

SOCAT version 2026: High-quality synthesis products for ocean CO₂ sink quantification

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Abstract – Ocean CO₂ uptake (3.2 Pg C yr⁻¹, 29% of emissions)^c has exceeded land CO₂ uptake (2.4 Pg C yr⁻¹) by 30% over the past decade. The community-led SOCAT (Surface Ocean CO₂ Atlas, www.socat.info) synthesis is key for quantification of ocean CO₂ uptake, thus providing vital information for climate policy. SOCAT delivers an annual public update of global *in situ* oceanic *f*CO₂ (fugacity of CO₂) measurements. Version 2026 adds 394 new data sets and updates 19 data sets from ships, moorings and uncrewed surface vehicles (USVs) (Fig. 1a, 2). The main SOCAT synthesis and gridded products contain 44.0 million, quality-controlled, *in situ* surface ocean *f*CO₂ measurements with an estimated uncertainty of better than 5 μatm collected between 1957 and 2025 (Fig. 2a-b). In addition, 8.4 million *f*CO₂ values with an uncertainty of 5-10 μatm, mainly from membrane-based sensors, are separately made available (Fig. 1a, 2c). Surface ocean *f*CO₂ data availability is low in the southern hemisphere, the Indian Ocean, the Pacific Ocean south of 30°S and the Arctic Ocean (Fig 1). With the importance of constraining ocean CO₂ uptake well recognized by the WMO Global Greenhouse Gas Watch (G3W) and the UNFCCC Global Stocktake, there is an urgent need for sustained funding of accurate surface ocean CO₂ measurements (in the Surface Ocean CO₂ Observing Network, <https://www.ioccp.org/soconet>) and their synthesis (in SOCAT).

