OV-10 RADIATIVE FLUX MEASURMENTS

W. L. Smith Jr.,
NASA LaRC, Hampton, VA.

C. K. Rutledge, T. Zhang, F. Denn, B. Fabbri, K. Hoffman, J. Madigan

AS&M, Inc., Hampton, VA.

CLAMS DATA WORKSHOP
Lanham, MD
February 26 – 27, 2002

NASA Langley OV-10

Operating Altitude
100ft – 10kft

Duration: ~2hours

2-3 flights/day

C-FAR : CERES Fixed wing Airborne Radiometer

Up and Downlooking Radiometers

- ASD Fieldspec (350-2200 nm; 10nm res) spectral flux
- Eppley broadband LW & SW fluxes

In-situ temperature, humidity, pressure

OV-10 OBJECTIVES

- Determine how well COVE upwelling measurements represent the nearby sea (Does the platform contaminate the measurements?)
- Determine how to scale up COVE data to satellite footprint
  - What's the nature of the variability in ocean optical properties on the scale of a MODIS pixel
- Measure spectral SW and broadband flux profiles to validate CERES SARB
- Make spectral albedo measurements coincident with CAR BRDF's
- Determine aerosol shortwave radiative forcing for a few cases


CHESAPEAKE

Measurement Strategy

Flux Profiles

- Straight legs at altitudes ranging from 100 ft to 10kft

Scene Variability (scales of 60 m +)

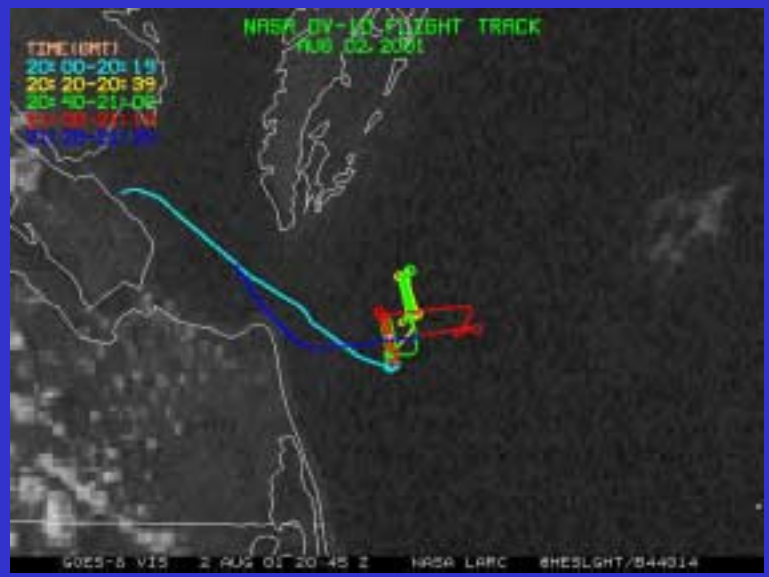
- 2x4 km crop-duster or 4 km daisy pattern (600 ft altitude)
- 100 ft legs

COVE Upwelling Validity tests:

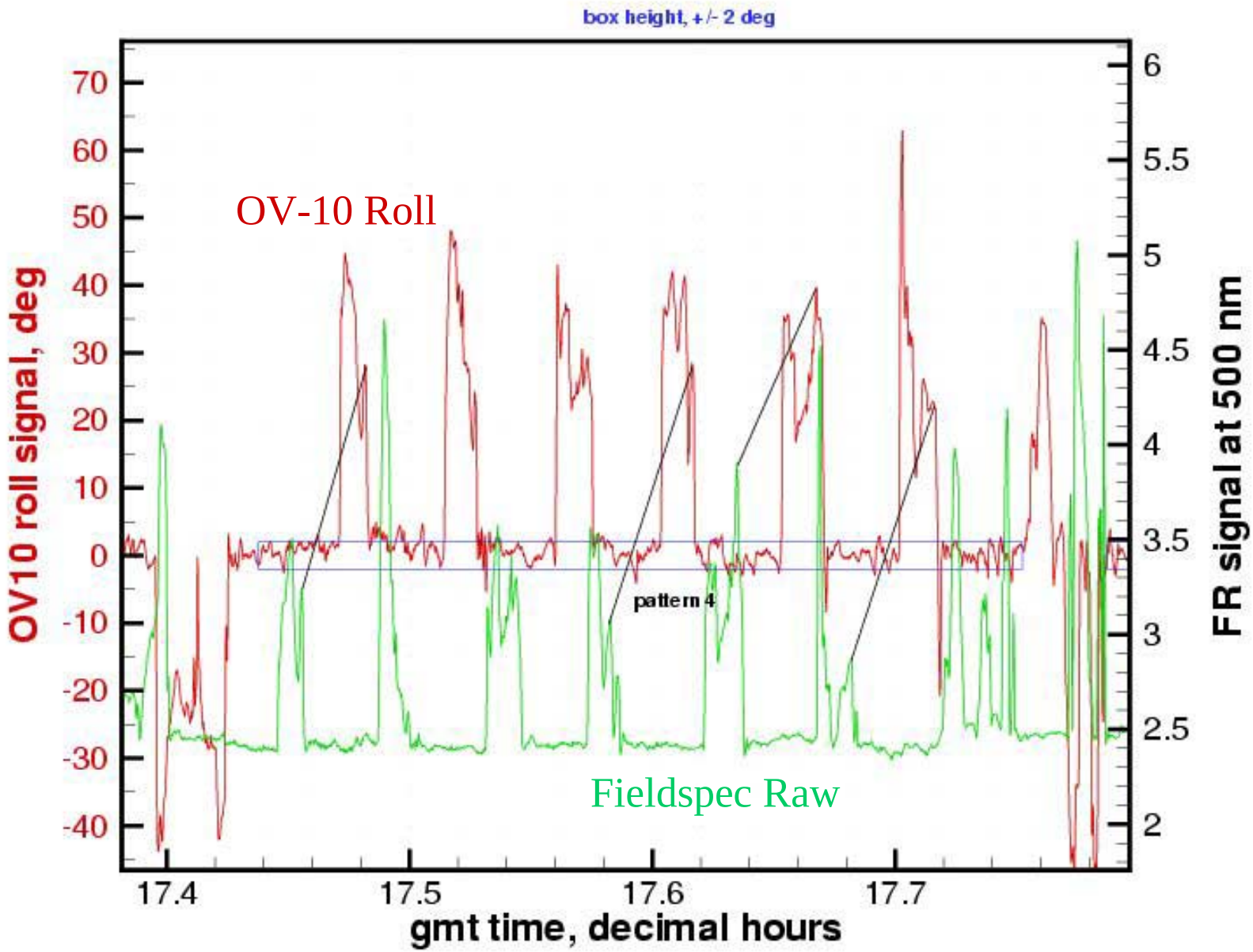
- 100 ft legs over COVE
- 600 ft crop-dusters (COVE vs Adjacent Sea)

