



## ENVI® ATMOSPHERIC CORRECTION MODULE (ACM)

### CORRECT EVEN THE MOST CHALLENGING ATMOSPHERIC CONDITIONS

#### BENEFITS

Correct multispectral and hyperspectral images

Use QUAC for in-scene correction

User defines all parameters with FLAASH

To ensure a true, reliable representation of a specific image scene, it is necessary to remove atmospheric interference before analyzing it. Correcting for atmospheric distortion is a pre-processing step that identifies atmospheric properties like the amount of water vapor and the distribution of aerosols, both of which affect surface reflectance. Because direct measurements of these atmospheric properties are rarely available, they must be inferred from the image pixels. The ENVI Atmospheric Correction Module provides two atmospheric correction modeling tools for retrieving spectral reflectance from multispectral and hyperspectral images: Quick Atmospheric Correction (QUAC®) and Fast Line-of-sight Atmospheric Analysis of Spectral Hypercubes (FLAASH®).\*

#### FLAASH

FLAASH is a first-principles atmospheric correction tool that corrects wavelengths in the visible through near-infrared and shortwave infrared regions. Unlike many other atmospheric correction programs that interpolate properties from a pre-calculated database of modeling results, FLAASH incorporates the MODTRAN4 radiation transfer code. The FLAASH model is highly tunable, allowing the user to define all parameters that influence atmospheric absorption and scattering such as relative solar position, atmospheric, aerosol, and scattering models, visibility parameters and more. FLAASH can also account for such atmospheric influences as adjacency effects, artifact suppression, and provide access to aerosol and water vapor retrieval.

The FLAASH user interface shown in Figure 2 (over), allows the user to set the desired options including choosing one of the pre-defined MODTRAN atmospheric profiles or a user defined profile.

#### Sensor Support

FLAASH supports multispectral and hyperspectral imaging sensors with wavelengths ranging from 0.4  $\mu\text{m}$  to 3  $\mu\text{m}$ . Wavelengths and full-width-half-maximum values are required sensor metadata. The radiance data must be in units of  $\mu\text{W}/(\text{cm}^2 * \text{sr} * \text{nm})$ .

#### API Support

FLAASH is not available via the ENVI API. It can only be accessed in an interactive ENVI session.

*\*The ENVI ACM is a third party module developed by Spectral Sciences, Inc. A separate license is required for the ENVI ACM.*

## QUAC

QUAC is an in-scene approach to atmospheric correction and determines parameters directly from the information contained within the scene using the observed pixel spectra. The QUAC method introduces a user-friendly interface and is easier to use than FLAASH, yet still produces reflectance spectra (results) that are extremely accurate. QUAC enables the retrieval of reasonably accurate reflectance spectra even when the sensor does not have a proper radiometric or wavelength calibration, or when the solar illumination intensity is unknown. The computational speed of the atmospheric correction method is significantly faster than for the first-principles methods, making it potentially suitable for real-time applications on aircraft and spacecraft.

QUAC is based on the empirical finding that the average reflectance of diverse material spectra (excluding highly structured materials such as vegetation, shallow water, and mud) is not dependent on each scene, making processing much faster than first-principles methods. QUAC also allows for any view angle or solar elevation angle. If a sensor does not have proper radiometric or wavelength calibration, or if the solar illumination intensity is unknown (with cloud decks, for example), QUAC can still retrieve reasonably accurate reflectance spectra as long as the following conditions are met:

- There are at least 10 diverse materials in a scene.
- There are sufficiently dark pixels in a scene to allow for a good estimation of the baseline spectrum.

The QUAC algorithm improves the accuracy of atmospheric correction by implementing the following capabilities:

- Applies mud filtering to exclude highly structured materials.
- Selects endmembers based on a small subset of available bands for most sensors. When a sensor spans both the visible and NIR-SWIR spectral regions, the algorithm excludes bands in the visible region.
- Constrains the gain curve to be constant for wavelengths below 650 nm.
- Suppresses the effects of dense vegetation.
- Removes cloud endmembers for hyperspectral sensors with 940 to 1020 nm water absorption bands.

## Sensor Support

QUAC supports multispectral and hyperspectral imaging sensors with wavelengths ranging from 0.4  $\mu\text{m}$  to 3  $\mu\text{m}$ . The data must have wavelength metadata, but can be in radiance or raw/uncalibrated units.

### About Harris Corporation

Harris Corporation is a leading technology innovator, solving customers' toughest mission-critical challenges by providing solutions that connect, inform and protect. Harris supports government and commercial customers in more than 100 countries and has approximately \$6 billion in annual revenue. The company is organized into three business segments: Communication Systems, Space and Intelligence Systems and Electronic Systems. Learn more at [Harris.com](http://Harris.com).

### API Support

QUAC is available in an interactive session and via the ENVI API. The QUAC algorithm can be called using the ENVI Task routine ENVIQUACTask. The ENVICalculateQUACGainOffsetTask can also be used to calculate that gains and offsets for QUAC.

### FOR MORE INFORMATION:

[HarrisGeospatial.com/ENVI](http://HarrisGeospatial.com/ENVI)

Email: [geospatialinfo@harris.com](mailto:geospatialinfo@harris.com)

Phone: 303.786.9900

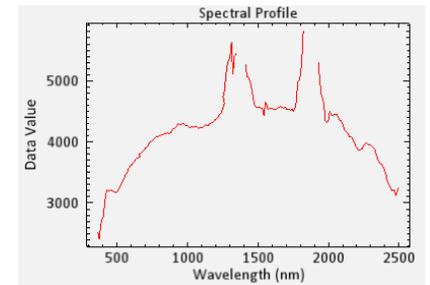
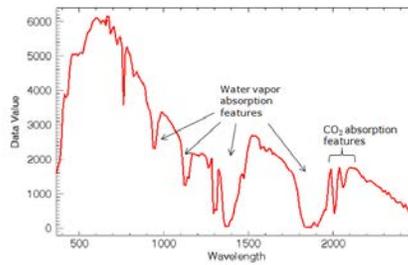


Figure 1 (Above): Radiance spectra from hyperspectral image (top); Reflectance spectra after processing with FLAASH or QUAC.

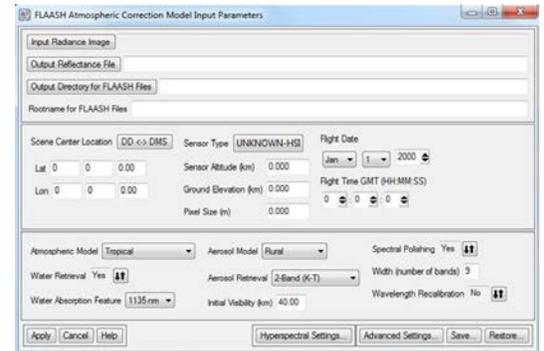


Figure 2 (Above): FLAASH User Interface

### FLAASH OPERATING SYSTEM SUPPORT

WINDOWS		MAC OS X	LINUX
32-BIT	64-BIT	64-BIT	64-BIT
•	•		•

### QUAC OPERATING SYSTEM SUPPORT

WINDOWS		MAC OS X	LINUX
32-BIT	64-BIT	64-BIT	64-BIT
•	•	•	•

FLORIDA | NEW YORK | VIRGINIA | BRAZIL | UNITED KINGDOM | UAE | SINGAPORE

### Non-Export Controlled Information

Harris is a registered trademark of Harris Corporation. Trademarks and trade names are the property of their respective companies.

© 2017 Harris Corporation 3/17 VIS-AL

