

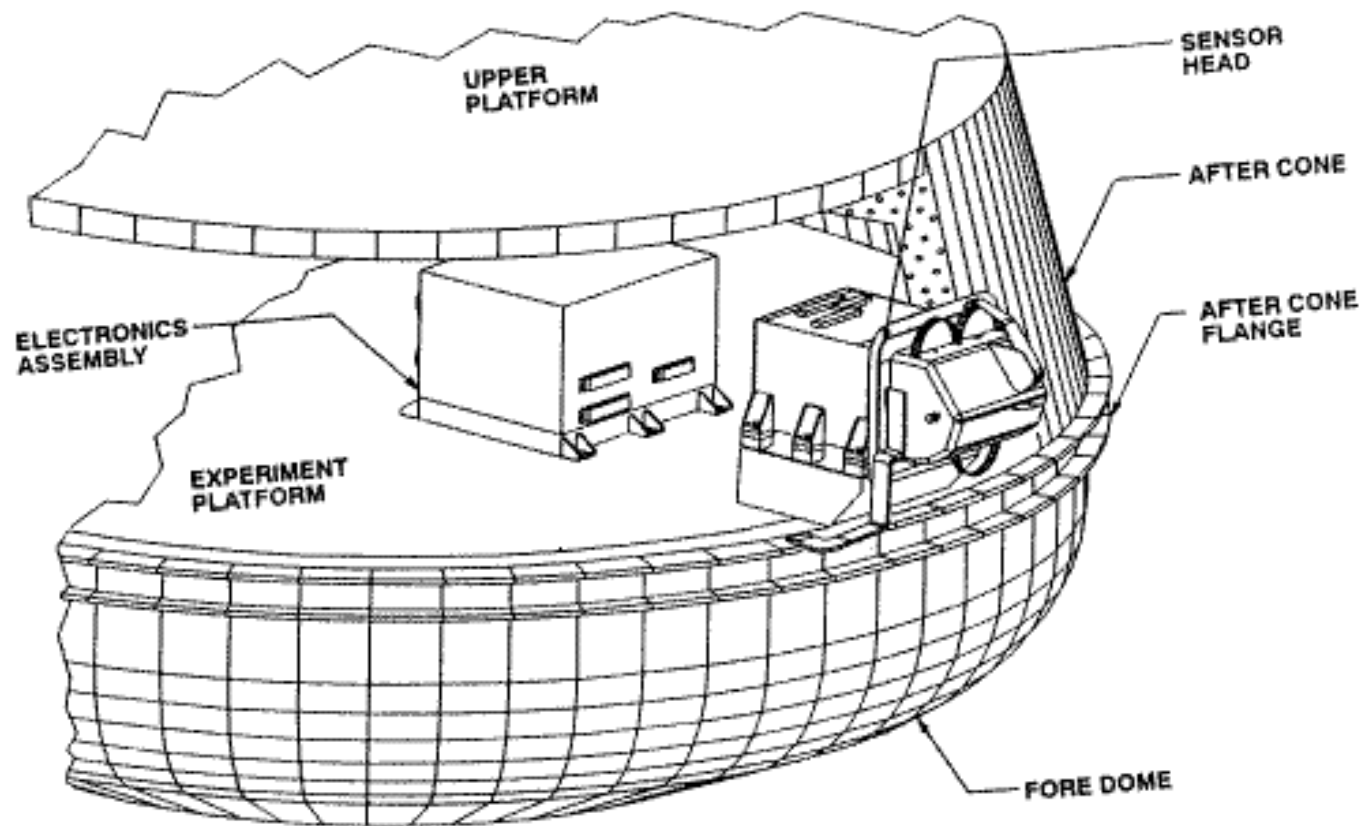
Results from the Descent Imager/Spectral Radiometer (DISR) experiment on Huygens

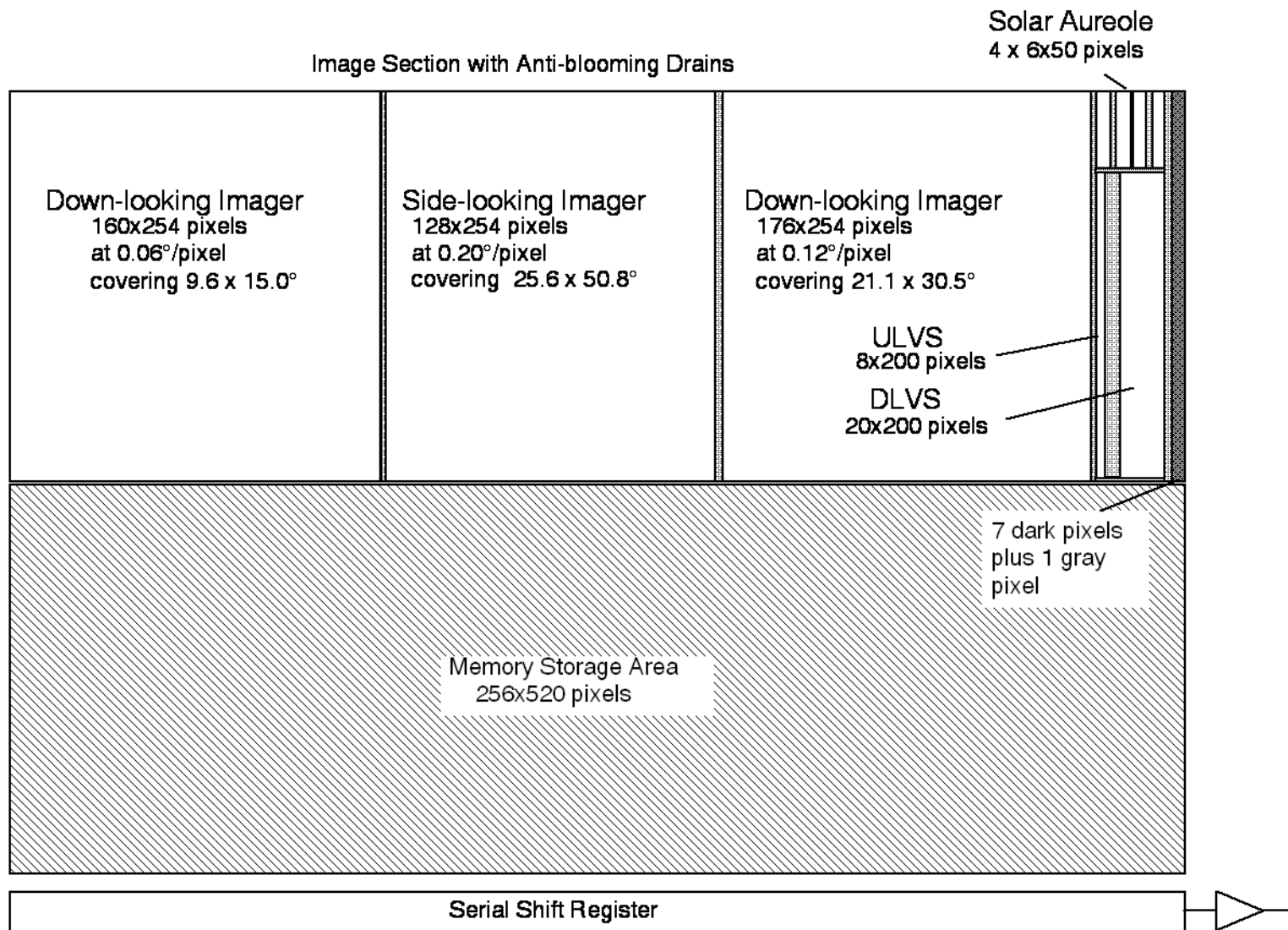
By

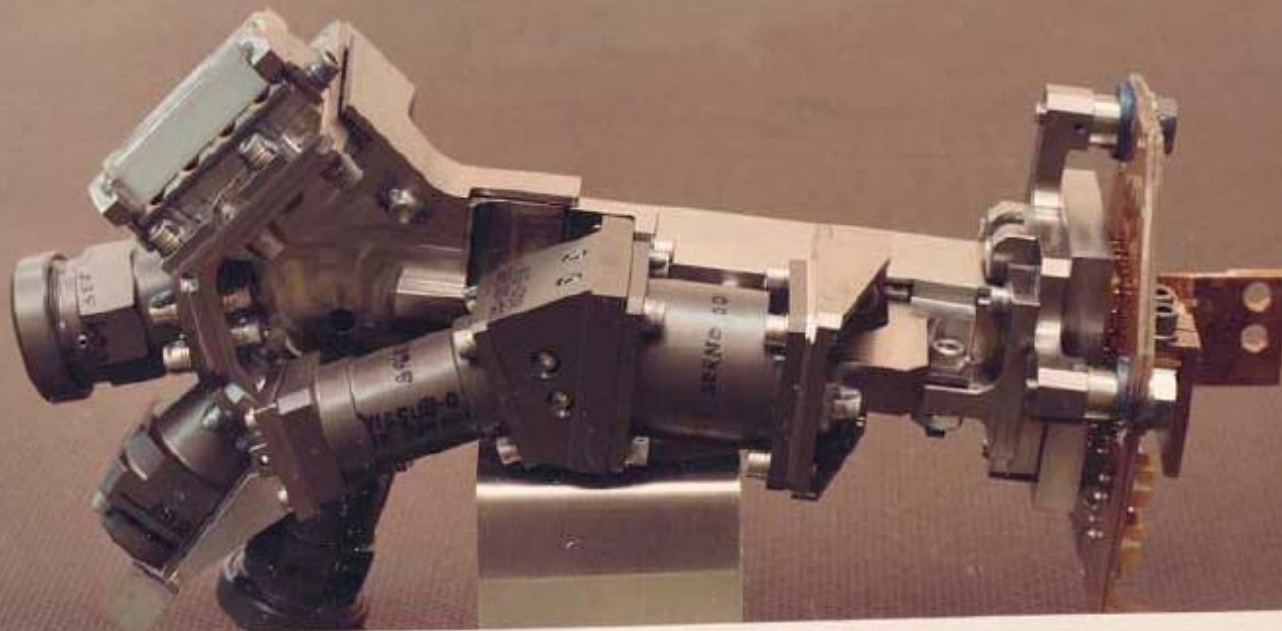
Marty Tomasko and the
DISR Team

DISR

- Frame transfer CCD (1/8 megapixel)
- Fiber optics from CCD to separate sets of foreoptics
 - Visible Spectrometer looking up, down
 - 4-Channel Solar Aureole Camera (blue, red, 2 polarizations)
 - 3 frame-imagers looking at different nadir angles
- Near IR Spectrometer (looks up and down)
- Ultraviolet Photometer (looks up and down)
- Lamp to illuminate surface for continuous reflectivity
- Sensor to detect azimuth of sun
- Hardware data compressor

