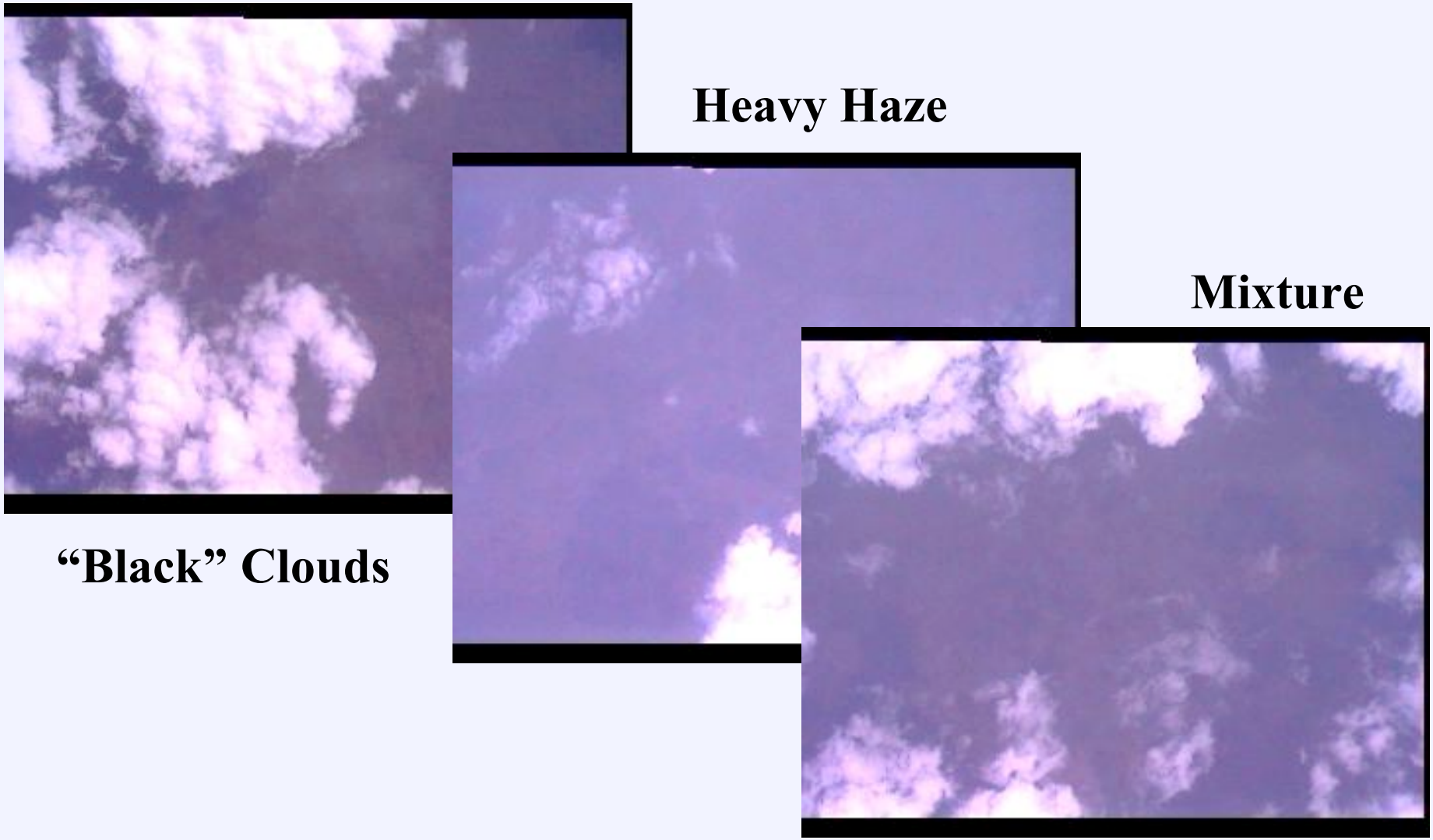
- Small ice particles have absorption cross-sections that lead to "non-black" clouds.