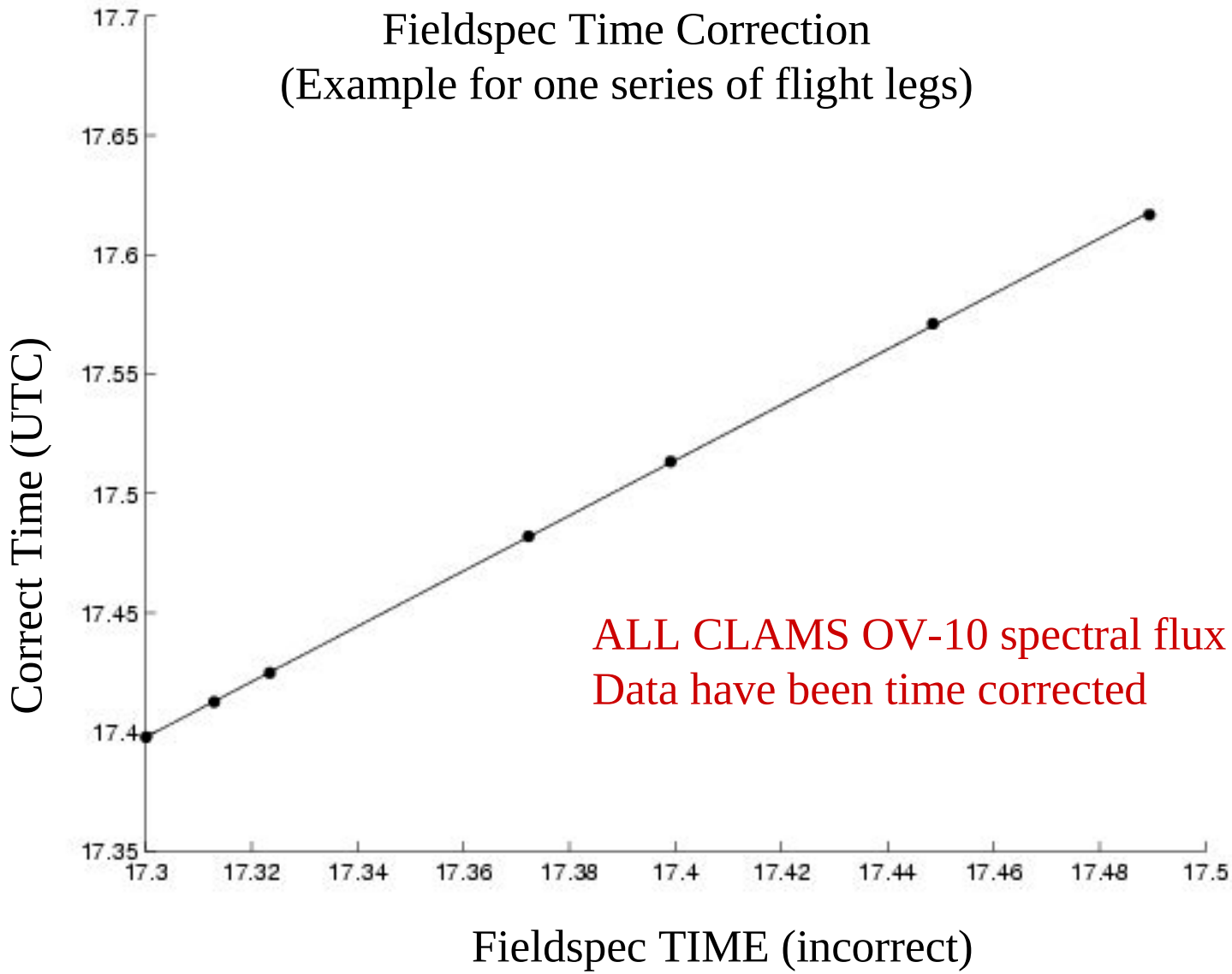
CAR BRDF Coincidence

- 600 ft crop-duster or daisy

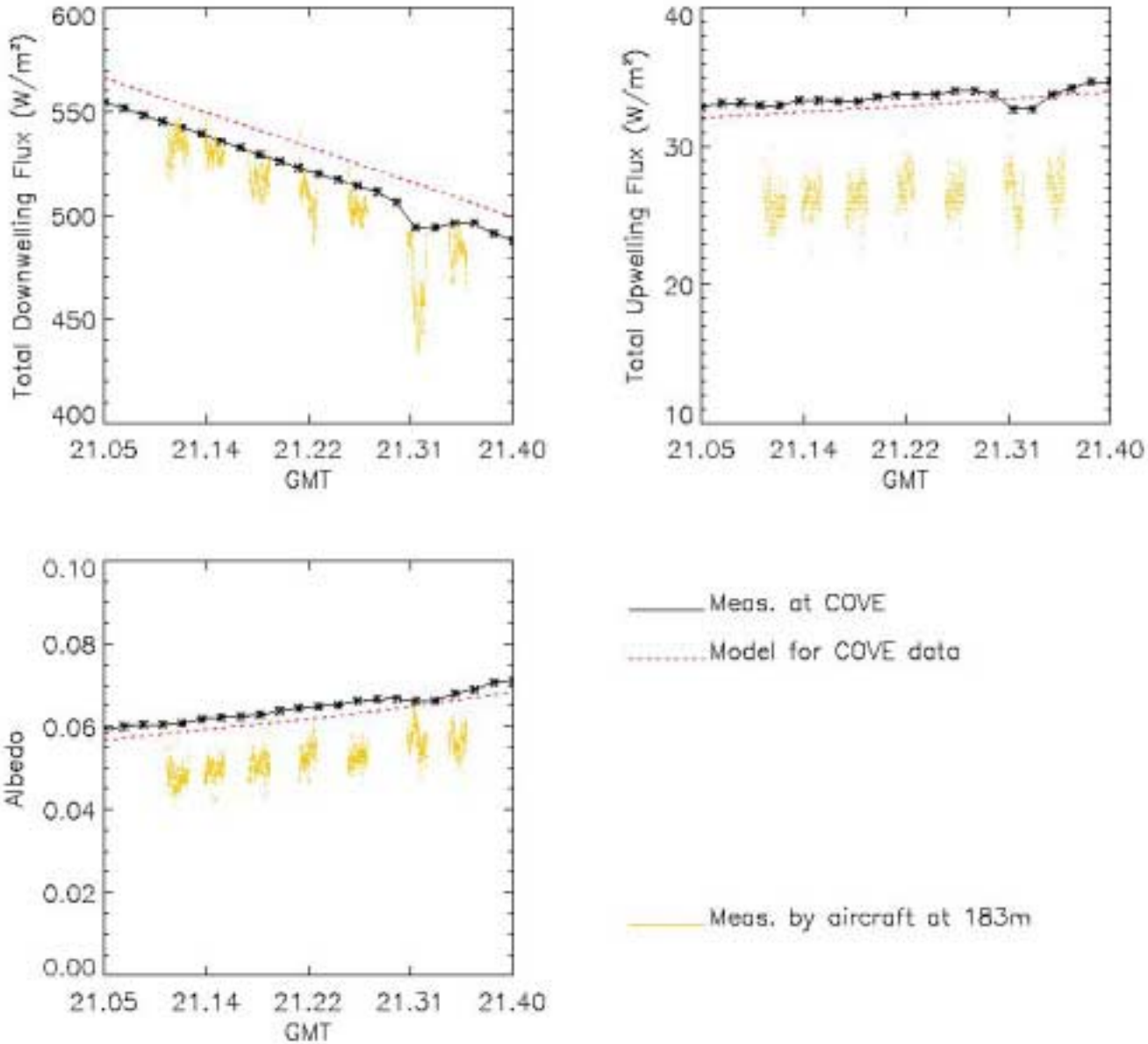


ASD FR Fieldspec TIME STAMP ERRORS