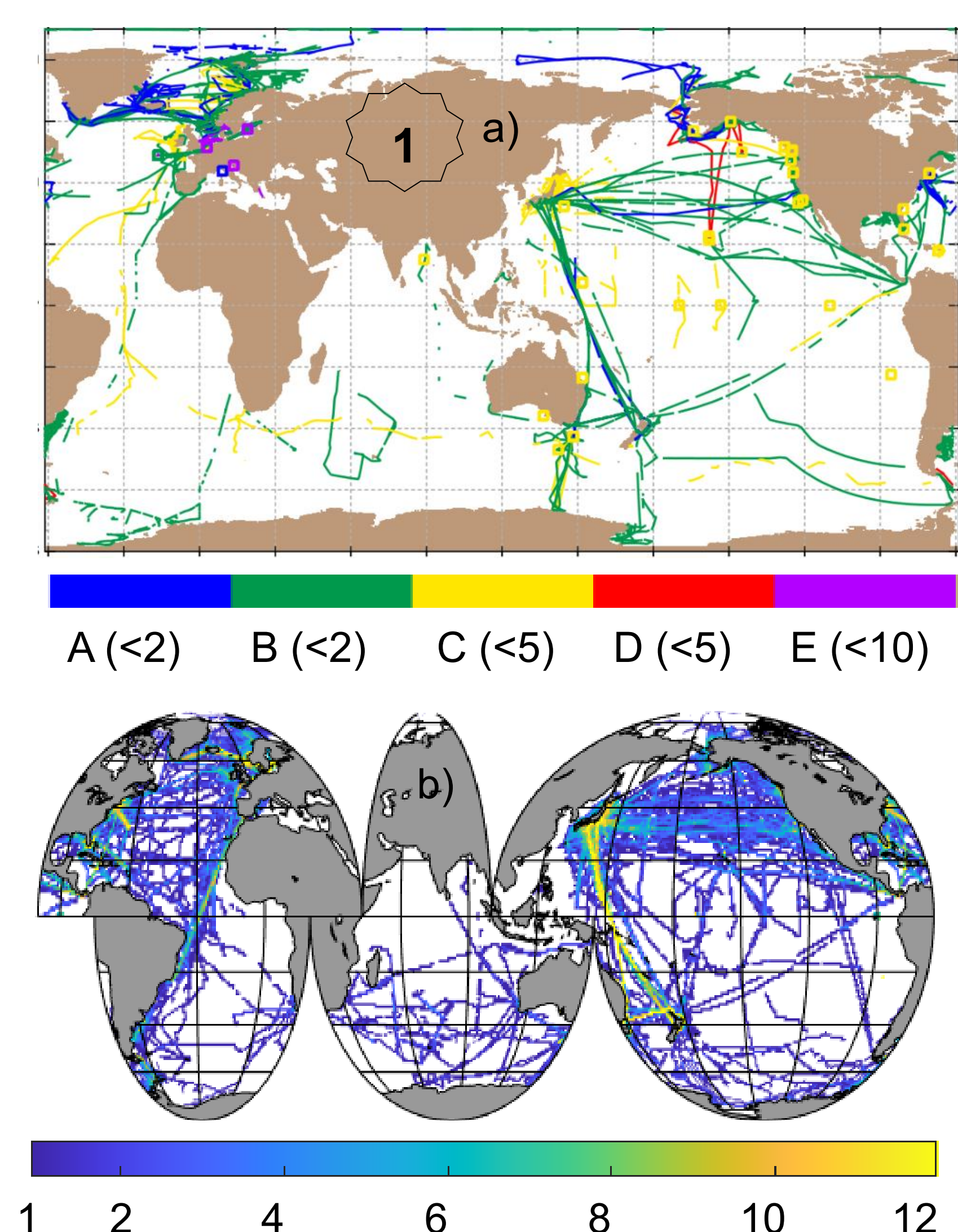


Fig. 1. a) Newly available *f*CO₂ values in v2026, colour coded by data set quality control flag (uncertainty in μatm in brackets). Squares indicate moorings. b) Number of year-months with 1° x 1° gridded *f*CO₂ (uncertainty of <5 μatm) for 2021 to 2025.

