

The Earth Climate Hyperspectral Observatory: Advances in Climate Change Detection, Attribution, and Remote Sensing

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Future satellite missions to monitor global change require the establishment of high-accuracy spectrally resolved benchmark data records of reflected shortwave radiation for trend detection and attribution. Not surprisingly, these same attributes also provide substantial improvements in the retrieval of microphysical and optical properties of clouds and aerosols over current discrete-band observations. The NASA Climate Absolute Radiance and Refractivity Observatory (CLARREO) mission, currently in pre-formulation, defines a set of fundamental direct observations of spectrally resolved reflected shortwave and emitted longwave radiation, and GNSS radio occultation in order to detect climate trends and to test and improve climate prediction models. The Earth Climate Hyperspectral Observatory (ECHO), a proposed pathfinder mission to CLARREO, focuses on measuring spectrally resolved Earth-reflected shortwave radiation over a spectral range that comprised approximately 95% of the solar radiative energy incident at the top-of-atmosphere.

This paper will report on the ECHO requirements specifically directed at objectives related to cloud and aerosol remote sensing, and more generally, characterizing the physical parameters responsible for the observed spectral and temporal variability in a benchmark data record. These objectives are centered on targeted remote sensing and data assimilation analyses to derive the dominant contributors to the observed spectral, temporal, and spatial perturbations in the reflected shortwave signal. Specific improvements in the retrieval of cloud and aerosol properties due to increased spectral coverage, spectral resolution, and radiometric accuracy will be discussed.