

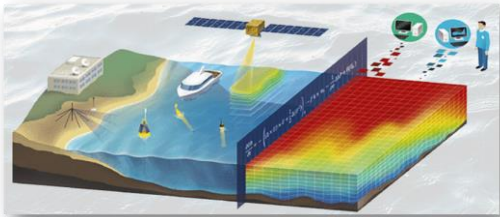


ETOOFS recent activities: connection with OceanPredict

Pierre Bahurel and Enrique Alvarez

The Expert Team on Operational Ocean Forecasting Systems (ETOOFs)

- now a GOOS component -



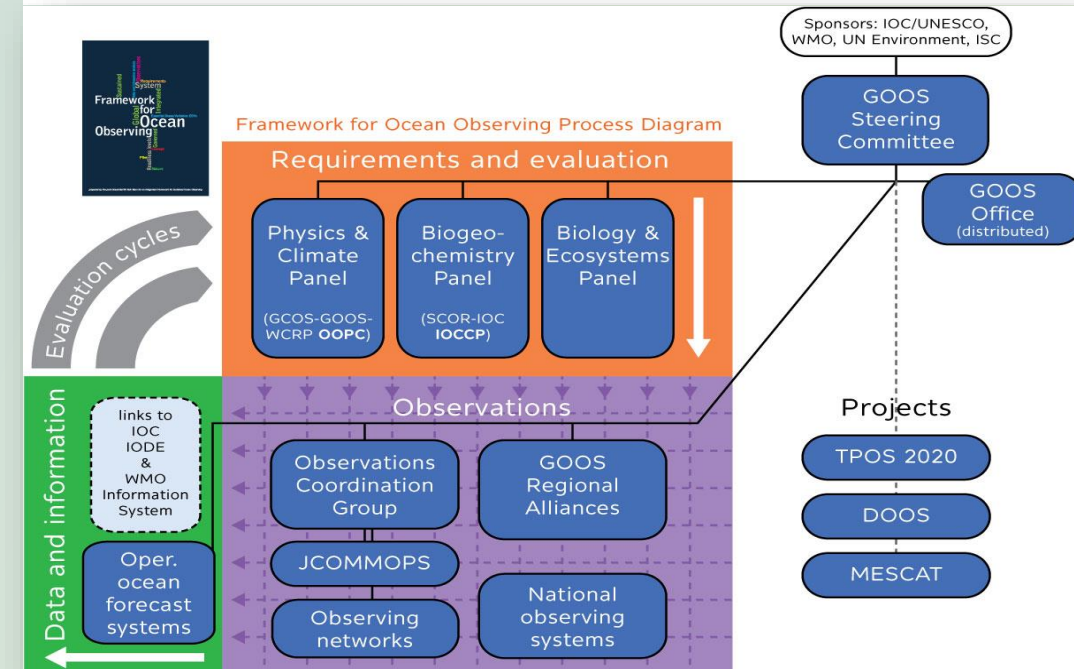
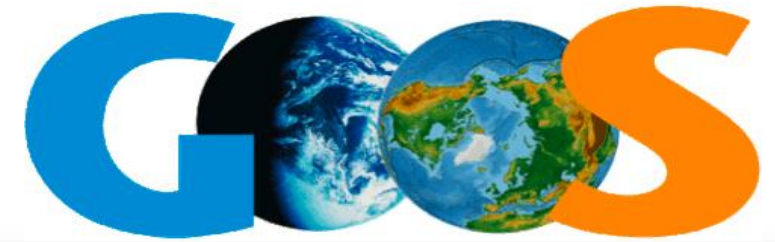
The role of ETOOFs is to create guidance, to improve capacity, quality and interoperability of ocean forecast systems and products.

ETOOFs was invented as a joint expert team for IOC & WMO (JCOMM).

After the dismantling of JCOMM, ETOOFs became a **GOOS component** and is supported by IOC.

