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 Multianngle 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.

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.

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