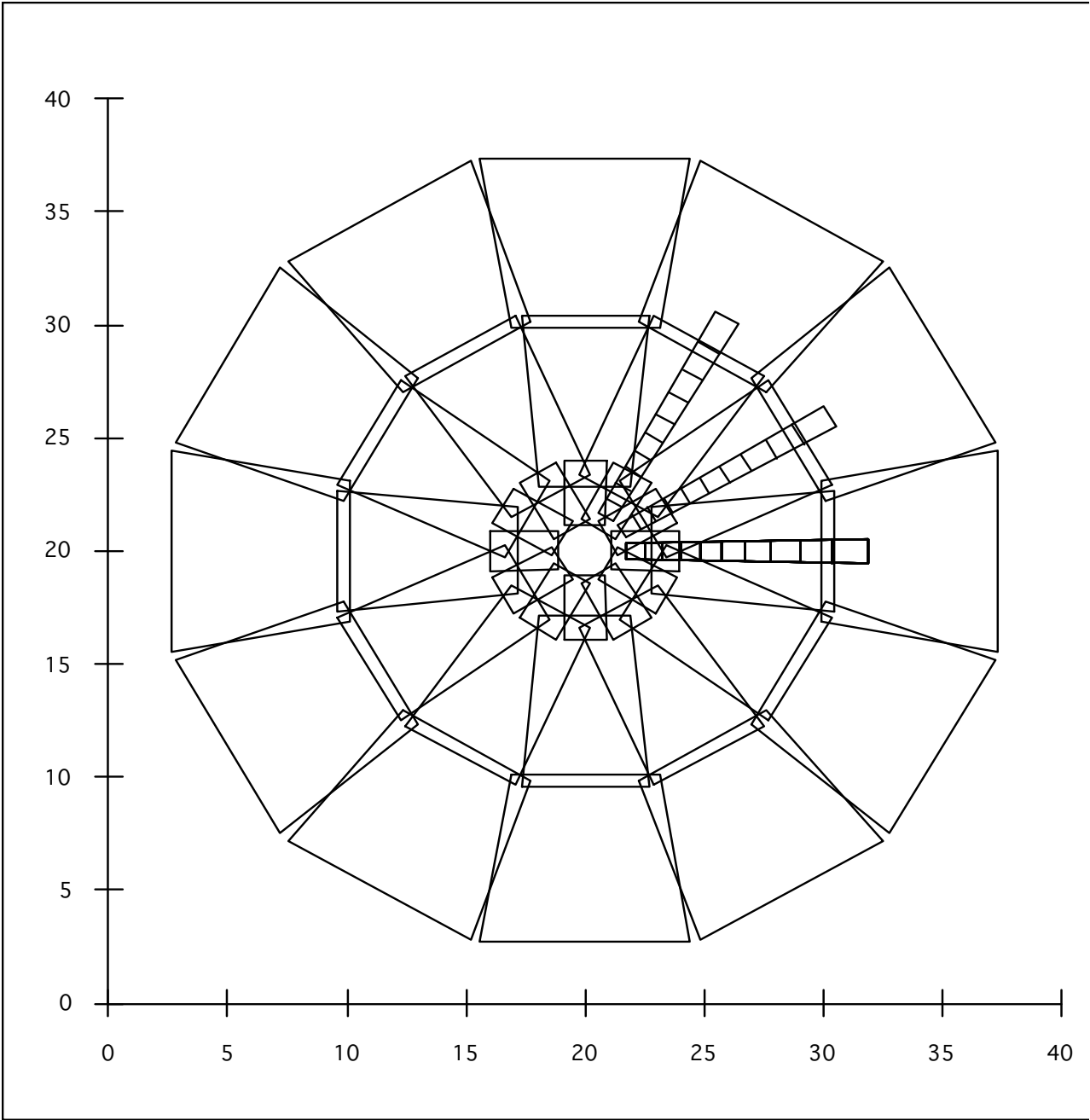


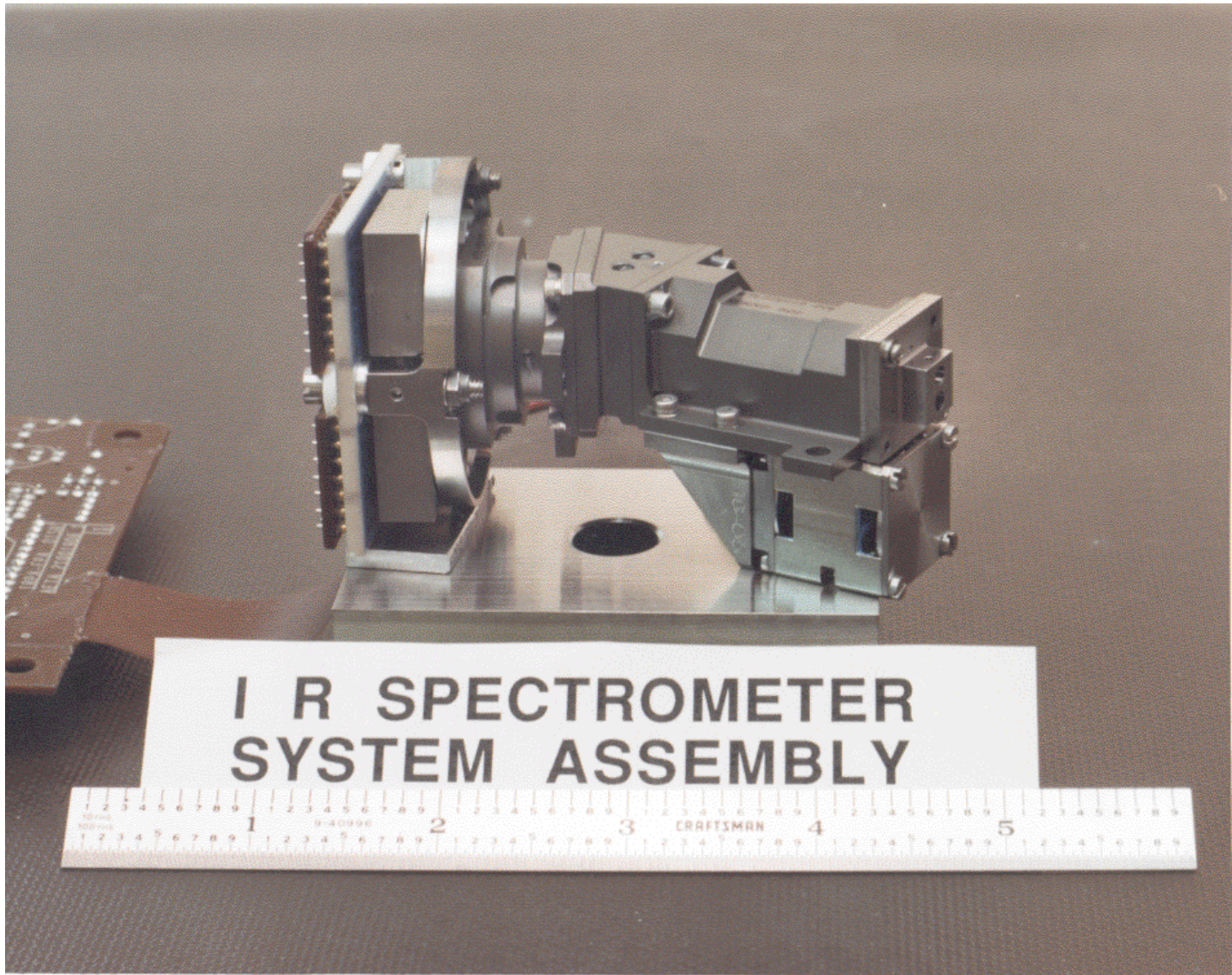




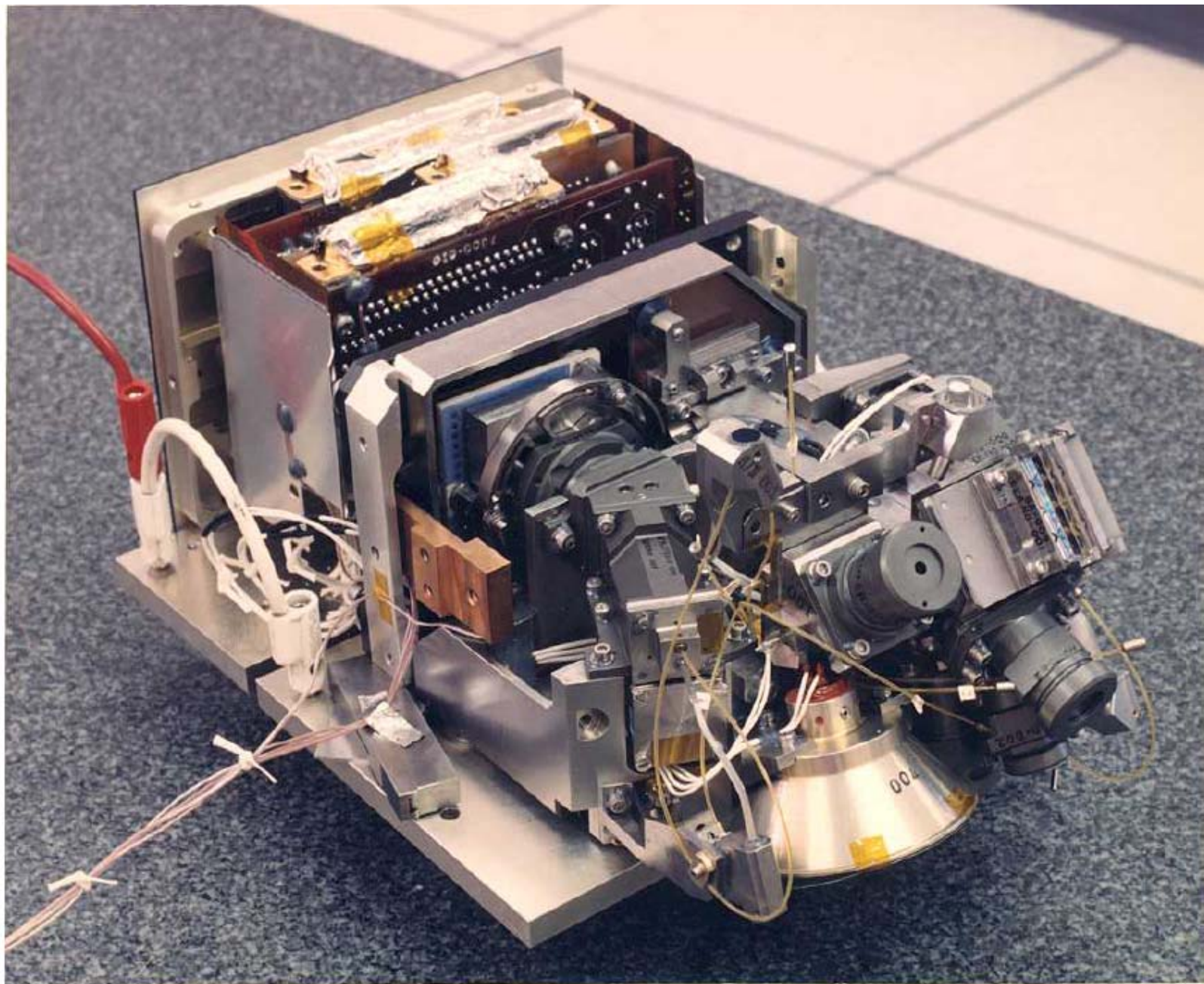
CCD SYSTEM ASSEMBLY

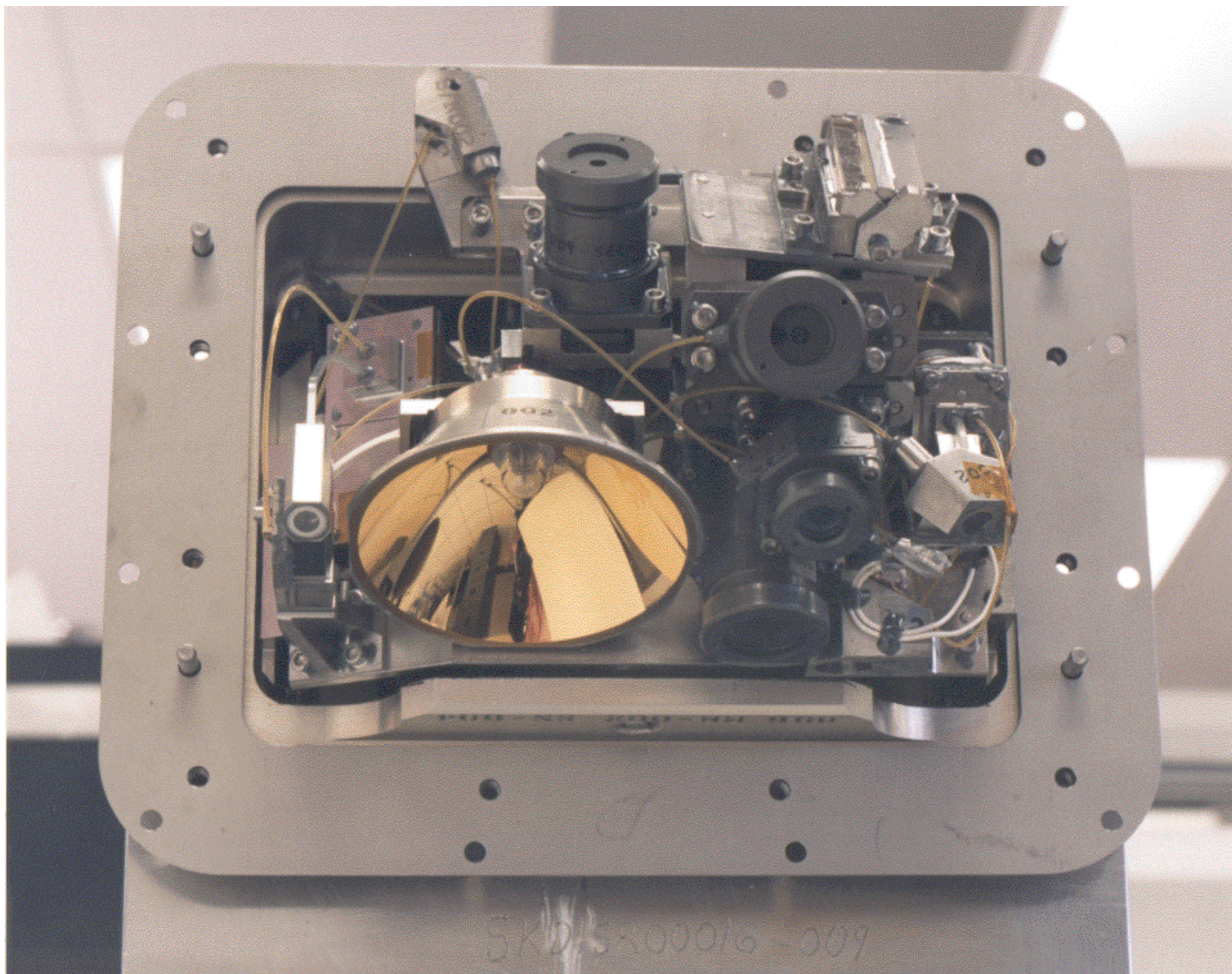


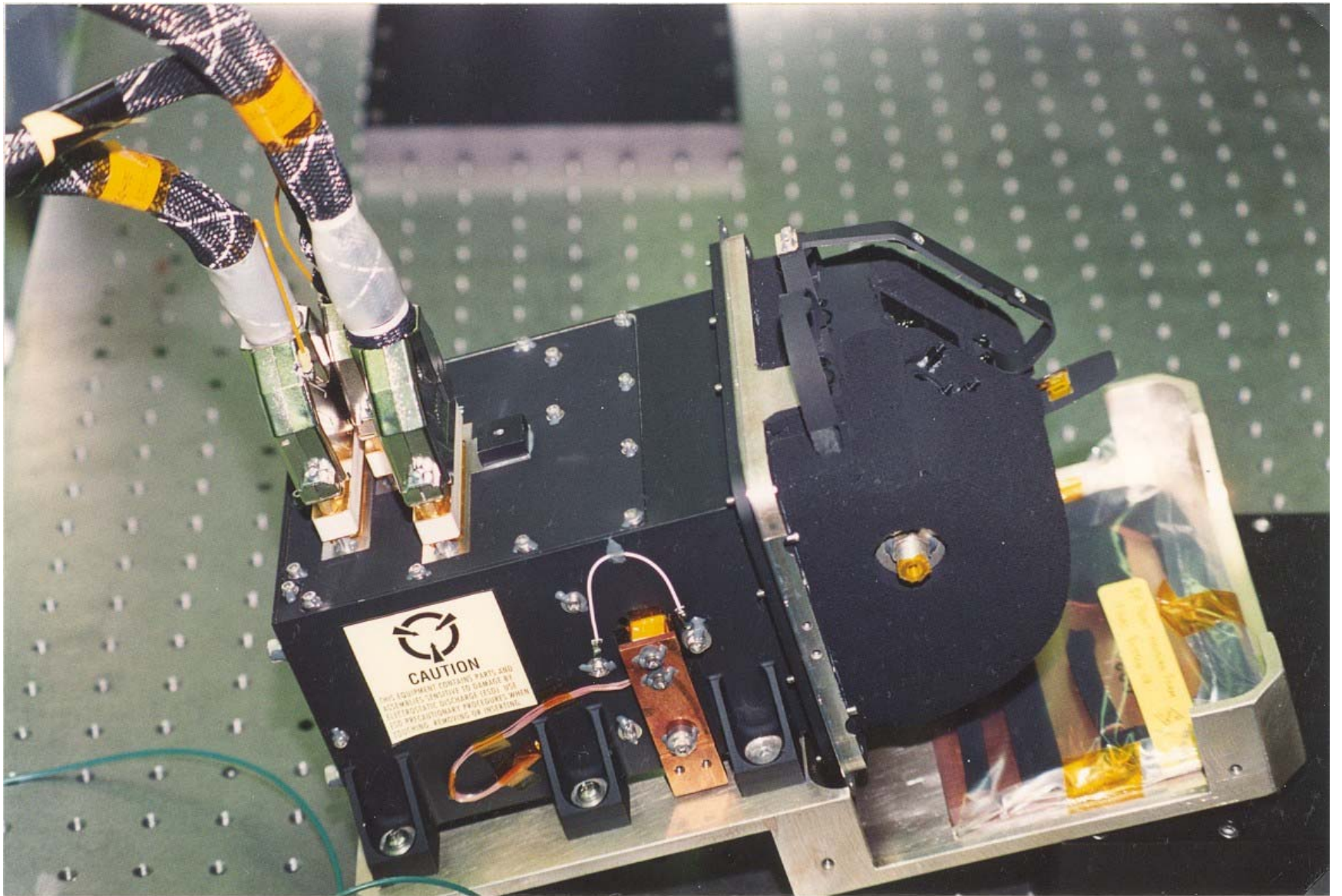




**I R SPECTROMETER
SYSTEM ASSEMBLY**







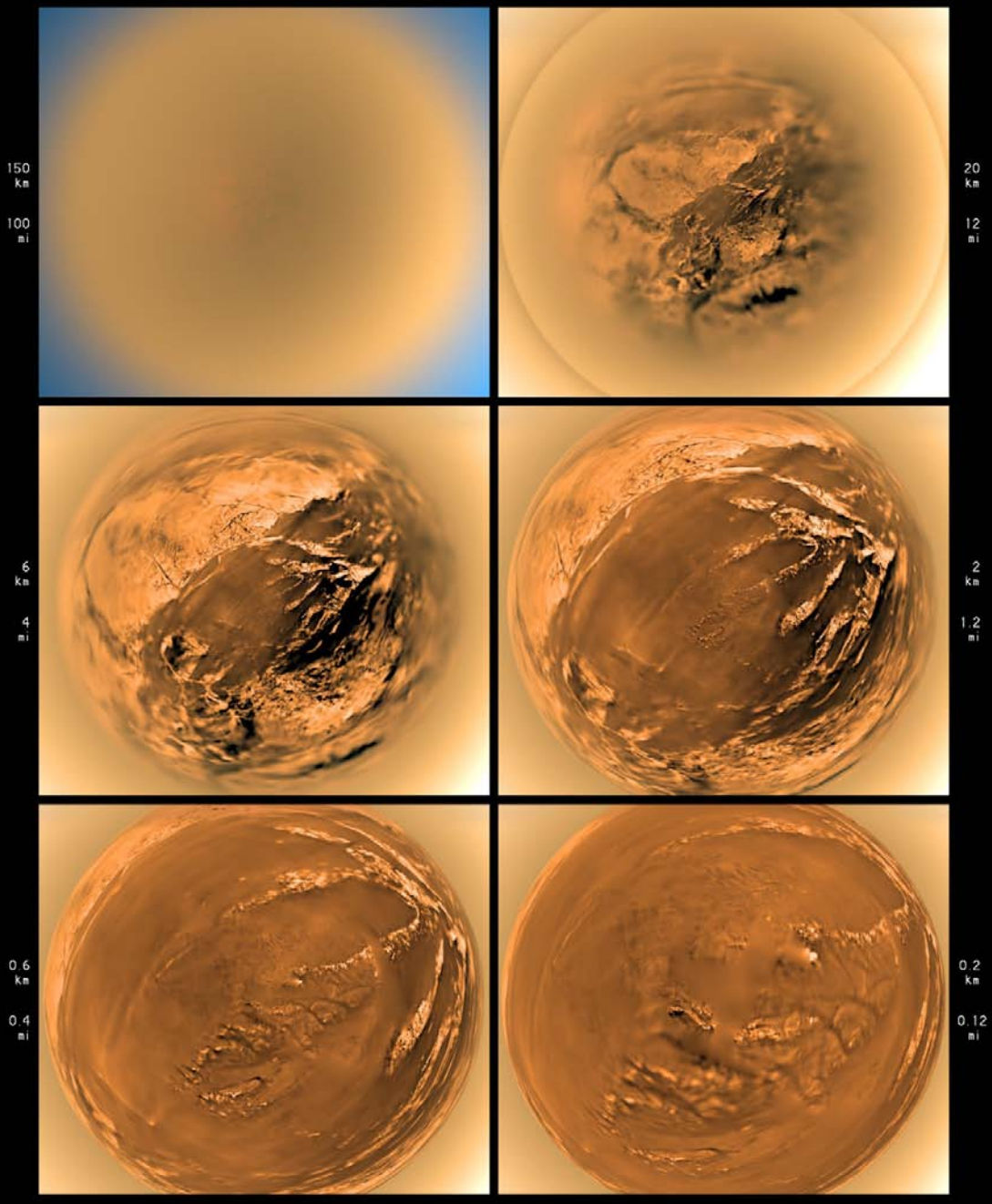
Aerial Views of Titan Around the the Huygens Landing Site

