

The GeoCarb Mission: One Tool in the Evolving Understanding of Methane and Carbon Monoxide Budgets

Robert B. Chatfield, and the GeoCarb Science Team

NASA plans to operate an instrument in geostationary orbit over the Americas beginning in 2022. This mission allows a coordinated study of climate-determining carbon species. Prime focus is on CO₂ fluxes, but the reactive species CO and CH₄ are particularly relevant to IGAC. Measurements of solar-induced fluorescence will describe plant photosynthesis contemporaneous with emissions.

To outline the technology: Grating mapping spectrometry, using a single slit and four focal planes set at 0.76, 1.60, 2.07, and 2.32 microns and ~17000 resolving power. Retrieval profiting from the rich heritage of OCO-2, GOSAT, TropOMI, and GOME/SCIAMACHY. Column concentrations of CO₂, CH₄, and CO, with finest resolution at 3 km x 6 km. A selection of scans allowing appreciable refinement in fluxes of CO₂ and CH₄. Rapid re-pointing allowing at least one synoptic observation of all North and South America daily, and 3 observations through the day for selected areas.

This presentation is an appeal to IGAC community to use GeoCarb to help improve the attribution of fluxes by sector and by geography. Cost constraints allow GeoCarb only limited listed goals. For example, GeoCarb aspires to constrain CH₄ emissions for the whole US, closing the ~60% gap between US EPA estimation and 3-d models. Detailed CO measurements should also aid photochemical and aerosol studies. NASA's TEMPO (UV-Vis geostationary) instrument will overlap GeoCarb. Consequently, HCHO, NO₂, aerosol, and CO may be intercompared, allowing elucidation of chemical sources and also transformation timescales. We expect that Sentinel-5P's TropOMI will lead the way here; geostationary imaging will allow diurnal views and reduced cloud obscuration of interesting areas.

Analysis of current data suggests interesting questions: (a) puzzling XCH₄ diel variations in the Amazonian rainforest; (b) time-varying CO/NO₂ relationships in urban plumes. We also urge the suite of airborne and small-sat measurements needed to complete the story at fine scales.