Marine Ecosystem Analysis and Prediction - MEAP

Co-chairs: Stefano Ciavatta (PML, UK), Katja Fennel (Dalhousie University, CA)

Terms of reference

Mission: Advancing the underpinning science and tools for integration of biogeochemical and ecosystem models into operational systems.

1) Carbon cycle research & accounting

- Quantification of carbon uptake
- National carbon accounting
- Sensitivity of carbon fluxes to climate forcing
- Climate projections

2) Marine productivity/ecosystem health

- Fisheries management
- Conservation of endangered species
- Design of MPAs
- Future projections for ecosystems
- Prediction of marine health indicators (eutrophication, acidification, deoxygenation

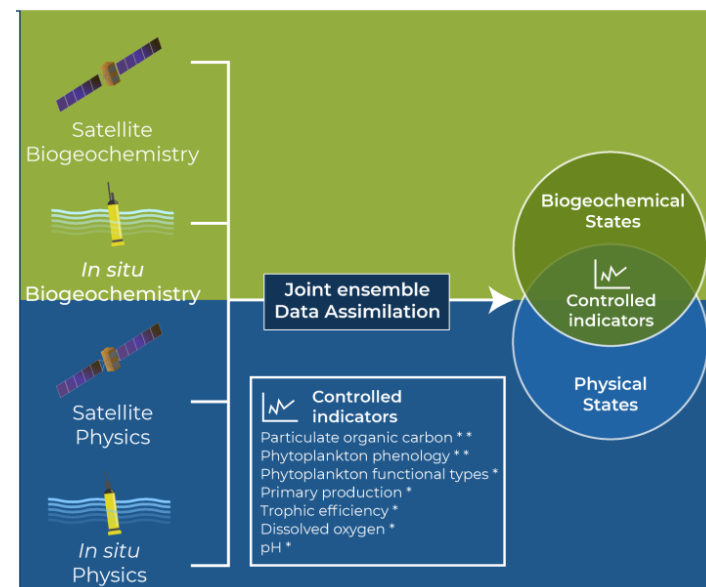# Projects: e.g. SEAMLESS

Programme: SPACE - Copernicus Evolution
Period: 2021-2023
Budget: €1.5M

Main objectives:

- To provide CMEMS with new capabilities to deliver indicators of climate-change impact and food security in marine ecosystems
- To unleash a seamless flow of information from novel observing networks to operational model predictions of ecosystem indicators
- To innovate current practices in biogeochemical ensemble DA

