COLLOQUE - ACIDIFICATION DES OCÉANS

Conséquences sur les écosystèmes et les activités humaines

Le suivi du pH: Indicateur ODD 14

28 mars 2019

Marion Gehlen
IPSL/LSCE – membre du CS AO

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE

Ifremer

FRB FONDATION POUR LA RECHERCHE SUR LA BIODIVERSITÉ

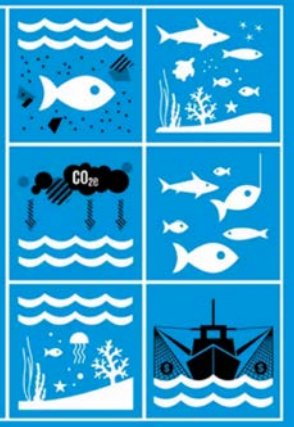
SUSTAINABLE DEVELOPMENT GOALS

KNOWLEDGE PLATFORM

14 LIFE BELOW WATER

SUSTAINABLE DEVELOPMENT GOALS
KNOWLEDGE PLATFORM

14 LIFE BELOW WATER



TARGETS

INDICATORS

14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	**14.1.1**	Index of coastal eutrophication and floating plastic debris density
14.2	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	**14.2.1**	Proportion of national exclusive economic zones managed using ecosystem-based approaches
14.3	Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	**14.3.1**	Average marine acidity (pH) measured at agreed suite of representative sampling stations
14.4	By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	**14.4.1**	Proportion of fish stocks within biologically sustainable levels

Monitoring global surface ocean pH

A new indicator developed for the **Copernicus Marine Service**:

Global surface ocean pH from 2001 onwards

➔ developed under the Multi-observation (MOB) TAC by

Anna Conchon (Mercator Ocean International), & Marion Gehlen (LSCE/IPSL)

Challenge:

Direct measurements of pH are rare; data sources include fixed ocean observatories (e.g. BATS, HOT) and scientific field campaigns

Approach:

- Reconstruction of global monthly mean surface ocean pH distribution (2001 to present) at 1°x1° spatial resolutio
- Use of observed in situ pH data for independent validation of reconstructed pH
- Compute global mean annual time series of surface ocean pH

Reconstruction of surface ocean pH

Global (1°x1°) monthly surface ocean pH: 2100 to present
CO2sys van Heuven et al, 2011, Lewis & Wallace, 1998

Copernicus Marine Service

surface ocean pCO_2 Denvil-Sommer et al., 2018

Alkalinity Carter et al. 2016, 2018

SST, SSS Copernicus Marine Service

Si, PO_4 WOA 2013

Surface ocean pCO_2: pCO_2^{oc} = g(SSS,SST,SSH,MLD,Chl, pCO_2^{atm},lon,lat)

from a neural network

- SSS, SST, SSH, MLD, CHI Copernicus Marine Service
- CO_2^{atm}: www.bgc-jena.mpg.de
- pCO_2^{oc}: Bakker et al., 2016 – Surface Ocean CO_2 Atlas (SOCAT), training

