

Multifunctional Web Enabled Ocean Sensor Systems for the Monitoring of a Changing Ocean

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Abstract: As stated by the marine research decision makers in Europe in the “Ostend Declaration” in 2010, a major challenge is to support the development of a truly integrated and sustainably funded European Ocean Observing System. This will be achieved with more long-term measurements of key parameters but is impaired by the costs and lack of reliability of ocean sensors in general. The NeXOS project aims to improve the temporal and spatial coverage, resolution and quality of marine observations through the development of cost-efficient innovative and interoperable in-situ sensors deployable from multiple platforms, and Web Services for key domains and applications. This will be achieved through the development of new, low-cost, compact and integrated sensors with multiple functionalities including the measurement of key parameters useful to a number of objectives, ranging from more precise monitoring and modelling of the marine environment to an improved assessment of fisheries. Seven compact and cost-efficient sensors will be developed, based on optical and acoustics technologies, addressing a majority of descriptors identified by the Marine Strategy Framework Directive for Good Environmental Status. One multifunctional sensor system will be specific to the problem of carbon cycle and ocean acidification related measurements, such as high precision optical measurement of pH and At, together with membrane based measurement of pCO₂. The sensor will respond to multiplatform integration, sensor and data interoperability, strict quality assurance and reliability requirements.

To develop a new cost-efficient compact and integrated sensor system for **passive acoustic measurements**. Development will focus on the pre and post-processing of acoustic information and improved transducer integration, reducing size and cost while increasing functionality in one integrated acoustics sensor system.