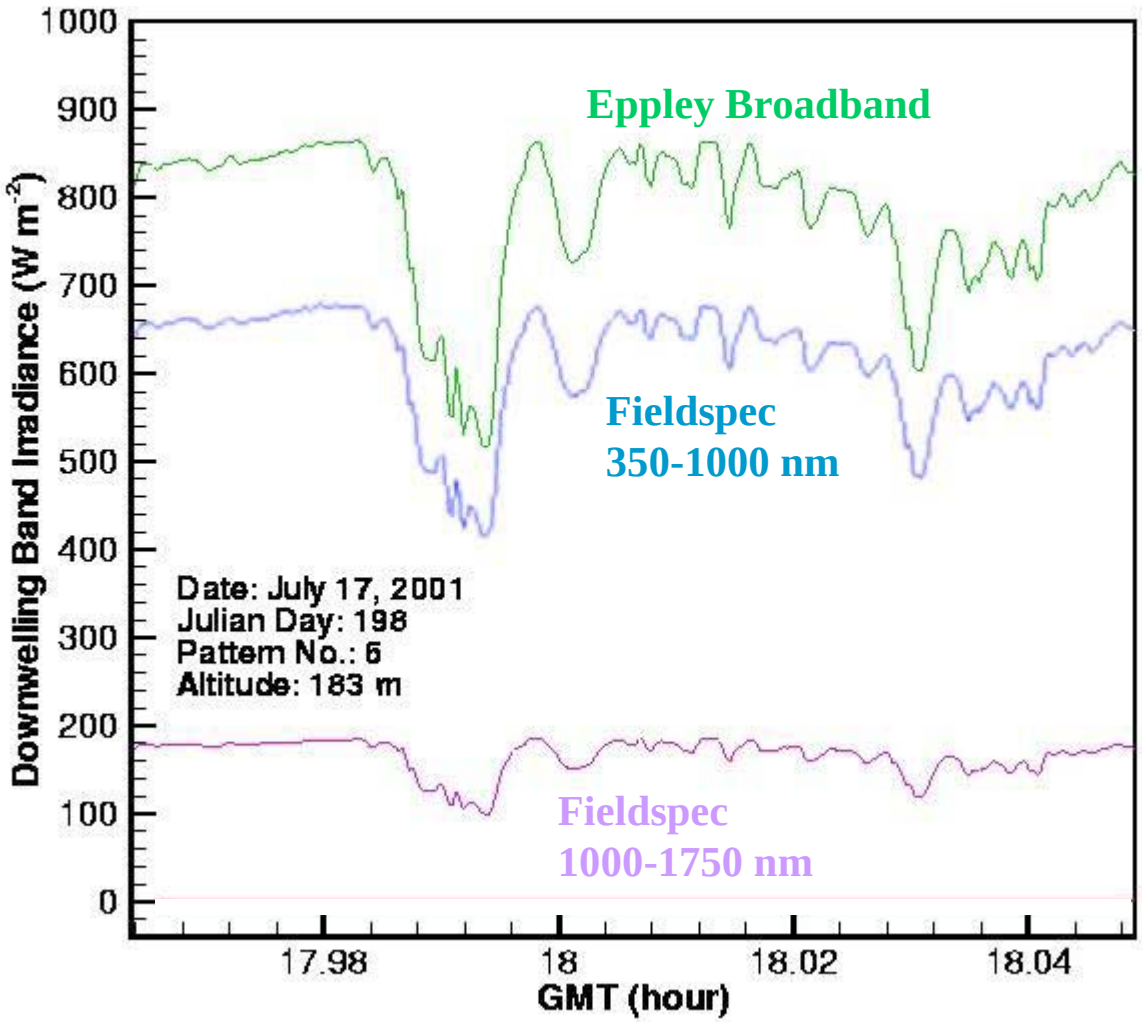



Fieldspec Time Correction
(Example for one series of flight legs)
Correct Time (UTC)
17.7
17.65
17.6
17.55
17.5
17.45
17.4
17.35
17.3
17.32
17.34
17.36
17.38
17.4
17.42
17.44
17.46
17.48
17.5
Fieldspec TIME (incorrect)
ALL CLAMS OV-10 spectral flux
Data have been time corrected

