OpenMODs project: advancing toward the widespread application of low-cost technologies in coastal ocean observing

**Abstract**

The ability to access user-friendly, low-cost instrumentation remains a limiting factor in coastal ocean observing; the majority of the state-of-the-art equipment used in ocean observation is difficult to deploy, costly to operate, and requires specific technical skills. Fortunately, recent technological advances have created opportunities to improve sensors, platforms, and communications that will enable a step change in coastal ocean observing by lowering their costs and enhancing their performances and end uses. Global observational systems are, however, mainly focused on open ocean waters (e.g. ARGO), while an equivalent observation program for the world’s coastal waters is still missing. POGO’s OpenMODs is a humanitarian project that tries to fill this data and knowledge gap by proposing a user-oriented framework to co-design low-cost, fit-for-purpose equipment and modes of operation fit for developing countries. Within the project, urgent needs/requirements have been established by potential users from developing countries/remote regions according to their application and science priorities. Some user communities (e.g. artisanal fishery associations) have been identified as potential partners/beneficiaries. As requested observations, a subset of EOVs has been selected owing their relevance to the specific applications. A strong connection with the education sector was also recommended.

**Overarching needs**

- Need for plan for the way forward
- Need for discussion hub and networking of science West Africa
- Need for additional platforms of opportunity (Involving Stakeholders)
- Need for simple expendable instrumentation
- Need for shared infrastructure (e.g. reference infrastructure and reference stations)
- Need for discussion hub and networking of science West Africa
- Need for pilot studies
- Need for neutral umbrella (POGO)
- Need for plan for the way forward

**Organization of the multipurpose low-cost effective ocean-observing (LEO) platform**

**Ocean observations are critical**

- Vast part of the coastal ocean is not regularly observed and very scarce publications are openly available
- The access to user-friendly, low-cost instrumentation is a limiting factor in coastal ocean observing
- The majority of marine observation equipment is difficult to deploy, costly to operate and requests specific technical capabilities
- The novel improvements in sensors, platforms and communication will enable a step change in coastal ocean observing philosophy

**What is POGO**

POGO is an international forum for leaders of the major oceanographic institutions around the world aimed at fostering a wider partnerships that advance efficiency and effectiveness in studying and monitoring the world’s oceans on a global scale. POGO has also promoted observations underpinning ocean and climate science providing training and technology transfer to emerging economies.

**OpenMODs Concepts**

- Humanitarian environmental project
- Comply with the Open Science approach
- Easy-to-use, sustainable (automated) equipment
- Low-cost technologies for the components, modular approach

**OpenMODs Objectives**

- To co-constructively as easy-access, flexible and affordable core set of ocean sensors and platforms
- To co-design the functionalities and the operational model of a coastal ocean observing network closely working with the potential users to meet their requirements

**OpenMODs project needs/requirements**

- Definition of simple modular design of autonomous platforms hosting multiple sensors for coastal ocean observations
- Identification of site-dependent socio-economic priorities and associated knowledge gaps
- Effective choice of those essential ocean variables that meet socio-economic priorities (temperature, salinity, chlorophyll a, turbidity, currents) via a comparative market analysis of relevant low-cost sensors
- Open science approach to remove the barriers for sharing/know any kind of output, resources, methods or tools at any stage of the development process
- Regional discussion hubs and networking in developing countries (e.g. West Africa and Asia) for self-sustain and capacity creation
- Urgent definition of areas where pilot studies adopting the OpenMODs philosophy can be implemented
- Need of neutral international umbrella to support the way forward (e.g. POGO)

**ALREADY AVAILABLE LOW-COST INSTRUMENTATION**

Examples of new technologies to measure EOVs

**PILOT STUDIES IMPLEMENTATION FLOW-CHART**

**RESULTS IMPACTS**

**RESULTS SUMMARY**

**STAKEHOLDERS**

- Users to meet their requirements.
- To conceive/identify an easy-to-use, flexible, and affordable core set of ocean sensors and platforms.
- To revise the requirements/progress in the preparation of the pilot studies that implement the OpenMODs philosophy in terms of education, science, and services, and to join the way for future initiatives.
- To co-constructively as easy-access, flexible, and affordable core set of ocean sensors and platforms.
- To define the operational model of a coastal observing network closely working with the potential users to meet their requirements.