

Release of SOCAT Version 4 - First annual release using automated data upload

Dorothee Bakker¹ (d.bakker@uea.ac.uk), Benjamin Pfeil^{2,3}, Karl Smith^{4,5}, Simone Alin⁴, Kim Currie⁶, Steve Jones^{2,3}, Alex Kozyr⁷, Camilla Landa^{2,3}, Siv Lauvset^{8,2}, Nathalie Lefèvre⁹, Nicolas Metzler⁹, Shin-ichiro Nakaoka¹⁰, Yukihiro Nojiri¹⁰, Kevin O'Brien^{4,5}, Are Olsen^{2,3}, Ute Schuster¹¹, Maciej Telszewski¹², Bronte Tilbrook^{13,14}, Chisato Wada⁹, Rik Wanninkhof¹⁵ and all >100 SOCAT contributors

Abstract - The Surface Ocean CO₂ Atlas (SOCAT, www.socat.info) is a synthesis activity by the international marine carbon research community (>100 contributors). SOCAT version 4 has 18.5 million quality-controlled, surface ocean fCO₂ (fugacity of carbon dioxide) observations with an accuracy of better than 5 µatm from 1957 to 2015 for the global oceans and coastal seas. Automation of data upload and initial data checks speeds up data submission and allows annual releases of SOCAT from version 4 onwards. SOCAT enables quantification of the ocean carbon sink and ocean acidification and evaluation of ocean biogeochemical models. SOCAT represents a milestone in research coordination, data access, biogeochemical and climate research and in informing policy.

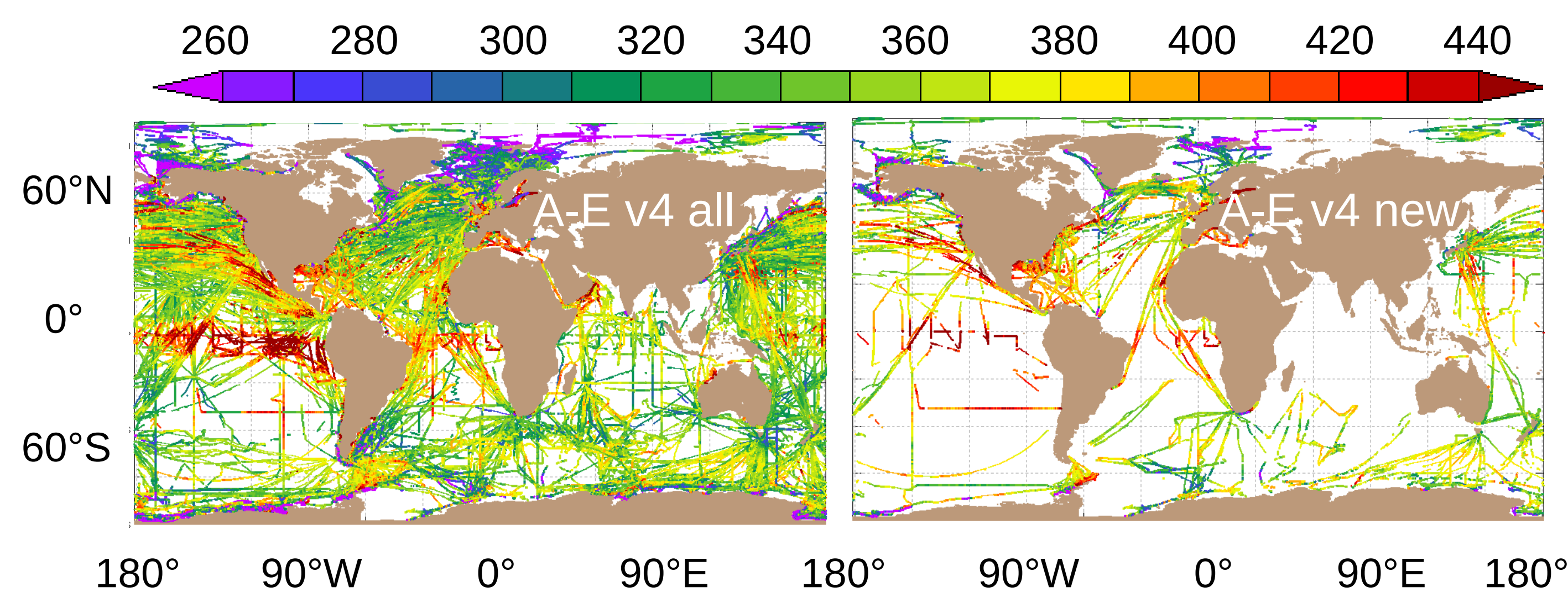


Fig. 1. a) All and b) newly added quality controlled, surface water fCO₂ observations (µatm) in version 4.

