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Detectability of planetary surface biosignatures: Modeled and measured disk-averaged spectra of the Earth

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We are using computer models to explore the observational sensitivity to changes in atmospheric and surface properties, and the detectability of biosignatures (eg. plants on land and phyoplankton in the ocean), in the globally averaged spectra and light curves of the Earth. Using AIRS (Atmospheric Infrared Sounder) data, as input on atmospheric and surface properties, we have generated spatially resolved high-resolution synthetic spectra using the SMART radiative transfer model, for a variety of conditions, from the UV to the far-IR (beyond the range of current Earth-based satellite data). We have then averaged over the visible disk for a number of different viewing geometries to quantify the sensitivity to surface types and atmospheric features as a function of viewing geometry, and spatial and spectral resolution.
These results have been processed with an instrument simulator to improve our understanding of the detectable characteristics of Earth-like planets as viewed by the first (and probably second) generation of extrasolar terrestrial planet detection and characterization missions (NASA Terrestrial Planet Finder-ESA Darwin and Life finder). Our spectra were modeled for both the proposed visible coronograph and mid-infrared interferometer architectures.
We have validated this model against observations by the Mars Global Surveyor Thermal Emission Spectrometer (MGS TES). This model was also used to analyze Earthshine data for the detectability of planetary characteristics and biosignatures in disk-averaged spectra.