Altitude

North

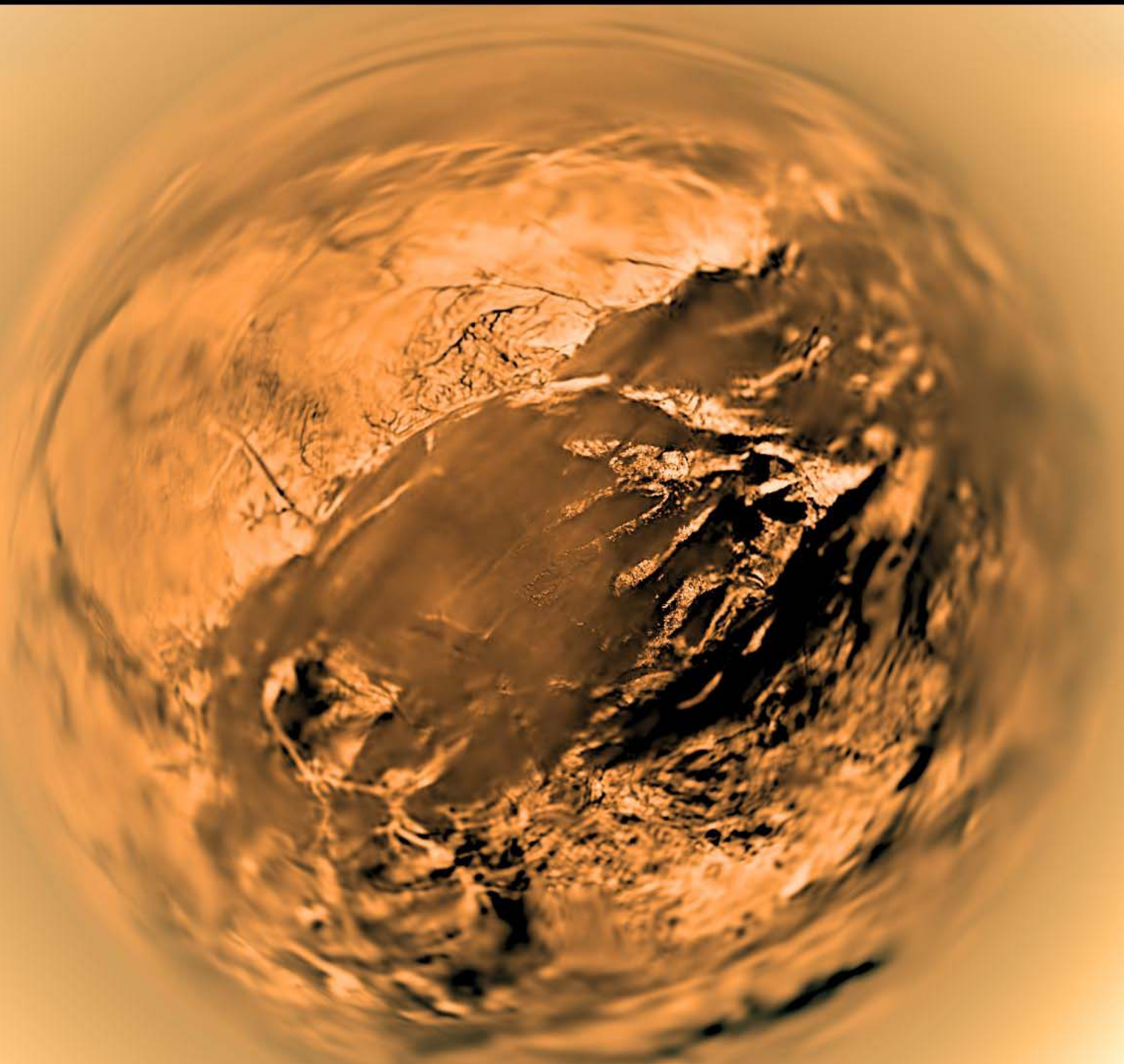
North

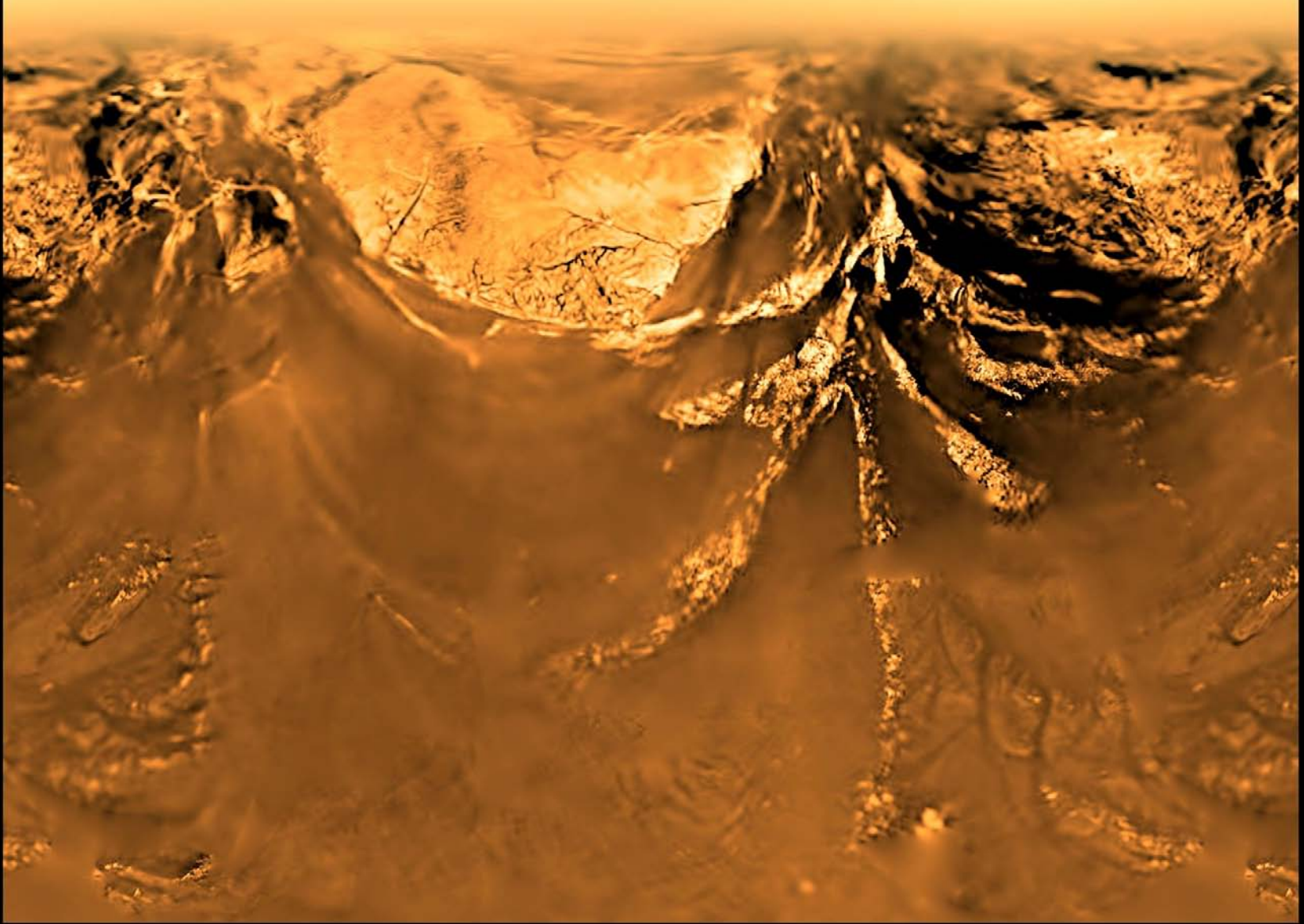
Altitude



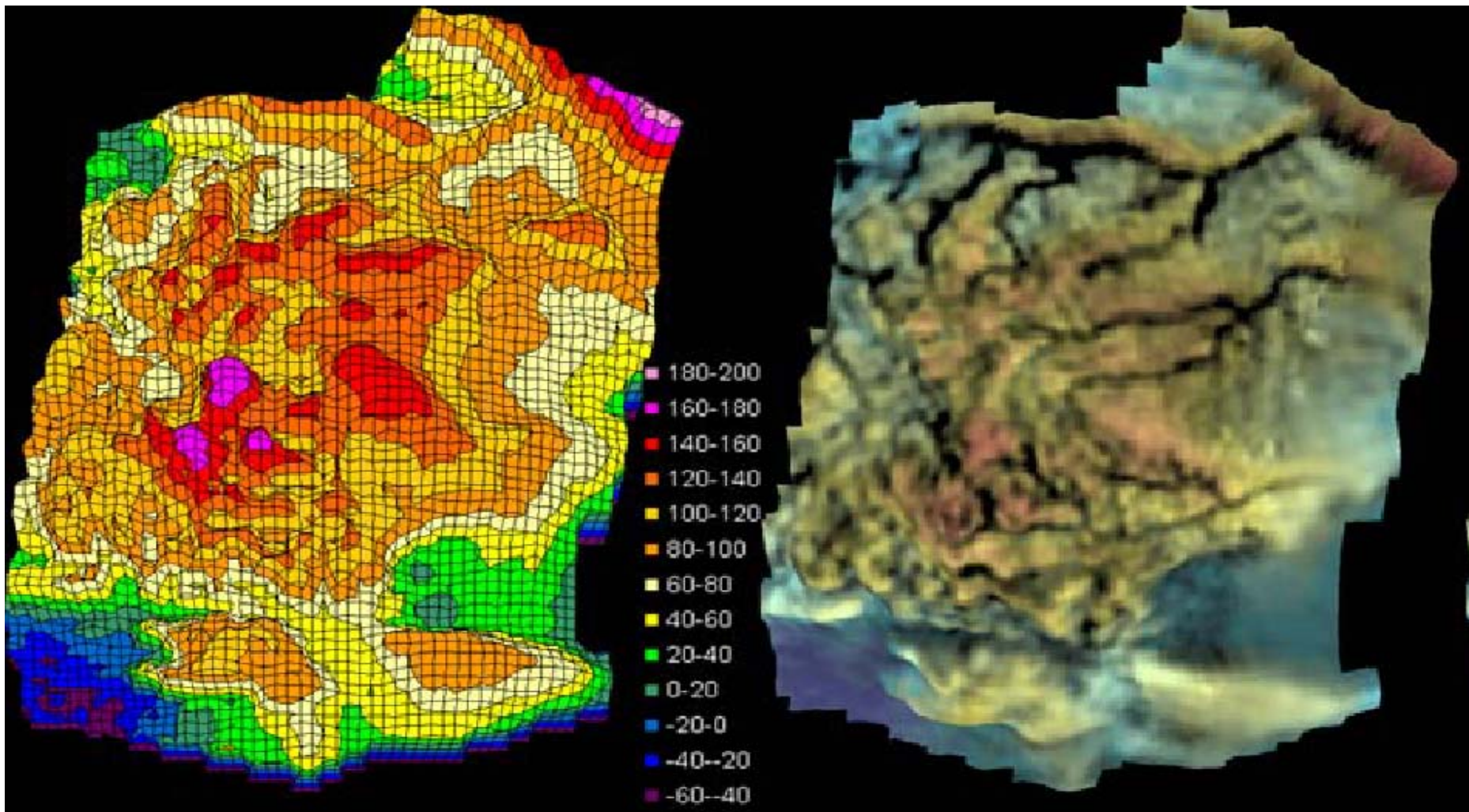
6
km

4
mi





First clear images of Titan's surface showed bright highlands cut by rain-fed streams draining into a lower, dark, dry lakebed.

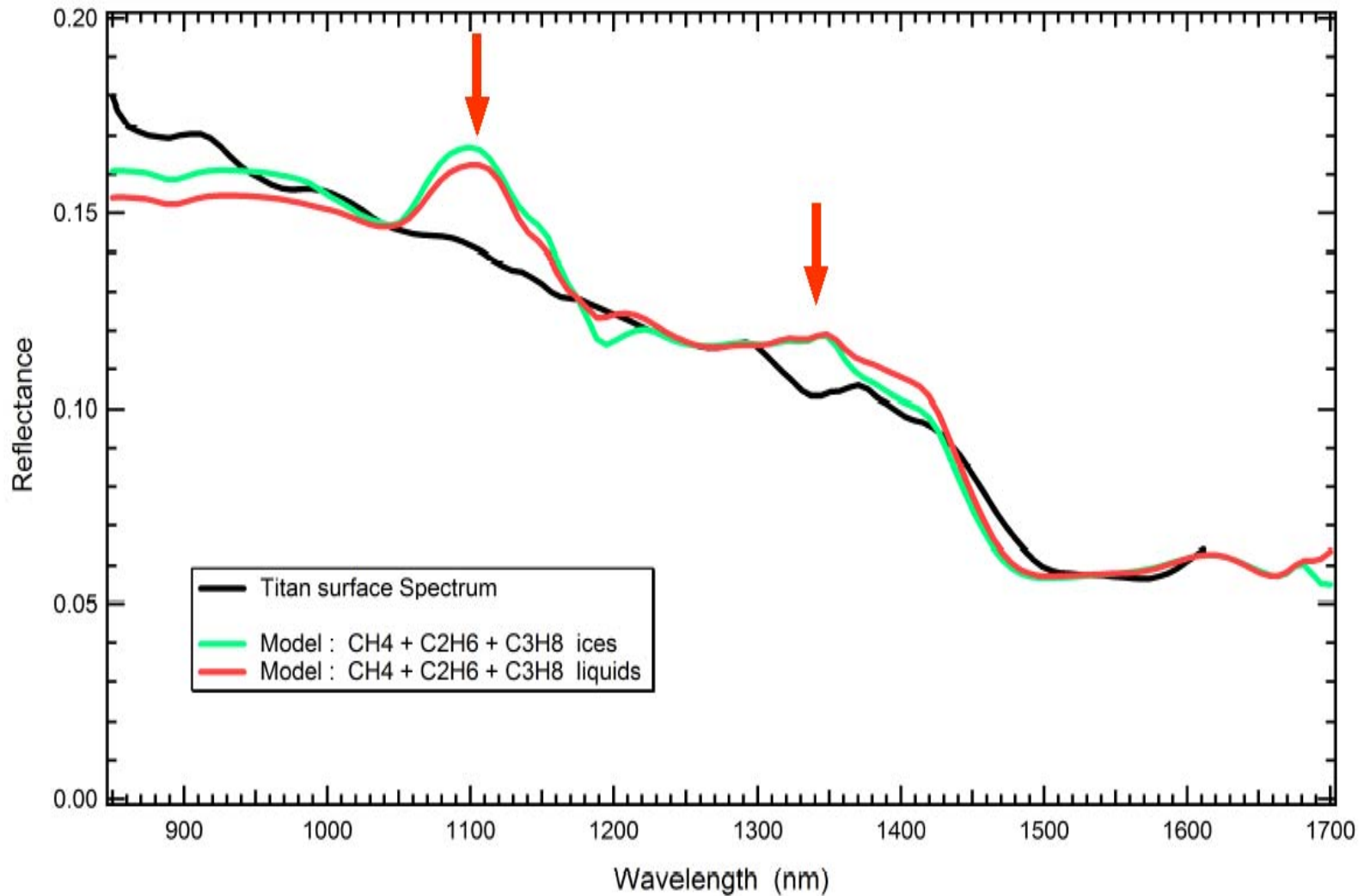


Elevation maps of highlands and lowlands were produced from views of the same terrain from different perspectives.

Our image from the surface is shown, with an Apollo image of the moon at the same perspective to the right.

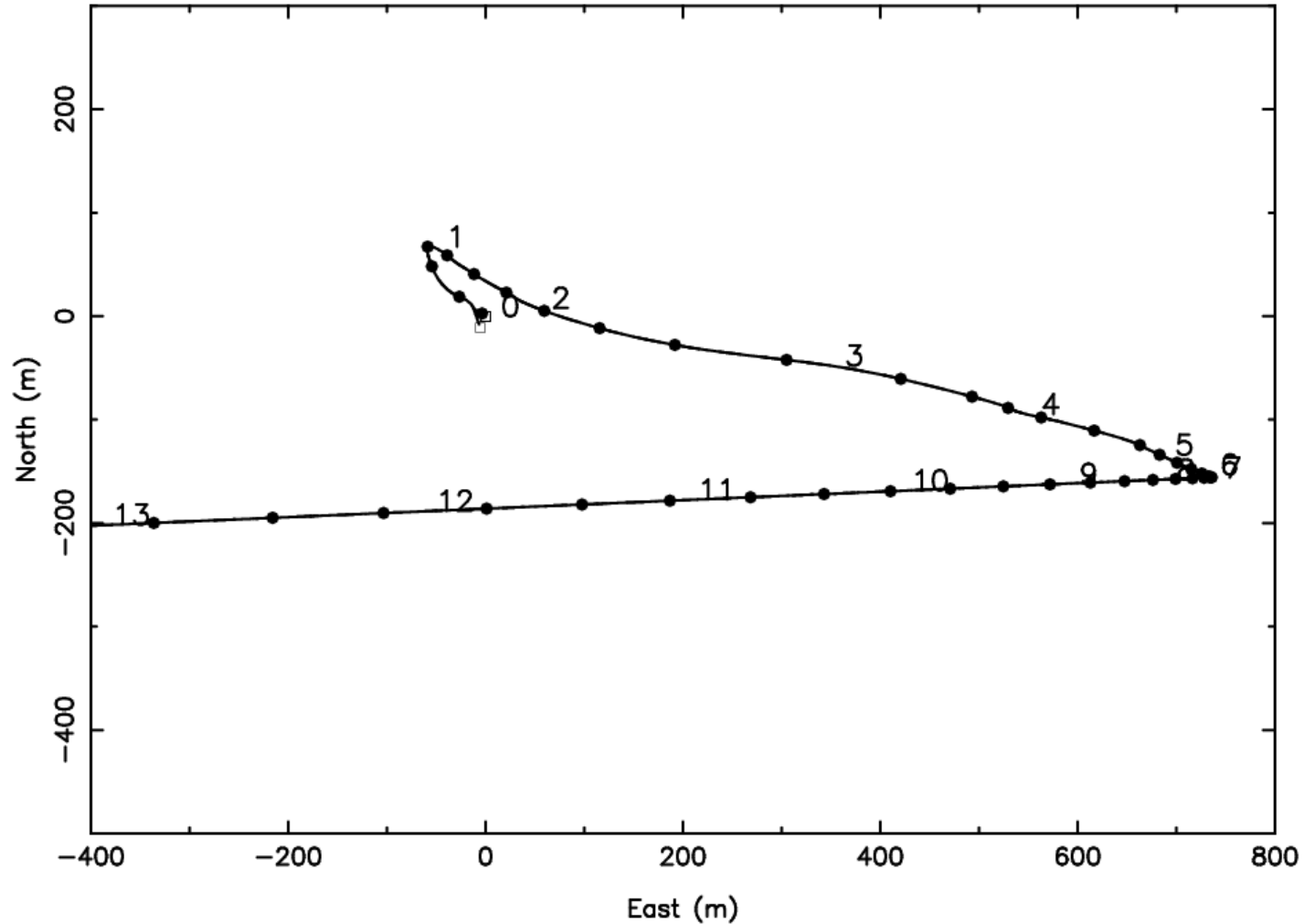
The rounded cobbles of ice in the dry lake bed provide evidence of fluid flow.





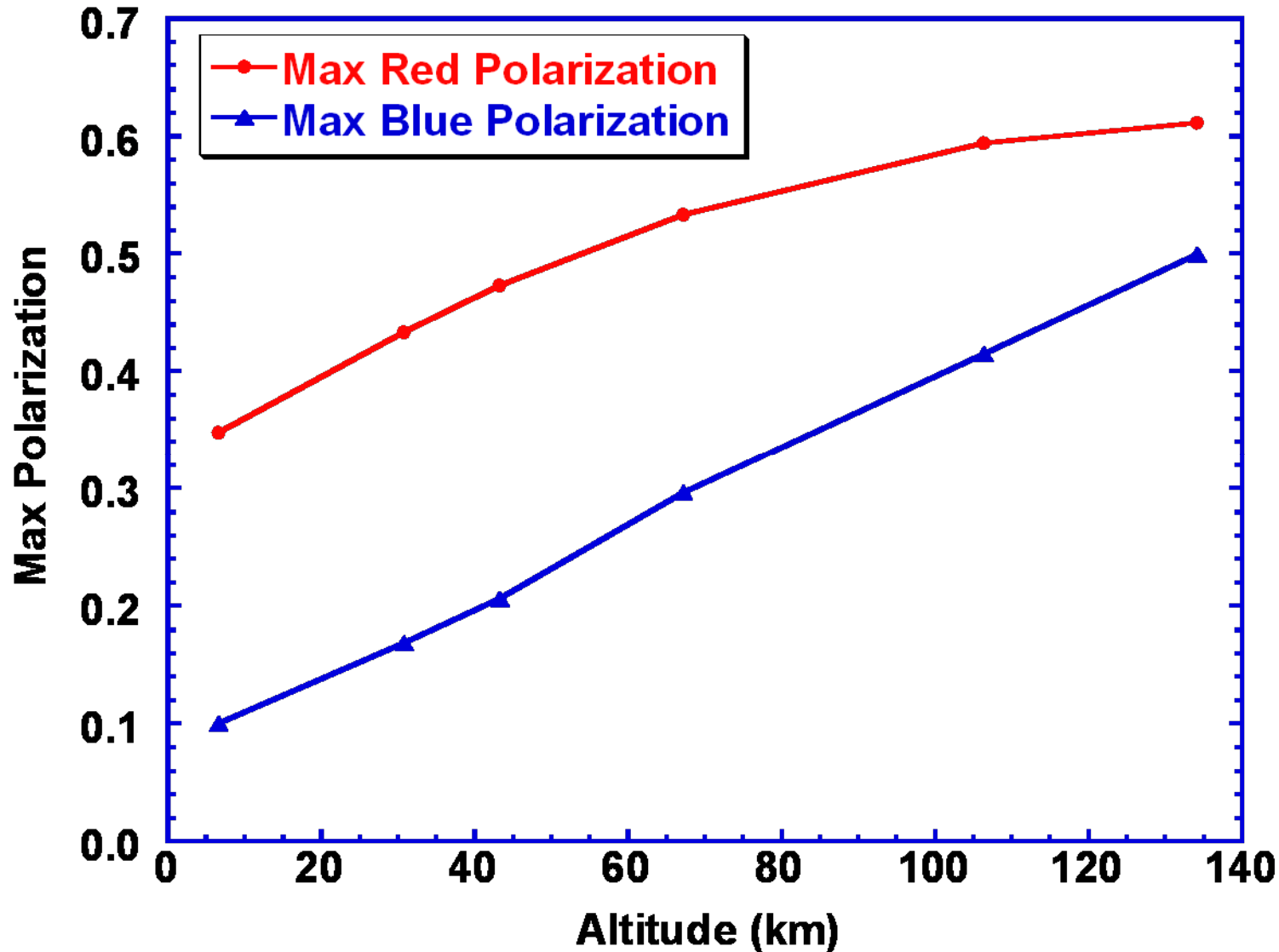
Measured surface reflection spectrum in near infrared for comparison with candidate surface materials

Huygens Trajectory



Measurements of meridional wind from ground track in surface images.

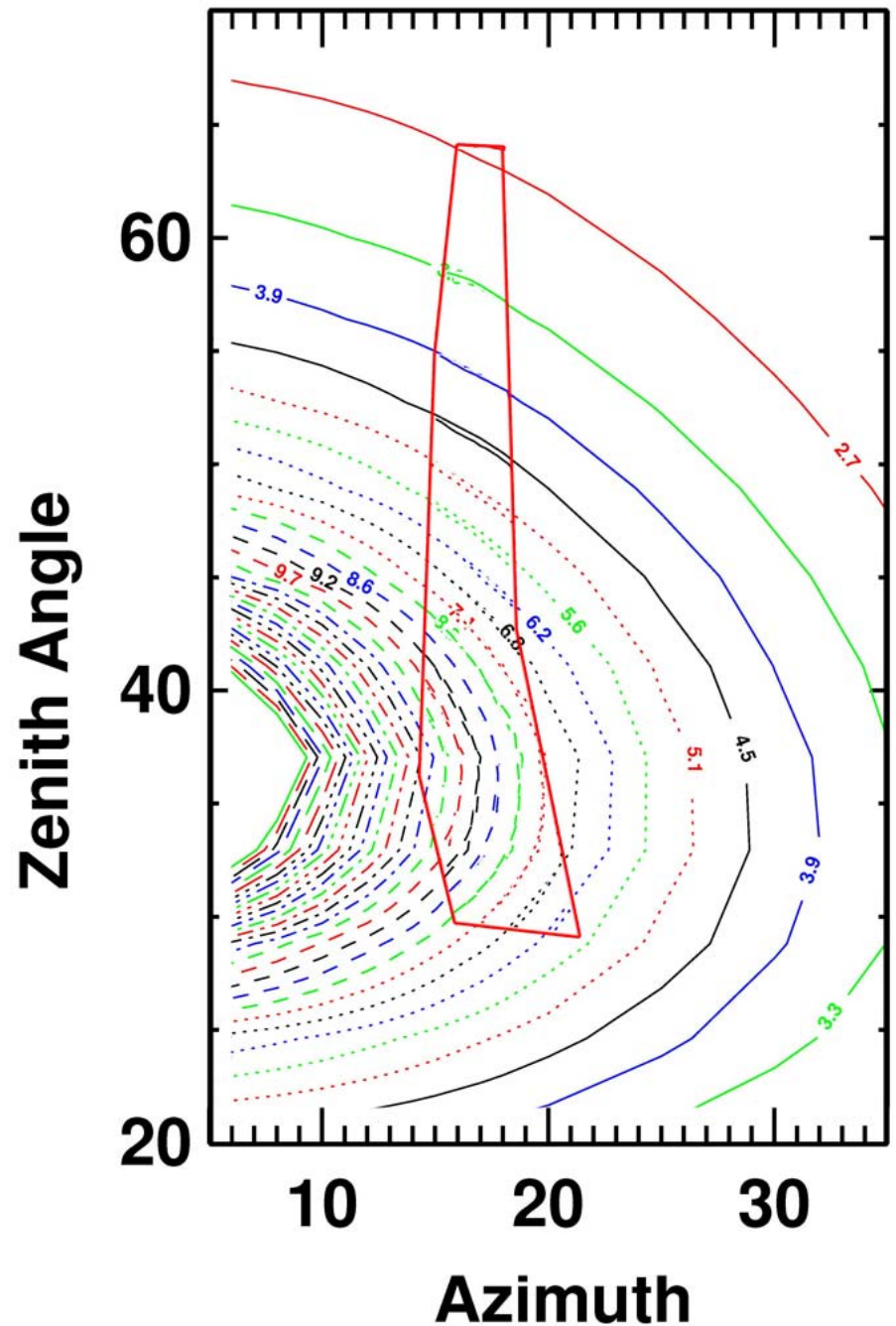
Maximum Degree of Polarization Vs. Altitude



Measured degree of polarization determines radius, r , of individual “monomers” in aerosols.

