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A BAYESIAN ERROR MODEL FOR MEASURING METHANE AND CARBON DIOXIDE CONCENTRATIONS FROM HYPERSPECTRAL MEASUREMENTS

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ABSTRACT. Carbon dioxide, methane, and other species emitted by industrial combustion processes, may be detected and quantified through hyperspectral imaging using mid-wavelength infrared (MWIR) imaging Fourier transform spectrometers (IFTS). These devices generate intensity images of the plume at a large number of distinct wavenumbers. This information may be used to infer the plume temperature and species concentrations, critical parameters for the species mass flow rate quantification. In this paper, Bayesian inference is employed to, first, accurately account for measurement uncertainty propagation onto the density estimates, and second, reduce the ill-posedness of the inverse problem by including prior information in the inference.

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