GOOS reports to IOC, WMO, UNEP and ISC

☞ *If GOOS is a super infrastructure to monitor the ocean with observations and models, ETOOFs represents the modelling and forecasting capacity.*



The Expert Team on Operational Ocean Forecasting Systems (ETOOFS)

- in transition, more open & goal-driven -



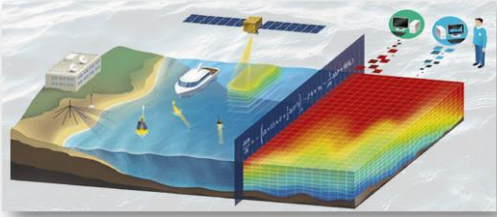
- Pierre BAHUREL, Mercator Ocean, France (Chair)
 - Enrique ALVAREZ FANJUL, Puertos del Estado, Spain (Vice-Chair)
 - Stefania CILIBERTI, CMCC, Italy
 - Shiro ISHIZAKI, JMA, Japan
 - Sudheer JOSEPH, INCOIS, India
 - Guimei LIU, NMEFC, China
 - Avichal MEHRA, NOAA, US
 - Aihong ZHONG, BoM, Australia
 - Lotfi AOUF, Météo-France, France
- with the support of IOC/GOOS
- Albert FISCHER, IOC, GOOS Director
 - Denis CHANG SENG, IOC, ETOOFS officer

ETOOFS experts were appointed at the time of JCOMM, following formal procedures of WMO. This core group has organized the integration within GOOS. We adopted a more open participation to adapt the group to our goals and foster our connection with the OOFs community. Coordination with OceanPredict is key.

👉 *ETOOFS shall reflect the expertise of our OOFs community, in the IOC/WMO/UNEP/ISC framework*

The Expert Team on Operational Ocean Forecasting Systems (ETOOFs)

- document, promote and support -



The role of ETOOFs is to create guidance, to improve capacity, quality and interoperability of ocean forecast systems and products.

ETOOFs Activities

1. Manage and maintain guide, scope and requirement documents for countries providing ocean forecasting services.
2. Manage and maintain an overview of active operational ocean forecasting systems.
3. Manage and promote the adoption of an international standard to support interoperability and common formatting of ocean forecast products and services.
4. Guide and initiate actions contributing to improving operational ocean prediction system efficiency, fidelity and service quality.
5. Promote and facilitate support for, and development of, operational and forecasting systems and their adoption in the wider community.
6. Provide advice on operational ocean forecasting systems related matters and prepare submissions on the requirements of operational ocean forecasting systems operated by countries to other international groups.

Manage and maintain documents and standards, to foster OOFs efficiency and international integration

Promote and support initiatives, to foster OOFs influence and capacity development

ETOOFS recent activities (1/3): the workshop



ONLINE WORKSHOPS
Operational Ocean Monitoring and Forecasting Systems

SAVE THE DATE

June 1-30th:
E-learning Platform Access

June 14-16th:
Awareness Workshop
Understanding the benefits of
Operational Ocean Monitoring and
Forecasting Systems

June 22-24th:
Practical Workshop
Implementing Operational Ocean
Monitoring and Forecasting Systems

The Global Ocean Observing System
GOOS

United Nations Educational, Scientific and Cultural Organization
UNESCO

Intergovernmental Oceanographic Commission
IOC

WORLD METEOROLOGICAL ORGANIZATION
WMO

WITH THE SUPPORT OF :

OTG@
OceanTeacher Global Academy

MERCATOR OCEAN INTERNATIONAL

ETOOFS recent activities (1/3): the workshop



Jennifer Veitch | 08:04
Good morning from Cape Town!

Sveda Nadra Ahmed | 08:04
everyone. from Pakistan

Clouza Maueua | 08:07
Good morning, from Mozambique

Jun-Hyeok Son | 08:07
greetings from Korea!!

Widya Ayuningtyas | 08:07
Hello from Jakarta

Shahram Soleimanpour | 08:07
from Iran

Clouza Maueua | 08:07
Good morning, from Mozambique

Jun-Hyeok Son | 08:07
greetings from Korea!!

