PART B

Hyperion On-Orbit Calibration Validation with AVIRIS in Argentina

Rob Green, Tom Chrien, Betina Pavri, and many others

Jet Propulsion Laboratory
California Institute of Technology
Arizaro Calibration Experiment
AVIRIS Image Arizaro, Arg 010207
Arizaro Calibration Target Measured Surface Reflectance

Zenith 36

Average(1824)
Standard Deviation
Standard Deviation of the Mean
Calibration Target Arizaro, Argentina 010207

The surface is highly variable at the 20 cm scale, but uniform at the 2 meter scale and greater.

50:50 Agreement 0.2%
Arizaro Surface

• The surface is highly variable at the 20 cm scale

• But uniform at the 2 meter scale and greater

• The surface has the highest most uniform spectra reflectance ever encountered by the JPL team
Optical Depth Measurements
Arizaro, Argentina 010207
Optical Depth Measurements
Arizaro, Argentina, 010207

Airmass

lnV_370
lnV_400
lnV_440
lnV_520
lnV_620
lnV_670
lnV_780
lnV_870
lnV_940
lnV_1030

Hyperion
Optical Depth Measurements
Arizaro, Argentina, 010207, 3700m

![Graph of Optical Depth Measurements]

- tau_370
- tau_400
- tau_440
- tau_520
- tau_620
- tau_670
- tau_780
- tau_870
- tau_1030

Legend:
- Hyperion
- AVIRIS

Time (hour)

Instantaneous Total Optical Depth (tau)
Arizaro Atmosphere

- Clear Stable sky
Preliminary Top-of Atmosphere Radiance
Arizaro, Argentina 010207

![Graph showing radiance vs. wavelength with two lines representing AVIRIS and MODTRAN](image)
Hyperion Image Arizaro 010207

Hyperion Image

Calibration Site

AVIRIS Image
Scene Based Estimate of Hyperion SNR

![Graph showing the Scene Based Estimate of Hyperion SNR. The x-axis represents Wavelength (nm) ranging from 400 to 2500, while the y-axis shows Mean/StdDev for Cal site ROI ranging from 0 to 250. The graph displays fluctuations in SNR across different wavelengths.]
Arizaro Calibration Experiment

- Comparison of predicted radiance to Hyperion measured radiance
Comparison of AVIRIS and Hyperion Data
Calibrated To Radiance
Ratio of Predicted over Hyperion Radiance for Arizaro 010207
Adjustment of Hyperion Calibration
Factor 1.1 in VNIR and 1.2 in SWIR
Ratio Predicted over Hyperion Radiance after adjustment

![Graph showing ratio predicted over Hyperion radiance after adjustment. The x-axis represents wavelength in nm, and the y-axis represents ratio. The graph includes annotations for VNIR*1.1 and SWIR*1.2.](image-url)
Laboratory Comparison of Radiometric Standards
Arizaro Calibration Experiment

- This preliminary analysis indicates Hyperion is underreport the radiance by 10 and 20 percent in the VNIR and SWIR spectrometers respectively.

- A 10 percent value is consistent with uncertainties in the ground calibration data.

- A full swath analysis is planned
Arizaro Calibration Experiment

- On orbit spectral calibration analysis
Note asymmetry between predicted radiance and Hyperion radiance at 760 nm

![Graph showing radiance comparison between Hyperion Adjusted and Predicted AVIRIS & MODTRAN](image-url)
Spectral agreement in VNIR is improved with 1.2 nm shift
Note asymmetry between predicted radiance and Hyperion radiance at 2000 nm
Spectral agreement in SWIR is improved with 1.5 nm shift.
Arizaro Calibration Experiment

- Analysis of atmospheric absorption bands in the Hyperion data indicates that for the Arizaro experiment a shift of 1.2 and 1.5 nm is needed in the on-orbit spectral calibration of Hyperion in the VNIR and SWIR spectrometers.
Future AVIRIS and Hyperion Full Swath Spectral Matching

- The following slides give an example of the AVIRIS spectral interpolation algorithm for Hyperion on-orbit calibration validation.

- This is required to explore Hyperion cross track characteristics with the AVIRIS underflight data

- This algorithm uses MODTRAN to interpolate AVIRIS data to 3 nm spectral resolution. These data may then be convolved to Hyperion data characteristics
MODTRAN Constrained for AVIRIS atmosphere
Rogers Dry Lake, CA
AVIRIS Measured Spectrum
Interpolation Function
AVIRIS Measured and Interpolated Spectrum
Summary

Two Hyperion underflight calibration experiment were successfully carried out in Argentina

Leoniceto
Arizaro

Analysis has focused on the Arizaro data. Initial analysis shows a 10 and 20 percent under reported of radiance in the VNIR and SWIR spectrometers respectively

Analysis of the spectral calibration shows a 1.2 and 1.5 nm shift in the on-orbit spectral calibration of the VNIR and SWIR spectrometer respectively.

These are preliminary results. Final results are expected to be published with the Hyperion special issue journal
AVIRIS Contributions

• AVIRIS and Imaging spectroscopy are providing the basis for a step forward in Earth remote sensing in the solar reflected spectrum

  – Based in the physics and chemistry of spectroscopy

  – Based in the general problem of unknowns and measurements

  – Based in the advance of optical, detector, dispersion and computer technology
Information

- Http://aviris.jpl.nasa.gov

- Rog@spectra.jpl.nasa.gov

- All AVIRIS Workshop Proceedings On-line at website

- AVIRIS Workshop March 5 to 8, 2002