

Seasonal and Diurnal Opportunities for XCH₄, XCO₂, and XCO for the Amazonian Rainforest Region Allowing Sampling and Validation

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There is considerable interest in the aggregate methane emissions from the Amazon and similar moist tropical regions, and XCH₄ measurements are well suited to constrain sources to the global atmosphere. Similarly, XCO₂ measurements constrain CO₂ in the region. XCO helps to partition CO₂ patterns among burning and respiration processes. GeoCarb may allow these column measurements over the Western Hemisphere, but satellite retrieval require exacting calibration and validation by sun-focused Fourier transform spectrometers (FTS). The rarity of sufficiently large gaps in the cloud cover over the Amazon and similar rainforests restricts the validation opportunities for useful FTS observations and even more the opportunities for accurate retrievals. TropOMI observational statistics are extremely poor for the region. We have used two data sources to evaluate FTS opportunities at Manaus, Brazil, an FTS operated for 8 months near Manaus by Mavendra Dubey, and also sun-photometer measurements at several stations. The promise of using data from other satellites, e.g. GOES-16 ((Geostationary Operational Environmental Satellite) and CALIOP (Cloud-Aerosol LIDar with Orthogonal Polarization gaps and aerosol layering will be described. We report initial results on five questions: (1) how frequent are observing opportunities of FTS?, (2) What evidence is there that gaps in clouds are wide enough for satellite retrievals at an appropriate accuracy, (3) What is the diurnal and seasonal variability of cloud gaps?, and (4) What limitations are currently suggested for unbiased FTS measurement of XCH₄ due to diurnal effects, and (5) What evidence is there for incidence of problematic high aerosol extinction at higher layers of the troposphere (800 hPa to 120 hPa) which alter the XCH₄ light-paths?

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