



## **Aerosol and Surface Parameter Retrievals for a Multi-Angle, Multiband Spectrometer**

This software retrieves the surface and atmosphere parameters of multi-angle, multiband spectra. The synthetic spectra are generated by applying the modified Rahman-Pinty-Verstraete Bidirectional Reflectance Distribution Function (BRDF) model, and a single-scattering dominated atmosphere model to surface reflectance data from Multiangle Imaging SpectroRadiometer (MISR). The aerosol physical model uses a single scattering approximation using Rayleigh scattering molecules, and Henyey-Greenstein aerosols. The surface and atmosphere parameters of the models are retrieved using the Lavenberg-Marquardt algorithm.

The software can retrieve the surface and atmosphere parameters with two different scales. The surface parameters are retrieved pixel-by-pixel while the atmosphere parameters are retrieved for a group of pixels where the same atmosphere model parameters are applied. This two-scale approach allows one to select the natural scale of the atmosphere properties relative to surface properties. The software also takes advantage of an intelligent initial condition given by the solution of the neighbor pixels.

*This work was done by Seungwon Lee, Rachel A. Hodos, and Paul A. Von Allmen of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

*This software is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at [danielb@caltech.edu](mailto:danielb@caltech.edu). Refer to NPO-47510.*

## **LogScope**

LogScope is a software package for analyzing log files. The intended use is for offline post-processing of such logs, after the execution of the system under test. LogScope can, however, in principle, also be used to monitor systems online during their execution. Logs are checked against requirements formulated as monitors expressed in a rule-based specification language. This language has similarities to a state machine language, but is more expressive, for ex-

ample, in its handling of data parameters. The specification language is user friendly, simple, and yet expressive enough for many practical scenarios.

The LogScope software was initially developed to specifically assist in testing JPL's Mars Science Laboratory (MSL) flight software, but it is very generic in nature and can be applied to any application that produces some form of logging information (which almost any software does).

*This work was done by Klaus Havelund and Margaret H. Smith of Caltech; Howard Barringer of University of Manchester, UK; and Alex Groce of Oregon State University for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

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## **TraceContract**

TraceContract is an API (Application Programming Interface) for trace analysis. A trace is a sequence of events, and can, for example, be generated by a running program, instrumented appropriately to generate events. An event can be any data object. An example of a trace is a log file containing events that a programmer has found important to record during a program execution. TraceContract takes as input such a trace together with a specification formulated using the API and reports on any violations of the specification, potentially calling code (reactions) to be executed when violations are detected.

The software is developed as an internal DSL (Domain Specific Language) in the Scala programming language. Scala is a relatively new programming language that is specifically convenient for defining such internal DSLs due to a number of language characteristics. This includes Scala's elegant combination of object-oriented and functional programming, a succinct notation, and an advanced type system. The DSL offers a combination of data-parameterized state machines and temporal logic, which is novel. As an extension of Scala, it is a very expressive and convenient log file analysis framework.

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## **AIRS Maps From Space Processing Software**

This software package processes Atmospheric Infrared Sounder (AIRS) Level 2 swath standard product geophysical parameters, and generates global, colorized, annotated maps. It automatically generates daily and multi-day averaged colorized and annotated maps of various AIRS Level 2 swath geophysical parameters. It also generates AIRS input data sets for Eyes on Earth, Puffer-sphere, and Magic Planet.

This program is tailored to AIRS Level 2 data products. It re-projects data into 1/4-degree grids that can be combined and averaged for any number of days. The software scales and colorizes global grids utilizing AIRS-specific color tables, and annotates images with title and color bar.

This software can be tailored for use with other swath data products for the purposes of visualization.

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## **POSTMAN: Point of Sail Tacking for Maritime Autonomous Navigation**

Waves apply significant forces to small boats, in particular when such vessels are moving at a high speed in severe sea conditions. In addition, small high-speed boats run the risk of diving with the bow into the next wave crest during operations in the wavelengths and wave speeds that are typical for shallow water. In order to mitigate the issues of autonomous navigation in rough water, a hybrid controller called