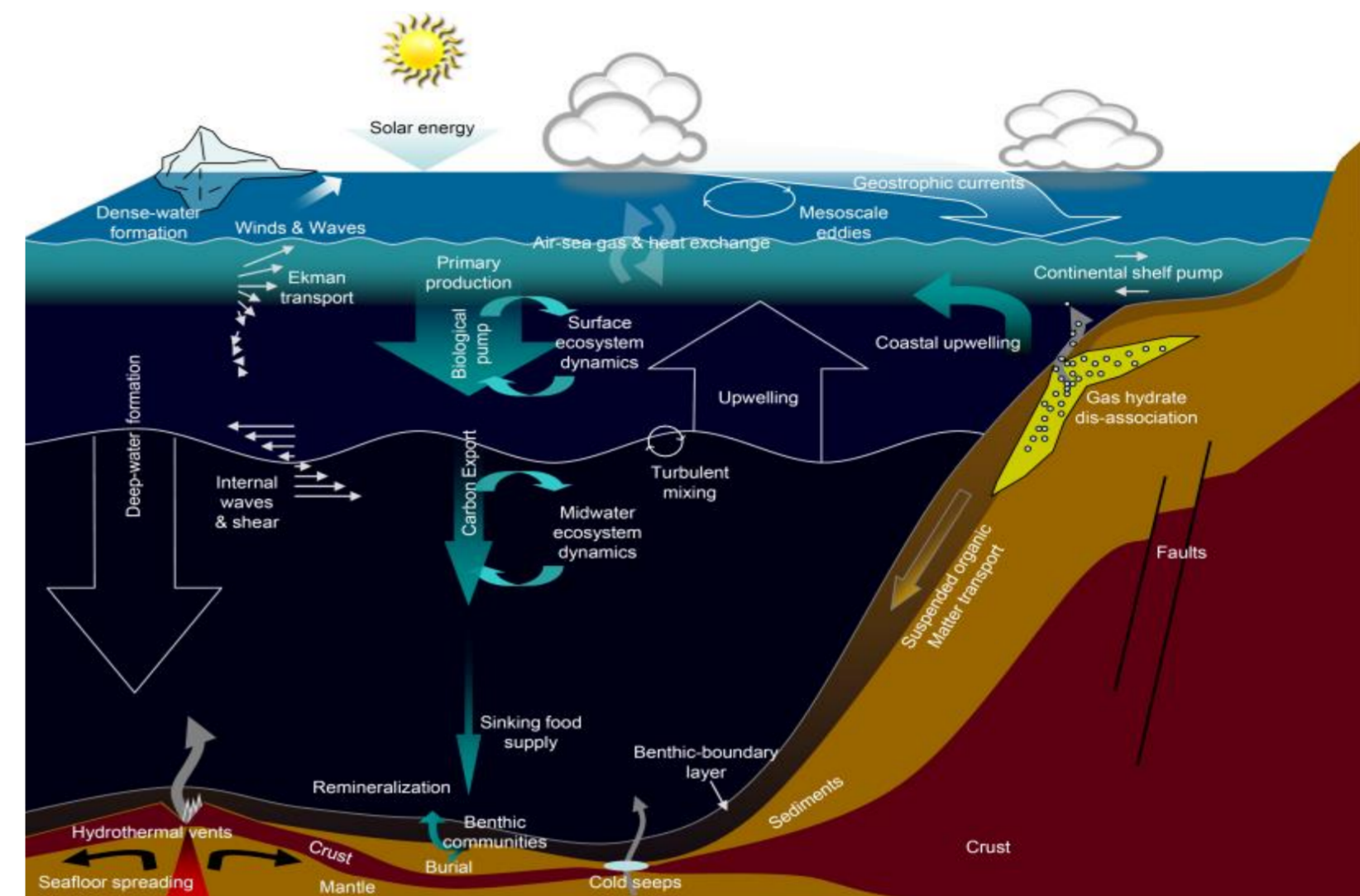


FIGURE 1: 2-D ILLUSTRATION OF MAJOR PROCESSES IN THE MARINE ENVIRONMENT INDICATING THE INTERCONNECTEDNESS OF ATMOSPHERIC, SURFACE OF THE OCEAN, BIOLOGICAL PUMP, DEEP-SEA, AND SOLID-EARTH DYNAMICS. BASED ON OTHER SIMILAR FIGURES PREPARED BY P. COCHONAT, C. BERNDT, EU FP6 ESONET NOE, AND THE US OCEAN OBSERVATORIES INITIATIVE [1]



Background and Objectives: A growing concern about the health of the world oceans resulting from multiple stressors as for instance effects of climate change and increasing offshore activities leads to the need of better observational tools and strategies. The objective of the NeXOS project is to serve those needs by developing new cost-effective, innovative and compact integrated multifunctional sensor systems for ocean optics, ocean passive acoustics, and an Ecosystem Approach to Fisheries (EAF), which can be deployed from mobile and fixed ocean observing platforms, as well as to develop downstream services for the Global Ocean Observing System, Good Environmental Status of European marine waters and the Common Fisheries Policy. This will be achieved through a number of innovations and the achievement of the following specific objectives:

To develop a new, compact and cost-efficient multifunctional sensor system for **optical measurement** of several parameters, including marine contaminants such as hydrocarbons and other components of the carbon cycle. This high-reliability sensor, will contribute to the monitoring requirements of the Marine Strategy Framework Directive (MSFD) on Good Environmental Status (GES), as it relates to hazardous substances and environmental parameters. The development will improve upon current technology and provide new approaches to meet demands of size, cost and multi-functionality. Integration on gliders, vessels equipped with the Ferrybox system, and fixed observatories for the monitoring of hydrocarbon exploitation as well as carbon capture and storage activities, will be performed, validated and demonstrated.

To develop a new low-cost sensor system for an **Ecosystem Approach to Fisheries** management, providing measurement of stock-relevant parameters, such as fluorescence (proxy of chlorophyll-a) as well as physical parameters (T, S, Depth). The integration of the enhanced system to European fishing vessels will be performed, validated and demonstrated.

To develop and integrate a miniaturised **smart sensor interface** common to all new NeXOS sensor systems. This interoperable standard interface will be reconfigurable to respond to sensor specificities and monitoring strategies, with connect-ability to the majority of ocean observing platforms.

To develop and apply innovative **sensor antifouling technologies** which are the main limiting factor of sensor reliability, and to develop and test improvements based on cost-efficiency, power-efficiency and economic viability. The technology will address the reliability requirements of current sensor systems, and improve cost-efficiency by the reduction of high-cost maintenance needs of observing systems.

To develop a common toolset for **web-enabled and reconfigurable downstream services**, for European marine databases and data facilitators, from Seadatanet to GOOS and the Global Earth Observation System of Systems (GEOSS). These services will facilitate publication of data in a standard format to global ocean observing initiatives and ocean modelling portals such as MyOcean, in agreement with the INSPIRE directive and the GEOSS guidelines.

To assess and optimise the economic **feasibility and viability** of the new sensor developments including the manufacturing phase, in the context of large scale industrial production and accounting for the operational phase of the life cycle of the sensors, addressing the position of European SMEs and industry players vis-à-vis their competitors.

To **demonstrate new developments** in real operational scenarios collaborating with pre-defined scientific and oceanographic missions, observatory maintenance, industrial sea operations (e.g. Oil&Gas) and fisheries fleet operations.

To work with producer and user communities to upgrade requirements and provide a system which allows easier transition to manufacturing and operations, bridging the gaps between science, industry and government.