Robert Duncan McIntosh | 08:07
Talofa from Samoa

Bhenz Rodriguez | 08:08
Good Day! from the Philippines 😊

Jordan/Buthainah Batarseh | 08:08
Good day all from Jordan

McIntosh | 08:07
Samoa

08:08
from the Philippines 😊

ah Batarseh | 08:08
from Jordan

one from Algeria.

08:05
aysia

08:06
n from Jakarta

08:04
from Istanbul

from Fiji island

everyone.

ed | 08:05
from Mauritius

08:10
om Australia

ETOOFS recent activities (2/3): the guide

Audience:



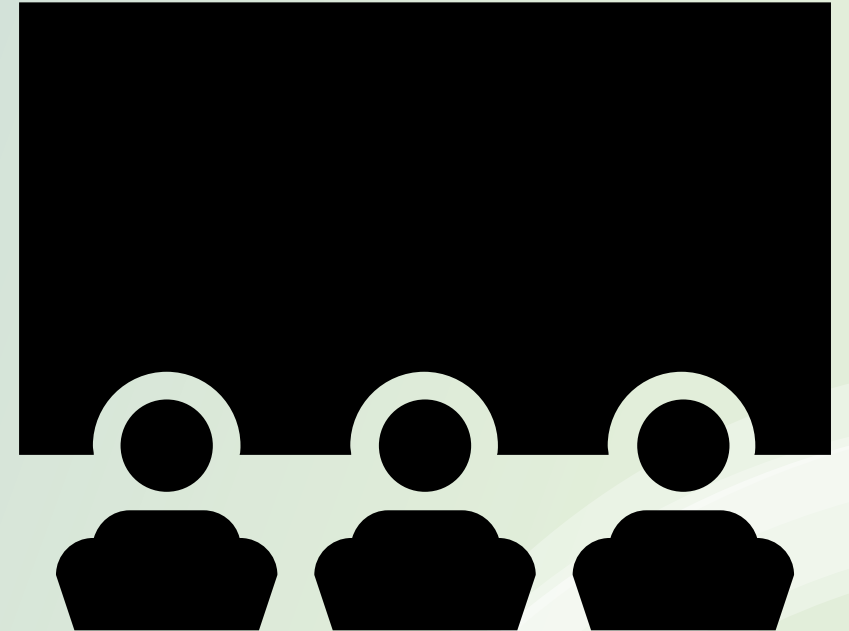
The target of the book is a person with knowledge on Earth science, but with a weak background on ocean forecasting



The level of technical difficulty is mild. This guide will not contain all the knowledge, but it will serve as a Gateway to get it.



The inclusion of relevant references is vital to fulfill this guide mission.




ETOOFS recent activities (2/3): the guide

Structure of the Guide

- | | |
|--|-------------------------------|
| 1. Introduction | Introductory chapters |
| 2. Motivation and scope of ocean monitoring and forecasting capacity | |
| 3. Definition of ocean forecasting systems: temporal and spatial scales solved by marine modeling system | |
| 4. Architecture of ocean monitoring and forecasting systems | Main overview chapter |
| 5. Circulation modeling | Detailed description chapters |
| 6. Sea Level and storm surge modeling | |
| 7. Wave modeling | |
| 8. Biogeochemical modeling | |
| 9. Coupled Prediction: Integrating Atmosphere-Wave-Ocean forecasting | Way forward chapters |
| 10. Challenges and Future perspectives in ocean modeling | |

ETOOFS recent activities (3/3): the booklet

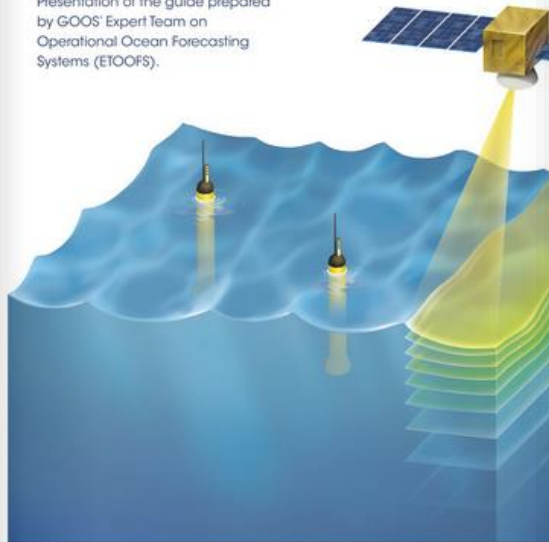
<https://www.mercator-ocean.fr/en/oofs-guide/>