Alkalinity

Empirical relationship: ALK = f(SSS, SST, nutrients), Carter et al. 2016, 2018

Reconstruction of surface ocean pH

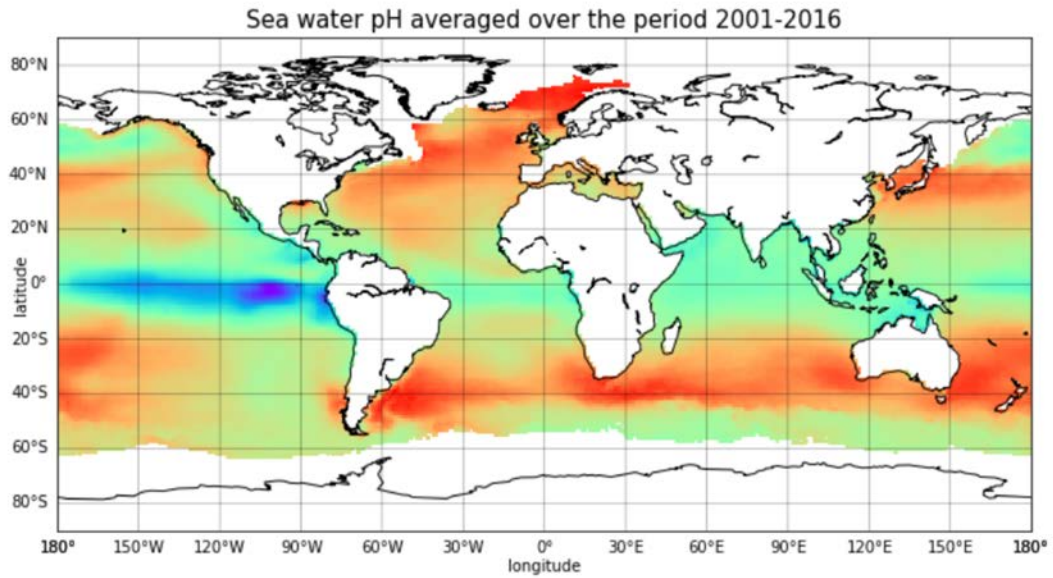
Validation against independent data:

Example:

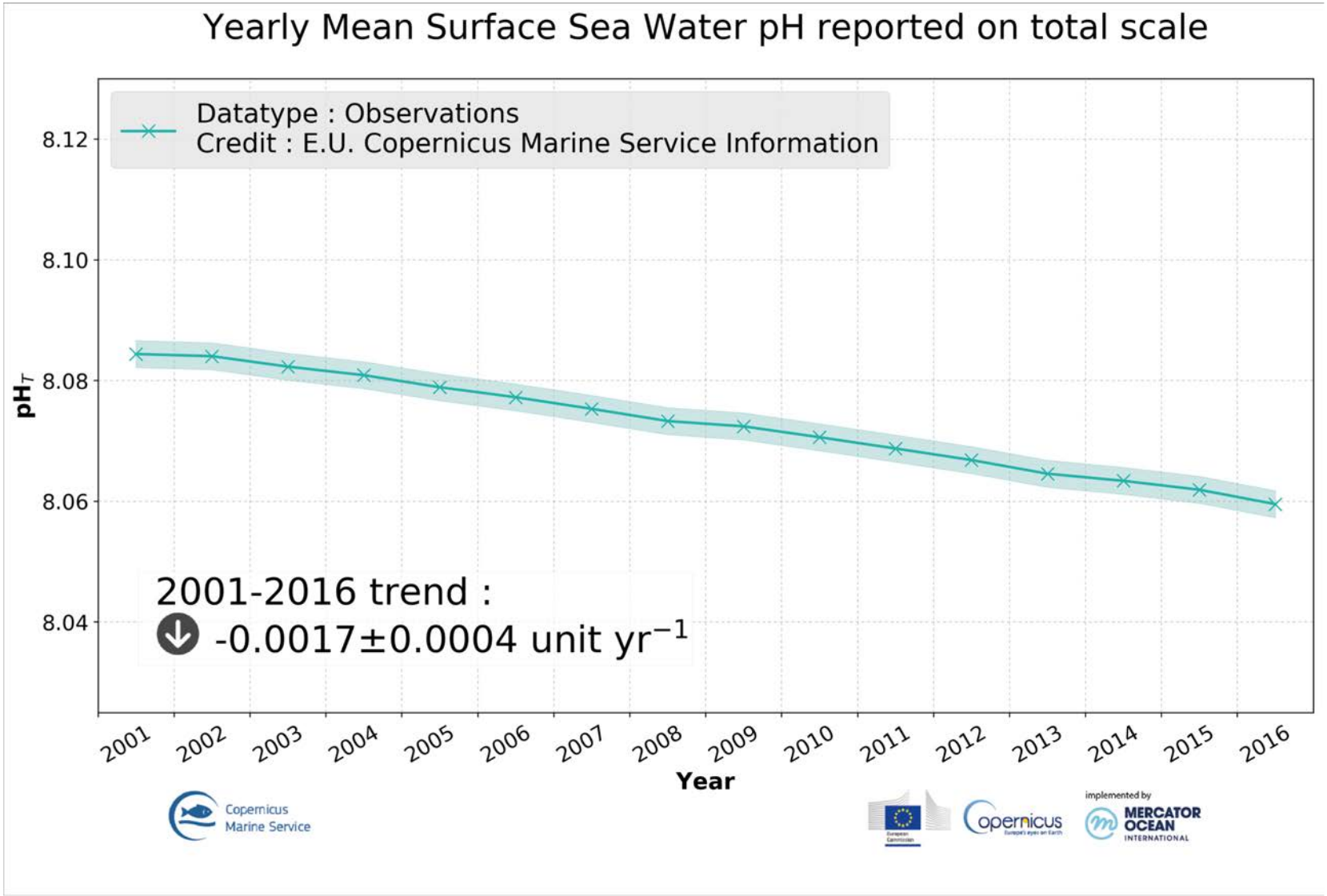
Copernicus Marine Service

GLODAPv2 bottle data n=4907 (Key et al., 2015)

