Overview of AVIRIS Acquisitions in Argentina as Part of the NM EO-1 Campaign in 2001

Robert O. Green, Mike Eastwood, Ian McCubbin, Chris Chovit, Jim Raney, Jack Holbrook, plus others...

Jet Propulsion Laboratory
California Institute of Technology
Sites Along the Way
Overview

• Imaging Spectroscopy Approach
• AVIRIS Instrument and Data
• Calibration and SNR
• Argentina Campaign
• Summary
AVIRIS: The Imaging Spectroscopy Approach

Spectroscopic Example
Three materials detected
Three materials identified
Expressed concentrations derived

Multi Spectral Example
AVIRIS Measurement of the Spectrum

224 AVIRIS Spectral Channels (10nm)

Example Atmospheric Transmittance Spectrum

Wavelength (nm)

MODIS Multi-Spectral Bands

Transmittance
AVIRIS Instrument

AVIRIS is designed with 200 µm detectors and F/1 optics. It is hard to imagine larger detectors or faster optics. The AVIRIS design is in the advanced technology zone of the physics of spectroscopic measurements.

AVIRIS Technology Status

- Thermal control 1997
- Low Altitude 1998
- INU/GPS 1998
- Geo rectification 1998
- Onboard calibrator 1999
- Detector arrays 2000
- Digital signal chain 2001
- Onboard data storage 2001
AVIRIS: PEARL HARBOR, HAWAII

Spectral
- Range: 370 to 2500
- Sampling: 9.8 nm
- Accuracy: 0.5 nm

Radiometric
- Range: 0 to Max Lambertian
- Sampling: 12 bits
- Accuracy: 96 percent

Spatial (ER-2 / Twin Otter aircraft)
- Swath: 11/2.2 km ER-2/TO
- Sampling: 20/4 m ER-2/TO
- Accuracy: 20/4 m ER-2/TO

Full INU/GPS geo rectification
Excellent calibration and high precision (SNR) are required for NASA Code Y science

- AVIRIS calibration is within 96% of an independent prediction
- AVIRIS SNR ranges from 1000 to 500 in the continuum regions of the spectrum

![AVIRIS Performance Graph](image)
RESEARCH AND APPLICATIONS

- Atmosphere: water vapor, clouds properties, aerosols, absorbing gases…
- Ecology: chlorophyll, leaf water, lignin, cellulose, pigments, structure, nonphotosynthetic constituents…
- Geology and soils: mineralogy, soil type…
- Coastal and Inland waters: chlorophyll, plankton, dissolved organics, sediments, bottom composition, bathymetry…
- Snow and Ice Hydrology: snow cover fraction, grain size, impurities, melting…
- Biomass Burning: subpixel temperatures and extent, smoke, combustion products…
- Environmental hazards: contaminants directly and indirectly, geological substrate…
- Calibration: aircraft and satellite sensors, sensor simulation, standard validation..
- Modeling: radiative transfer model validation and constraint…
- Commercial: mineral exploration, agriculture and forest status…
- Algorithms: autonomous atmospheric correction, advance spectra derivation…
Argentina 2001

- In September/October 2000 it was proposed that AVIRIS deploy to Argentina in January to support NM EO-1 with summer underflight and validation acquisitions.

- On the 30th of December 2000 the Twin Otter left Las Vegas headed for Buenos Aires at 140 knots.

- On the 3rd of January 2001 AVIRIS was shipped to Buenos Aires.

- On the 13th of January AVIRIS collected the first image in Argentina onboard the Twin Otter.
Unpacking AVIRIS
Ready for Installation
Twin Otter
AVIRIS in Twin Otter
Press Conference on the Twin Otter
Argentina 2001 First Image January 13th
Nominal Plan

Zone 0
Buenos Aires

Zone 1
Posadas

Zone 2
Resistencia

Zone 3
S. M. de Tucumán

Zone 4
Jujuy

Zone 5
La Rioja

Zone 6
Córdoba

Zone 7
Mendoza

Zone 8
Neuquén

Zone 9
Comodoro Rivadavia

Zone 10
Gdor. Gregores

Zone 11
Madryn
Arizaro Region
Arizaro Target 010207
AVIRIS Argentina 2001

- AVIRIS began imaging on the 13 of January
- AVIRIS finished on the 20th of February
- AVIRIS flew 25 days and collected more than 125 flight lines
- More than 216 gigabytes of data were measured
- Two simultaneous under flights of NM EO-1
- Two simultaneous under flights of SAC-C
- The data have been calibrated and delivered to investigators
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
Beautiful Argentina (Aconcogua, Mendoza)