Contours of brightness near sun determines number of monomers, N , in aerosol particle.

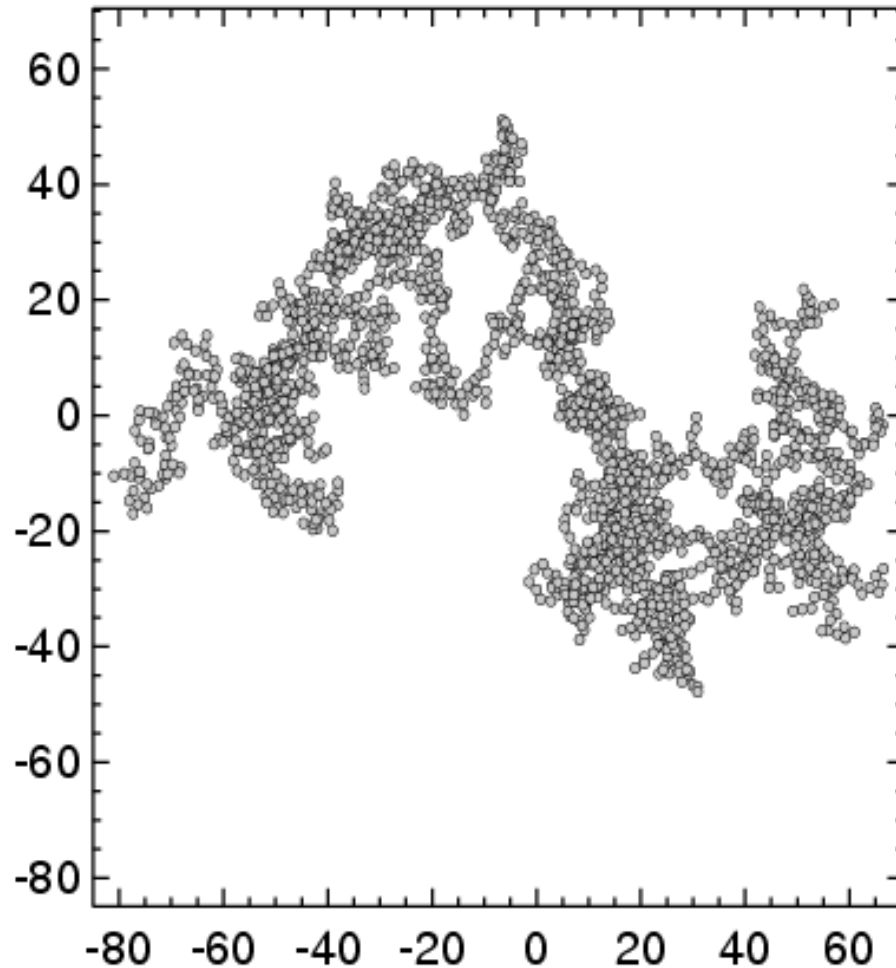
We find $N=3000$ of $r=0.05 \mu\text{m}$ monomers in each particle.



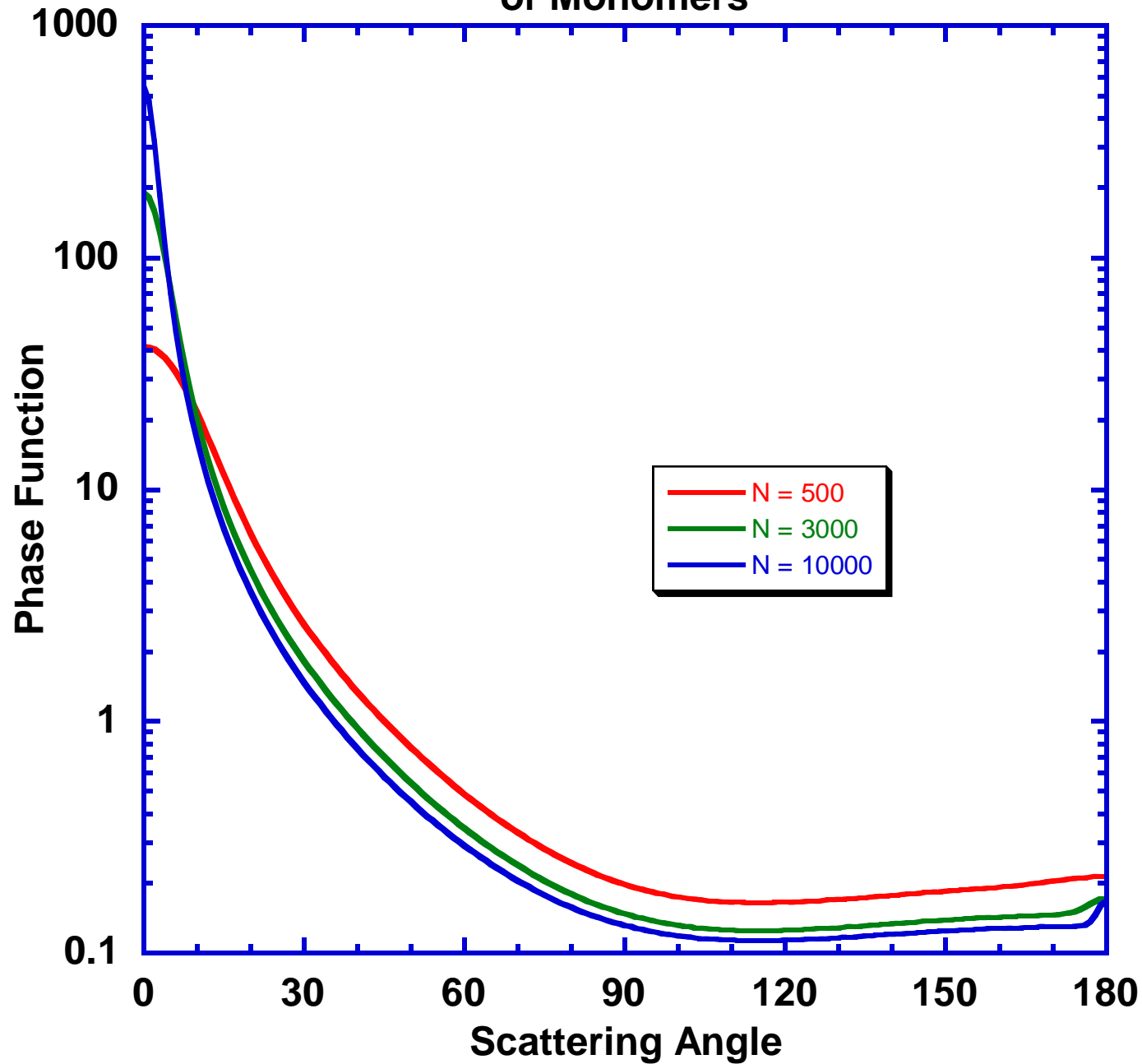
View of fractal with 2048 monomers of $0.05\mu\text{m}$ radius.

Scales are in units of monomer radius.

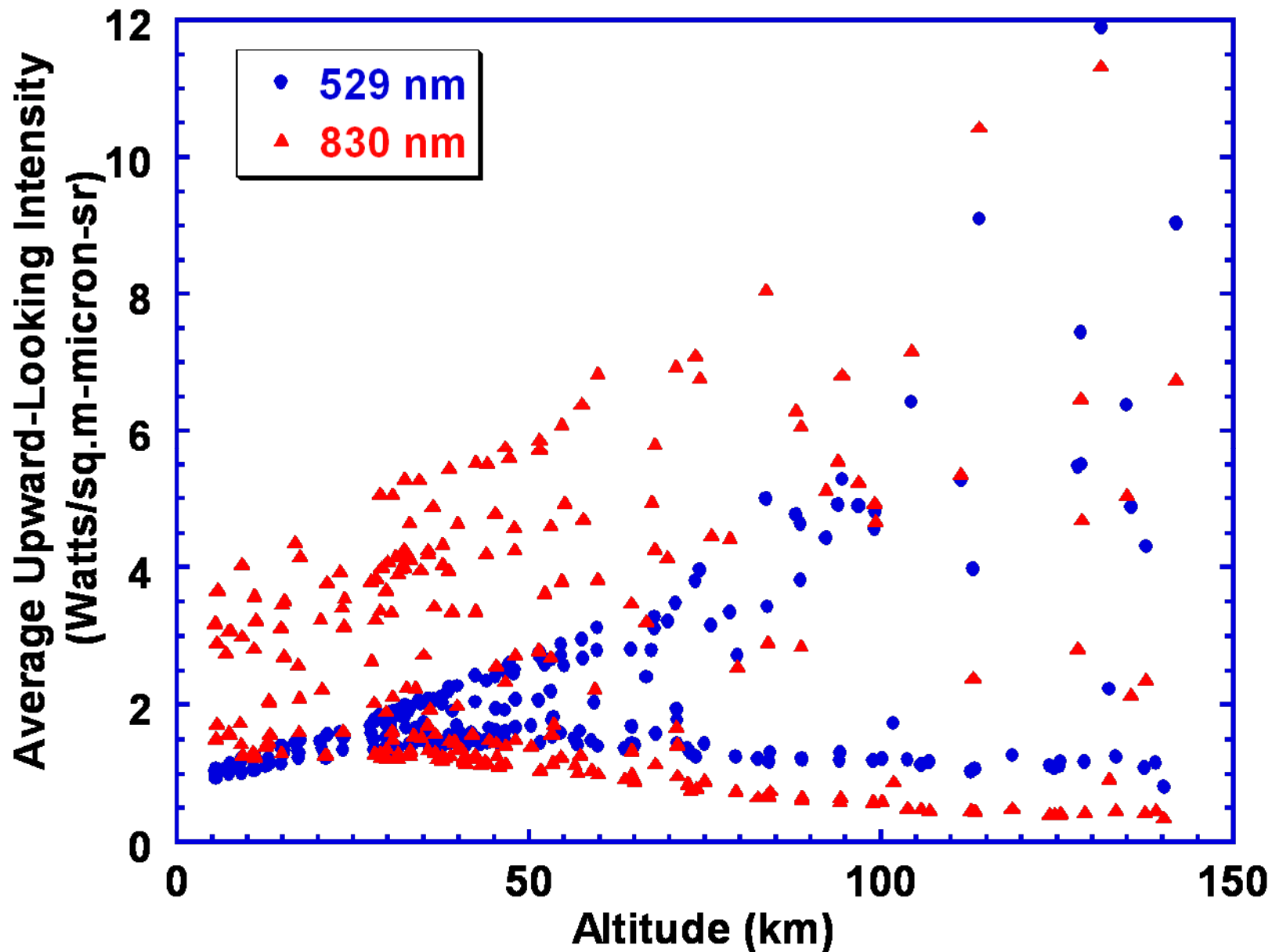
Particle with 3000 monomers would be similar, but still larger.



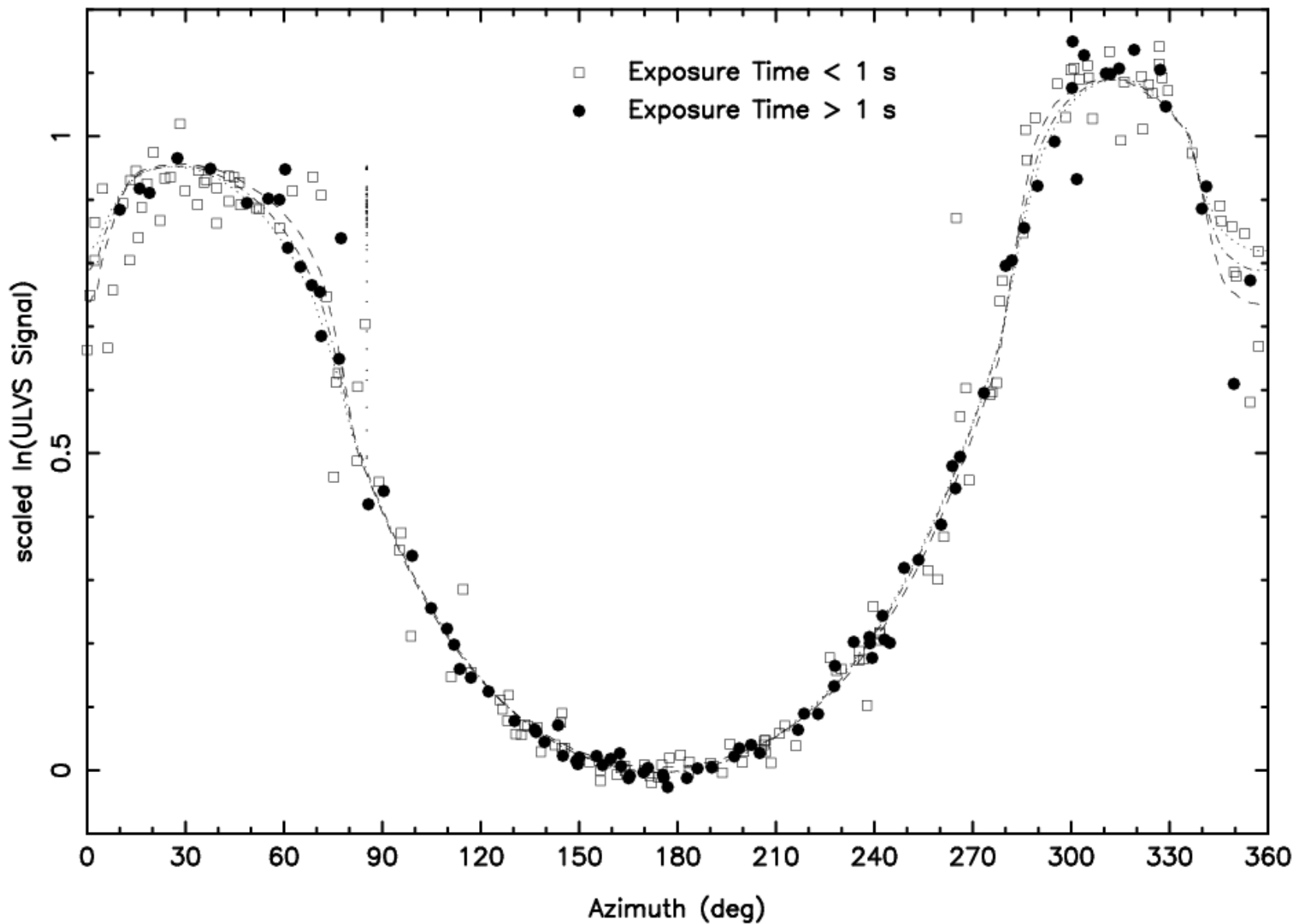
Phase Function of Aerosols for Different Numbers of Monomers



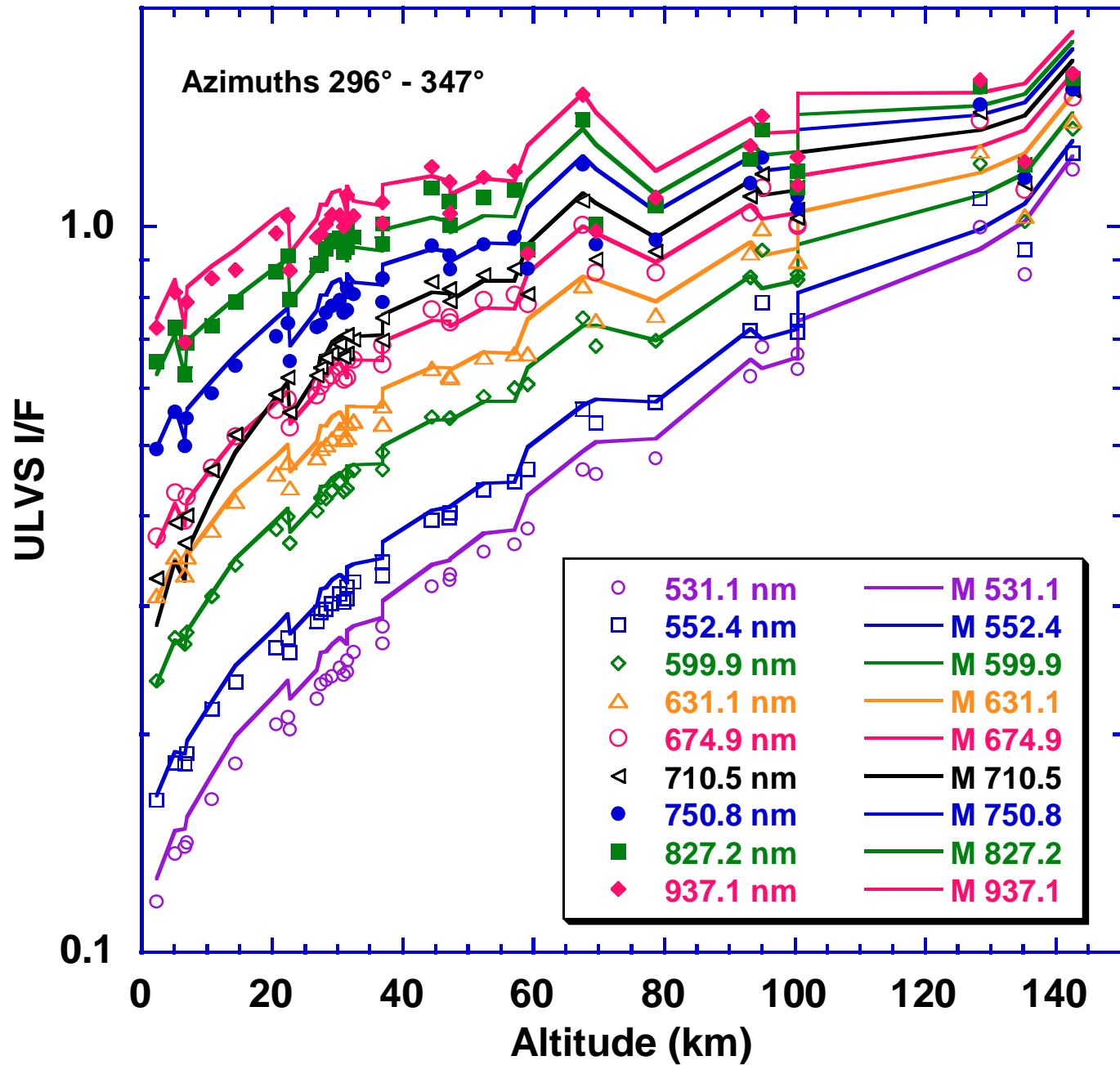
Average ULVS Intensity Vs. Altitude



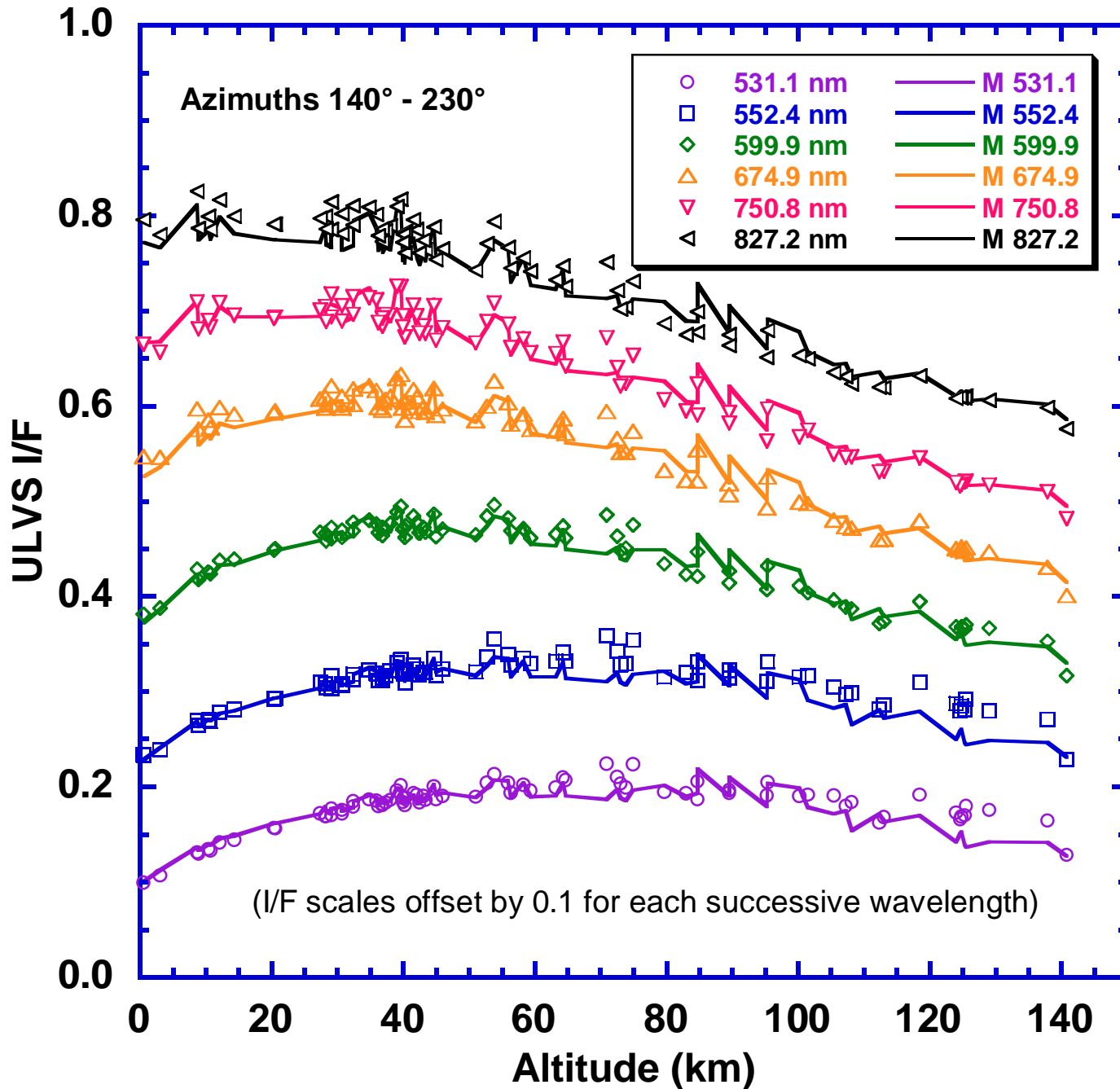
ULVS Signal as Function of Azimuth for Model 2006-01-02



