Atmospheric Compensation for Imaging Spectrometer Systems with Changing Imaging Geometry

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Abstract

Spectral radiance measurements obtained from space-based or airborne imaging spectrometer systems that are looking downward through the atmosphere at the earth's surface contain a wealth of surface information. However, the radiance measurements must be compensated for the influence of the atmosphere in order to retrieve surface reflectance spectra, which is an intrinsic physical property. A physically-based atmospheric compensation process requires the use of fast and accurate radiative transfer calculations, such as are available from the MODTRAN® code. The data processing for a system with a constant imaging geometry over an image scene is considerably more straightforward than that for a system with a continuously varying geometry over an image scene.

The focus of this study is on the challenge of performing a physically-based atmospheric correction on data measured by a space-based imaging spectrometer system with a variable imaging geometry over an image scene. A technique developed to handle this atmospheric compensation scenario involves processing an entire cube at once but operating on virtual sub-cubes and applying MODTRAN® calculations using a different set of viewing geometry values for each sub-cube. This technique and results from an analysis of various atmospheric and viewing geometry conditions over an image scene on the atmospheric compensation process are discussed.