

Mapped Observation-Based Oceanic DIC, monthly climatology from January to December (based on observations between 2004 and 2017), from the **Max-Planck-Institute for Meteorology (MOBO-DIC_MPIM)**



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Citation

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Method:

We apply and extend the SOM-FFN approach by Landschützer et al. (2013) to obtain time-varying gap-filled mapped fields of dissolved inorganic carbon (DIC) in the water column. In the SOM-FFN approach, the first step is to cluster the ocean into regions of similar physical and biogeochemical properties using self-organizing maps (SOM). In the second step, a feed-forward network (FFN) is run in each SOM-cluster to approximate and apply the statistical relationship between the target data (here: DIC), and better constrained predictor data that are available as mapped global fields.

We adjusted the SOM-FFN method in several ways compared to the original method by Landschützer et al. (2013), that mapped oceanic surface pCO₂. As we map the DIC in the water column, we extend the mapping grid from three dimensions (latitude,

longitude, and time), to four (latitude, longitude, time, and depth), and instead of monthly interannual fields, we resolve a monthly climatology based on the period from 2004 through 2017. As different predictors are available and/or meaningful when mapping DIC in the water column, we also have a different set of predictor data compared to the approach used by Landschützer et al. (2013).

To overcome potential biases in the random selection of training and internal validation data, we use a bootstrapping approach, running the SOM-FFN method ten times. We take the mean across this ensemble as our final DIC field. We define the standard deviation across the ensemble as the uncertainty within the method, and name it ensemble spread.

For the full description of the method and its validation, please refer to both the Main Text and the Supporting Information of Keppler et al. (2020, in review at GBC).

Matlab Code

The Matlab Codes written to create this data set can be made available upon request.

Content

The NetCDF file contains*:

- Dissolved inorganic carbon (**DIC** in $\mu\text{mol kg}^{-1}$, on the grid: lon, lat, depth, month)
- Ensemble spread (**DIC_err** in $\mu\text{mol kg}^{-1}$, on the grid: lon, lat, depth, month)
- Longitude (**lon**; 179.5°W to 179.5°E, at 1° resolution)
- Latitude (**lat**; 64.5°N to 64.5°S, at 1° resolution)
- Depth (**depth**; from 2.5 m to 1975 m, on 33 depth levels)
- Month of the year (**month**; 1 to 12)

* the first word in the brackets denotes the name of the variables in the NetCDF file

Inquiries

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References

Landschützer, P., Gruber, N., Bakker, D.C.E., Schuster, U., Nakaoka, S., Payne, M.R., Sasse, T.P., Zeng, J., 2013. A neural network-based estimate of the seasonal to inter-annual variability of the Atlantic Ocean carbon sink. *Biogeosciences* 10, 7793–7815. <https://doi.org/10.5194/bg-10-7793-2013>