

# NRSC Website-Science Story

## **“Ground-Based Remote Sensing of Total Columnar CO<sub>2</sub>, CH<sub>4</sub>, and CO using an EM27/SUN FTIR spectrometer at a Suburban Location (Shadnagar) in India”**

Greenhouse gases (GHGs) play an important role in modifying local air pollution as well as Climate Change. Monitoring GHGs is therefore of utmost importance. Our scientific team from the National Remote Sensing Center (NRSC) of Indian Space Research Organization (ISRO) deployed a ground-based remote sensing measurement system, namely an EM27/SUN Spectrometer, for retrieving total columnar concentrations of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and carbon monoxide (CO) at a suburban location (Shadnagar) in India. The precise retrievals of GHGs from the ground-based FTIR are first of its kind in the country. The instrument records direct solar absorption spectra in the near-infrared spectral region. From these spectra, accurate and precise column-averaged abundances of the target gases were estimated. The spectrometer and the data processing were performed following the strict quality requirements of global network of the “COllaborative Carbon Column Observing Network” (COCCON). As solar absorption measurements quantify the vertically integrated gas abundances, they are much less affected by vertical transport than the measurements at the surface level and therefore complement each other. They provide the ground-truth as reference for satellite validation, also measuring the column-averaged abundances of the target gases globally, used for model validation, and carbon cycle studies.

The team of NRSC/ISRO in collaboration with the scientists from Karlsruhe Institute of Technology (KIT) and the Royal Belgian Institute for Space Aeronomy, worked together on the data from the Shadnagar site in India. In the reported article (DOI: 10.1109/LGRS.2022.3171216), the diurnal as well as the seasonal variation in the total column of CO<sub>2</sub>, CH<sub>4</sub> and CO at the site have been evaluated. To utilize the Copernicus Sentinel-5P/TROPOMI spatial CH<sub>4</sub> and CO products, validated CH<sub>4</sub> and CO products against EM27/SUN FTIR Spectrometer over the site and found the results in good agreement.

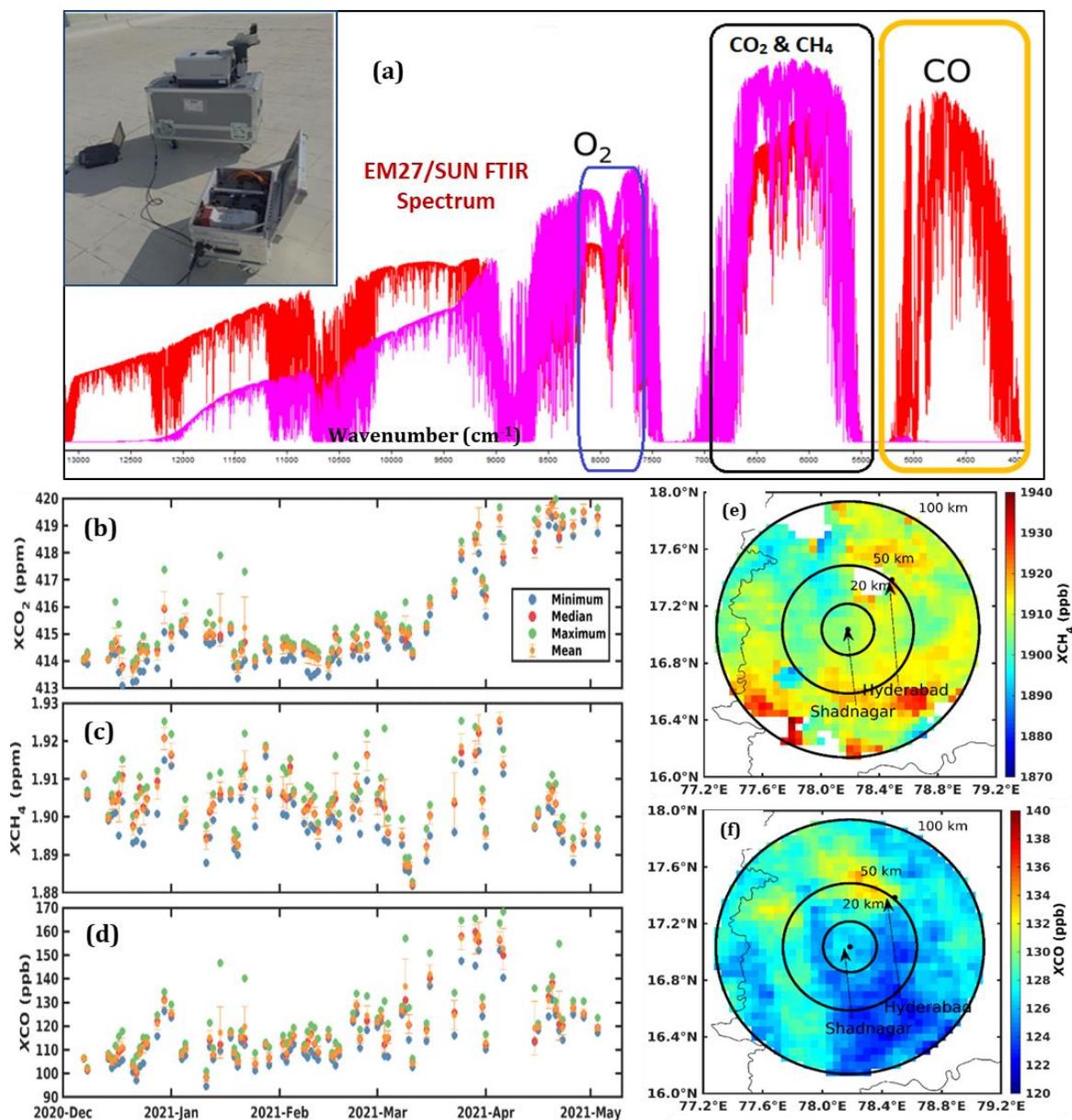


Figure a) The EM27/SUN FTIR Spectrometer (red color spectral curve ranges from 4000-13000 cm<sup>-1</sup> with Indium gallium arsenide-InGaAs detector with Germanium filter and pink color spectral curve ranges from 5500-12000 cm<sup>-1</sup> with InGaAs detector) installed at NRSC/ISRO, Shadnagar. (b-d) show daily maximum, minimum, median, and average values with  $\pm 1 \sigma$  of XCO<sub>2</sub>, XCH<sub>4</sub>, and XCO respectively during the study period at the Shadnagar site in India. (e-f) XCH<sub>4</sub> and XCO shows S-5P observations within radius of 20 km, 50 km and 100 km around the study site.