**GODAE Ocean View International School “New Frontiers in Operational Oceanography”**

**Operational Oceanography:**

Operational Oceanography consists of (i) providing an accurate description of the present state and variability of the oceans including its living resources, (ii) providing continuous forecasts of the future conditions of the oceans, (iii) assembling long term data sets that can provide data for descriptions of past states, and time series showing trends and changes.

Meeting this challenge requires systematic and long-term routine measurements of the oceans, and their rapid interpretation and dissemination. At the heart of operational oceanography forecasting systems are physical laws, observations and numerical models that allow us to describe the 4D ocean: horizontal, vertical, and time. To make prediction models as reliable as possible, it is necessary to assimilate large volumes of frequently updated measurements.

These data come from satellite and in situ observations. Satellite altimetry in particular, is an invaluable aid in the observation of the oceans. In situ observations, for example through large-scale international programs such as Argo, provide also access to the subsurface ocean and complement space-oriented programs. Today, multi-platform observing systems allow us to characterize ocean state and variability at a variety of spatial and temporal scales and reaching the coastal ocean. Data assimilation is needed to improve the consistency between data and numerical model simulations, to dynamically interpolate and extrapolate heterogeneous measurements, and to better exploit the results from observations.

**Operational Oceanography Products and Services for Society:**

Outputs from numerical models are essential to understand basic scientific questions and also allow us to generate data products, often through intermediary value-adding organizations. Examples of final products include ocean currents, ocean climate variability, climatology and seasonal weather forecasting, warnings (of coastal floods, ice and storm damage, harmful algal blooms and contaminants, etc.), ship routing, prediction of seasonal or annual primary productivity, sustainable use of fishing resources, search and rescue operations, etc. The final products and forecasts must be distributed rapidly to industrial users, government agencies, and regulatory authorities and are good examples of the mission oriented innovation approach in operational oceanography.

Operational Oceanography has been developed widely in recent years in Europe (through several European projects such as DIADEM, MERSEA, MyOCEAN, etc ...) within the Copernicus Program and in parallel with the development of observing systems, in particular from space and within EuroGOOS.

**The GOV International School:**

Continuing the tradition of two very successful international summer schools held in France in 2004 (Chassignet and Verron, 2006) and in Australia in 2010 (Schiller and Brassington, 2011), this is the third international school that focuses on: “Operational Oceanography”.

In the coming years, current graduate students and young scientists will be challenged by many new observations (SWOT, Sentinel, AUVs, floats, etc.), complex high resolution numerical models and data assimilation (high resolution, predictability, uncertainty, changing computing platforms, etc.), and the need to work on many scales (open ocean-shelf interactions, coupled ocean-ice-atmosphere, biogeochemistry, etc.).

The school brings together senior experts and young researchers (pre- and post-doctorate) from across the world and expose them to the latest research in oceanography, specifically how it will impact operational oceanography.

In addition to formal lectures, shorter talks by experts in the field acquaint the participants with a wide range of applications. Attendees have also had the opportunity to present their work via poster sessions. The lecture notes are being reviewed by the attendees and will be published as a proceedings volume.

**Why in Mallorca?**

The school is taking place in Majorca, Spain, under the joint auspices of IMEDEA and SOCIB that provide science based operational oceanography contributions in the Balearic Islands and the Mediterranean Sea. Mallorca was actually chosen given the emerging role of Spain in the European and international landscape of operational oceanography. IMEDEA (CSIC-UIB) is a joint research center between the Spanish Research Council (CSIC) and the University of the Balearic Islands (UIB). The main focus of the research performed at IMEDEA is to advance knowledge in critical and strategic areas as well as to improve the quality of life of European citizens and, in particular, the population of the Balearic Islands. SOCIB (Balearic Islands Observing and Forecasting System) is a scientific and technological multi-platform ocean infrastructure devoted to the observation and forecasting of the coastal and open ocean, focusing on meso and submesoscale and providing hindcasts and forecasts for marine operations.