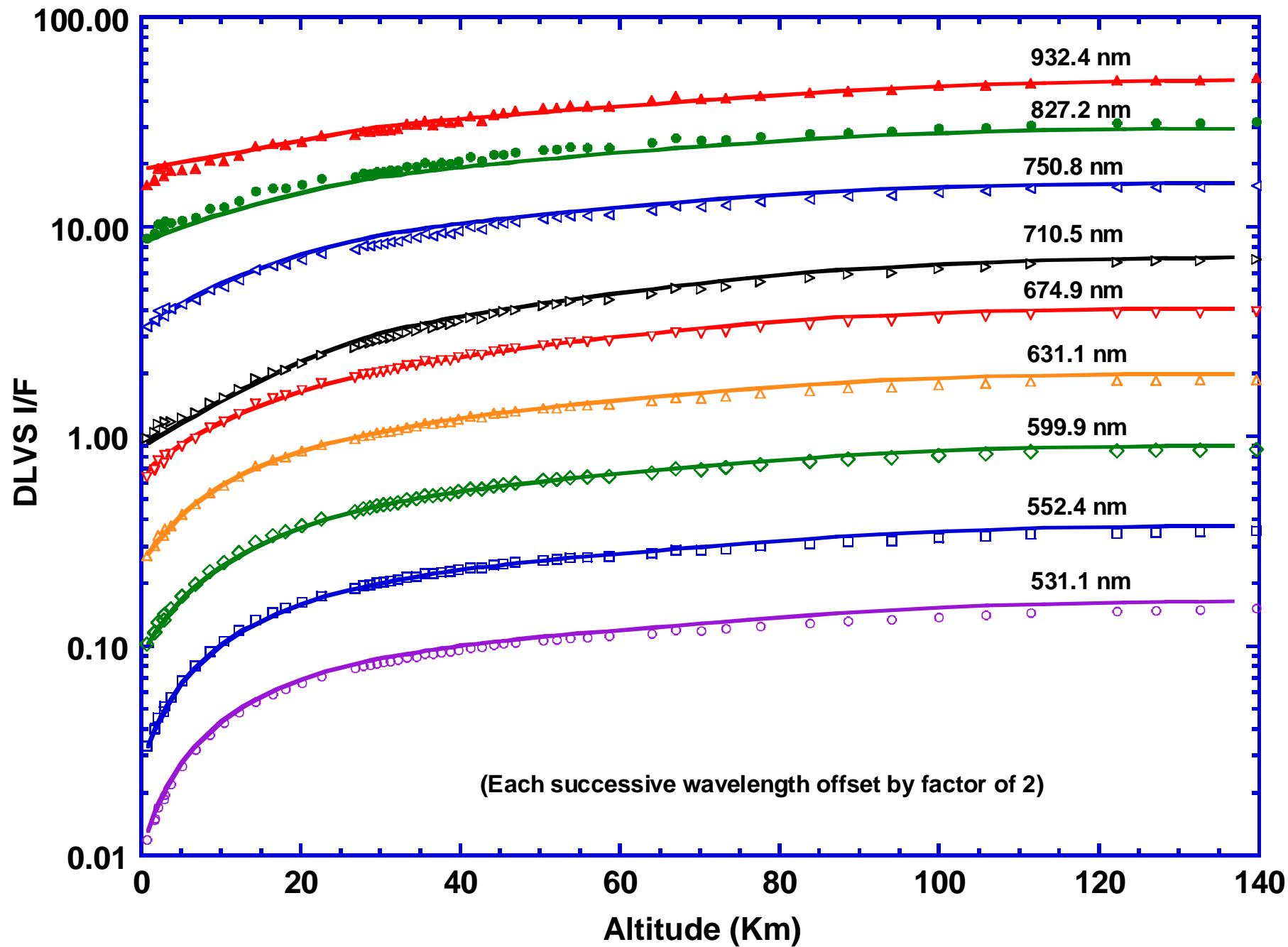
ULVS I/F vs. Altitude



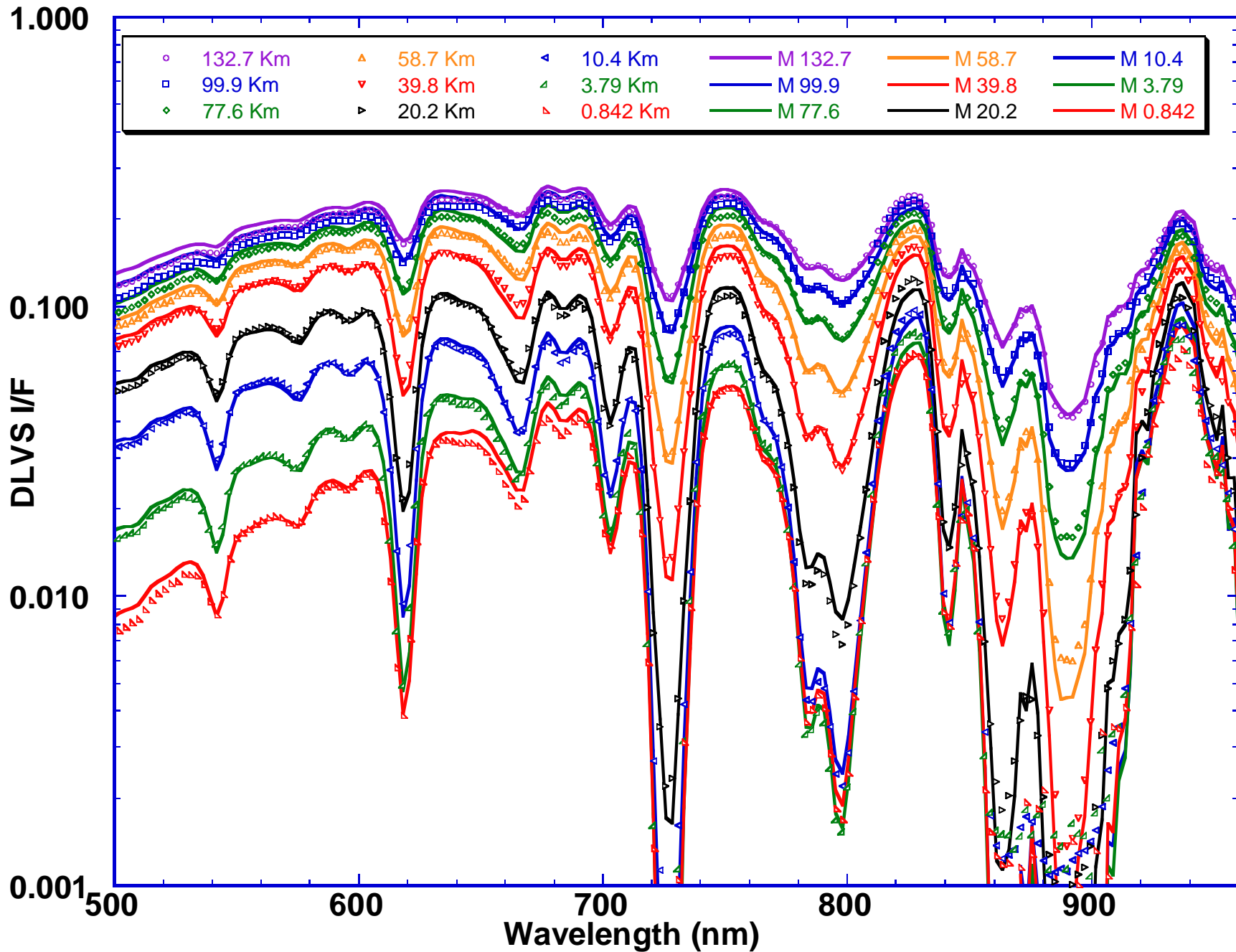
ULVS I/F vs. Altitude



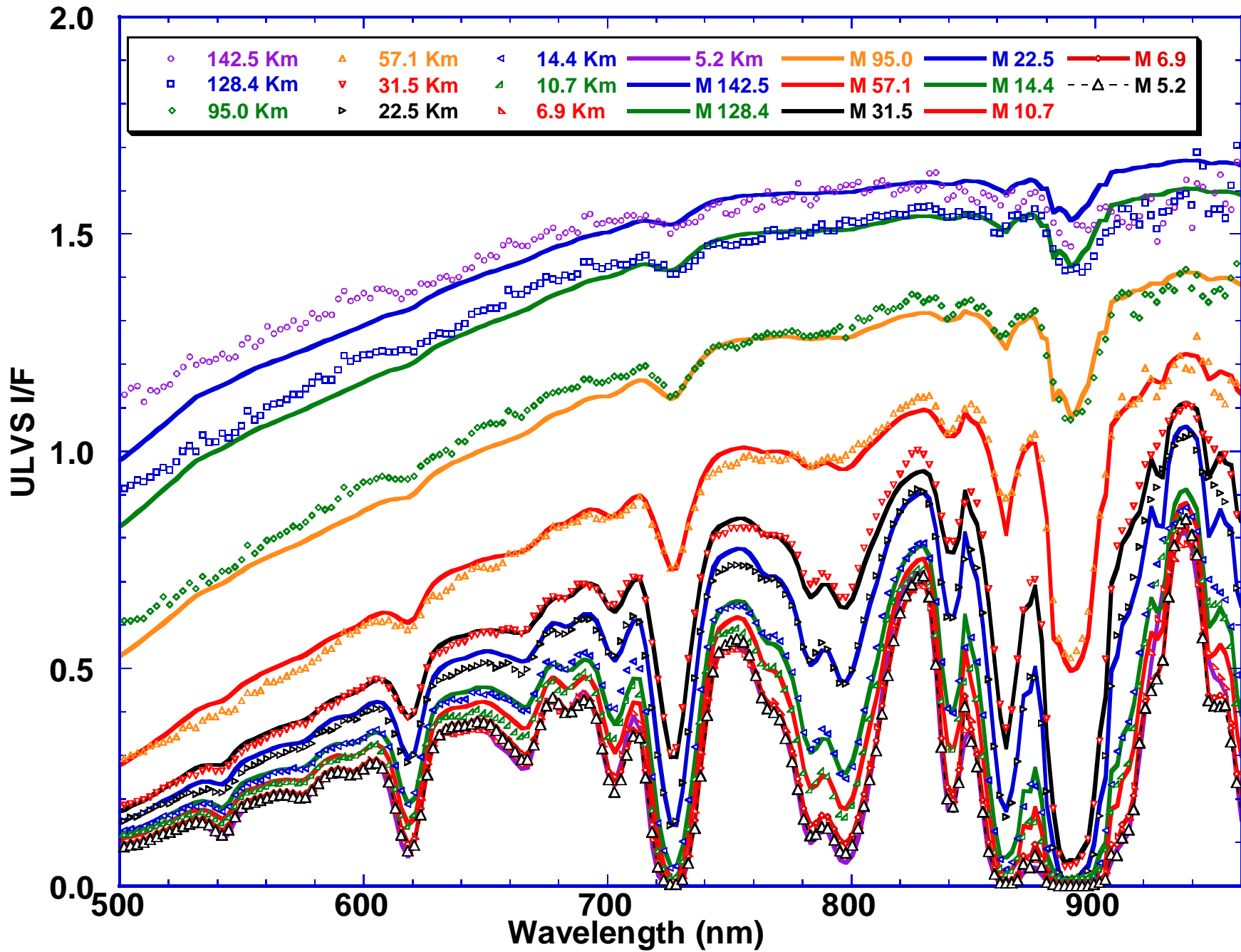
DLVS I/F vs. Altitude



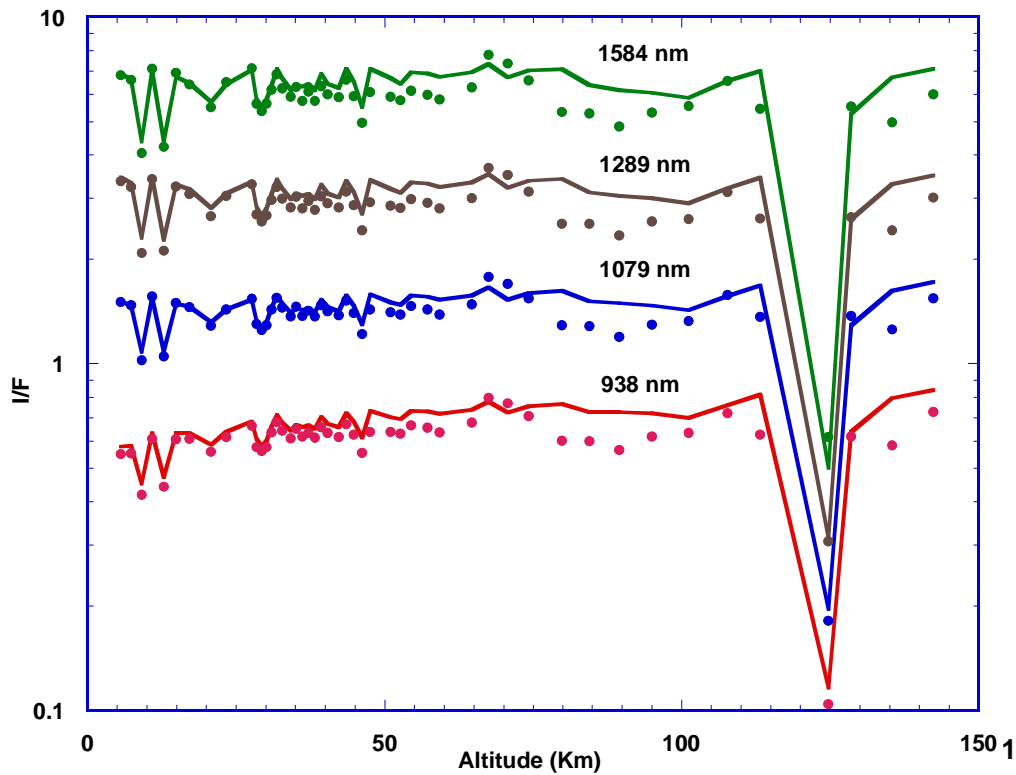
DLVS I/F vs. Wavelength



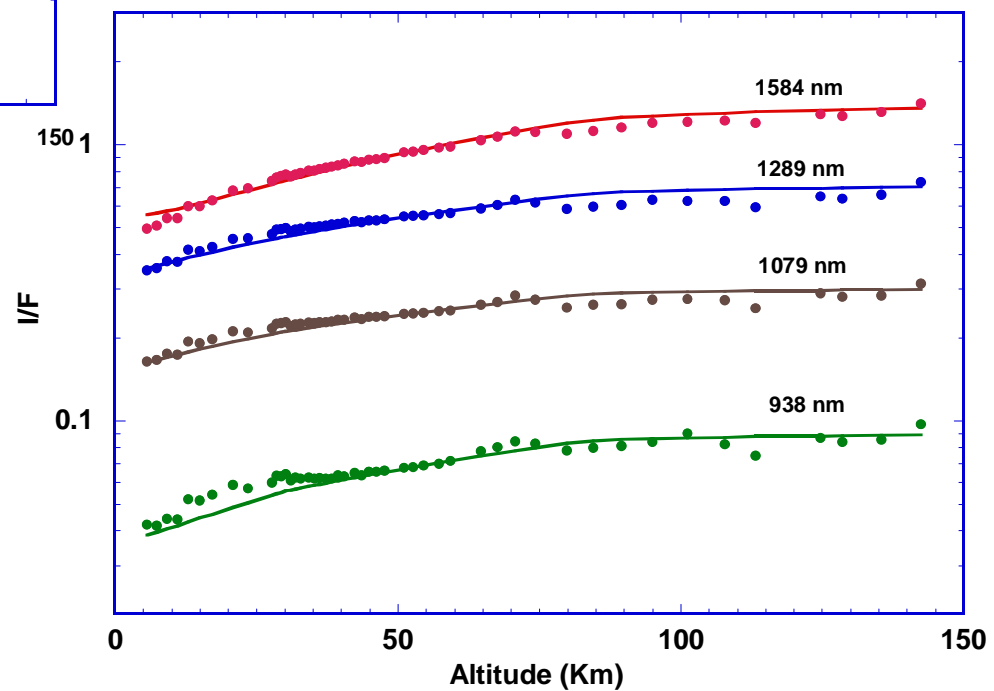
ULVS I/F vs. Wavelength



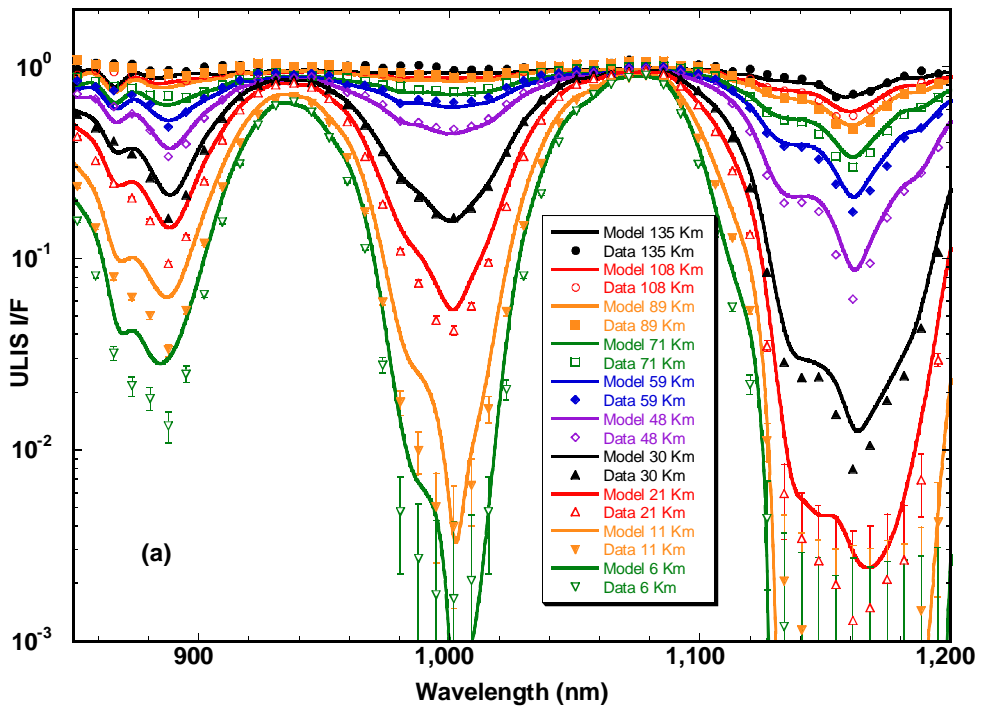
ULIS I/F vs Altitude