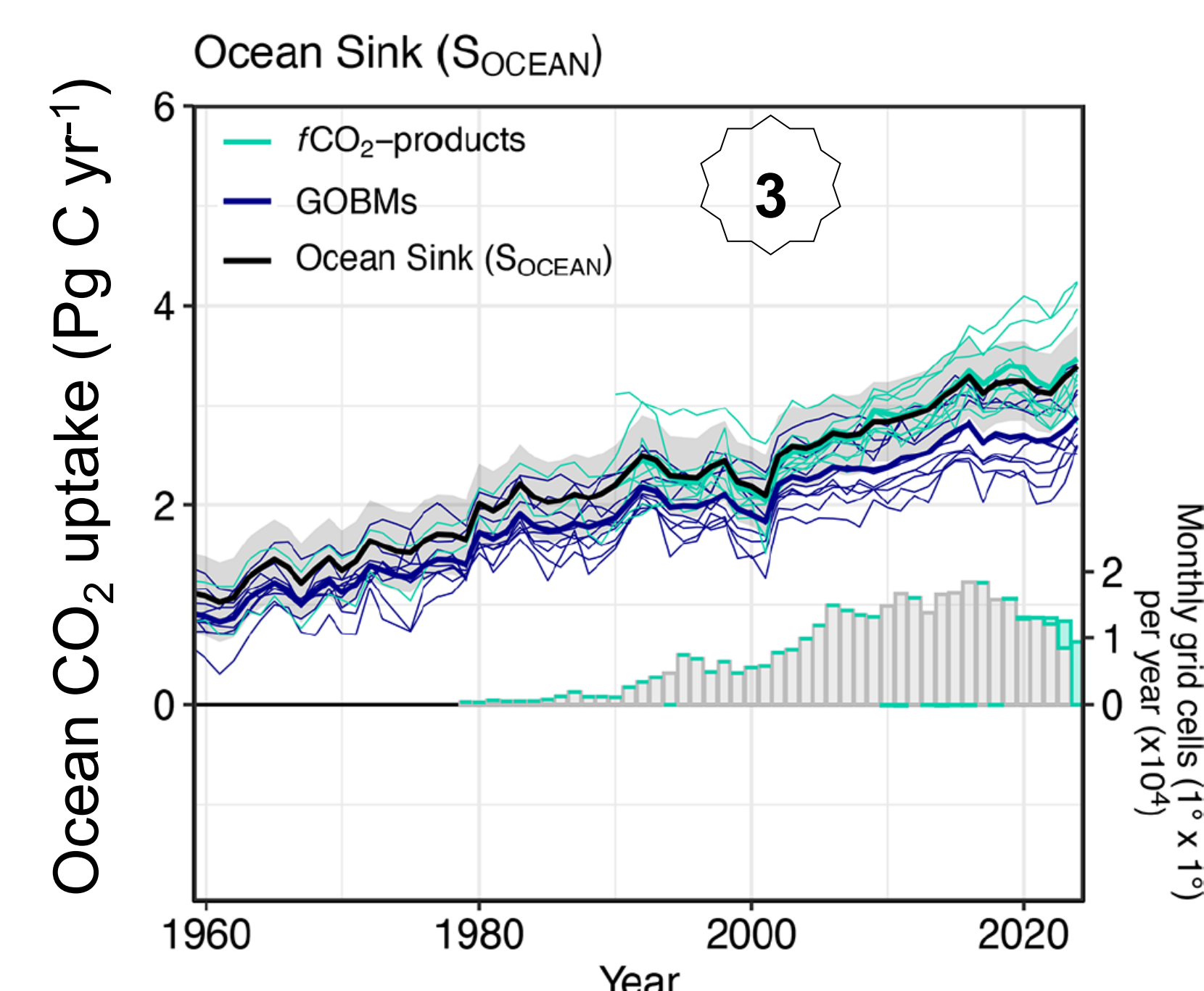
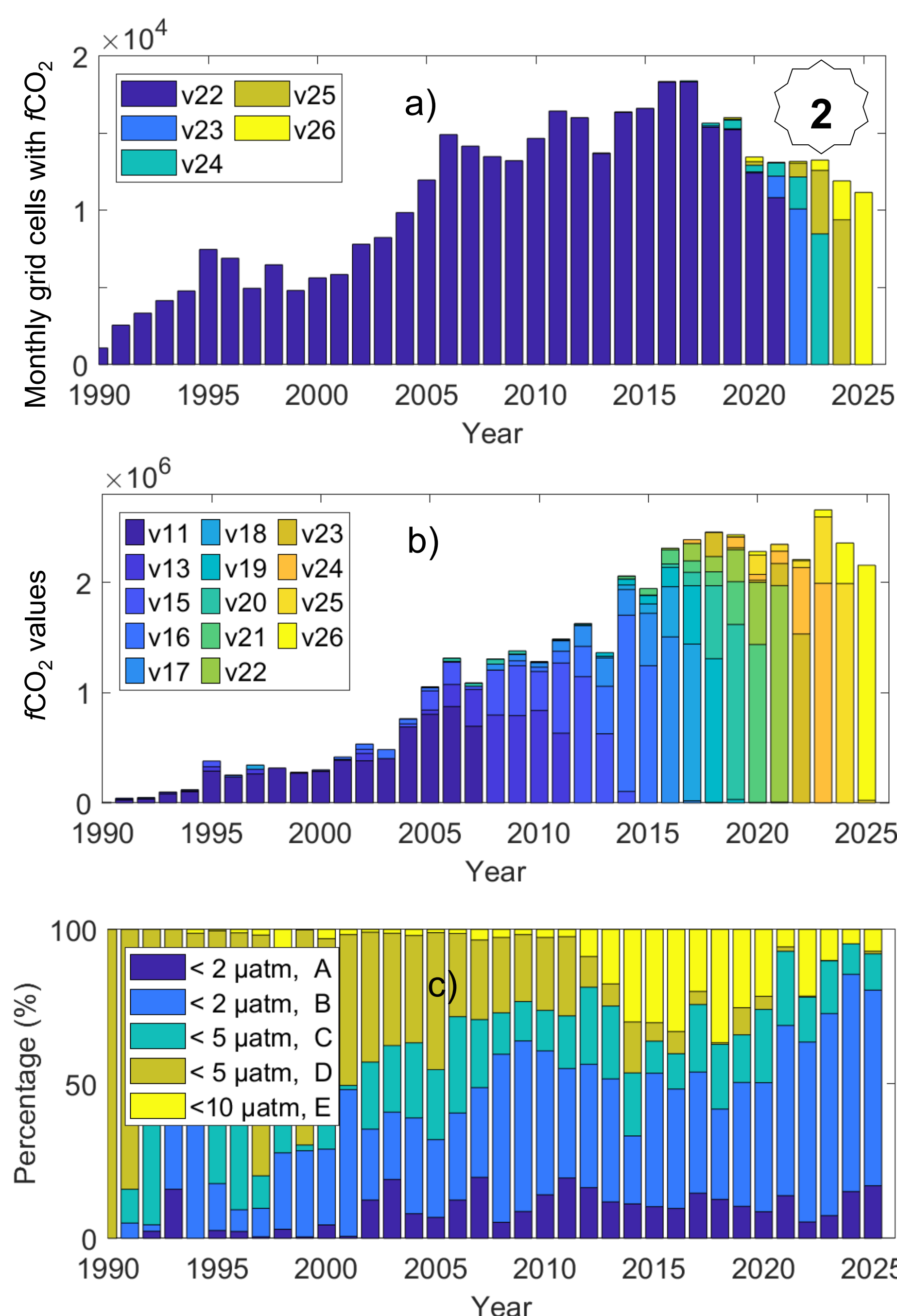


Fig. 2. a) Number of monthly, 1° x 1° grid cells with *f*CO₂ (uncertainty of <5 μatm) by year for v2022 to v2026. b) Number of *f*CO₂ values (uncertainty of <5 μatm) by year by SOCAT version. c) Percentage of *f*CO₂ values with an uncertainty of <2, 5 and 10 μatm by year.