The Global Ocean Observing System
United Nations Educational, Scientific and Cultural Organization
International Oceanographic Commission
WORLD METEOROLOGICAL ORGANIZATION

Implementing Operational Ocean Monitoring and Forecasting Systems

Presentation of the guide prepared by GOOS' Expert Team on Operational Ocean Forecasting Systems (ETOOFS).



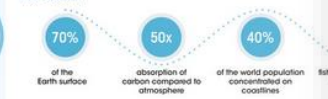
WITH THE SUPPORT OF
MERCIATOR OCEAN



Introduction

Given the importance of the ocean for human development, forecasting has become a vital endeavor. Satellite and in situ observation networks have provided data and information, which are used by decision-makers to inform and sustainable management of the ocean.

The ocean

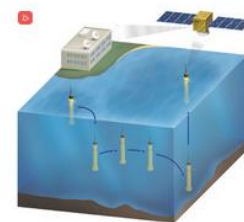


70% of the Earth surface
50x absorption of carbon compared to atmosphere
40% of the world population concentrated on coastlines

A science in constant evolution

The first scientifically successful ocean forecasting method was developed during World War II to facilitate plane landings. Since that early success, the technique has evolved into what it is today: a complex body of codes, data and technologies able to deal with the non-linear and chaotic nature of ocean processes, thanks to an increasing computing capacity.

Model resolution is constantly improving allowing us to better represent major ocean currents and fronts such as water velocity in the Beaufort Gyre with SeaWiFS.




Building ocean forecasting systems

Numerical model. Additionally to physical processes, ocean observation (frequency radar, imagery, etc.) can be assimilated into the model. The model is then used to forecast future states, so the model can "advance on time" from the present ocean state.


In situ buoys sample the ocean surface and depth and transfer their measurements to operational oceanography centers via satellite communication. The ocean can also be monitored with satellites that take images of the Earth surface (see cover page).

A science at the service of marine operations and applications

Ocean forecasting activities go beyond the execution of numerical models. Usually, the importance of these systems relies on their ability to fulfil the needs of multiple socio-economic sectors, often through dedicated applications, such as oil spill forecasting systems. Providing key information and standards on ocean forecasting services is crucial to foster their worldwide development and application to support the blue economy and sustained use of the ocean's resources.



Oil spill at sea in Mauritius. Source: International Maritime Organization (IMO) Flickr account



Ocean circulation modeling

The physical processes, properties and circulation of our ocean are described with the numerical result of the approximated Navier-Stokes equations. The state of the ocean at any time and location can be represented by three-dimensional distribution of temperature, salinity, currents, pressure, density and sea ice.


What is an ocean circulation model?

Ocean circulation modeling is one of the main blocks of the operational ocean monitoring and forecasting systems. It provides an overall description of the ocean's physical essential variables (i.e. temperature, salinity, currents, sea surface height, ocean heat flux) for ocean predictions and for supporting climate studies.

Key challenges

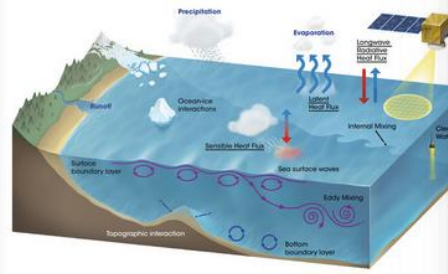
- Sea level rise
- Sea ice melting
- Ocean temperature trend and anomaly
- Currents for navigation, offshore energy development
- Water quality and oil spill monitoring

Related ocean variables



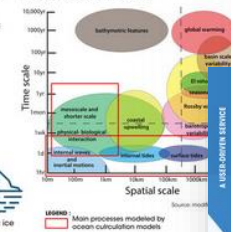
Modeling ocean circulation


An ocean circulation model represents many physical processes: Evaporation, precipitation and runoff change the water density and salinity. Ocean heat regulates Earth's climate system. Currents, together with waves and tides, drive ocean mixing and water masses transformation.