Coordinator and seven investigators of MEAP-TT

www.seamlessproject.org   @SEAMLESSproject
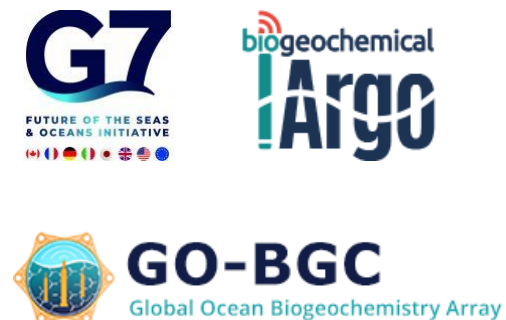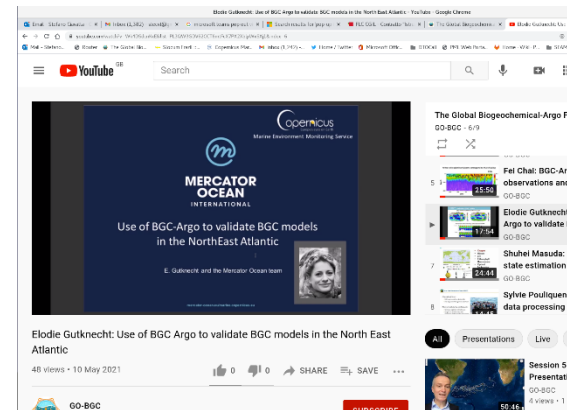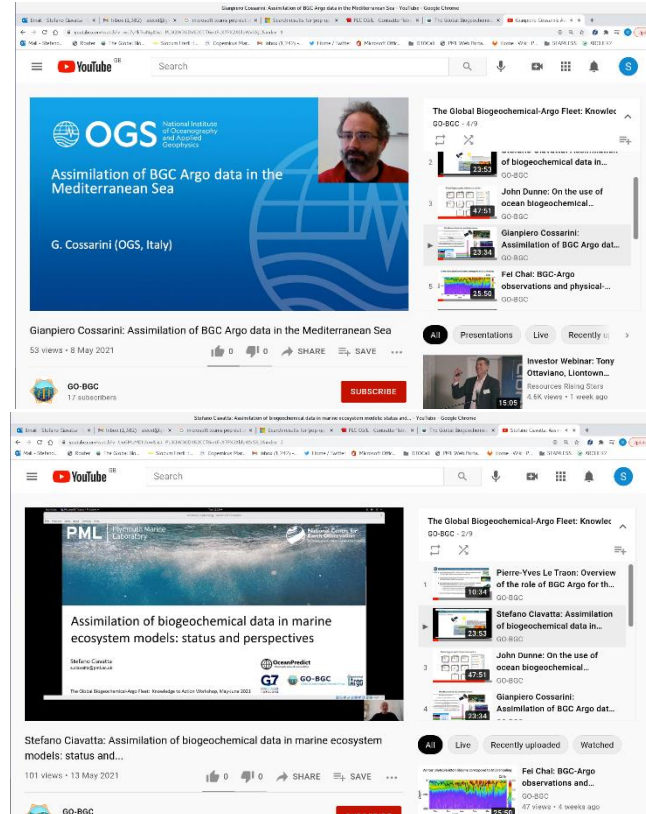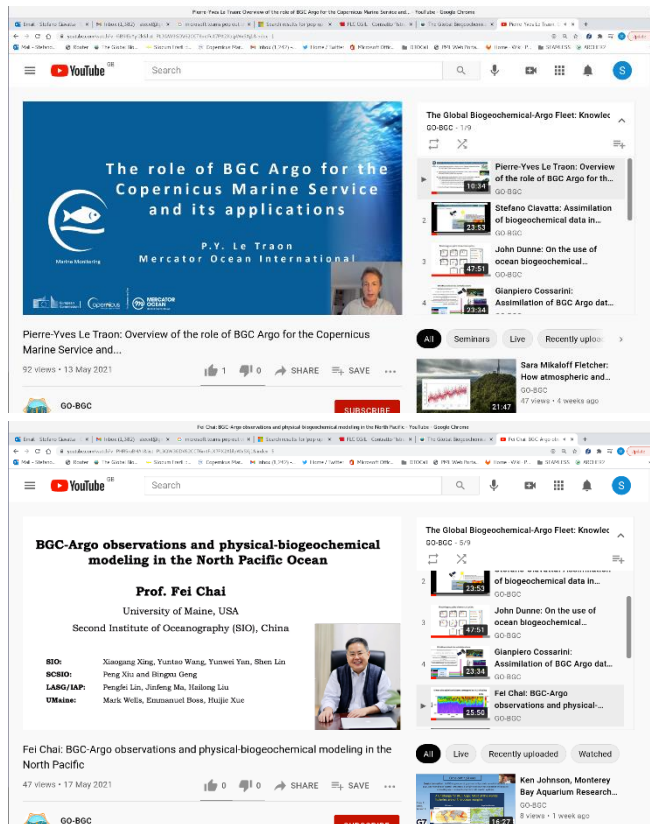
Communication of TT outcomes

- **What are the products/knowledge/advances generated by the TT?** (data, reports, events, etc.? – please highlight)

- Leading/contributing the ET-OOFS Guidebook, BGC chapter
- Editors of the Special issue of Biogeosciences/Ocean on "Biogeochemistry in the BGC-Argo era: from process studies to ecosystem forecasts", 2021
- IOCCG (2020). Synergy between Ocean Colour and Biogeochemical/Ecosystem Models.
- Fennel & MEAP-TT, 2019, OceanObs paper + co-authorship in several others

Communication of TT outcomes

- Contributions to the The Global Biogeochemical-Argo Fleet: Knowledge to Action Workshop, linked to the G7 FSOI, May 2021