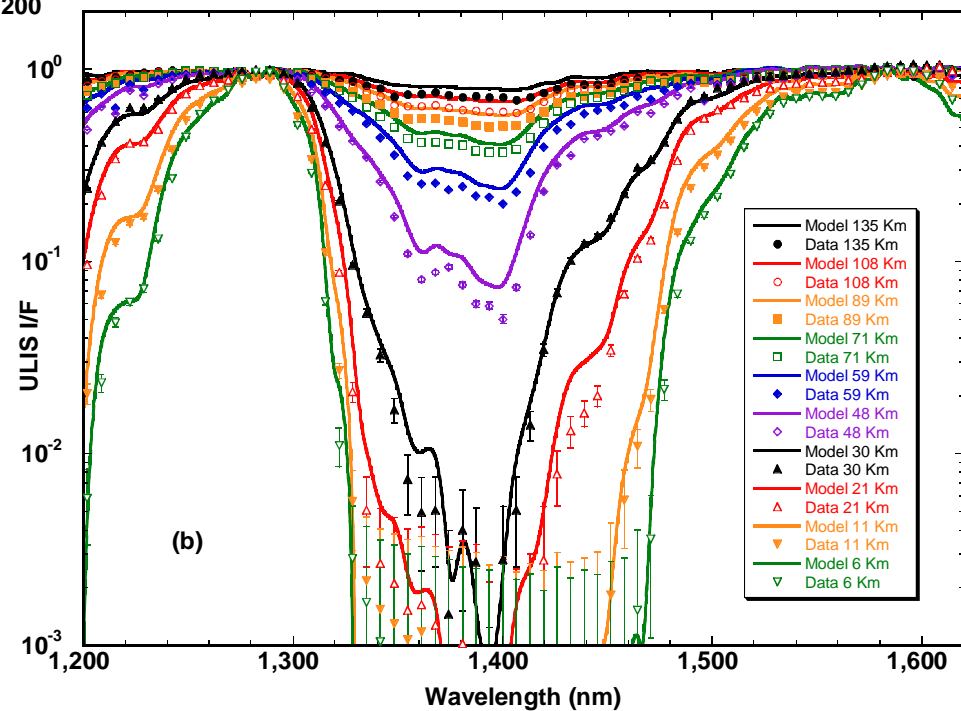
DLIS I/F vs. Altitude

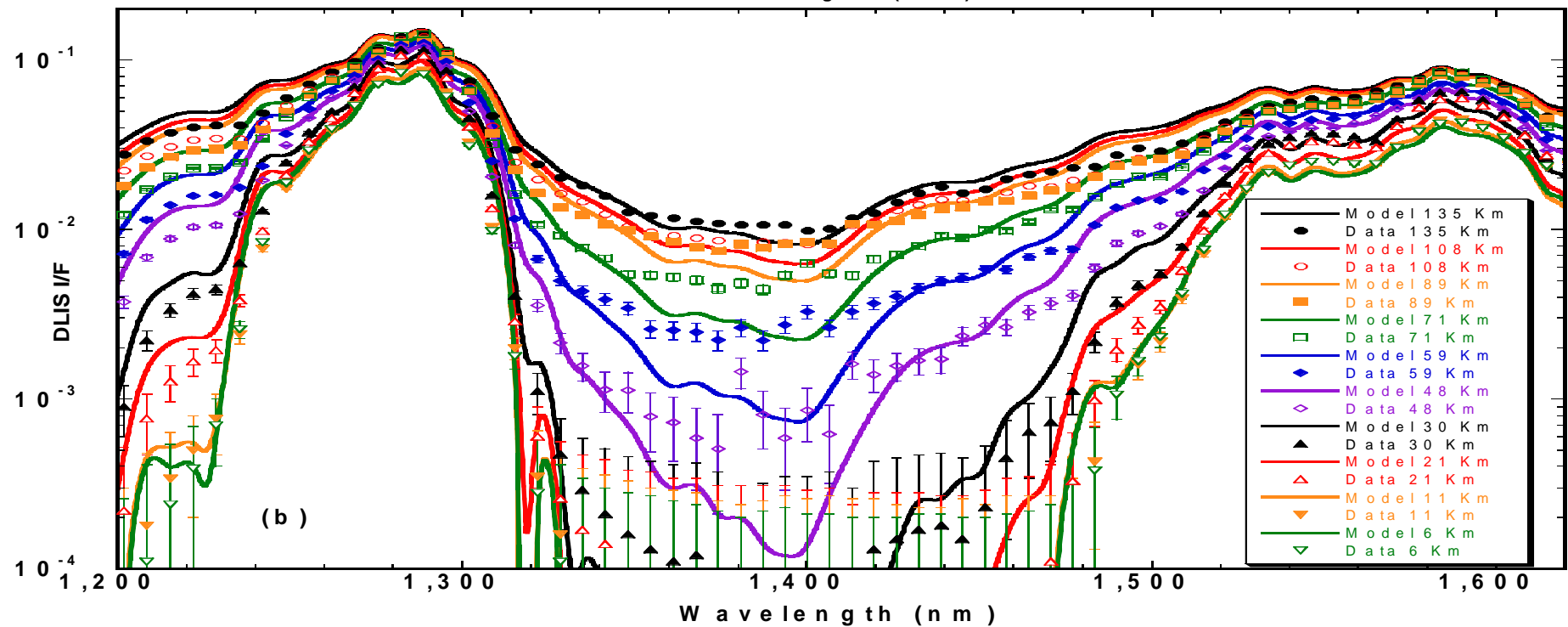
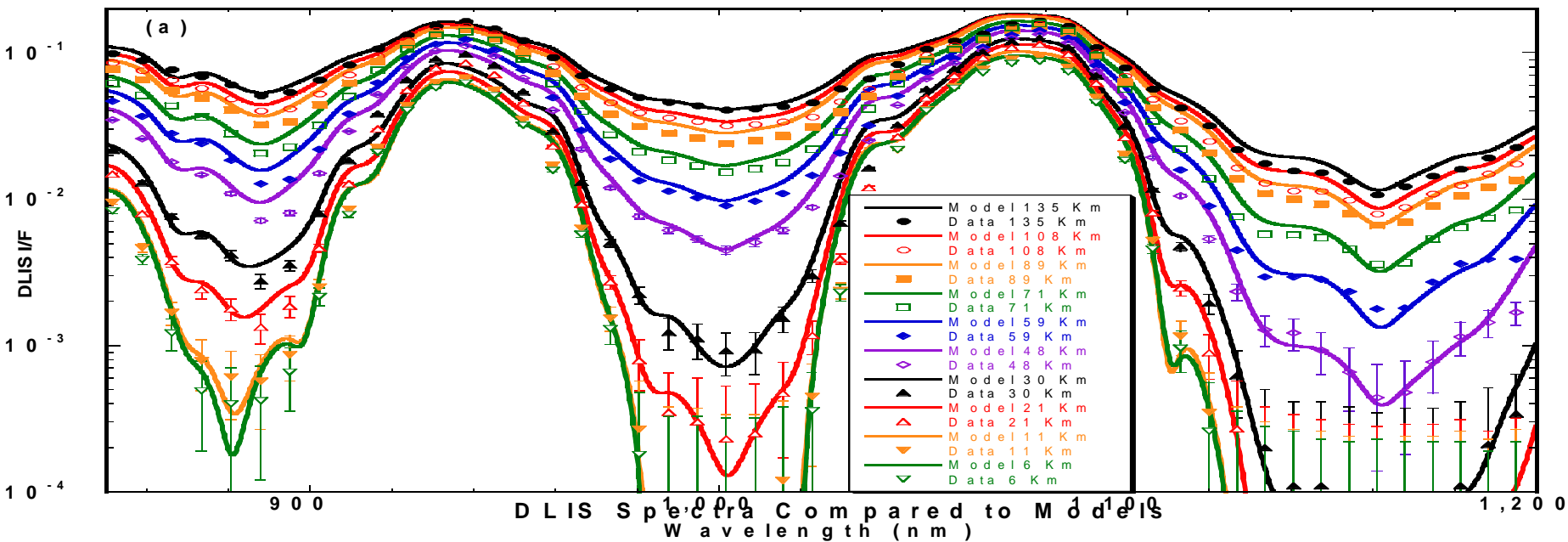


ULIS Spectra Compared to Models

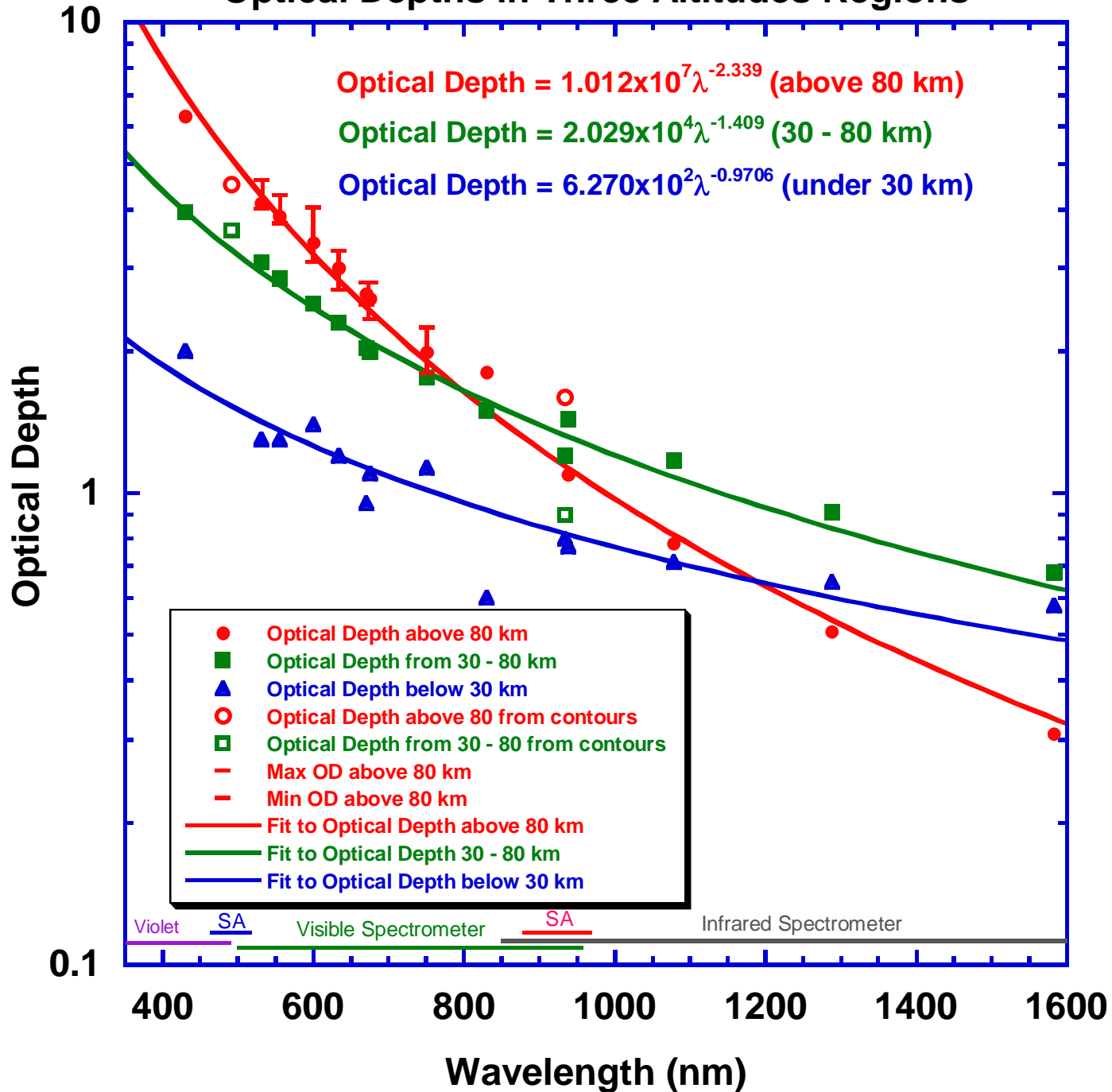


ULIS Spectra Compared to Models

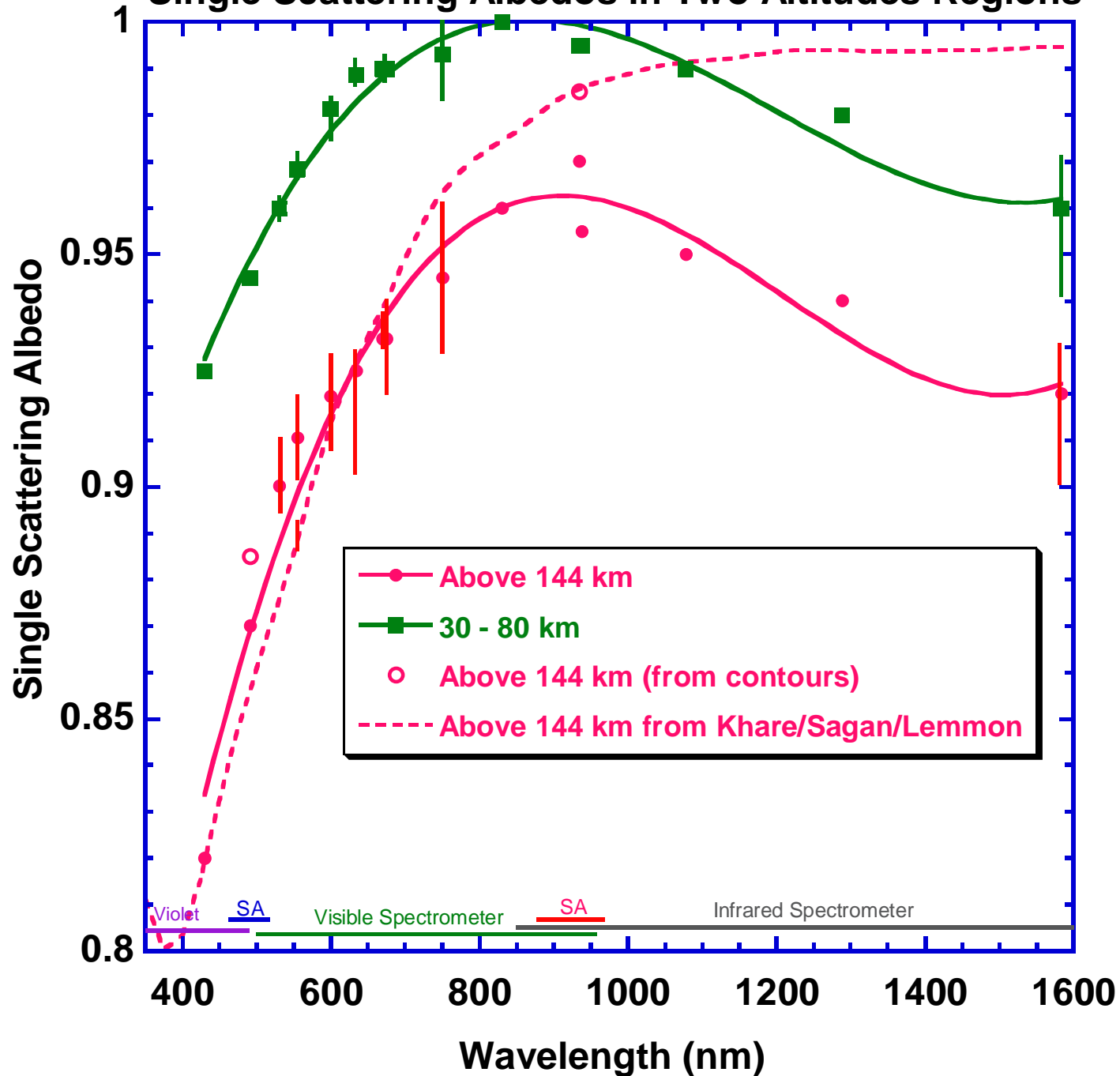




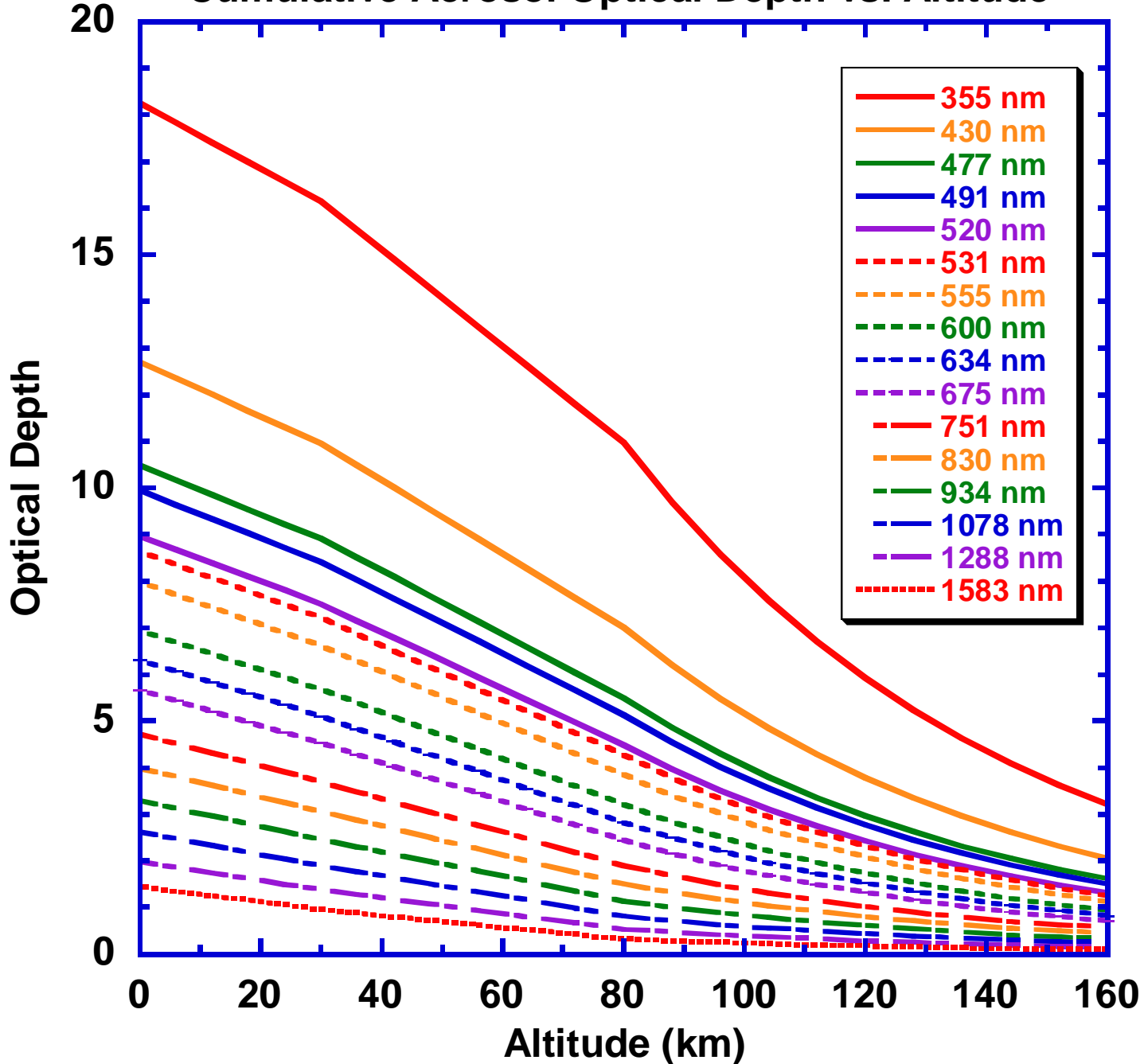
Optical Depths in Three Altitudes Regions



