Status of COCCON sites in the Tokyo metropolitan area (Tsukuba, Yotsuya, Yokosuka, and Fuchu) 2026

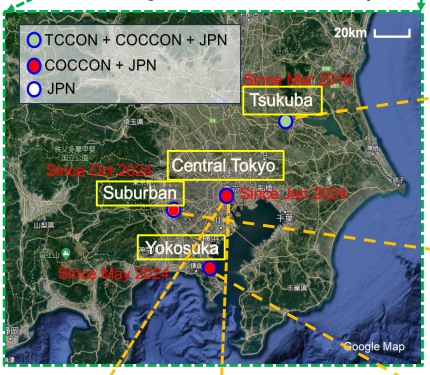
Isamu Morino[1], Matthias Max Frey[2], Astrid Müller[1] , Akihiro Hori[1], Kenji Yamaguchi[1], Nobuhiko Kuze[3], Yoshihiro Nakashima[4], Soshi Shuto[4], Takuma Miyakawa[5], Masahiro Yamaguchi[5], Prabir K. Patra[5], Hirofumi Ohyama[1], Hiroshi Tanimoto[1], Yugo Kanaya[5]

[1] National Institute for Environmental Studies (NIES), Tsukuba, Ibaraki 305-8506, Japan; [2] Institute of Meteorology and Climate Research, Karlsruhe Institute of Technology, Karlsruhe, Germany; [3] Faculty of Science and Technology, Sophia University, Chiyoda-ku, Tokyo 102-8554, Japan; [4] Faculty of Agriculture, Tokyo University of Agriculture and Technology, Fuchu, Tokyo 183-8538, Japan; [5] Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokohama, Kanagawa 2360001, Japan

TCCON/NDACC (high-resolution IFS 125 HR or FIS 120/5 HR FTS) and COCCON (EM27/SUN FTS) sites operated by Japanese organizations



Measurements by COCCON FTSs (EM27/SUN) in the Kanto area, Japan

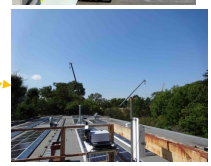


JPN: Japan Pandora Network



NIES, Tsukuba

EM27/SUN in the back is the Tsukuba COCCON instrument (SN 063), and EM27/SUN in the front is the instrument (SN 301) we recently purchased and are making the test measurement.

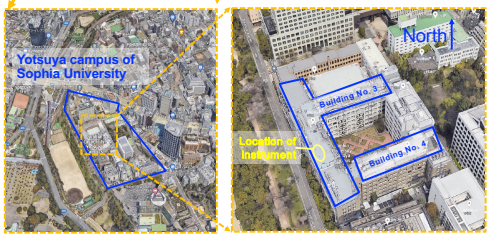


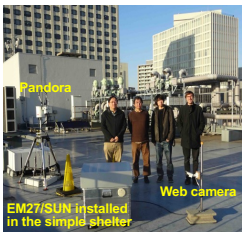
Tokyo University of Agriculture and Technology, Fuchu



JAMSTEC, Yokosuka

Yotsuya COCCON site in central part of Tokyo metropolitan region. Observations since Jan 2024

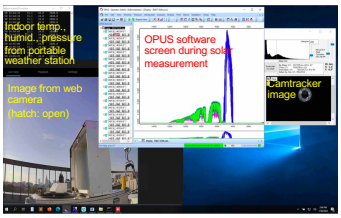








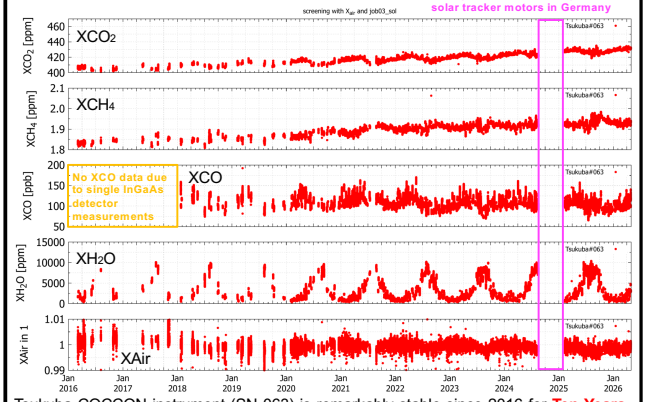
Development of a simple shelter for EM27/SUN



