

Inorganic Carbon

ESSENTIAL CLIMATE VARIABLE (ECV)
FACTSHEET



GLOBAL CLIMATE
OBSERVING SYSTEM
KEEPING WATCH OVER OUR CLIMATE



ECV IN BRIEF

Domain: Ocean
Subdomain: Biogeochemical
Scientific Area: Carbon Cycle and other GHGs
Products: Interior ocean carbon storage.
 At least 2 of: Dissolved Inorganic Carbon (DIC), Total Alkalinity (TA) or pH; pCO₂ (to provide Air-sea flux of CO₂)



Inorganic Carbon

The ocean is a major component of the global carbon cycle, absorbing enormous quantities of carbon in natural cycles driven by the ocean circulation, biogeochemistry and biology. Since seawater has very high capacity for absorbing carbon, the ocean has an inhibitory effect on the atmospheric accumulation of carbon dioxide and related greenhouse effect. The net ocean carbon uptake depends significantly on chemical and biological activity, and therefore it varies due to changing oceanic conditions and ecosystem composition. The chemical pathways of the inorganic carbon in the ocean mean that this uptake causes a decline in ocean pH, also known as ocean acidification.

ECV Product¹

PRODUCT	DEFINITION	REQUIREMENTS				
		FREQUENCY	RESOLUTION	REQUIRED MEASUREMENT UNCERTAINTY	STABILITY	STANDARDS/ REFERENCES
Interior ocean carbon storage. At least 2 of: Dissolved Inorganic Carbon (DIC), Total Alkalinity (TA) or pH	Interior ocean carbon storage, calculated from at least two of Dissolved Inorganic Carbon, Total Alkalinity or pH. [mol C kg ⁻¹]	decadal	Every 20°	TA/DIC ±2 µmol kg ⁻¹ M; pH ±0.005		
pCO₂ (to provide Air-sea flux of CO₂)	Surface ocean partial pressure of CO₂ [µatm]	Weekly to decadal	Every 10°, (Denser in the coastal domain, surface)	±2 µatm		

¹ Current Products and Requirements as in the Implementation Plan 2016 (GCOS-200). GCOS is reviewing and will update the requirements until 2022. More information on: gcos.wmo.int and climatedata.wmo.int.



Data Sources²

- ▶ Global Ocean Data Analysis Project (GLODAPv2):
<http://glodap.info/>
- ▶ CLIVAR and Carbon Hydrographic Data Office (CCHDO):
<http://cchdo.ucsd.edu/>
- ▶ Surface Ocean CO₂ Atlas (SOCAT):
<http://www.socat.info>
- ▶ National Centers for Environmental Information Ocean Carbon Data System (NCEI OCADS):
<https://www.nodc.noaa.gov/ocads/>
- ▶ Lamont-Doherty Earth Observatory (LDEO) Climatology:
https://www.nodc.noaa.gov/ocads/oceans/LDEO_Underway_Database/

Anthropogenic CO₂ in the ocean

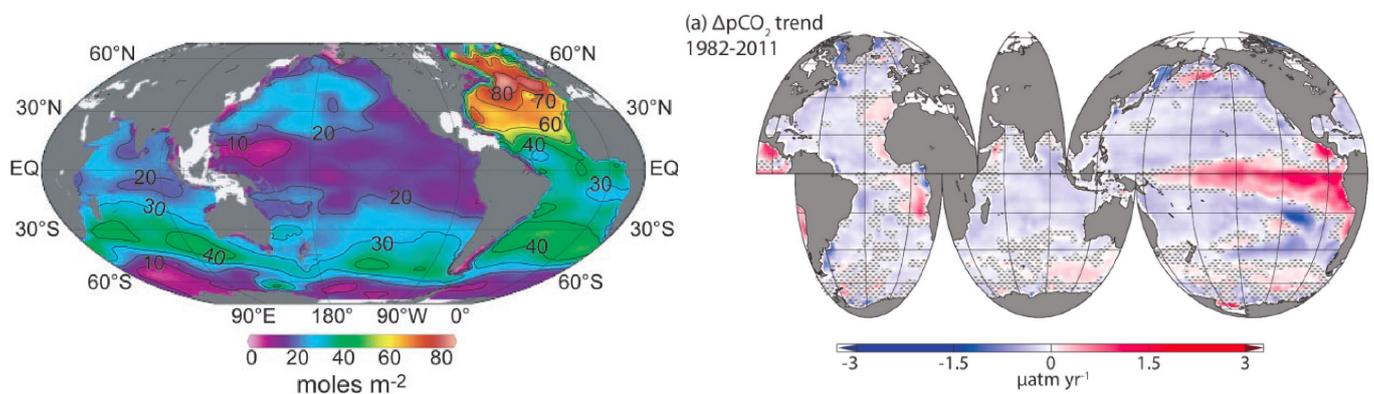


Figure left: Column inventory of anthropogenic CO₂ in mid-1990s. Figure right: Long-term linear trend of pCO₂ - pCO₂air over the 1982 through 2011 period.

Reference: Sabine, C. L., Feely, R. A., Gruber, N., Key, R. M., Lee, K., Bullister, J. L., Wanninkhof, R., Wong, C. S., Wallace, D.W.R., Tilbrook, B., Millero, F. J., Peng, T.-H., Kozyr, A., Ono, H., and Rios, A. F. (2004): The oceanic sink for anthropogenic CO₂, *Science*, 305, 367-371.

Reference: Landschützer, P., Gruber, N., Bakker, D.C.E., (2016): Decadal variations and trends of the global ocean carbon sink, *Global Biogeochemical Cycles*, 30, 1396-1417, doi:10.1002/2015GB005359.

² This list provides sources for openly accessible data sets with worldwide coverage for which metadata is available. It is curated by the respective GCOS ECV Steward(s). The list does not claim to be complete. Anyone with a suitable dataset who would like it to be added to this list should contact GCOS.