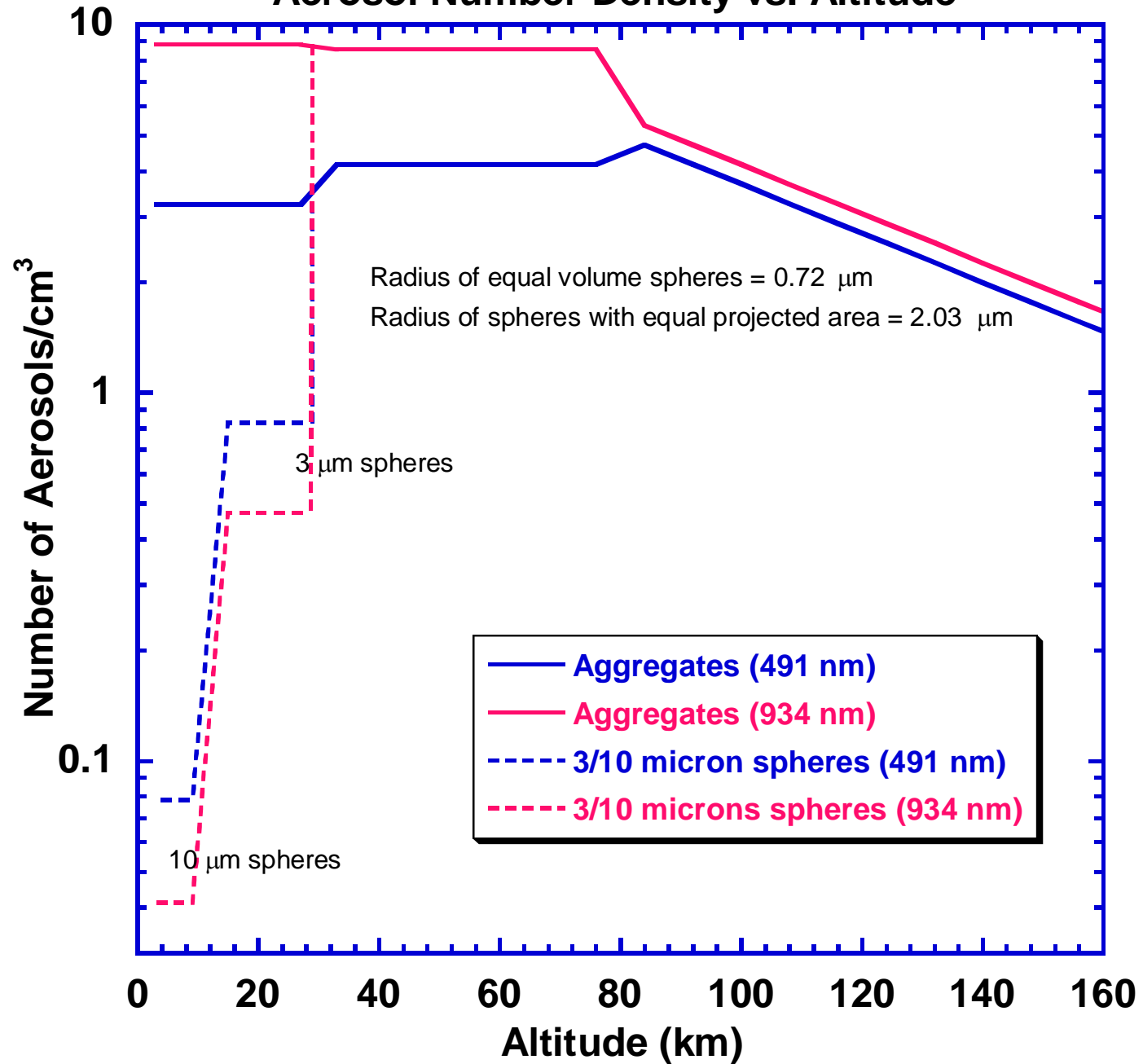
Single Scattering Albedos in Two Altitudes Regions



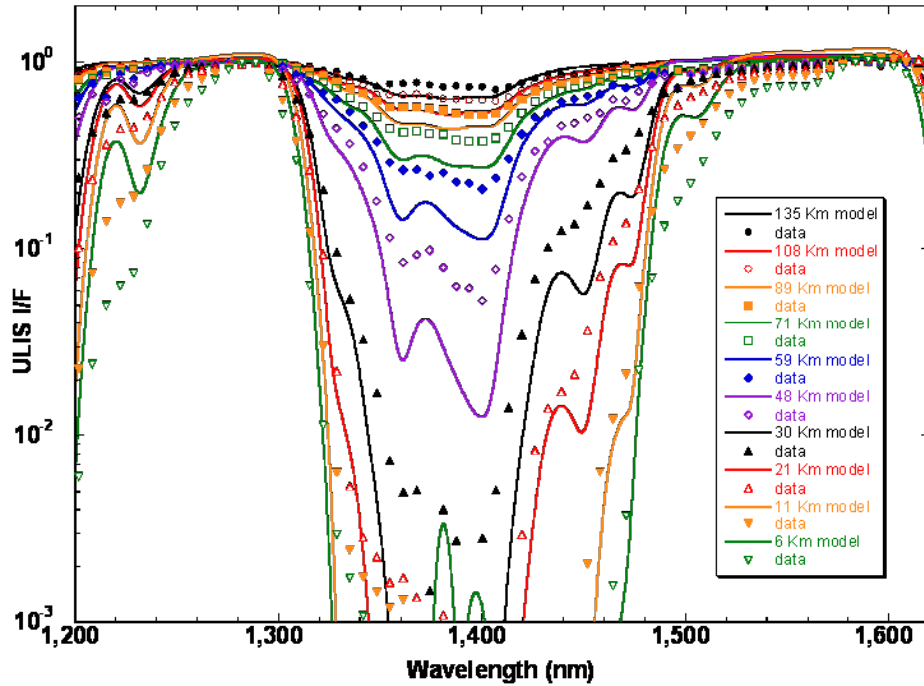
Cumulative Aerosol Optical Depth vs. Altitude



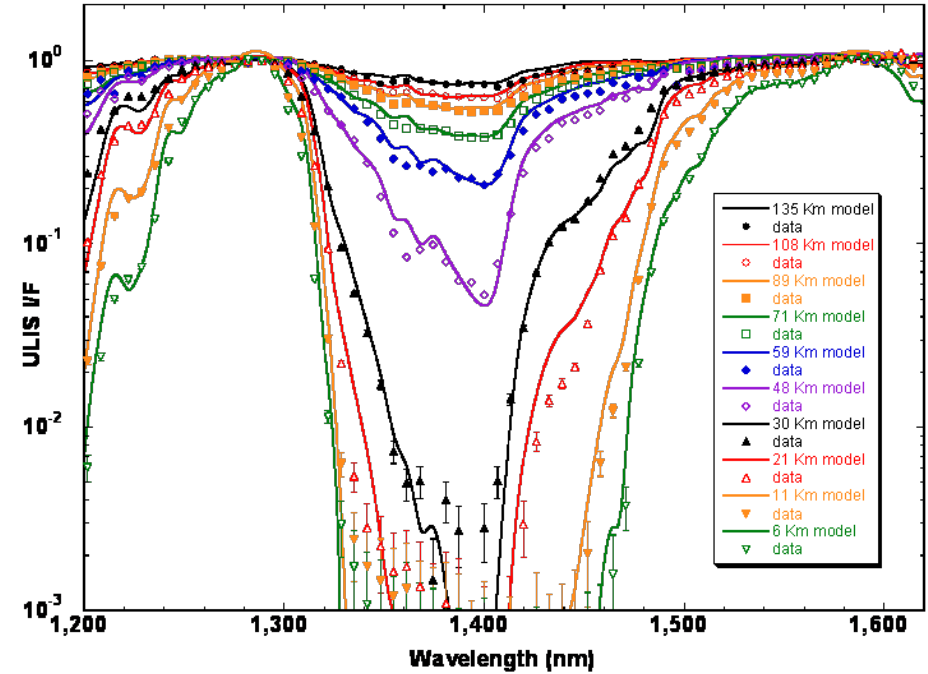
Aerosol Number Density vs. Altitude



ULIS Spectra Compared to Models using Irwin Coefficients



ULIS Spectra Compared to Models using Modified Irwin Coefficients

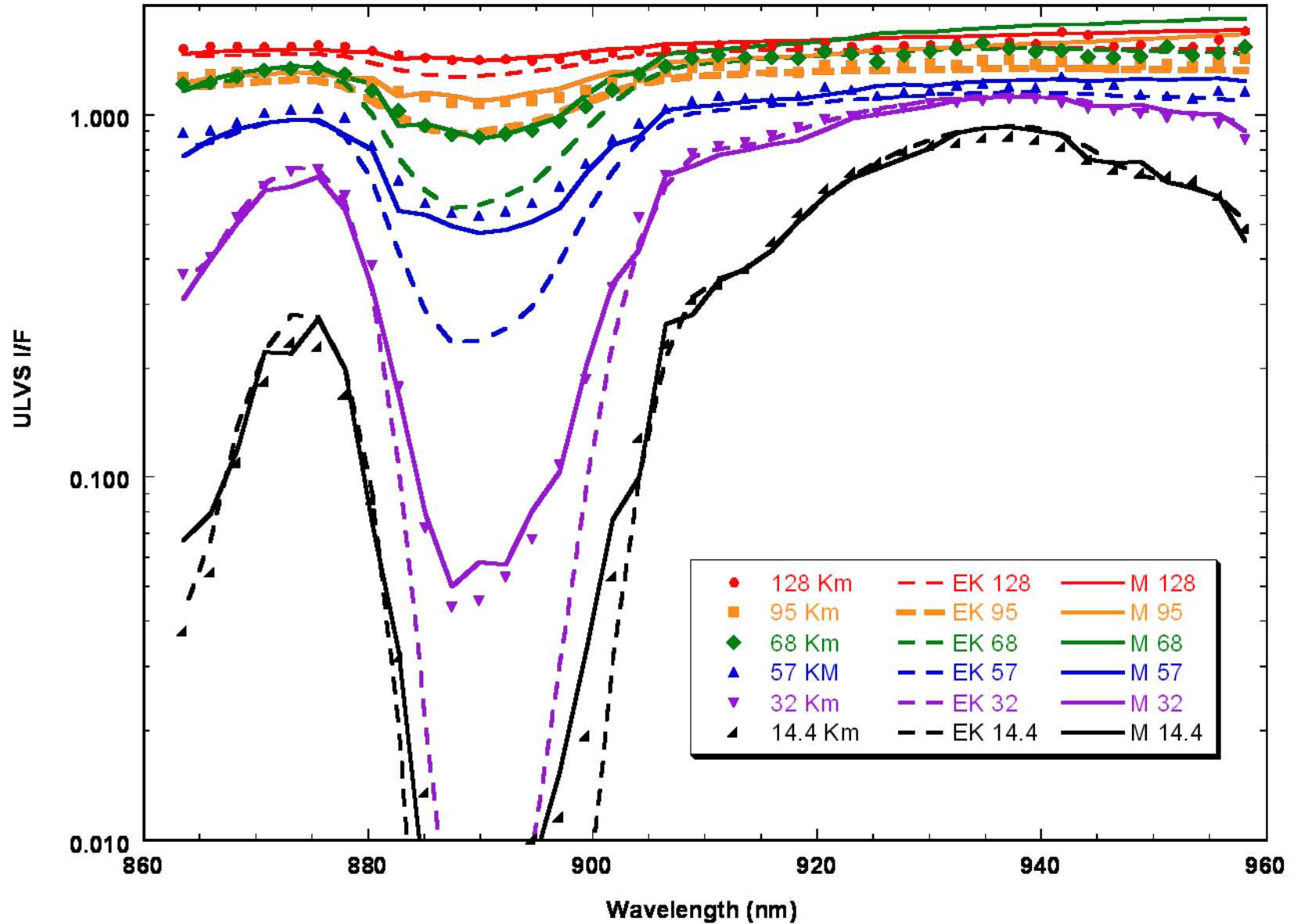


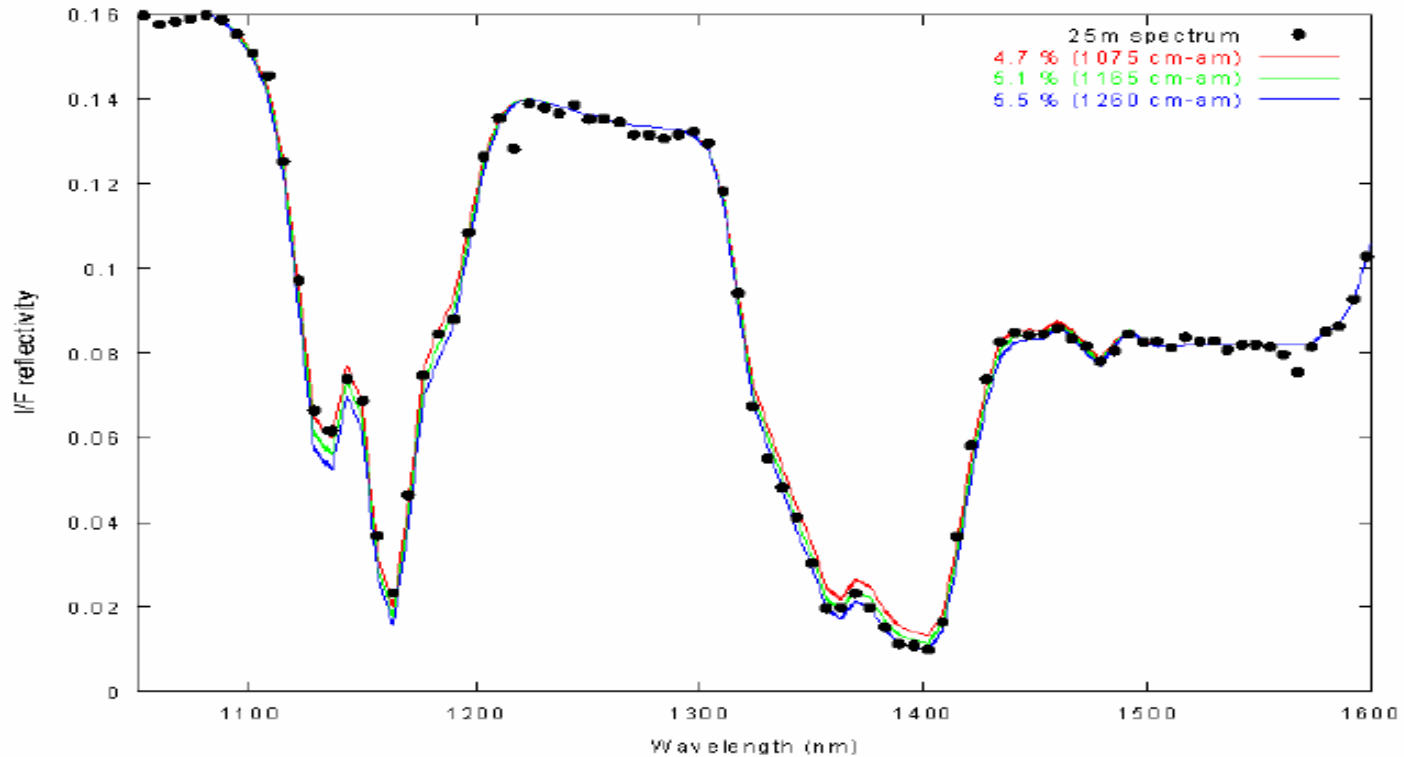
New values for methane absorption coefficients:

Left show DISR ULIS data (points) compared to model with old coefficients.

Right shows comparison with new coefficients.