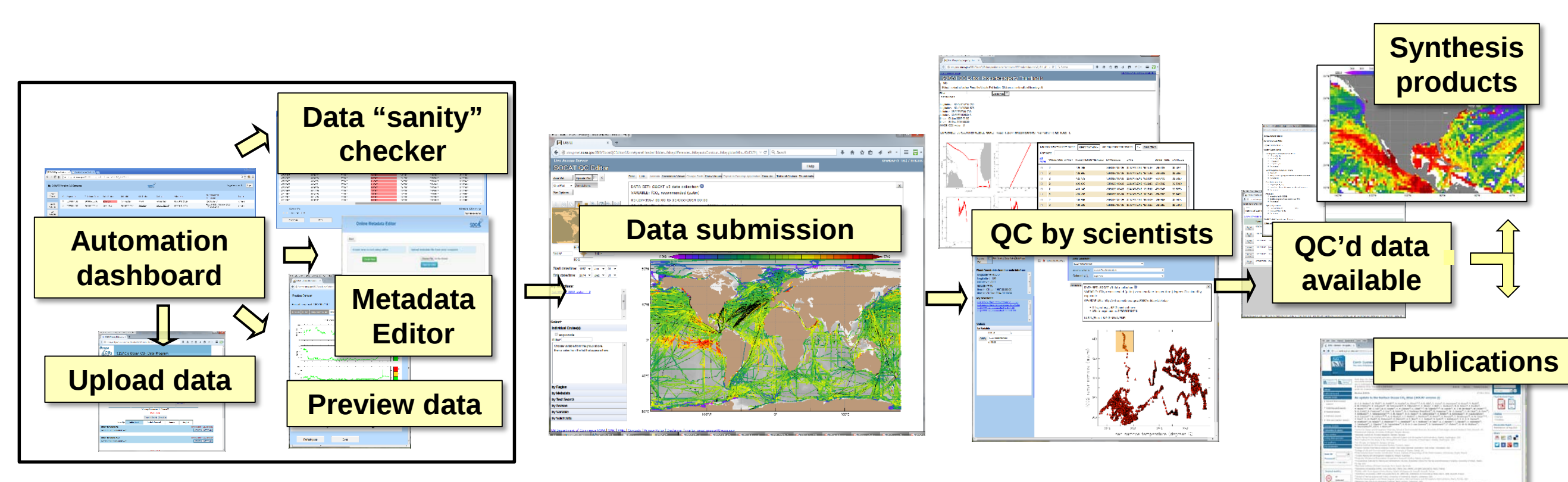


Fig. 3. Data flow upon SOCAT automation from data upload, via submission to quality control and release of synthesis products.

