CLARREO cornerstone of the Earth Observing System: measuring decadal change through accurate emitted infrared and reflected solar spectra and radio occultation

Paper 7826-33
Time: **16:50 - 17:10**
Author(s): Stephen P. Sandford, NASA Langley Research Ctr. (United States)

The Climate Absolute Radiance and Refractivity Observatory (CLARREO) is one of four Tier 1 missions recommended by the recent NRC Decadal Survey report on Earth Science and Applications from Space (NRC, 2007). The CLARREO mission addresses the need to provide accurate, broadly acknowledged climate records that are used to enable validated long-term climate projections that become the foundation for informed decisions on mitigation and adaptation policies that address the effects of climate change on society. The CLARREO mission accomplishes this critical objective through rigorous SI traceable decadal change observations that are sensitive to many of the key uncertainties in climate radiative forcings, responses, and feedbacks that in turn drive uncertainty in current climate model projections. These same uncertainties also lead to uncertainty in attribution of climate change to anthropogenic forcing.
For the first time CLARREO will make highly accurate, global, SI-traceable decadal change observations sensitive to the most critical, but least understood, climate forcings, responses, and feedbacks. The CLARREO breakthrough is to achieve the required levels of accuracy and traceability to SI standards for a set of observations sensitive to a wide range of key decadal change variables. The required accuracy levels are determined so that climate trend signals can be detected against a background of naturally occurring variability. Climate system natural variability therefore determines what level of accuracy is overkill, and what level is critical to obtain. In this sense, the CLARREO mission requirements are considered optimal from a science value perspective. The accuracy for decadal change traceability to SI standards includes uncertainties associated with instrument calibration, satellite orbit sampling, and analysis methods. Unlike most space missions, the CLARREO requirements are driven not by the instantaneous accuracy of the measurements, but by accuracy in the large time/space scale averages that are key to understanding decadal changes.

This paper will summarize the CLARREO observations, science objectives and instrument requirements. The CLARREO observations include a nadir viewing infrared interferometer covering the spectral region of 200 to 2000 cm-1, with 1 cm-1 spectral resolution and also includes a reflected solar spectrometer, pointed by a two-axis gimbal, covering the spectral region from 320 to 2300 nm, with 4 nm spectral sampling. The solar spectrometer will be capable of pointing to the moon and sun for calibration, as well as

tracking other sensors FOV for Reference Intercalibration of other radiometers such as CERES or VIIRS. Finally, the observations include radio occultation receivers and antennas to allow use of both the GPS and Galileo Global Navigation Satellite Systems.

The CLARREO mission utilizes 90-degree polar orbits to enable global sampling of the nadir infrared and reflected solar spectra, sampling of the complete diurnal cycle, and reference intercalibration sampling in all climate regimes and orbit conditions from equator to pole. This orbit sampling meets the CLARREO mission accuracy requirements for global and zonal space scales, as well as seasonal and annual time scales.