End-to-End Processing of CRISM Along-Track Oversampled Observations with Atmospheric and Temperature Corrections

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Overview

- Compact Reconnaissance Imaging Spectrometer for Mars (CRISM): hyperspectral instrument aboard the Mars Reconnaissance Orbiter (MRO) [1]
- Two imaging spectrometers: S (362 nm to 1055 nm) and L (1000 nm to 3969 nm), with spacing 6.55 nm/spectral band
- We have developed an end-to-end processing approach, particularly effective on along-track oversampled (ATO) observations
- Derivation of single scattering albedo (SSA) values using Discrete Ordinates Radiative Transfer program (DISORT) with the Hapke surface scattering function
- Neural network-based method to derive temperature maps to account for the thermal effects found for wavelengths >2.6 µm, enabling retrieval of SSA values for all CRISM wavelengths [2]
- Maximum likelihood method (MLM) approach that accounts for Poisson-based noise, regularizes and projects ATOs at 12 m/pixel [3]
- Compare: 18 m/pixel via CRISM Analysis Tool (CAT)
- Over the next 6 months, we will process 100 ATOs and archive them with PDS4 standards in the Geosciences Node

To provide feedback on which 100 scenes to process from the ~300 existing ATOs, please email Daniel Politte at politte@wunder.wustl.edu to receive the full list


Sensor Space Data and Spectral Comparison

CRISM ATO000397C1 S Sensor Space IOF
RGB 0.7097, 0.5885, 0.5337 micrometers

CRISM ATO000397C1 L Sensor Space IOF
RGB 2.5294, 1.5065, 1.0601 micrometers

Projected Products in Context

Recovered Hydration Indices

ATO000397C1 at Nili Fossae

Nili Fossae

CRISM ATO000397C1 Temperature Map Neural Network

Metallic textures modified for along-track oversampling

S&L spectrometers

S only

L only

DISORT (e.g., aerosols, gases)

M & L

SSA sensor space

SSA projected, 12m

DISORT

Processing Steps and Products

Example Spectra 10 by 10 pixel means

Without modeling both surface and atmosphere emission

Volcano scan to remove gases

Original IOF

SSA sensor space

SSA projected, 12m

Projected Product Spatial Comparison

Temperature Map Recovery

Background: MGS MOLA Global Colorized Hillshade 463 m (via USGS Astrogeology Science Center)

CRISM ATO000397C1 Temperature Map Neural Network

Projected Product Spatial Comparison

AT00000297C1 Data

RGB 0.7, 0.49, 0.14 micrometers

12 m/pixel MLM

CRISM ATO000397C1 Data

RGB 0.7, 0.49, 0.14 micrometers

12 m/pixel MLM

Projected Product Spatial Comparison

AT00000297C1 Data

RGB 0.7, 0.49, 0.14 micrometers

12 m/pixel MLM

CRISM ATO000397C1 Temperature Map Neural Network

Metallic textures modified for along-track oversampling