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Title:
Balloon-borne FTIR solar absorption spectrometry for measurements of atmospheric composition

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Abstract.

The MkIV Interferometer, a Fourier Transform Infrared (FTIR) spectrometer, designed and built at the Jet Propulsion Laboratory, has made over a dozen balloon flights over the past decade. Its wide spectral bandwidth (650 to 5650 cm-1) together with its high spectral resolution (0.01 cm-1), allow the MkIV instrument to simultaneously measure over 30 different atmospheric gases, plus many isotopic variants, in the same airmass. Atmospheric vmr profiles retrieved from spectra of such breadth and high quality impose strong constraints on models of atmospheric chemistry and transport. These same spectra also reveal inadequacies/inconsistencies in the spectroscopic data base.

In this paper we describe the MkIV experiment, the observation technique, and the data reduction methods. Retrieved vertical profiles are evaluated for their precision and accuracy, and we examine the dominant error sources. We conclude that the high resolution, broad-band (survey) approach employed by the MkIV instrument, although offering less precision than narrow-band species-specific measurement techniques, has important advantages: The wealth of information contained in each spectrum allows the identification, characterization, and correction/avoidance of many important sources of systematic errors (e.g. spectroscopic inconsistencies and inadequacies, instrument lineshape uncertainties, pointing errors) which would otherwise dominate the error budget. It also allows realistic uncertainties to be assigned to the measured quantities, simplifying quality control during subsequent averaging/retrieval of the results.