INVERSION OF HYPERSPECTRAL DATA USING FAST PRINCIPAL COMPONENT-BASED RADIATIVE TRANSFER MODEL

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Hyperspectral observations from satellite-based sensors provide high information content for the Earth's atmospheric and surface properties; however, in order to analyze hyperspectral data efficiently, fast and accurate radiative transfer model is needed. We have developed a Principal Component-based Radiative Transfer Model (PCRTM), which can simulate hyper spectra in cloudy atmosphere from far IR to visible and UV spectral regions quickly and accurately. Multi-scattering of multiple layers of clouds/aerosols is included in the model. The computation speed is 3 to 4 orders of magnitude faster than the medium speed correlated-k option MODTRAN5 and LBLRTM. The PCRTM calculated radiance spectra agree with the MODTRAN and LBLRTM within 0.02%. Comparisons of the PCRTM model calculations with observed AIRS, CrIS, IASI, NAST-I, and SCIAMACHY data will be presented.

A highly efficient inversion algorithm that is based on PCRTM will be presented. The PCRTM retrieval algorithm has been successfully applied to retrieving atmospheric temperature and moisture profiles, CO_2, CO, CH_4, N_2O, and O_3 profiles, cloud optical depth, size, phase, and height. Surface properties such as surface emissivity spectra and surface skin temperatures are also retrieved simultaneously.

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