Communication of TT outcomes

- Contribution to the CMOS webinar series, Feb 2021

- Contribution to the OceanSITES 13th Science Committee, Sept 2020
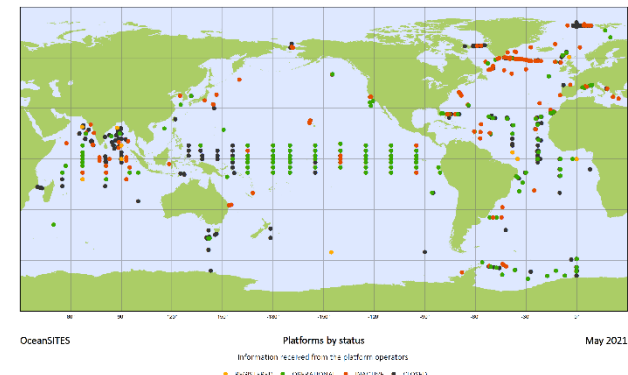
Communication of TT outcomes

- **We host stakeholder groups @ each quarterly video-meeting**

November 2020

June 2021

September 2021 ?

ARC-MFC	Tsuyoshi Wakamatsu, Annette Samuelsen (NERSC)
BAL-MFC	Xin Li, Fabian Schwichtenberg (BSH)
BS-MFC	Luc Vandenbulcke (ULG)
GLO-MFC	Julien Lamouroux (MOi)
IBI-MFC	Marcos Garcias-Sotillo (PdE)
MED-MFC	Gianpiero Cossarini, Anna Teruzzi (OGS)
NWS-MFC	Stefano Ciavatta (PML), David Ford (MetOffice)
INS-TAC	Henning Wehde (IMR)
OC-TAC	Antoine Mangin (ACRI), Stefano Ciavatta (PML)
MOB-TAC	Raphaëlle Sauzède (LOV), Stéphanie Guinehut (CLS)

Co-chair: Annette Samuelsen (NERSC/ARC-MFC) and Julien Lamouroux (MOi/GLO-MFC)
Meetings: from 2020, quarterly online meetings
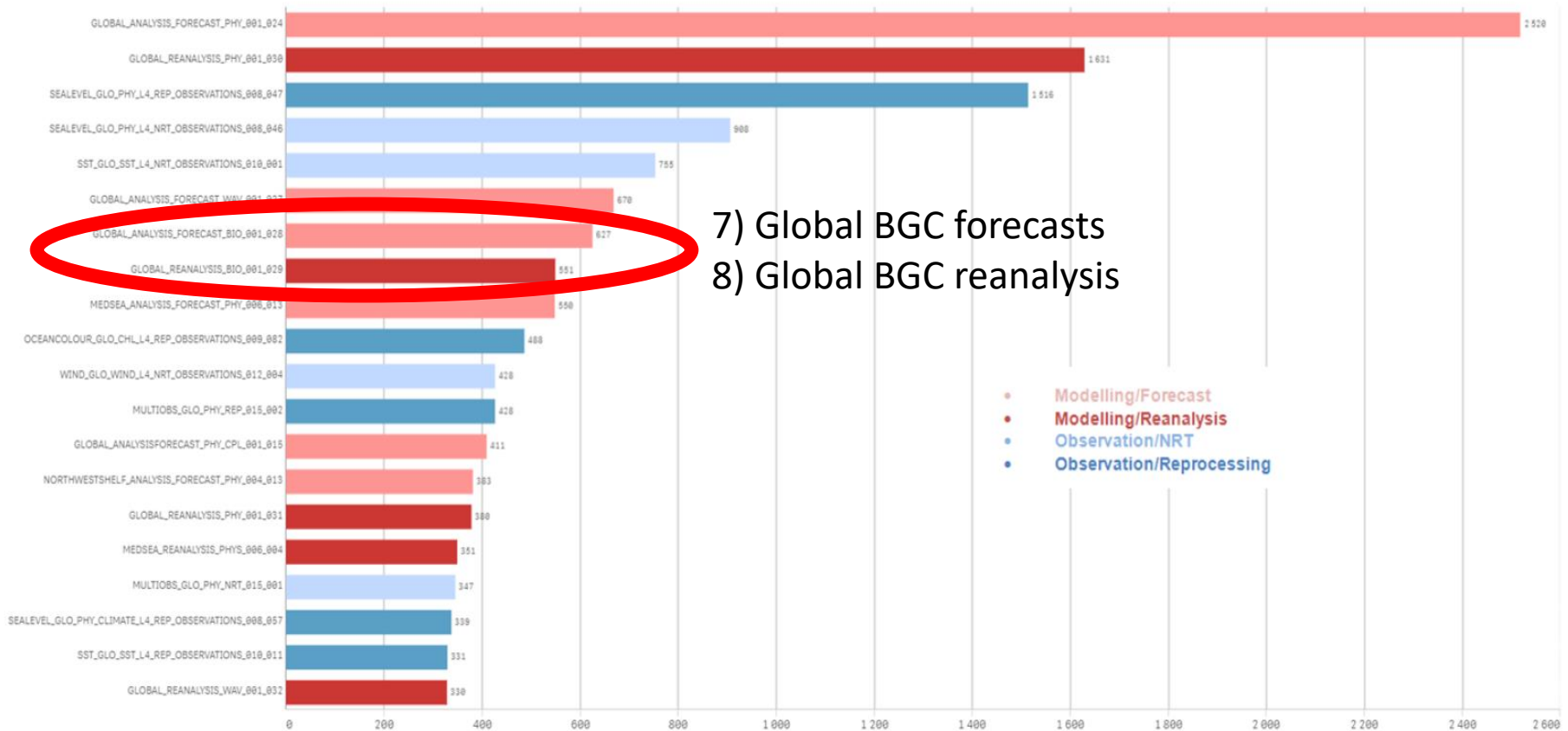
Working Group on Operational oceanographic products for fisheries and environment

