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Poster
On March 4, 2024, the Environmental Defense Fund in partnership with the Harvard Center for Astrophysics launched MethaneSAT, the next U.S.-based greenhouse gas sensor. MethaneSAT is a wide-swath near-infrared sensor with an O2 band at 1.27 um and a CO2+CH4 band at 1.59-1.65 um. It will fly in a polar sun-synchronous orbit and observe an average of thirty 200 km x 200 km land areas per day. Compared to OCO-2, it has about 3 times lower spectral resolution and higher per-pixel noise, but much greater native spatial resolution at roughly 130 m x 400 m. The operational CH4 retrieval will be a proxy retrieval using only the CO2+CH4 band. This retrieval is largely insensitive to atmospheric scattering, but relies on the assumption that CO2 can be used as a reference gas and that the CO2 and CH4 anomalies are uncorrelated over the scene of interest.

In this work, we present a full-physics retrieval that utilizes both the 1.27 um and CO2+CH4 bands which allows simultaneous retrieval of CH4 and CO2 columns. In both current and future greenhouse gas missions O2 information is usually obtained from the 0.76 um O2 A-band while use of the 1.27 um O2 band has largely been avoided due to the difficulty in modeling the intense airglow in the upper atmosphere at 1.27 um. In this study we will simulate radiances accounting for airglow emission which will then be used to drive retrieval simulations. We will compare our full physics results to the proxy CH4 approach as well as full physics results from a theoretical instrument that uses O2 information at 0.76 um instead. The latter allows us to compare the use of these two different O2 bands, which is relevant for many current (e.g., OCO-2 and GOSAT) and future sensors (e.g. CO2M and MicroCarb). We will also determine whether, when averaged to 2 x 2 km2, the MethaneSAT CO2 retrieval will have comparable error statistics to OCO-2, opening up a host of potential CO2 studies from this exciting new instrument.
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