16th Observation Coordination Group (OCG-16)

7-10 April 2025, Brest, France

Surface Ocean CO_2 Reference Network (SOCONET)
OCG Emerging Network Report 2025

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Reporting period: May 2024 – March 2025

1. Highlight the key network successes

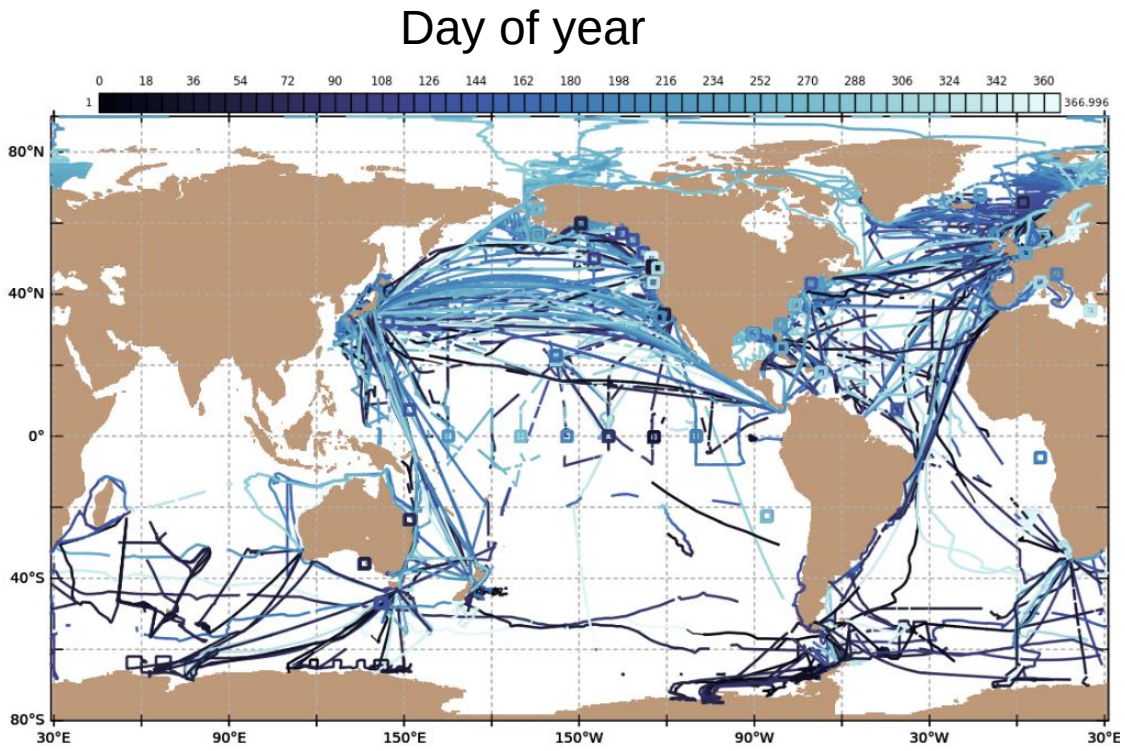
- Development and approval of an interim SOCONET Steering Committee (iSC) with a term to mid-2025.
- Development of an approval-ready draft of the Terms of Reference for the SOCONET SC to be used from mid-2025 onwards. Four major sections (Purpose, Membership, Leadership and Roles and Responsibilities) were completed and will serve to govern the network internationally.
- Work with IOC-WMO Joint Centre for Oceanography and Marine Meteorology in situ Observations Programmes Support (OceanOPS) aimed at drafting the elements of initial functionality for SOCONET dashboard.
- Development of long-term (48 months) funding support for 1 FTE (0.75 FTE Technical Support at OceanOPS and 0.25 FTE Coordination at IOCCP) for SOCONET for years 2025-2028. Successful funding proposal submitted to the EU Horizon Europe call, and resources became available on 1 January 2025 as part of a project called TRICUSO. Additional funds from US NOAA were earmarked for SOCONET work and will be used to lead specific developments identified by the Steering Committee.
- Significant effort was made around development of the specific Service Level Agreement between SOCONET and OceanOPS. Specifically, identifying services specific for SOCONET which OceanOPS will be providing from mid-2025 based on funding from TRICUSO project was targeted. Dedicated online meetings with TRICUSO management and OceanOPS Team were held and more are planned.
- Development of draft requirements for the SOCONET stations labelling process. Based on specific and transparent measurements accuracy requirements, a number of stations (ships, moorings, yachts, ASV's) will be qualified as SOCONET Reference Station (sometimes referred to as Tier 1) and others as SOCONET Associated Stations (sometimes referred to as Tier 2) as agreed by the community in November 2023. Currently requirements for Reference Stations are in final draft form.
- Community-wide stock-take exercise of all currently active SOCONET assets and their operators. Active inquiries with SOCAT data submitters allowed to gradually update this SOCONET "participants list", which will serve as a basis for formal development and approval

of SOCONET governance structures and data quality requirements. Currently SOCONET consists of 116 platforms (59 ships, 55 moorings and 2 USVs) with recurring surface ocean CO_2 measurements.