Fisheries WG

TT community interactions

2020 TOP PRODUCTS


7) Global BGC forecasts
8) Global BGC reanalysis

Legend:
- Modelling/Forecast
- **Modelling/Reanalysis**
- Observation/NRT
- **Observation/Reprocessing**

Courtesy of Laurence Crosnier, MOi

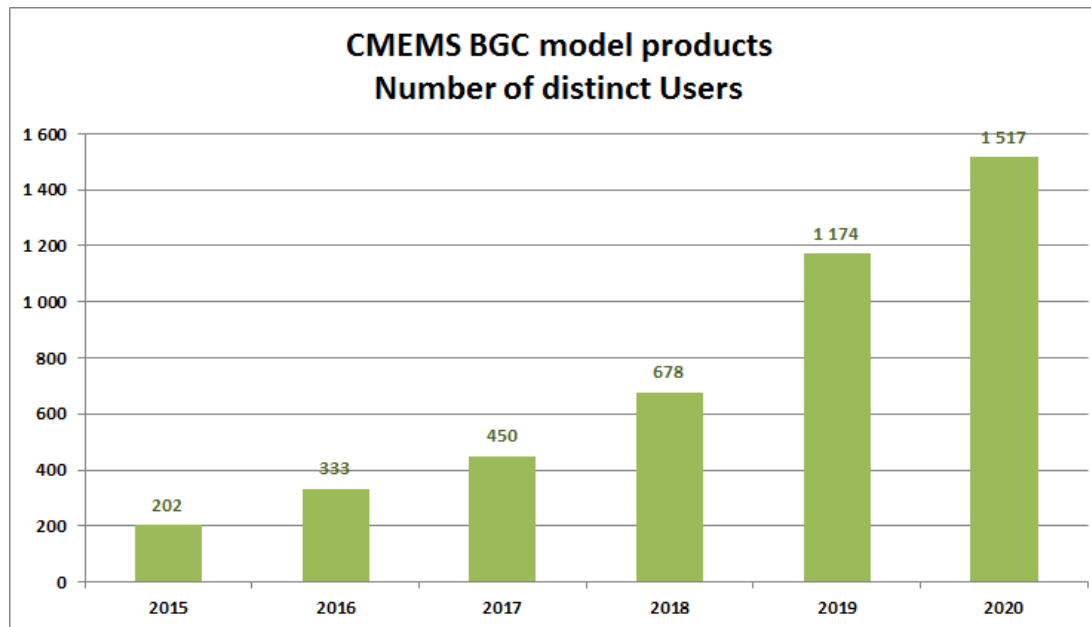# Users of Copernicus Marine Service BGC models

