



COPERNICUS
MARINE ENVIRONMENT MONITORING SERVICE

QUALITY INFORMATION DOCUMENT

Ocean Monitoring Indicator (OMI) of the Copernicus Marine Environment Monitoring Service

Global yearly pH time series

GLOBAL_OMI_HEALTH_carbon_ph_area_averaged

Issue: 2.0

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Approval date by the CMEMS product quality coordination team:

QUID for CMEMS OMI: GLOBAL_OMI_HEALTH_carbon_ph_area_averaged	Ref:	CMEMS-OMI-QUID-GLO-HEALTH-carbon-ph-area-averaged
	Date:	December 2019
	Issue:	2.0

CHANGE RECORD

Issue	Date	§	Description of Change	Author	Validated By
1.0	January 2019	all	Creation of document	Marion Gehlen, Trang Chau	
1.1	October 2019	/	Update of Figure 1	Trang Chau	
2.0	December 2019	/	Update of Figure 1 (temporal extension)	Thi Tuyet Trang Chau, Marion Gehlen, Frédéric	

Product name: GLOBAL_OMI_HEALTH_CARBON_PH_AREA_AVERAGED

Dataset name: GLOBAL_OMI_HEALTH_carbon_ph_area_averaged

Indicator evaluation method:

The OMI yearly mean surface sea water pH reported on total scale is computed from monthly pH values which are distributed as part of the CMEMS product MULTIOBS_GLO_BIO_REP_015_005. The associated quality information document provides details on the evaluation of pH fields.

Scientific validation:

The average surface water pH decreased by 0.0017 pH units between 2001 and 2017 (Figure 1). Although the time interval covered by the OMI differs from that of published trend estimates at Eulerian time series, it falls within the range of these data-based estimates: (1) station ALOHA (HOT, 22.75°N, 158°W) = 0.0019 ± 0.0002 pH units/yr (Dore et al., 2009); (2) station BATS (31.72°, 64°17'W) = 0.0017 ± 0.0003 pH units/yr (Bates, 2007); (3) station ESTOC, 24.04°N, 15.50°W) = 0.0018 ± 0.0003 pH units/yr (Santana-Casiano et al., 2007; González-Dávila et al., 2010).

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Yearly Mean Surface Sea Water pH reported on total scale

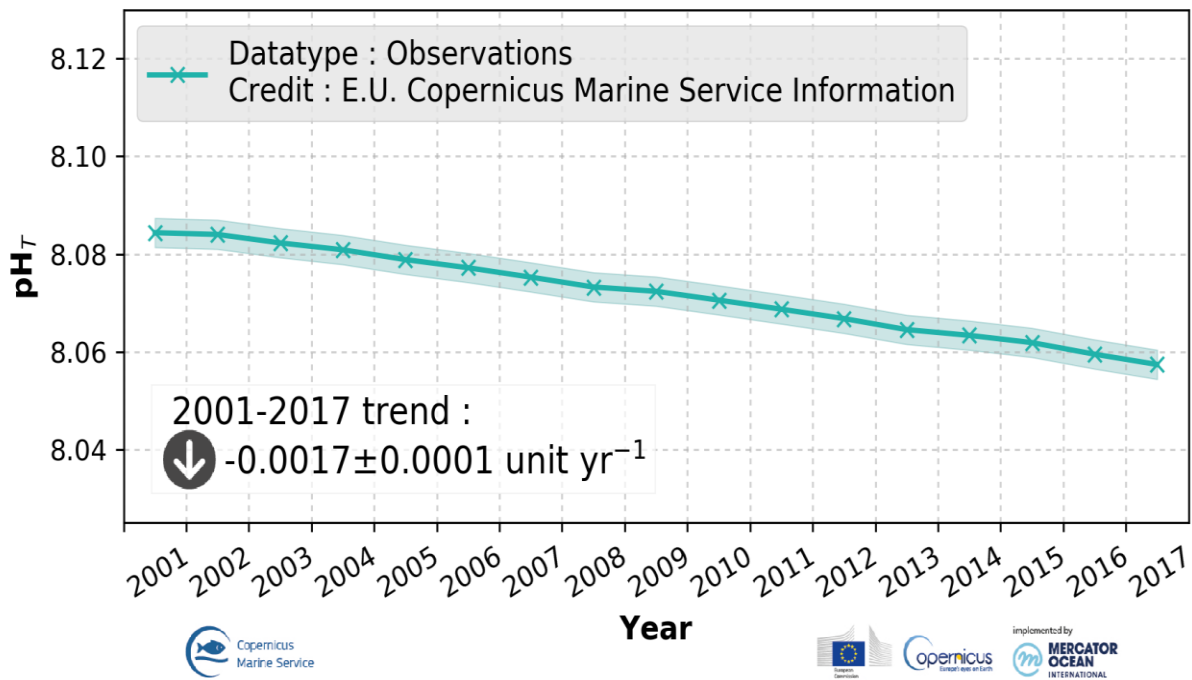


Figure 1: Time series of annual global mean surface sea water pH over the period 2001-2017 using a reconstruction methodology (see method).

Product used for indicator evaluation:

The OMI yearly mean surface sea water pH reported on total scale is computed from monthly pH values which are distributed as part of the CMEMS product MULTI-OBS-GLO-BIO-REP_015_005.

The total uncertainty of yearly mean surface sea water pH is 0.003 pH unit.

It is evaluated from the contributions of (1) speciation uncertainty, (2) mapping uncertainty, (3) uncertainty due to spatial averaging and (4) measurement uncertainty.

(1) *Speciation uncertainty* is evaluated through uncertainty propagation within following Orr et al. (2018) within the speciation software CO₂sys (Lewis and Wallace, 1998; Van Heuven et al., 2011). Input to the uncertainty propagation routine were default values for dissociation constants, and uncertainty estimates for alkalinity fields from LIAR (Carter et al., 2016; 2018),

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respectively biome-scale estimates for pCO₂ from Denvil-Sommer et al. (2018). The RMSE computed from monthly error maps is taken as an estimate of (1): 0.0143 pH unit.

(2) *Mapping uncertainty* is set equal to the RMSE computed from the comparison between reconstructed pH values and the Glodapv2 bottle data set: 0.0285 pH unit.

(3) *Uncertainty due to pH space and time variability* is taken as the standard deviation of monthly reconstructed pH fields: 0.0340 pH unit.

(4) *Measurement uncertainty* was taken from Orr et al. (2018) as 0.01 pH unit.

Contributions of individual uncertainty terms are squared, divided by the effective degree of freedom (Neff) and summed to yield (total uncertainty)². The effective degree of freedom takes into account pH decorrelation length scales. Those were not assessed for this release. Here we use a constant decorrelation length scale of 20° and 3 month which for a latitude band extending from 65°S to 65°N and excluding land points yields Neff = 327.

Please refer to CMEMS-MOB-QUID-015-005-V1.0 for additional information.

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