**Specific questions;**

1. For those that are not familiar with it, tell us about the GOV Summer School

The GOV international school is one of the main educational activities supported by GODAE OceanView. After the two first international summer schools held in Lalonde-Les-Maures (France, 2004) and Perth (Australia, 2010), the GODAE OceanView School is being held in Mallorca (Pollença) from October 2 to 13, under the title "New Frontiers in Operational Oceanography". The school brings together more than 50 specialists from all over the world with the aim of showing the latest advances in oceanography, possibilities cross-platform observation systems, real-time data availability, model integration and assimilation. There are 66 students from 5 continents, 31 countries. The students were selected based on qualifications (career status and achievements, and motivation) and references. The selection process was highly competitive with over 170 applications from 56 countries.

During the intense two week's school there are 54 lectures, poster sessions, workshops, debates, visit to SOCIB research vessel, hands-on EUMETSAT and Copernicus Marine Service (EU Commission).

During the training days, lectures offer practical workshops where international projects and applications are announced, as well as open spaces for debate.

A direct outcome of the school is a book that will be published shortly after the school finishes (early 2018). The reviewing process is occurring during the school, involving the students. They have to make a review of the chapters, with comments and feedback to the lecturers. It is planned the book will be translated in several languages. All the lectures and activities have been recorded and will be made available.

1. What were the goals of the Summer School this year?

The GODAE OceanView International School 2017, under the title "New Frontiers in Operational Oceanography", points to those frontiers, both in terms of scientific challenges and applications to society.

In the coming years, current graduate students and young scientists will be challenged by many new observations (SWOT, Sentinel, AUVs, floats, etc.), complex high resolution numerical models and data assimilation (high resolution, predictability, uncertainty, changing computing platforms, etc.), and the need to work on many scales and more and more overlapping with other compartments of the Earth system (open ocean-shelf interactions, coupled ocean-ice-atmosphere, biogeochemistry, mesoscale and submesoscale etc.) and a wide range of applications (ecosystem monitoring, climate predictions, oil spill management, shipwrecks rescue, plastic and debris drifts, etc)

1. What were the highlights this year?

Four specific directions are addressed, namely the coastal ocean areas that are characterized by multiple and interacting scales including open ocean shelf-slope exchanges, the coupled ocean-atmosphere system, ocean biogeochemistry, and the use of new datasets (from the upcoming satellites such as European Sentinels and the upcoming US-French SWOT).

The increasing international dimension of Operational Oceanography is also clearly highlighted in the school with an unprecedented attendance of the international scientific community.

Through EUMETSAT et CMEMS presentations and hands-on activities there is also an exceptional chance for the students to actually handle data, tools and pre-operational software.

1. Any additional comments you would like to add

The study of ocean dynamics is key to understand and predict climate change. In order to understand the ocean, it is necessary to monitor it and collect all kinds of data, for which the 21st century oceanographers use the latest advances in oceanography: satellites, in situ measurement instruments, multiplatform campaigns and numerical prediction models.

The combination of increasingly accurate information from satellites designed for oceanographic research, coupled with the technological development of new observing instruments, has revolutionized and completely changed the way of investigating the sea, leaving behind the long oceanographic campaigns and giving way to monitoring ocean with different instruments and technologies, and also using modeling in a systematic way.

The GODAE OceanView program offered to early career scientists, professionals and students on the current state of the art in operational oceanography and related advances in the ocean sciences.

The GODAE OceanView International School directors are:

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  Jacques Verron, IGE, Grenoble, France

And sponsors are:

- Copernicus Marine Environment Monitoring Service (CMEMS)

- Centre National d’Etudes Spatiales (CNES)

- European Organization for the Exploitation of Meteorological Satellites(EUMETSAT)

- European Space Agency (ESA)

- National Aeronautics and Space Administration (NASA)

- Mediterranean Institute for Advanced Studies (IMEDEA)

- Spanish National Research Council (CSIC)

- University of Balearic Islands (UIB)

- Balearic Islands Coastal Observing and Forecasting System (SOCIB)

- International Laboratory on Global Change (LINCGlobal)

- European Geosciences Union (EGU)

- European Marine Research Network (EUROMarine)

- Scientific Committee on Ocean Research (SCOR)

- PortBlue, Pollença

- International Ocean Carbon Coordination Project (IOCCP)