A new US network for ground-based remote sensing of carbon dioxide, methane, and CO

Jason M. St. Clair[1,2], Hayoung Park[1,3], Saswati Das[1,2], Thomas F. Hanisco[1], Lesley Ott[1]

[1]NASA Goddard Space Flight Center; [2]University of Maryland Baltimore County; [3]University of Maryland College Park

Abstract

The utility of ground-based remote sensing of CO_2 and CH_4 has been well established by the Total Column Carbon Observing Network (TCCON), with its data used for satellite validation, inverse model ground-truthing, and carbon cycle scientific studies. Because TCCON sites are expensive and physically large, their number (~28) is limited. The introduction of the compact EM27/SUN by Bruker and Karlsruhe Institute of Technology led to the Collaborative Carbon Column Observing Network (COCCON), with the potential for a much higher number of deployed network sites, which will benefit the satellite validation, inverse modeling, and carbon cycle communities. We present plans for a major contribution to ground-based greenhouse gas remote sensing in the United States with 14 EM27/SUNs deployed by NASA, anchored by a new TCCON site at NASA Goddard Space Flight Center.

Instrumentation

The Total Column Carbon Observing Network (TCCON) utilizes high resolution Bruker FT spectrometers, typically IFS 125HR, to obtain total column measurements of CO_2, CH_4, and other species.

The high-resolution instruments are expensive and large, severely limiting their global coverage.



Lower resolution instruments, such as the Bruker EM27/SUN, can provide useful column measurements if they are stable and the column measurements are tied to a TCCON location or other reference.

CH4 ALERT

Four EM27s from GSFC and one from JPL will be deployed to Africa for the CH4 ALERT project, led by PI Elsa Ordway (UCLA) and with numerous international partners.

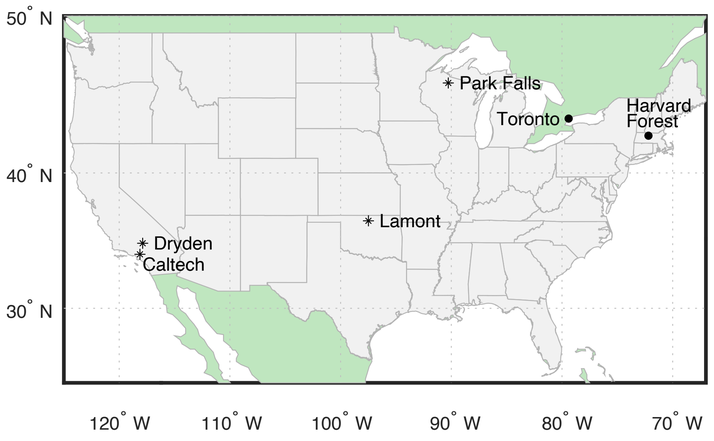
Ask me or Morgan Lopez (LSCE) for info if interested in knowing more.

New NASA GSFC-based Network

NASA Goddard recently purchased EM27/SUNs: 10 for NASA's Increasing Participation of Minority Serving Institutions (IPMSI) ground network program, and 3 for traveling and reference standards based out of GSFC.

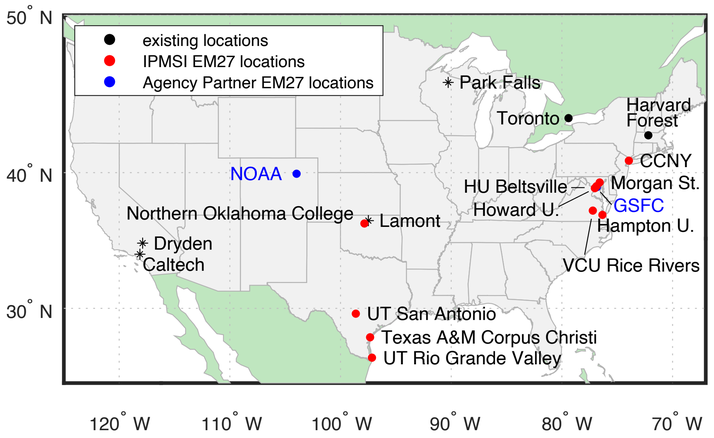
Current TCCON (*) and EM27 (•) stationary sites with public data

- Coverage over the CONUS is sparse.



TCCON and EM27 stationary sites once the GSFC network is deployed.

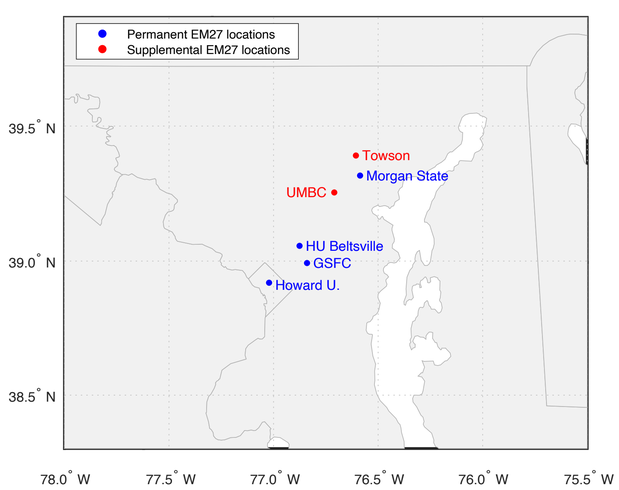
- The GSFC network greatly increases the number of sites in urban locations.
- MSI network partners will focus on science objectives unique to their instrument location.



Region of Higher Density

Sites in the DC/Baltimore metro area will provide a data set with higher geographic density.

Combined with satellite observations and aircraft overflights (e.g., ALEGROS 2024, SARP 2024 & 2025, WRAVENS 2026), this provides a unique observational data set in an urban/suburban region.



Network Progress



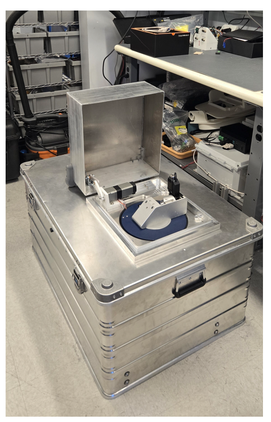


GSFC IFS 125HR is installed in shipping container lab on our building roof. Tracker enclosure design and build still TBD, targeting first data in 2027.

Industry partner: SciGlob

SciGlob is designing and building enclosures for the GSFC EM27s, in collaboration with NASA.

Automated enclosure prototype #1 testing at GSFC continues.





Automated enclosure prototype #2 is being built at SciGlob.



Interim enclosures enable earlier deployments to a few sites to start the data record and establish data transfer and processing protocols.

Howard DC (left) is operational, Howard Beltsville will start in July, CCNY in ~ August.