Environment policies (eg Marine Strategy Directive, Green Deal), Climate and Carbon, Ocean Health (eutrophication, acidification), Protection of endangered marine species, Fishery and Aquaculture management
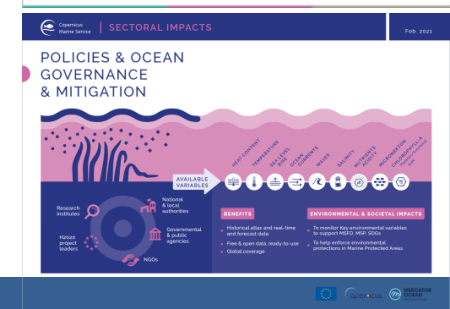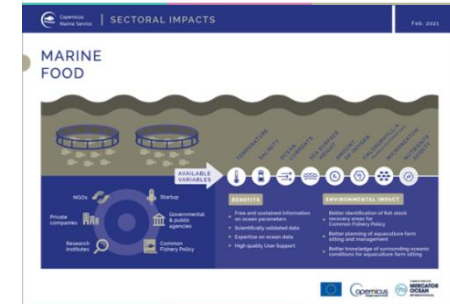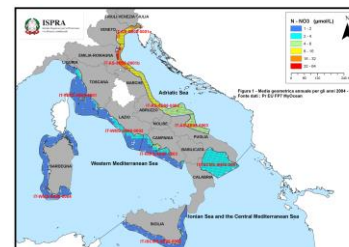
Courtesy of Pierre-Yves Le Traon, MOi

TT community interactions

- **What groups does the TT collaborate with?**

On observing systems…

On fisheries…

TT future plans in UN decade context

- **What gaps in knowledge/expertise need to be filled from your TT perspective?**

- improve accuracy of model prediction through better understanding, formulation & parameterization of ecosystem processes and humbly revise current paradigms (e.g. mixotrophy, role of bacteria in C cycle, viruses, spectral optics…)
- Data assimilation methods for BGC (non-linearity, non-gaussianity, uncertainties)
- MEAP can facilitate efficient exchange of experiences and solutions among international experts working on operational assimilation of expanding float/glider fleet data.

- Convince users of the reliability of BGC model outputs (DA helps!)

- AI/ML in the ocean BGC framework

- BGC in high resolution models

- difficulty to ensure a good representation of the biogeochemical modelling communities in the South American and African continents

- **What do you see as challenges for the TT in the next 3-5 years?:** To fill the above gaps

TT future plans in UN decade context

- **Where do you anticipate benefit in the Decade?**
  - more visibility for MEAP challenges and needs
  - more direct interaction with stakeholders and policy makers

- **How do you plan to engage with SynObs and/or CoastPredict?**

Synobs aims to optimize various combinations of different platforms in the ocean observation:
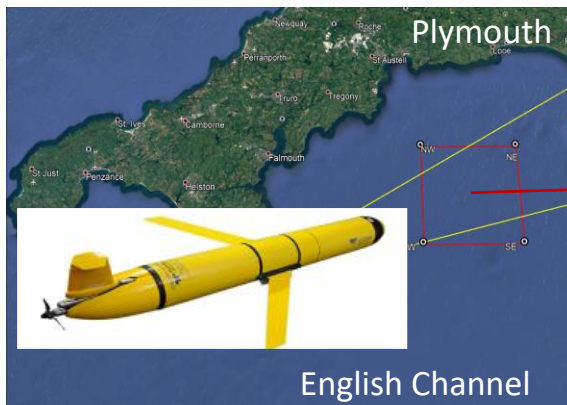
4. Satellite ocean colour observations and in-situ (Argo) observations

Eg: Skakala et al., 2021; Teruzzi et al., submitted

OceanPredict
Advancing the science of ocean prediction

- **If available, what is the longer-term outlook in the TT field of expertise (next 10 years)?**

- Fully integrated biogeochemical-physical monitoring-modelling systems with smart guidance of the observing platforms

Plymouth

English Channel

Chlorophyll model forecasts

Courtesy of Gianmario Rinaldi, Shenan Grossberg

UNIVERSITY OF EXETER

See also Skakala et al., 2021