2. How has the network advanced across the OCG Network Attribute areas

Global in scale

- SOCONET continuous to coordinate regional networks and local operations at a global scale.
- The figure below shows SOCONET distribution (based on data submitted to SOCAT for years 2019-2023). Specific regions such as the Indian Ocean or South Pacific and a number of smaller basins and regions remain unsampled or the availability of data continues to be a challenge. Similarly, in many regions, a temporal sampling bias remains.



Observes one or more Essential Ocean Variables or Essential Climate Variables

- SOCONET continuous to observe predominantly Inorganic Carbon EOV/ECV.
- In late 2024, the IOCCP/GOOS Biogeochemistry Panel has expanded its expertise by inviting a dedicated Expert to serve on the IOCCP SSG as a champion for re-energizing and expanding the group of experts of marine nitrous oxide and methane measurements previously collaborating within the SCOR Working Group 143 and following the US OCB 2018 Workshop on the topic. SOCONET and IOCCP will be developing a strategy for including Nitrous Oxide EOV into the SOCONET Implementation Plan.

Observations are sustained

- Observations date back to 1957 and more than 46.7 million observations were collected and are available in SOCAT to date, which is 3.9 million increase during this reporting period.

- Despite the significant increase in the number of data points in the collection, a number of major contributors report funding uncertainty into the future.

Community of practice

- Advances in this category are described in other sections of this report.

Maintains network mission and targets

- SOCONET Implementation Plan will include specific targets relevant for the mission which is well developed and described.

Delivers data that are free, open and available in a timely manner

- Data collected on SOCONET continue to be submitted through the established SOCAT data system. Data are freely and openly available through SOCAT as well as country-specific National Data Centers wherever they exist. ERDDAP services are available for annual SOCAT releases.
- Work on pilot near-real time data delivery for a selected number of operators is planned in response to GGGW TT-Modeling request. Details to be developed through the WMO GGGW TT work in collaboration with capable SOCONET operators.

Ensures metadata quality and delivery

- Metadata is collected and included with SOCAT data product. Metadata format and content will be aligned with OceanOPS metadata requirements as soon as the SOCONET Technical Coordinator will be in place, which is expected in mid-2025.

Develops, updates, and follows Standards and Best Practices

- A major update of the SOCAT Quality Control Cookbook took place in the past several months. There are several significant differences and updates compared to the previous 2018 version, including metadata formats, handling data from novel sensors and more. The updated Cookbook is available from the SOCAT website.

Undertakes capacity development

- Richard Sanders (SOCONET iSC) is working with partners in the South African Environmental Observation Network (SAEON) to build a bridge between African and European carbon observing activities in the context of SOCONET. Following the initial discussions, a SOCONET webinar is planned for May 2025, to be followed by an in-person workshop to be held in Africa with aims to scope the regional SOCONET capacities and establish some level of formalization in connection with SOCONET.

3. Future Plans and Opportunities - at network and/or cross-network OCG level

- Recruitment of a full Steering Committee in accordance with the approved network ToRs
- Monitoring of implementation of basic, advanced and network-specific services at OceanOPS, following the employment of SOCONET Technical Coordinator in June-July 2025.
- Development of basic requirements for an observing network sampling design, allowing

modelling tools (regional, basin-scale and global) to support optimal distribution of network assets. After consultation with a wider modelling community, which is planned in the form of a 2-stage (online followed by in-person) scoping workshop in 2025, these requirements will be included in the SOCONET Implementation Plan.

- Following the final approval of the Observational Requirements document by the SOCONET SC, the plan is to implement the labelling process and establish procedures to increase the readiness level of stations aimed at increasing the number of Reference Stations.
- Development of initial activities for a Task Team on air xCO_2 measurements. One of SOCONET's ambition is to provide atm xCO_2 information over the global oceans, and developing strong working relationship with WMO's Global Atmospheric Watch.
- Conclusive discussions with Ship-Of-Opportunity-Programme for CO_2 (SOOP-CO2) under GOOS-WMO Ship Observations Team need to be held to determine details of existing overlap between previously established and mostly inactive SOOP-CO_2 network and SOCONET. A formal agreement at the GOOS OCG level will have to be reached to allow efficient co-existence of both structures, or to agree on an alternative efficient solution.
- Continuous work on formal and structural unification of SOCONET and SOCAT.
- Development of the SOCONET website and adequate social media channels.
- Work on aligning SOCONET with Terms of Reference for the WMO GGGW Task Team focused on GGGW Implementation Plan related to observing networks.
- Development and publication of a SOCONET Implementation Plan

4. Challenges and Concerns - at network and/or cross-network OCG level

- Longevity of availability of significant proportion of personnel and infrastructure currently involved as well as funds available for SOCONET operation
- SOCONET capacity building (in other words implementation of readiness level improvements across identified volume of sub-optimal operators) requires dedicated effort, which currently is not included in available human resources.
- Work towards aligning the SOCONET data exchange (SOCAT, currently mostly manual) with the WMO Information System 2.0 (WIS 2.0) which provides data discovery and retrieval capabilities to the Global Telecommunication System (GTS). None of the ocean biogeochemistry data is served by WIS yet and a dedicated SOCONET Task Team might have to be established to implement this important milestone.

5. Asks from OCG (Exec, networks, OceanOPS, and/or GOOS), and any priority topics that should be addressed at OCG-16

- Approval of SOCONET ToRs