- Aluminum shipping box with a hatch
- Remote controlled opening and closing hatch system with a rain sensor
- Heater, cooler, and an exhaust fan
- Portable weather logger (temperature, humidity and pressure)
- Web camera
- Portable Wi-Fi
- Portable battery as UPS installed in the battery box

Tsukuba (SN 063) COCCON time series

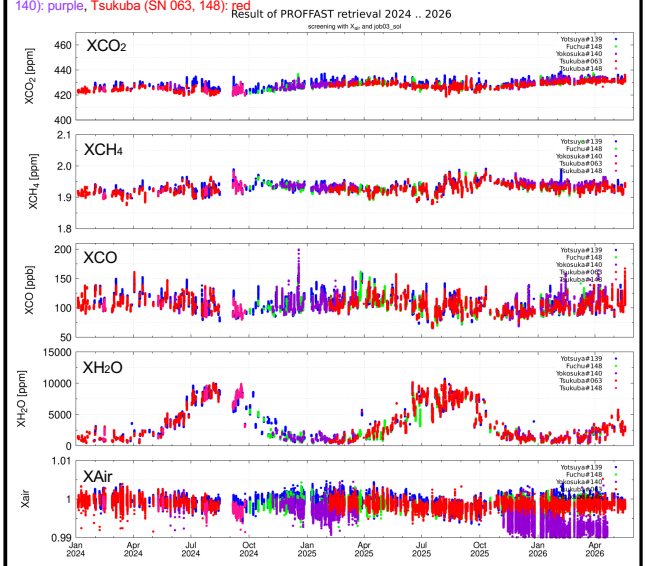
Processed with PROFFAST 2.4.1



Tsukuba COCCON instrument (SN 063) is remarkably stable since 2016 for **Ten Years.** Since we had troubles with the solar tracker azimuth motor etc. in Jul 2024, we sent the instrument to Bruker for repairs, then started again the operation from Feb 2025. Therefore, there are no records between Jul 2024 and Jan 2025.

Tsukuba, Yotsuya, Yokosuka, and Fuchu COCCON time series from Jan 2024

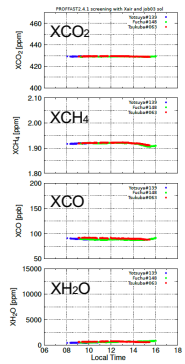
Processed with PROFFAST 2.4 or 2.4.1, Yotsuya (SN 139): blue, Fuchu (SN 148): green, Yokosuka (SN 140): purple, Tsukuba (SN 063, 148): red



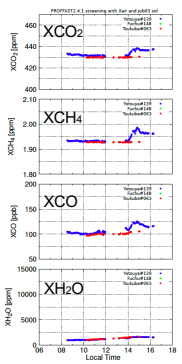
No records at Tsukuba between Jul 2024 and Jan 2025 due to the solar tracker repair. The Yokosuka data after Dec 2025 has an issue with the interferometer.

Daily plots

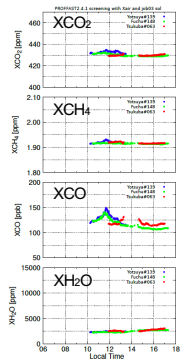
19 Feb 2026
Day with prevailing northwest seasonal winds