OV-10 Broadband Measurements still Uncertain



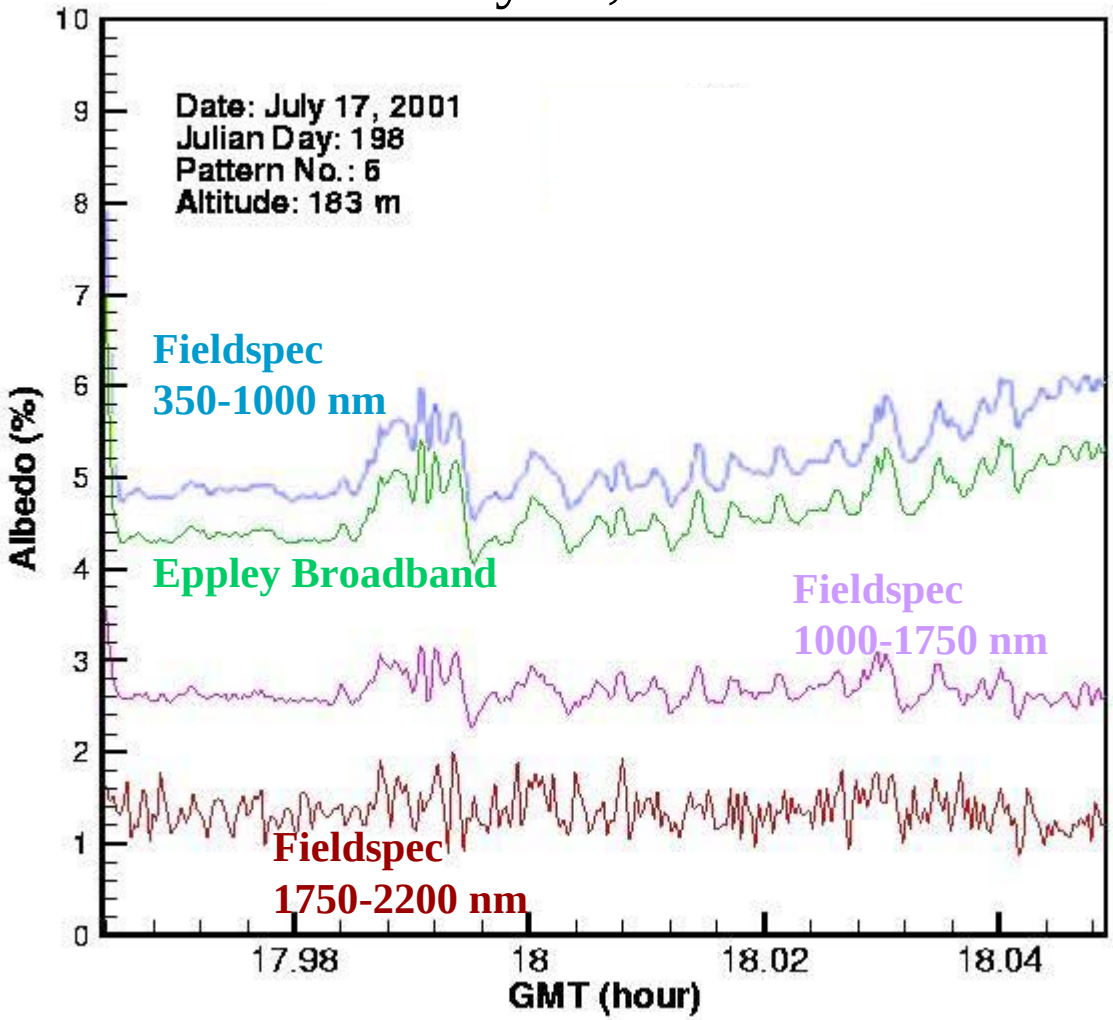
Downwelling Irradiance
July 17, 2001

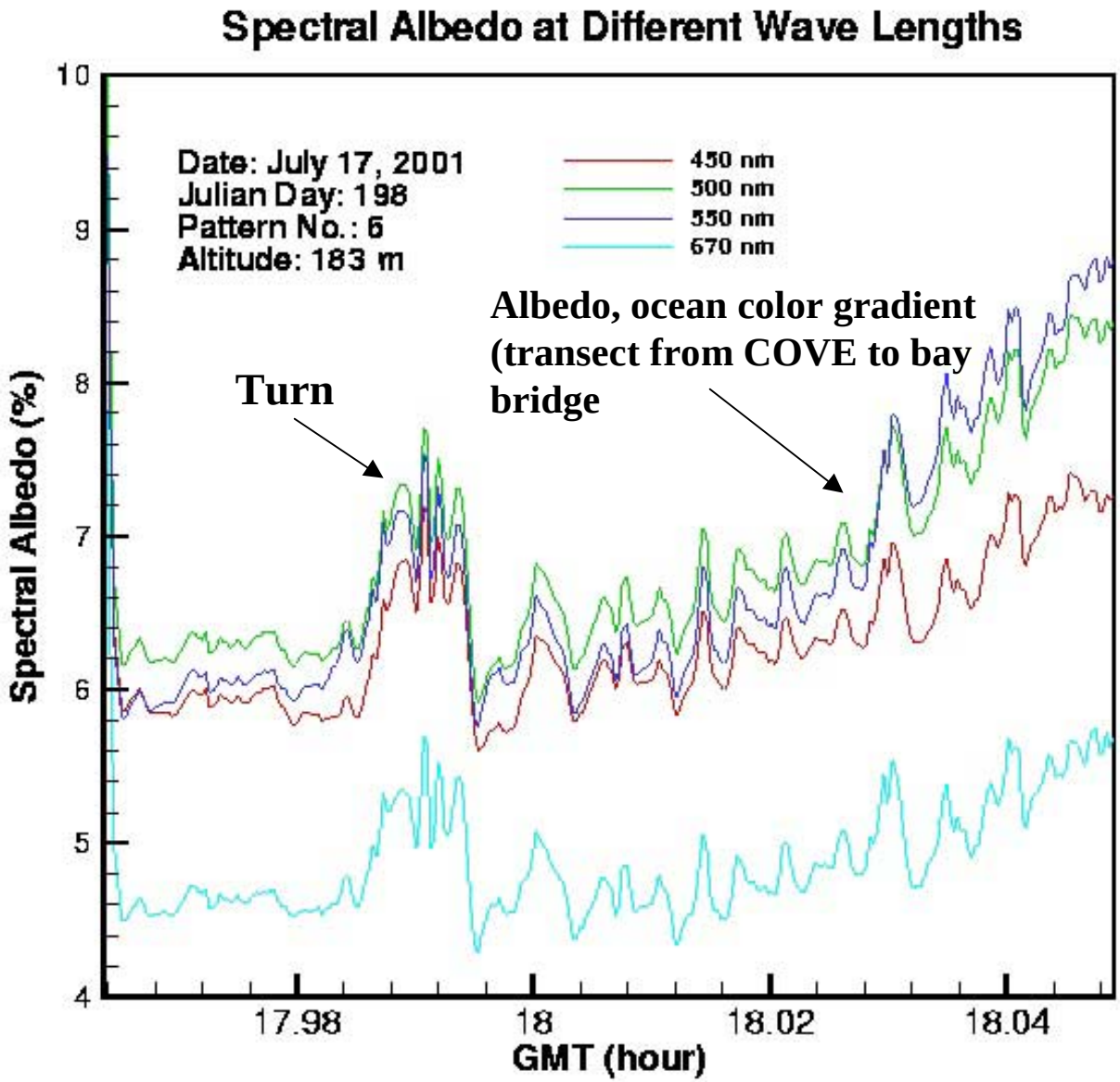