Black Cloud, Haze, and Clear skies (over Mozambique, 24 August 2000)



24 August: Clouds and Haze, and Clear over Mozambique (MOPITT-A Video)



UWisc S-HIS SAFARI Summary (2)

- **Suggested Collaborations:**
  - Carbon Monoxide: MOPITT-A (Jim Drummond, Wallace McMillan)
  - Land Surface Emissivity: MAS (Chris Moeller, Paul Menzel)
  - Cloud/Smoke: MAS (Steve Ackerman, Steve Platnick)
  - Profiling: In situ FTIR on UWash CV 580 (Bob Yokelson)
- **Submitted Abstracts:**
  - Radiometric evaluation of MODIS emissive bands through comparison to ER-2 based MAS data (SPIE*); C. C. Moeller, D. D. LaPorte, H. E. Revercomb, W. P. Menzel
  - Infrared Land Surface Emissivity Retrieval from High-spectral Resolution Upwelling Radiance (AMS**); Robert Knuteson, Brian Osborne, Henry Revercomb, Dave Tobin
  - CO and CH_4 Column Retrieval from S-HIS and NAST-I (AMS**); Kenneth Vinson, Henry Revercomb, H. Ben Howell, Robert Knuteson

* EOS VI Conference, July 29 – Aug 3, 2001, San Diego, CA

** 11th Conf. on Satellite Met. & Ocean., 15-18 Oct., 2001, Madison, WI

S-HIS Data Collection Record

DATE	ER-2 SORTIE	MISSION	DATA START/END		(HOURS)	SCAN MODE
17 AUG 2000	00-147	SKUKUZA / MOZAMBIQUE	N/A			
20 AUG 2000	00-148	BOTSWANA	N/A			
22 AUG 2000	00-149	NORTHERN PROVINCE, SA	N/A			
24 AUG 2000	00-150	INHACA ISLAND, MOZ.	06:50	13:50	(7)	NADIR
25 AUG 2000	00-151	SUA PAN, BOTSWANA	06:50	13:00	(6)	NADIR
27 AUG 2000	**00-152**	**OKVANGA DELTA**	**07:35**	**13:00**	**(5.5)**	**SCANNING**
29 AUG 2000	00-153	NORTHERN PROVINCE, SA	07:50	13:50	(6)	SCANNING
31 AUG 2000	**00-154**	**NORTHERN PROVINCE, SA**	**07:00**	**08:45**	**(1.5)**	**NADIR**
1 SEP 2000	**00-155**	**NIGHT FLIGHT ZAMBIA 17:00**	**22:00**	**(5)**	**NADIR**	
4 SEP 2000	00-156	SUA PAN, BOTSWANA	N/A			
6 SEP 2000	00-157	MONGU TOWER, ZAMBIA	06:30	12:30	(6)	NADIR
7 SEP 2000	**00-158**	**TIMBAVATI, S.A.**	**07:17**	**13:00**	**(5.5)**	**NADIR**
9 SEP 2000	00-159	PRETORIA AIR SHOW	N/A			
11 SEP 2000	**00-160**	**NAMIBIA**	**07:30**	**14:30**	**(7)**	**NADIR**
13 SEP 2000	00-175	NAMIBIA	06:30	14:30	(8)	SCANNING
14 SEP 2000	00-176	NAMIBIA	08:00	09:00	(1)	SCANNING
17 SEP 2000	00-177	ZAMBIA	06:30	14:00	(7.5)	SCANNING
21 SEP 2000	00-178	OFFSHORE MOZAMBIQUE	07:30	13:00	(5.5)	SCANNING
23 SEP 2000	00-179	SKUKUZA	07:30	12:00	(4.5)	SCANNING
			TOTAL HOURS:		**89**	

N/A = Data Not Available

http:\\cimss.ssec.wisc.edu (S-HIS link)