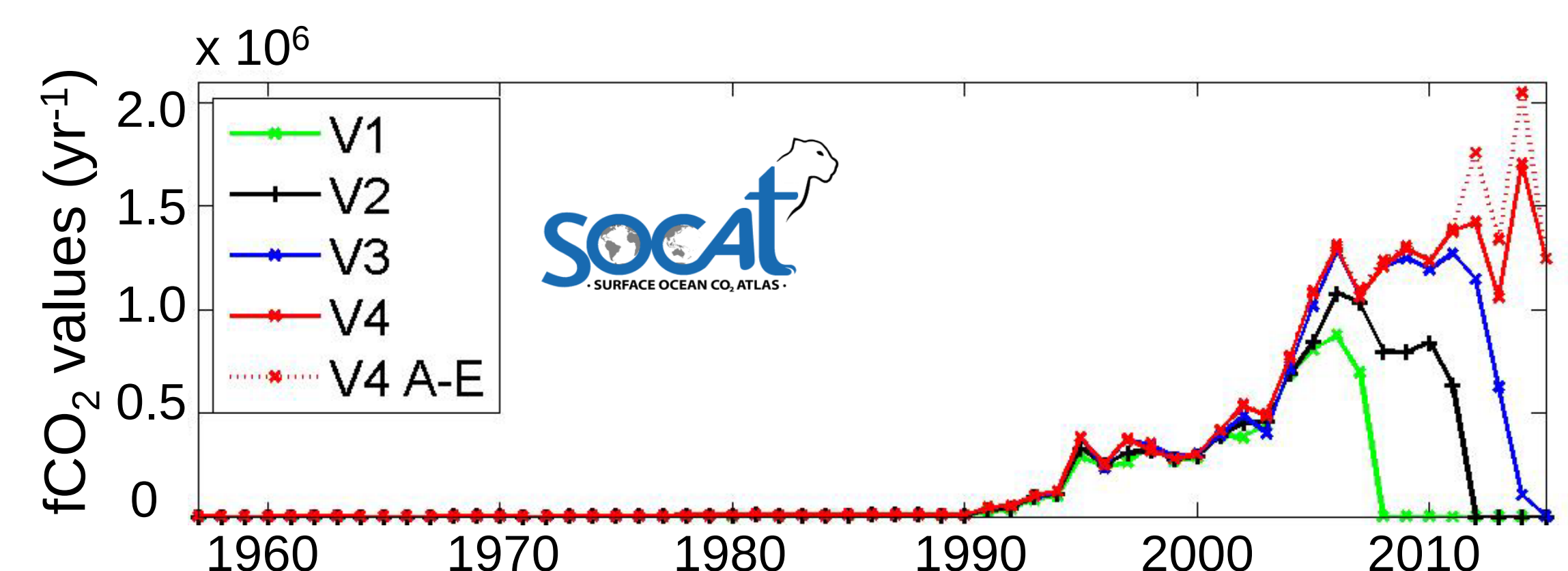


Fig. 2. Number of surface water fCO₂ values per year with flags of A–D in versions 1 to 4 and with flags of A–E in version 4.

Table 1. Data set quality control flags in versions 3 and 4. All criteria need to be met for assigning a flag of A to E. A flag of E is mainly for alternative sensor data with adequate calibration. Other data set flags are S (suspend) and X (exclude).

	A	B	C	D	E
Accuracy of fCO ₂ values (µatm)	<2	<2	<5	<5	<10
High-quality cross-over	yes	no	(no)	(no)	no
Followed approved methods / Standard Operation Procedures	yes	yes	yes/ no	yes/ no	no
Metadata complete	yes	yes	yes	no	yes
Data quality control acceptable	yes	yes	yes	yes	yes

Key features:

- Synthesis and gridded, quality controlled, observational products of surface ocean fCO₂ for the global oceans and coastal seas, V4 (2016): 18.5 million fCO₂, 1957 - 2015, V3 (2015): 14.5 million fCO₂, 1957 - 2014, V2 (2013): 10.1 million fCO₂, 1968 - 2011, V1 (2011): 6.3 million fCO₂, 1968 - 2007, with an accuracy for fCO₂ < 5 µatm (flags of A–D, WOCE 2),
- Calibrated sensor data also available (<10 µatm, flag of E),
- During quality control (QC), scientists assign a flag to each data set (see Table 1) and WOCE flags of 2 (good), 3 (questionable) and 4 (bad) to fCO₂ values.
- QC criteria in version 4 are similar to version 3.
- Sea surface temperature and salinity not QC-ed.
- Atmospheric CO₂ measurements accepted (no QC yet);
- Additional surface water parameters accepted (no QC),
- No sustained funding for SOCAT,
- **V5 submission ends 15/01/2017, QC ends 31/03/2017.**

Automation (NEW) and data access:

- Automation of data upload, initial data checks speeds up data submission and enables annual, public releases of SOCAT.
- Online viewers and downloadable.
- SOCAT data is discoverable, accessible and citable.
- Future: Automation of metadata upload.

Scientific findings and impact of SOCAT:

- Large year-to-year variation in the global ocean carbon sink^{b,e,f},
- Models underestimate global ocean carbon sink variability^f,
- >140 peer-reviewed scientific publications and high-impact reports cite or name SOCAT,
- SOCAT informs >10 mapping products^{b,f,g}, the Surface Ocean pCO₂ Mapping Intercomparison (SOCOM)^f and the Global Carbon Budget^d,
- SOCAT informs on ocean acidification^c,
- SOCAT enables quantification of the land carbon sink^{d,e,f},
- SOCAT is used for model evaluation^d, including CMIP^a.

Data policy - To generously acknowledge the contribution of SOCAT scientists by invitation to co-authorship, especially for data providers in regional studies, and/or reference to relevant scientific articles.

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Documentation – **V3**: Bakker et al. (2016) ESSD in press; **V2**: Bakker et al. (2014) ESSD 6:69-90; **V1**: Pfeil et al. (2013) ESSD 5:125-143; Sabine et al. (2013) ESSD 5:145-153.

References – Eyring et al., 2016^a; Landschützer et al., 2014^b; Lauvset et al., 2015^c; Le Quéré et al., 2015^d; Rödenbeck et al., 2014^e, 2015^f.

Affiliations - ¹UEA, UK (d.bakker@uea.ac.uk); ²UiB, Norway; ³BCCR, Norway; ⁴NOAA-PMEL, USA; ⁵JISAO, UW, USA; ⁶NIWA, New Zealand; ⁷CDIAC, USA; ⁸Uni Research, Norway; ⁹LOCEAN, France; ¹⁰NIES, Japan; ¹¹University of Exeter, UK; ¹²IOCCP, Poland; ¹³CSIRO, Australia; ¹⁴ACECRC, Australia; ¹⁵NOAA-AOML, USA.