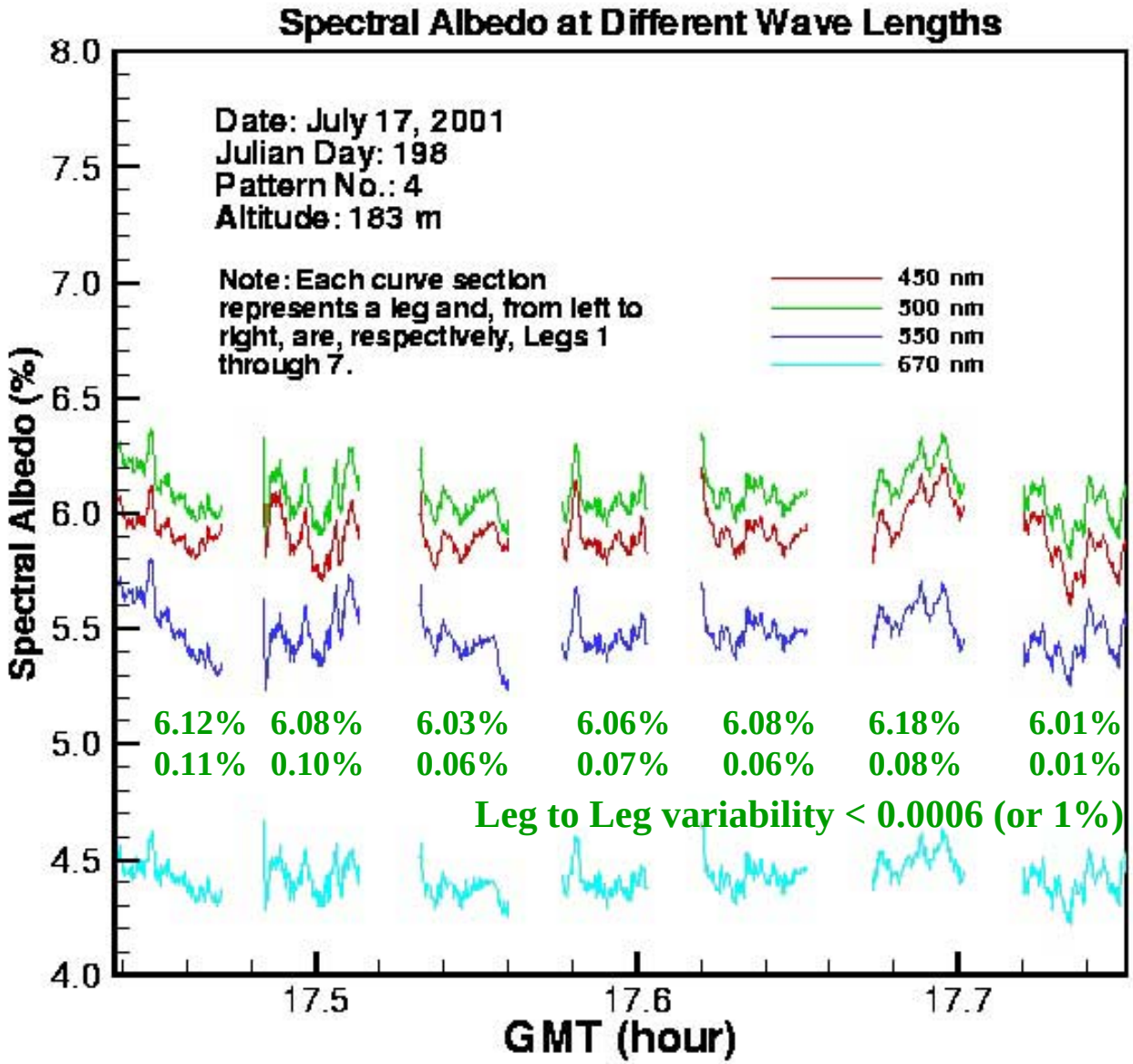
Electronic Noise (~10% of signal) has been eliminated from the Eppley data without affecting the radiative signal