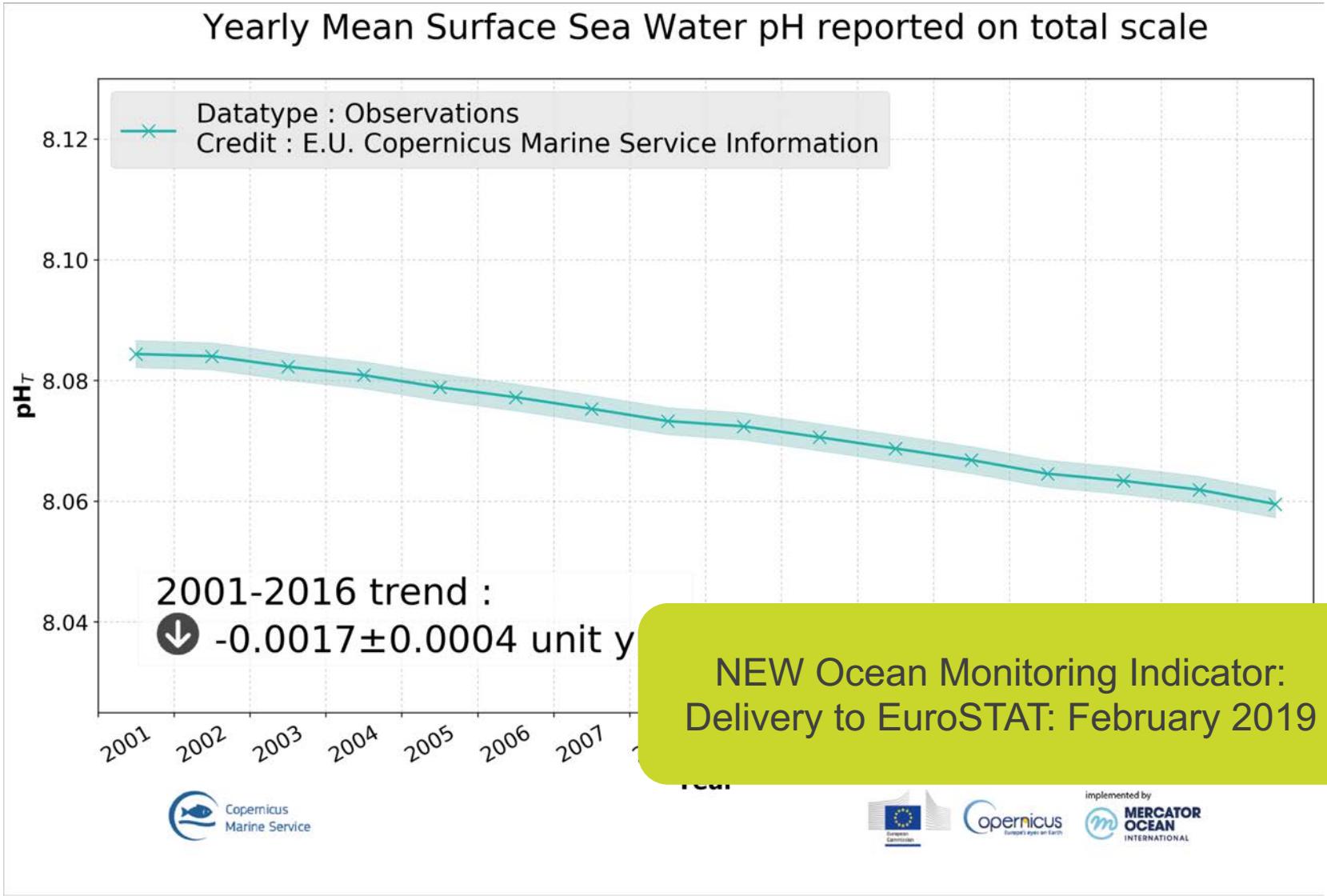
Model	RMSE	r^2	Absolute bias
Global	0.03	0.61	0.02