Various ocean circulation models

Various ocean circulation models depending on the process, spatial and time scales.





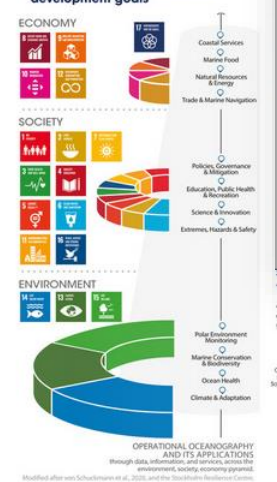
Downstream products and outreach


One of the main characteristics is the ability to provide updated data to end-users to develop specific applications.

Main downstream applications and their impact

At the end of the ocean value chain, the Operational Oceanography users and beneficiaries in the formal and media most useful to applications that put the ocean products to use through the development of multi-channel technological platforms, specific models, competent to enable marine policy implementation, support B...

Monitoring the ocean to achieve all United Nations sustainable development goals





Future perspectives on ocean modeling

Ocean Observing and Forecasting Systems keep improving with new advanced methodologies applied to ocean modeling, data assimilation, collection of ocean observations as well as their implementation into operations.

Identifying user requirements to improve data relevance and long-run service quality

Important steps have been carried out to facilitate the dialogue among service providers and users.

- Identifying user requirements and needs.
- Co-developing and testing the applications and solutions.

Operational oceanography and forecast services shall:

- Gather user requirement and feedback
- Boost user uptake
- Implement service evolution strategy

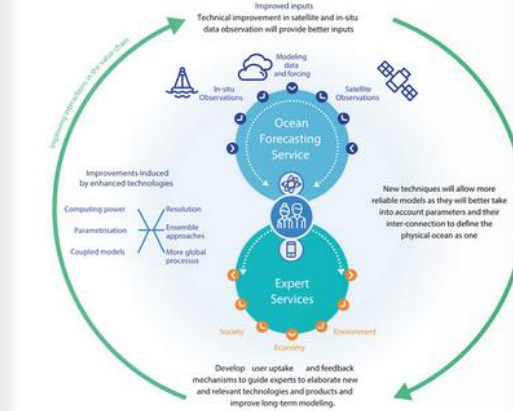
Technical ways forward

- New high-power computing systems
- Improved data assimilation
- Forecasting based on machine learning
- Seamless prediction
- Big data
- Increased resolution and accuracy of satellite observations

Focus on: a path to a digital ocean


Moving towards a consistent, high-resolution, multi-dimensional and near real-time representation of the ocean with state-of-the-art Artificial Intelligence and computer resources will empower scientists, citizens, governments to monitor, preserve, and enhance marine and coastal habitats.

Perspectives on the Operational Oceanography and Forecasting Systems Value Chain



Supporting users and applications with human interaction

A user support service, along with a user learning service allows us to better understand user's needs and provide them with on-the-spot or custom made products dedicated to specific applications.



OceanPredict and ETOOFS

- OceanPredict a network to develop cutting-edge science & technology for ocean forecasting, to run experiments, to identify best practices *with the goal to improve the overall quality of OOF systems*
- ETOOFS a body to document operational standards and best practices and support their adoption through capacity building, *with the goal to improve the OOF capacity worldwide.*
- *ETOOFS needs OceanPredict to ensure proper scientific and technical content, and innovation*
- *ETOOFS can help OceanPredict to reach out with the formal decision frameworks of IOC, WMO & al (connection with national bodies, connection with intermediate users)*



Thanks!