6 Feb 2026
Day when high values of XCO_2, XCH_4, and XCO were observed in central Tokyo



17 Apr 2025
Day when high values of XCO_2, and XCO were observed in all sites



Summary

- COCCON instruments at four COCCON sites in the Tokyo metropolitan area (Tsukuba: SN 063, Yotsuya: SN 139, Yokosuka: SN 140, and Fuchu: SN148) are operating since 2024.
- **The Tsukuba COCCON instrument has been remarkably stable since 2016, with a data record exceeding ten years.** We sent the instrument to Bruker for repairs in July 2024 due to issues with the solar tracker azimuth motor, etc., and resumed operation in February 2025. Therefore, there are no records between July 2024 and January 2025.
- **The Yokosuka site will officially join COCCON soon!** The Yokosuka data after December 2025 has an issue with the interferometer.
- At the Fuchu site, the simple shelter will be installed, after repairing two old simple shelters, by end of 2026 fiscal year.
- We purchased three additional COCCON instruments (SN 292, SN 301, and SN 302)and two of them finished setup and test measurements. There is a blue screen issue for one instrument (SN 302).
- In March 2026, four COCCON sites in the Tokyo metropolitan area joined the Tokyo Field Campaign (Tokyo-FC, https://espo.nasa.gov/tokyo-fc). As part of the campaign, four more COCCON instruments were deployed in the Tokyo and Osaka metropolitan areas (two in Tokyo: Isezaki and Kisazaru; and two in Osaka: Sakai and Kobe). Three TCCON sites (Rikubetsu, Tsukuba, and Saga) also joined the campaign.

Publication list with use of the Japanese COCCON FTS data

1. M. Frey, M. K. Sha, F. Hase, et al., Building the COllaborative Carbon Column Observing Network (COCCON): long-term stability and ensemble performance of the EM27/SUN Fourier transform spectrometer, Atmos. Meas. Tech., 12, 1513–1530, https://doi.org/10.5194/amt-12-1513-2019, 2019.
2. H. Ohyama, I. Morino, V. A. Velazco, et al., Validation of XCO_2 and XCH_4 retrieved from a portable Fourier transform spectrometer with those from in-situ profiles from aircraft borne instruments, Atmos. Meas. Tech., 13, 5149–5163, https://doi.org/10.5194/amt-13-5149-2020, 2020.
3. H. Ohyama, K. Shiomi, N. Kikuchi, et al., Quantifying CO_2 emissions from a thermal power plant based on CO_2 column measurements by portable Fourier transform spectrometers, Remote Sensing of Environment 267, 112714, https://doi.org/10.1016/j.rse.2021.112714, 2021.
4. C. Alberti, F. Hase, M. Frey, et al., Improved calibration procedures for the EM27/SUN spectrometers of the COllaborative Carbon Column Observing Network (COCCON), Atmos. Meas. Tech., 15, 2433–2463, https://doi.org/10.5194/amt-15-2433-2022, 2022.
5. H. Ohyama, M. M. Frey, I. Morino, et al., Anthropogenic CO_2 emission estimates in the Tokyo Metropolitan Area from ground-based CO_2 column observations, Atmos. Chem. Phys., 23, 15097–15119, https://doi.org/10.5194/acp-23-15097-2023, 2023.
6. J. Lee, S. Jeong, H. Park, et al., Emission Characteristics of Greenhouse Gases and Air Pollutants in Northern Hemisphere Cities: Comprehensive Assessment Using Ground-based Fourier Transform Spectrometers, J. Geophys. Res. Atmos., 129, e2023JD040562, https://doi.org/10.1029/2023JD040562, 2024).
7. M. K. Sha, S. Das, M. M. Frey, et al., Validation of Satellite (Sentinel-5 Precursor, OCO-2, and GOSAT) Missions Using the COllaborative Carbon Column Observing Network (COCCON), Remote Sens. 17, 734, https://doi.org/10.3390/rs17050734, 2025.
8. T. Umezawa, Y. Tohjima, Y. Terao, et al., Long-term and interannual variations of atmospheric methane observed by the NIES and collaborative observation networks, Prog. Earth Planet. Sci., 12, 39, https://doi.org/10.1186/s40645-025-00711-9 (2025).
9. S. Das, M. K. Sha, M. Kiel, et al., Comparing v11.2 OCO-2 and v11 OCO-3 XCO_2 Retrievals with Ground-Based COCCON Measurements, AGU Earth and Space Science, accepted on 28 May 2026.