Reconstruction of surface ocean pH



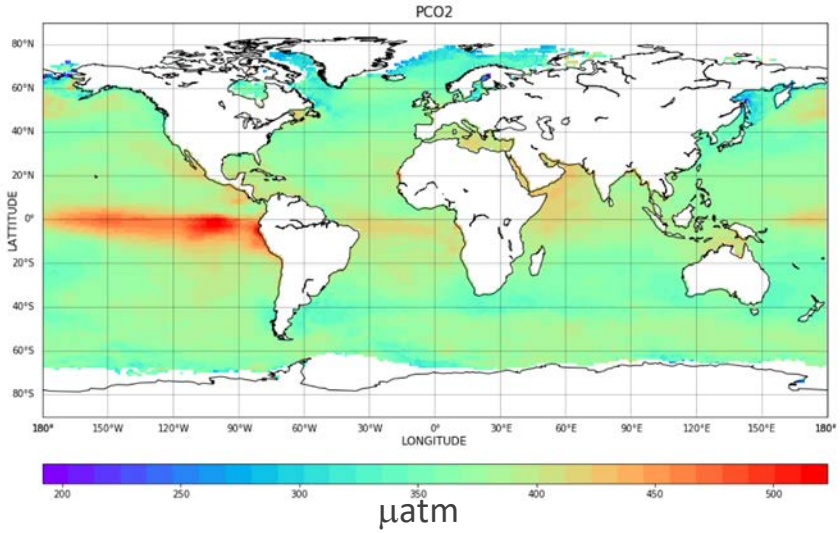
Reconstruction of surface ocean pH

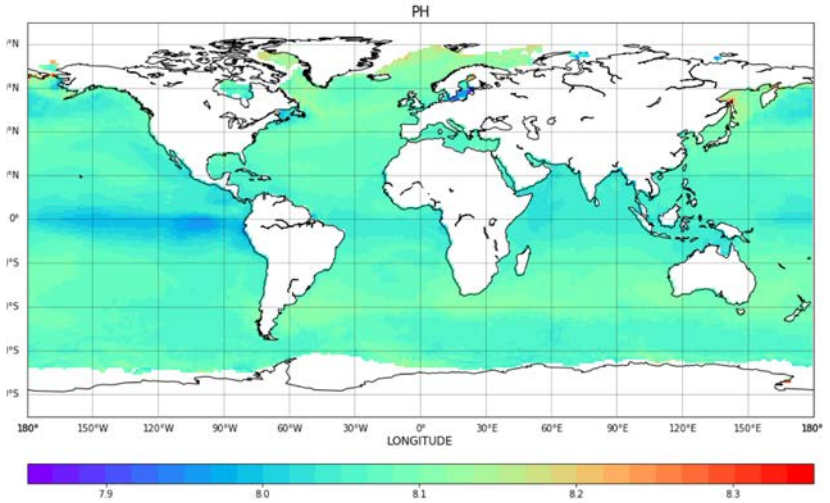


NEW Ocean Monitoring Indicator:
Delivery to EuroSTAT: February 2019

Surface ocean pCO_2 and pH

pCO_2^{atm} : 396.52 +/-0.12 (NOAA)

