

Version 5 of the Surface Ocean CO₂ Atlas (summary for NCEI)

The Surface Ocean CO₂ Atlas (SOCAT, www.socat.info) is a synthesis activity by the international marine carbon research community and has more than 100 contributors worldwide. SOCAT provides access to synthesis and gridded, quality controlled, observational products of surface ocean fCO₂ (fugacity of carbon dioxide) for the global oceans and coastal seas. SOCAT version 5 has 21.5 million, *in situ*, surface ocean fCO₂ measurements with an accuracy of better than 5 μatm and a WOCE flag of 2 (good) from 1957 to 2016. Calibrated sensor data with an accuracy of better than 10 μatm are also available.

During quality control, marine scientists assign a flag to each data set, as well as WOCE flags of 2 (good), 3 (questionable) or 4 (bad) to individual fCO₂ values. Data sets are assigned flags of A and B for an accuracy of better than 2 μatm, flags of C and D for an accuracy of better than 5 μatm and a flag of E for an accuracy of better than 10 μatm. Bakker et al. (2016) describe the quality control criteria used in SOCAT versions 3 to 5. Quality control comments for individual data sets can be accessed via the SOCAT Data Set Viewer (www.socat.info).

All data sets, where data quality has been deemed acceptable, have been made public. The main SOCAT synthesis files and the gridded products contain all data sets with flags of A to D and fCO₂ values with a flag of 2. Access to data sets with a flag of E and fCO₂ values with flags of 3 and 4 is via additional data products and the Data Set Viewer (Table 8 in Bakker et al., 2016).

SOCAT publishes a global gridded product with a 1° longitude by 1° latitude resolution. A second product with a higher resolution of 0.25° longitude by 0.25° latitude is available for the coastal seas. Gridded products are available monthly, per year and per decade. Two powerful, interactive, online viewers, the Data Set Viewer and the Gridded Data Viewer (www.socat.info), enable investigation of the SOCAT synthesis and gridded data products. SOCAT data products can be downloaded. Matlab code is available for reading these files. Ocean Data View also provides access to the SOCAT data products (www.socat.info). SOCAT data products are discoverable, accessible and citable.

SOCAT versions 3 to 5 should be cited as Bakker et al., 2016 (until a publication on versions 4 and 5 is published). The SOCAT Fair Data Use Statement (www.socat.info) asks users 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.

The SOCAT website (www.socat.info) provides a single access point for online viewers, downloadable data sets, the Fair Data Use Statement, a list of contributors and an overview of scientific publications on and using SOCAT. Automation of data upload and initial data checks 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. More than 180 peer-reviewed scientific publications and high-impact reports cite SOCAT. SOCAT represents a milestone in research coordination, data access, biogeochemical and climate research and in informing policy.

Reference for SOCAT versions 3 to 5

Bakker, D. C. E., Pfeil, B. Landa, C. S., Metzl, N., O'Brien, K. M., Olsen, A., Smith, K., Cosca, C., Harasawa, S., Jones, S. D., Nakaoka, S., Nojiri, Y., Schuster, U., Steinhoff, T., Sweeney, C., Takahashi, T., Tilbrook, B., Wada, C., Wanninkhof, R., Alin, S. R., Balestrini, C. F., Barbero, L., Bates, N. R., Bianchi, A. A., Bonou, F., Boutin, J., Bozec, Y., Burger, E. F., Cai, W.-J., Castle, R. D., Chen, L., Chierici, M., Currie, K., Evans, W., Featherstone, C., Feely, R. A., Fransson, A., Goyet, C., Greenwood, N., Gregor, L., Hankin, S., Hardman-Mountford, N. J., Harlay, J., Hauck, J., Hoppema, M., Humphreys, M. P., Hunt, C. W., Huss, B., Ibáñez, J. S. P., Johannessen, T., Keeling, R., Kitidis, V., Körtzinger, A., Kozyr, A., Krasakopoulou, E., Kuwata, A., Landschützer, P., Lauvset, S. K., Lefèvre, N., Lo Monaco, C., Manke, A., Mathis, J. T., Merlivat, L., Millero, F. J., Monteiro, P. M. S., Munro, D. R., Murata, A., Newberger, T., Omar, A. M., Ono, T., Paterson, K., Pearce, D., Pierrot, D., Robbins, L. L., Saito, S., Salisbury, J., Schlitzer, R., Schneider, B., Schweitzer, R., Sieger, R., Skjelvan, I., Sullivan, K. F., Sutherland, S. C., Sutton, A. J., Tadokoro, K., Telszewski, M., Tuma, M., Van Heuven, S. M. A. C., Vandemark, D., Ward, B., Watson, A. J., Xu, S. (2016) A multi-decade record of high quality fCO₂ data in version 3 of the Surface Ocean CO₂ Atlas (SOCAT). *Earth System Science Data* 8: 383-413. doi:10.5194/essd-8-383-2016.