5.063 Satellite observations of isoprene from the Cross-track Infrared Sounder.

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Abstract:

Isoprene (C_5H_8), the most important of the non-methane biogenic volatile organic compounds, plays a crucial role in atmospheric chemistry: by affecting the oxidative capacity of the atmosphere through reaction with OH, and as an important precursor of O_3 and secondary organic aerosols. Its annual emissions have been estimated at 270–1000 TgC (overwhelmingly from terrestrial plants), which is equivalent to the size of the annual biogenic CH_4 source. Accurate isoprene measurements from airplane and surface sites are sparse. Top-down constraints on the global distribution of isoprene sources have relied on an indirect approach using its oxidation product formaldehyde (HCHO). However, such estimates suffer from errors due to (1) the fact that HCHO is also derived from other volatile organic compounds, and (2) uncertainty in the isoprene-formaldehyde relationship and spatial smearing between the two. This has led to an ambiguous understanding of the various factors controlling the spatial and temporal distribution of isoprene.

Direct measurements of global atmospheric isoprene are needed to improve quantification of isoprene's roles in atmospheric chemistry and the carbon cycle. We have recently simulated the spectral signals of atmospheric isoprene for its strongest absorption band in the ~900 cm^{-1} region based on the environmental conditions over Amazonian forest. We will present retrievals of atmospheric isoprene directly from existing CriS satellite observations, as well as an evaluation of the results using a combination of in-situ measurements, GEOS-Chem modeling, and retrieval simulations.