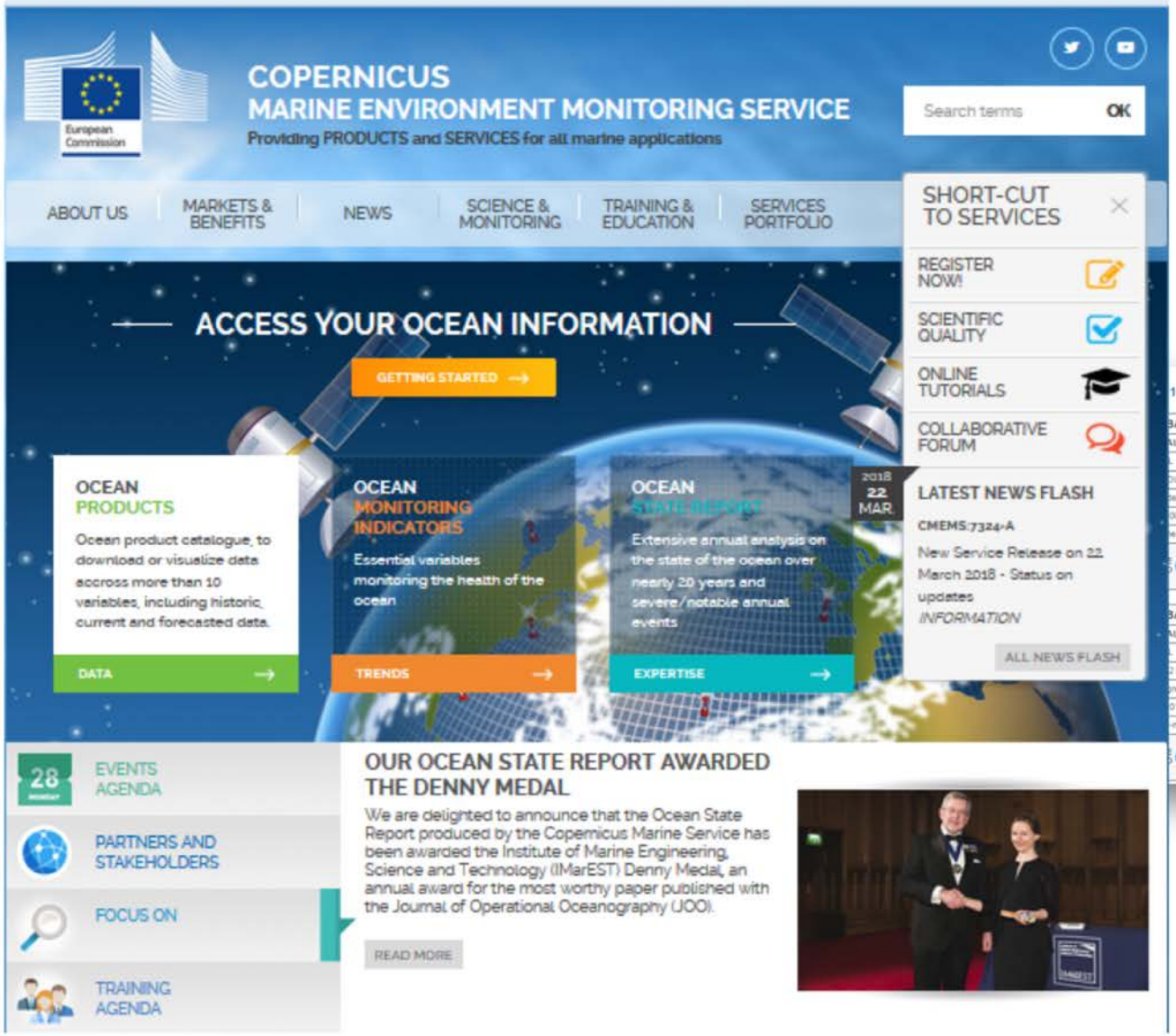




yearly averages 2013

Marine Monitoring

marine.copernicus.eu



K. von Schuckmann (karina.von.schuckmann@mercator-ocean.fr)

THE COPERNICUS MARINE SERVICE

Marine Monitoring

MULTI-YEAR
10 to 45 years

REAL-TIME
Daily, hourly

FORECAST
2 to 10 days

1 Global
2 Arctic
3 Baltic
4 NWS
5 IBI
6 Med Sea
7 Black Sea

ESSENTIAL MARINE VARIABLES

- Physics
- Sea-ice
- Waves
- Biogeochemistry

OBSERVATIONS
In-situ & Satellites

NUMERICAL MODELS &
data assimilation

Open and Free access

K. von Schuckmann (karina.von.schuckmann@mercator-ocean.fr)

European Commission | Copernicus Europe's eyes on Earth | MERCATOR OCEAN

CMEMS MONITORING & REPORTING

Marine Monitoring

Copernicus Marine Service REPORTING: OBJECTIVE

Develop a fundamental source of CMEMS value-added information and indicators for the monitoring & reporting of the European regional seas and the global ocean state, variability and change from the past to the present.

PRESENT → PAST

Copernicus Marine Service

OCEAN MONITORING & REPORTING

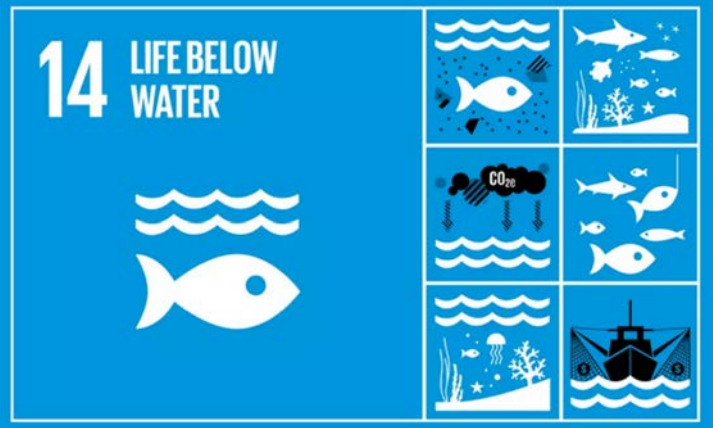
- OCEAN STATE
- OCEAN VARIABILITY
- CLIMATE CHANGE

EUROPE: Link to C3S, EEA/MSFD, ICES, EC, EuroGOOS, …

INTERNATIONAL: Link to SDG, BAMS, GCP, WMO, Ocean & Climate platform, …

K. von Schuckmann (karina.von.schuckmann@mercator-ocean.fr)

SUSTAINABLE DEVELOPMENT GOALS
KNOWLEDGE PLATFORM



Copernicus Marine Service

pH, New Ocean Monitoring Indicator

- time series of global annual mean pH
- distributed through CMEMS portal, first quarter 2019
- global, 1°x1° resolution, monthly fields
- data-based: model assessment
- monitoring of ocean pH at regional, basin and global scale

Jürgen Freund/ iLCP