Fig. 3. Ocean CO₂ uptake in the Global Carbon Budget 2025^c. Turquoise lines indicate SOCAT-based estimates, purple lines model results.

Key features of SOCAT v2026 (www.socat.info)

- A community-led synthesis with secondary quality-control (QC), an annual, public release, interactive viewers and data download
- *In situ* surface ocean *f*CO₂ measurements from ships, moorings, USVs, yachts and drifters for the global ocean and coastal seas from 1957 to 2025
- 44.0 million *f*CO₂ values with an estimated uncertainty of < 5 μatm in the main synthesis and gridded products (Fig. 1b, 2a-b)
- 8.4 million *f*CO₂ values with an uncertainty of 5-10 μatm, mainly from membrane-based sensors, separately available (Fig. 1a, 2c)
- QC cookbook^d requires 1) Complete metadata for all new data, 2) Flag E for membrane-based sensor *f*CO₂ deemed acceptable.

SOCAT news

- A second SOCAT hub has opened at the Flanders Marine Institute (VLIZ), Belgium, in 2026, initially for 2 years.
- First quality control hackathon in 2026
- Consultation on SOCAT governance in 2026.

Scientific findings, applications and impact

- Ocean CO₂ sink (29% of emissions for 2015-24) larger than the land CO₂ sink (21%)^c.
- Ocean CO₂ uptake from SOCAT-based products exceeds model estimates by 0.6 Pg C yr⁻¹ for 2015-24^c (Fig. 3).
- Low *f*CO₂ data availability in the southern hemisphere, Indian Ocean, Pacific Ocean south of 30°S and Arctic Ocean (Fig 1).
- Quantification of ocean CO₂ uptake^{c,i} and acidification^{e,g,i}
- Evaluation of Earth System Models^a and sensor data^k
- Cited in >100 scientific articles and reports annually. Ocean CO₂ synthesis product^h, <https://oceanco2.github.io/co2-products/>
- Value chain^f critical for climate policy, WMO G3W^l, UNFCCC Global Stocktake, Sustainable Development Goals (SDG) 13 and 14 and the Decade of Ocean Science

SOCAT outlook

- V2027 data submission by **15/01/2027** & QC by **19/03/2027**
- Upgrade of SOCAT interactive viewers and QC platform
- Automation of metadata upload ongoing

Data Use: To generously acknowledge the contribution of SOCAT scientists by invitation to co-authorship, especially for key data providers in regional studies, and/or reference to relevant scientific articles. **Acknowledgements:** We thank the numerous contributors, funding agencies, IOCCP and SOLAS. **Data product:** Bakker et al. (2026) SOCATv2026, NCEI Accession 0315110, <https://doi.org/10.25921/8dba-fr90>; **Method:** Bakker et al. (2016) ESSD 8: 383-413; **Gridding:** Sabine et al. (2013) ESSD 5:145-153. **References:** Eyring et al., 2016^a; Fay et al., 2025^b; Friedlingstein et al., 2026^c; Gkritzalis et al., 2024^d; Gregor and Gruber, 2021^e; Guidi et al., 2020^f; Jiang et al., 2019^g; Jiang et al., 2026^h; Lauvset et al., 2015ⁱ; Rödenbeck et al., 2015^j; Williams et al., 2017^k; <https://g3w.wmo.int/site/global-greenhouse-gas-watch-g3w/>. **Affiliations:** ¹UEA, UK; ²NOAA-PMEL, USA; ³Arizona State University, USA; ⁴BIOS, Bermuda; ⁵UiB, Norway; ⁶BCCR, Norway; ⁷VLIZ, Belgium; ⁸CICOES, USA; ⁹NOAA-NCEI, USA; ¹⁰NORCE, Norway; ¹¹Hereon, Germany; ¹²LOCEAN/IPSL, France; ¹³NIES, Japan; ¹⁴OceanOPS, France; ¹⁵NOAA-AOML, USA; ¹⁶GEOMAR, Germany; ¹⁷NOAA-GML, USA; ¹⁸IOCCP, Poland; ¹⁹CSIRO, Australia; ²⁰AAPP, Australia.