ULVS I/F Vs. Wavelength

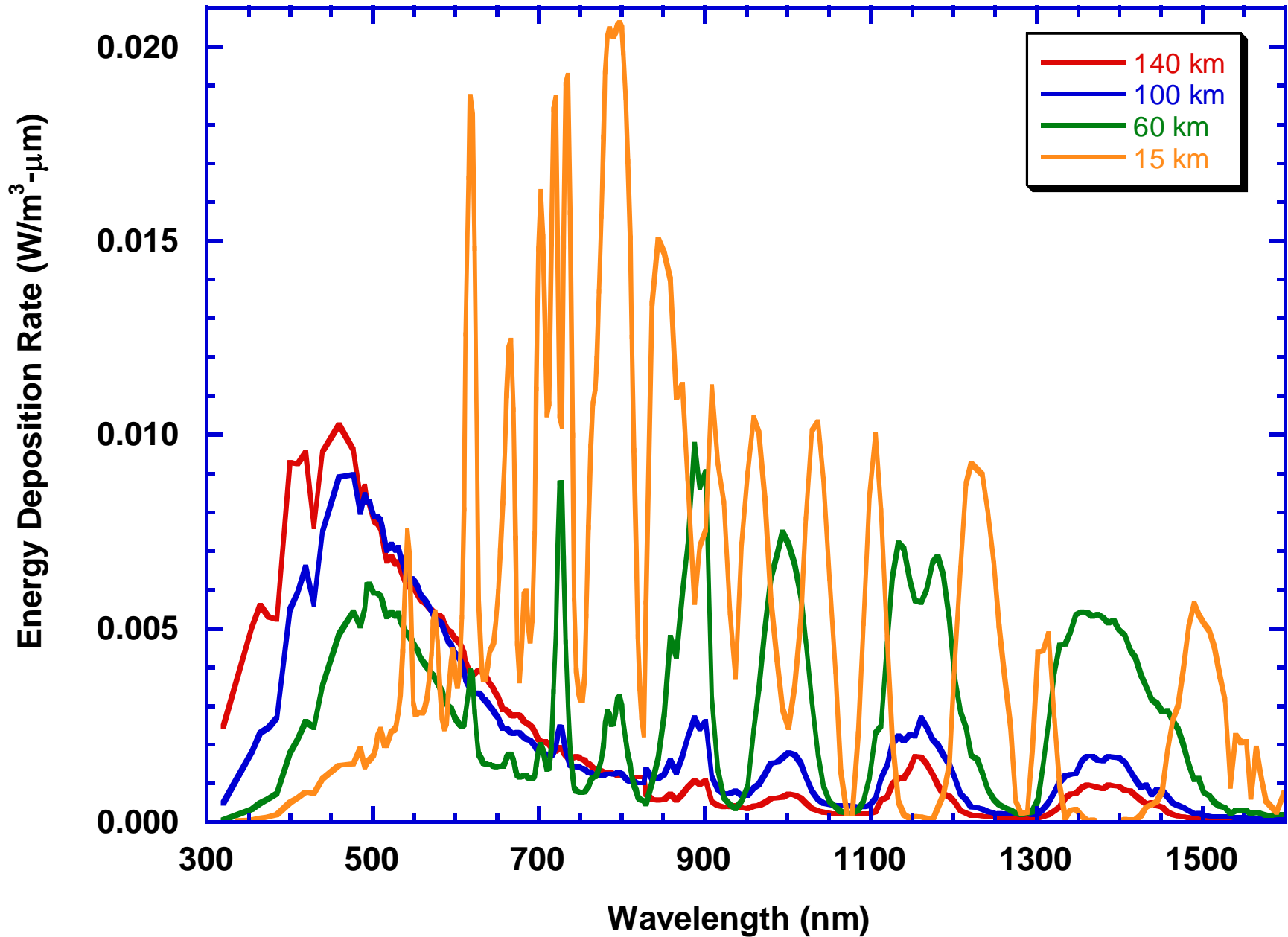




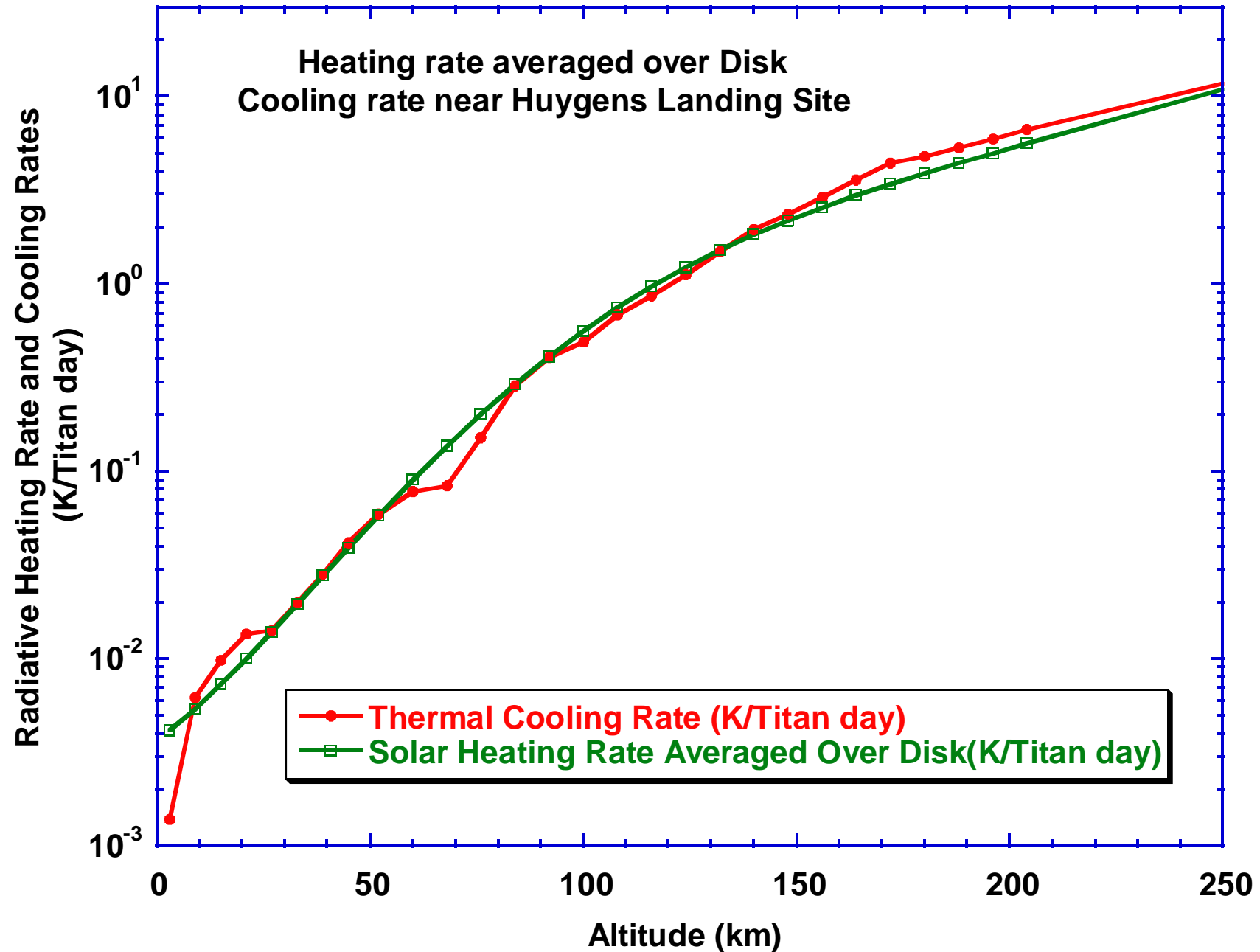
DISR spectrum from 25 m altitude compared to model spectra with 4.7, 5.1, and 5.5% methane.

We find 5.1 \pm 0.8% methane mixing ratio near surface.

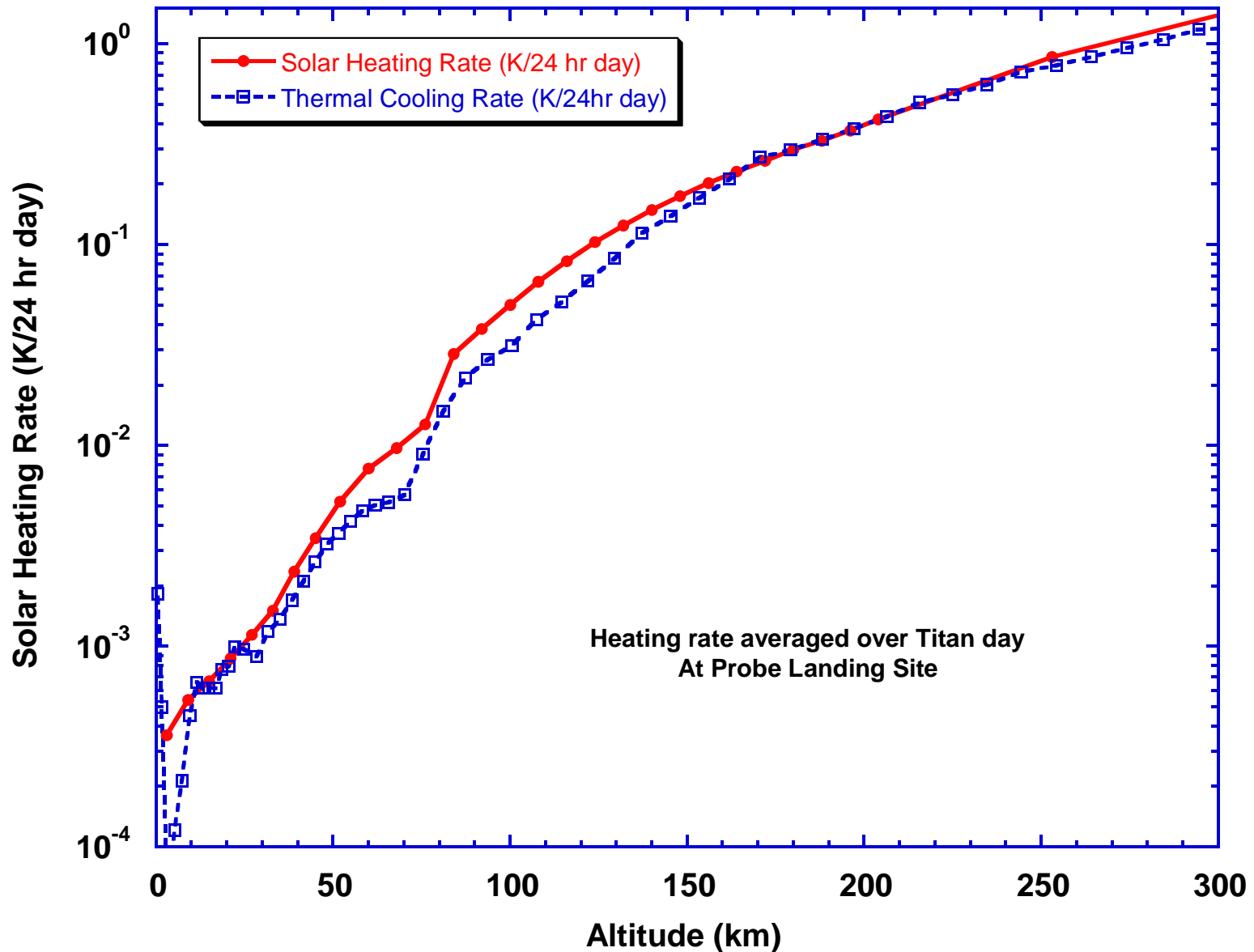
Energy Deposition Rate vs. Wavelength at SZA=0



Solar Heating and Thermal Cooling Rates Vs. Altitude



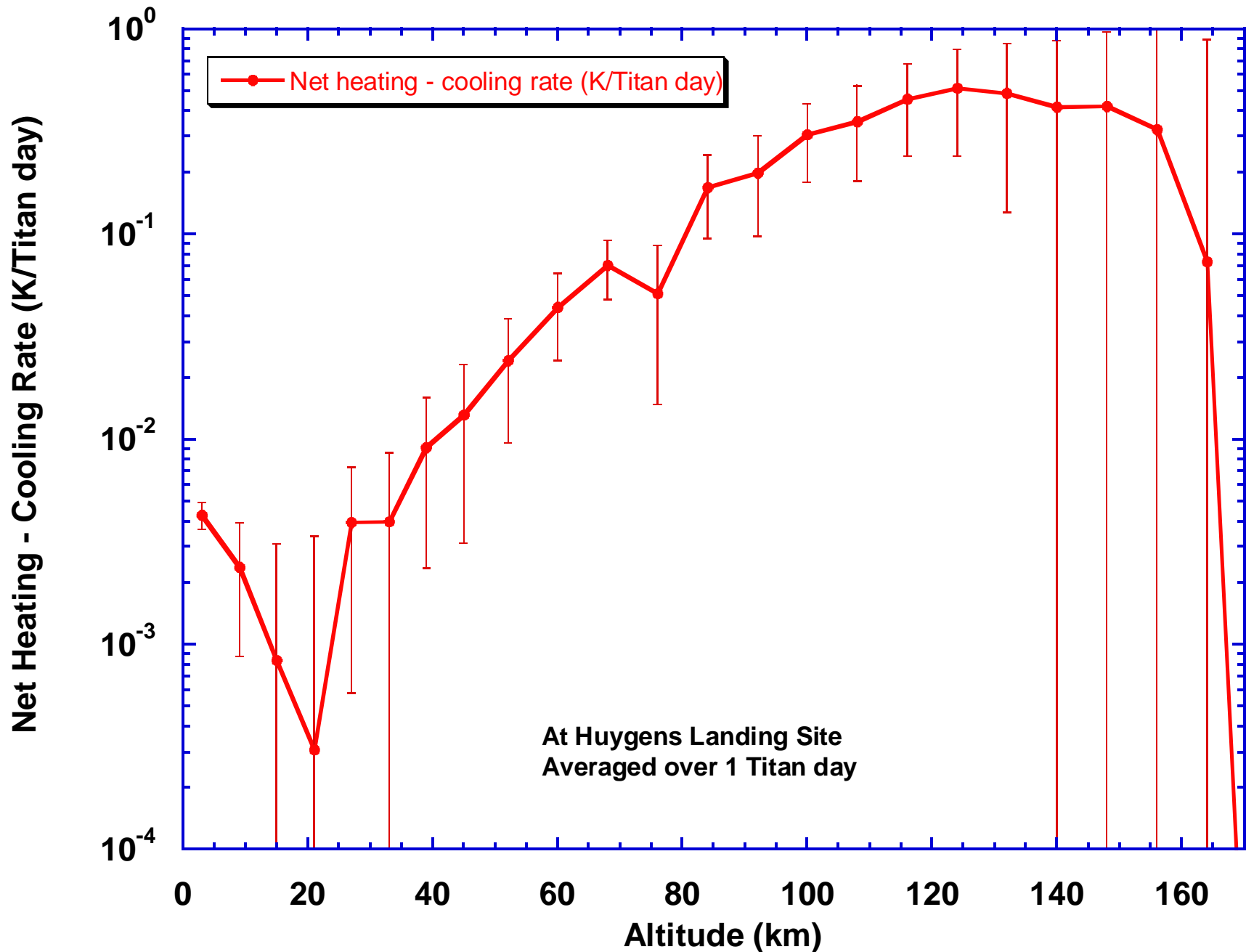
Solar Heating and Thermal Cooling Rates Vs. Altitude



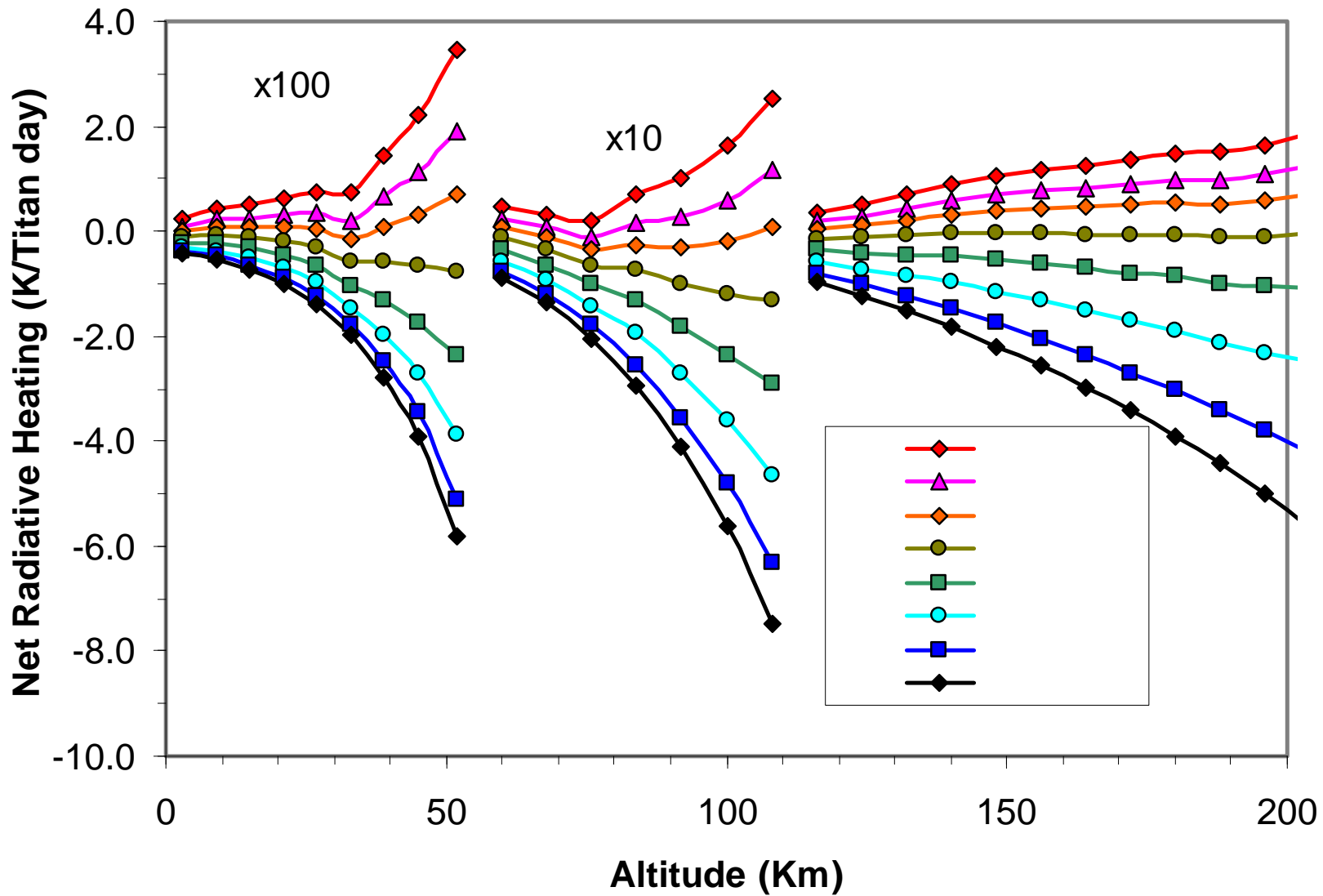
Heating rate averaged over Titan day
At Probe Landing Site

Solar Heating and Thermal Cooling rates have been computed at the Huygens Landing Site

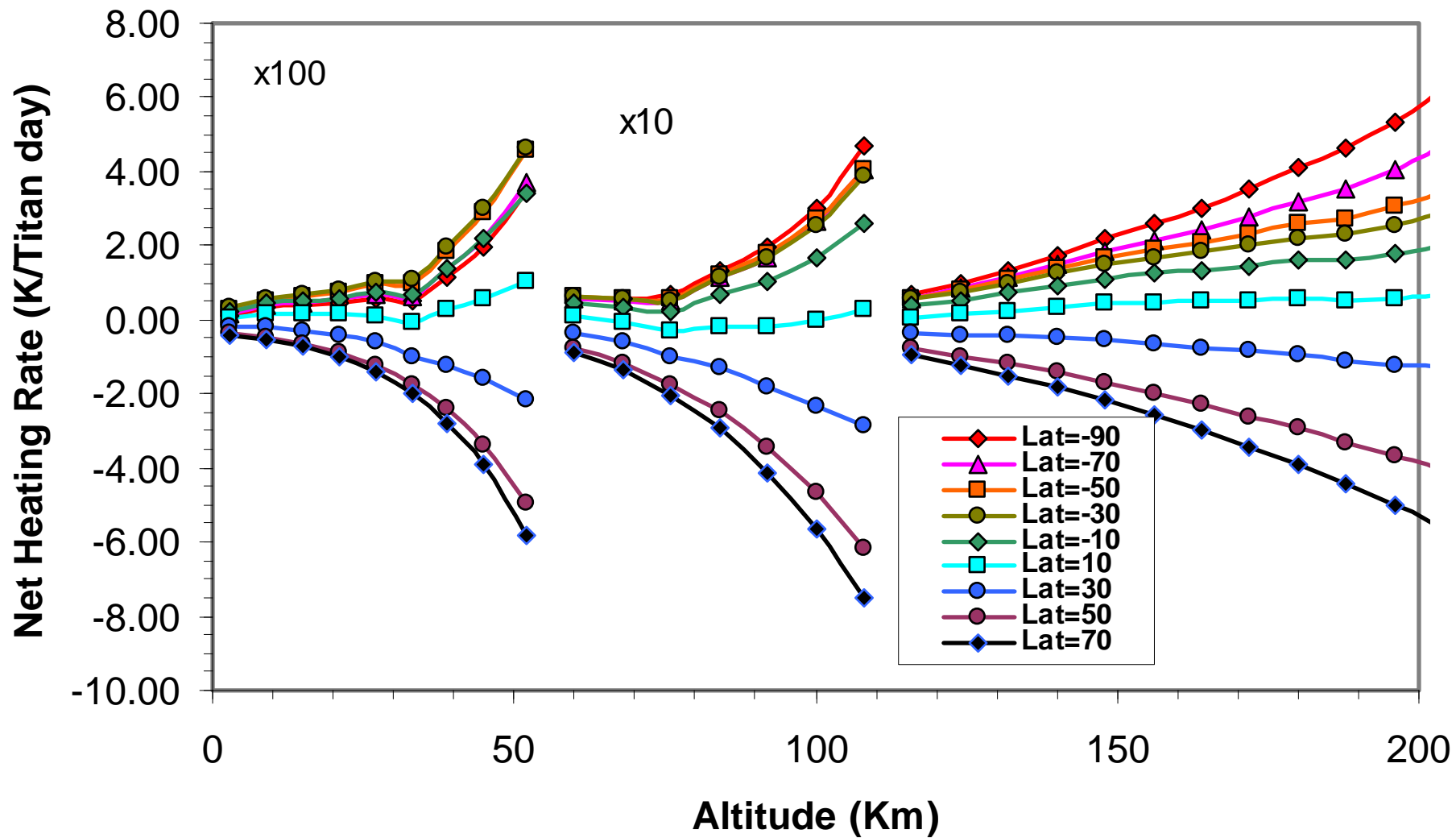
Net Heating - Cooling Rate Vs. Altitude



Net Radiative Heating Rate Vs. Altitude (at equinox)



Net Heating Rate Vs. Altitude at 25 deg tip



DISR Science Results

- Images of surface showing evidence of rain and fluid flow
- Measurements of heights of terrain
- Measurement of reflection spectrum of surface
- Measurements of zonal and meridional wind
- Size, optical properties, vertical distribution of haze aerosols
- Measurements of methane absorption coefficients for long paths at low temperature
- Measurement of methane mixing rate
- Solar heating rate and thermal cooling rate compared at landing site for heat balance studies