Time-stamp errors corrected so that the Eppley and and Fieldspec data track very well

ALBEDO COMPARISON
July 17, 2001

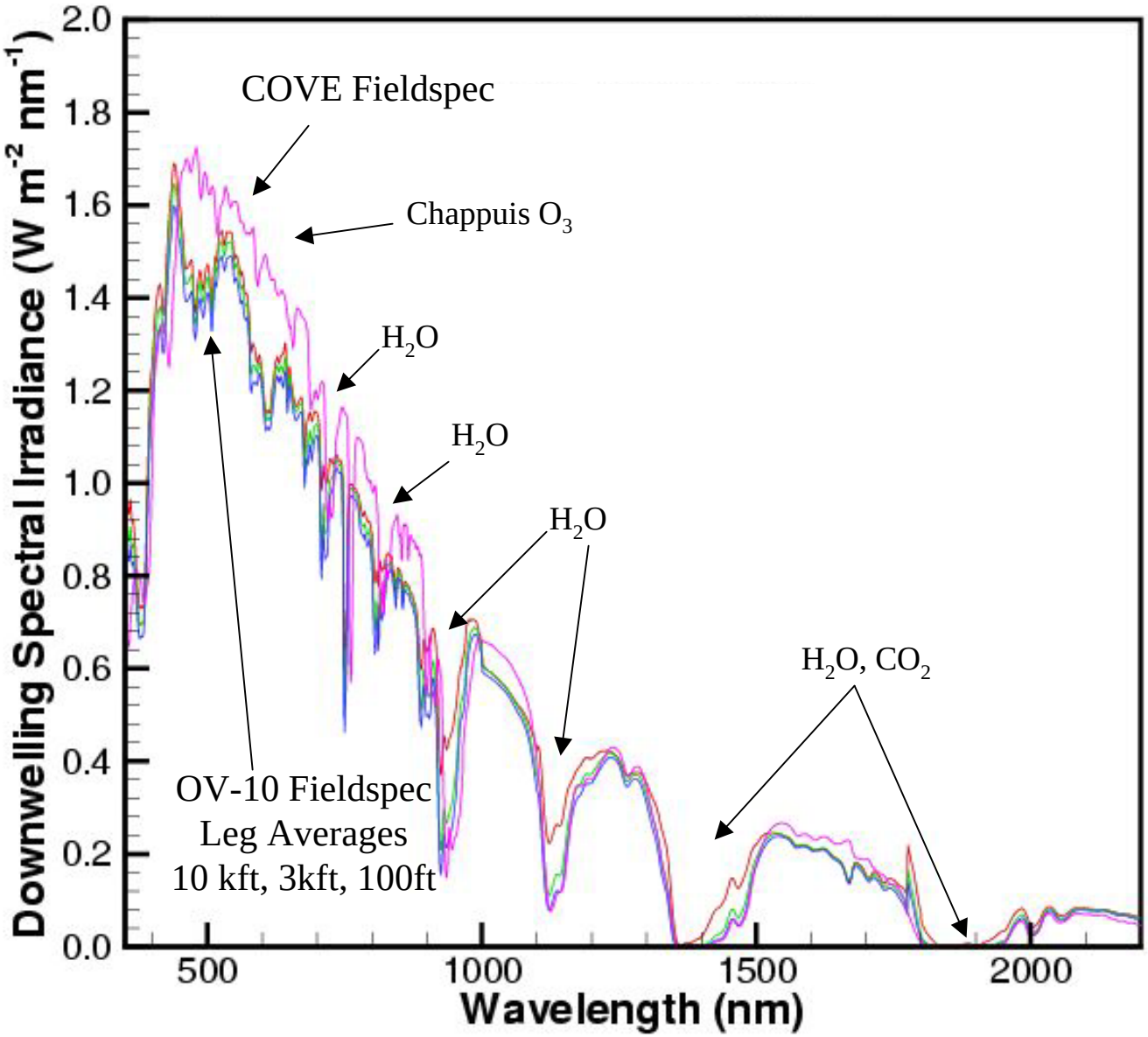


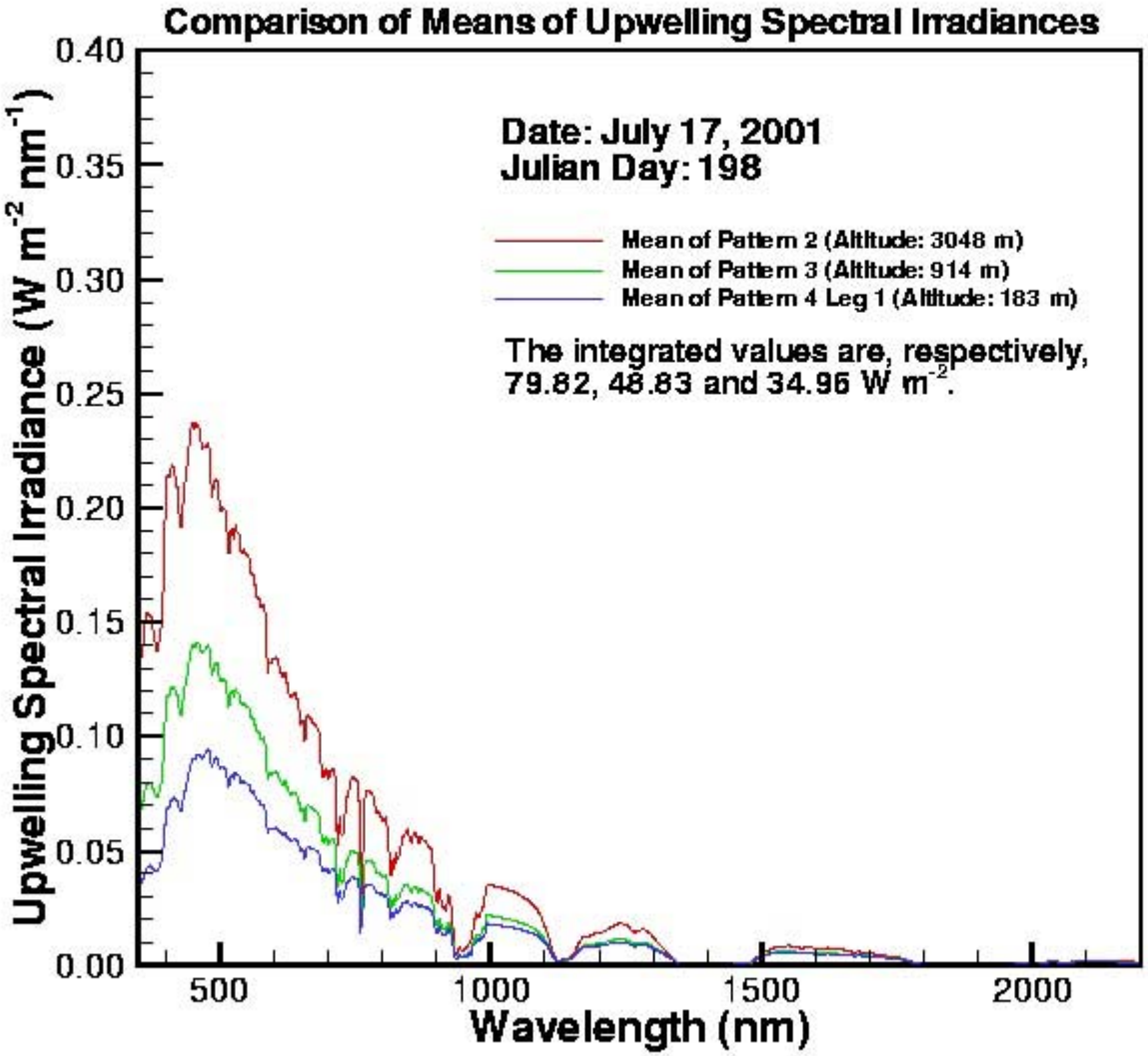

Spectral Albedo at Different Wave Lengths
Date: July 17, 2001
Julian Day: 198
Pattern No.: 6
Altitude: 183 m
450 nm
500 nm
550 nm
670 nm
Albedo, ocean color gradient (transect from COVE to bay bridge
Turn
Spectral Albedo (%)
10
9
8
7
6
5
4
17.98
18
18.02
18.04
GMT (hour)



500 nm
=mean
=sigma

Comparison of OV-10 and COVE Downwelling Spectral Flux




Comparison of Means of Upwelling Spectral Irradiances
Date: July 17, 2001
Julian Day: 198
Mean of Pattern 2 (Altitude: 3048 m)
Mean of Pattern 3 (Altitude: 914 m)
Mean of Pattern 4 Leg 1 (Altitude: 183 m)
The integrated values are, respectively, 79.82, 48.83 and 34.96 W m-2.
Upwelling Spectral Irradiance (W m-2 nm-1)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
500
1000
1500
2000
Wavelength (nm)

Summary

- 12 OV-10 flights were made during CLAMS (~25 hours)
- A time stamp problem with the spectral flux data was discovered and has been corrected
- Electronic noise in the broadband data on the order of 10% has been effectively eliminated with a digital filter.
- Spectral and broadband fluxes track very well
- Analysis of the 600 ft crop-duster patterns indicate variability in ocean optical properties in the vicinity of COVE on the scale of a few MODIS pixels (2-4 km) is very small (less than 0.0006 in albedo on July 17)
- Work is under way to refine all our radiometer calibrations including an absolute calibration for the ASD spectral radiometers – Mauna Loa calibration just completed
- Several vertical flux profiles were obtained coincident with CERES overpass. Spectral column absorption and radiative forcing calculations await resolution of calibration issues.
- Upwelling flux differences between the OV-10 and COVE are unrealistically large (~30%). Need to determine if this is a measurement problem on the OV-10 or calibration issue.
- The uplooking spectral radiometer on the OV-10 suffered an unknown anomoly – apparent light loss in the visible. Under investigation.