

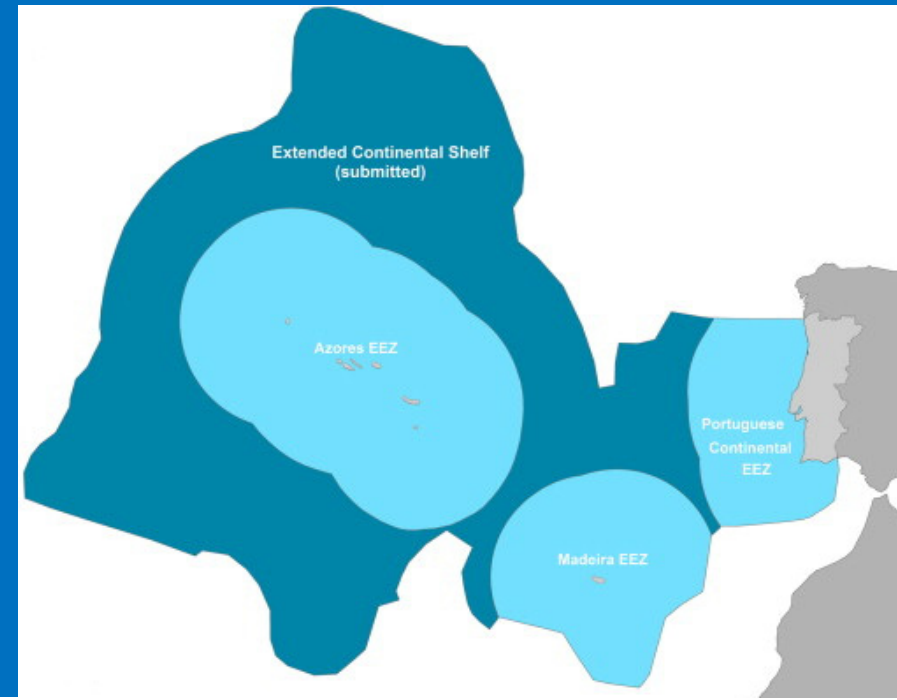
NEW NEEDS AND NEW TOOLS FOR MARINE MANAGEMENT

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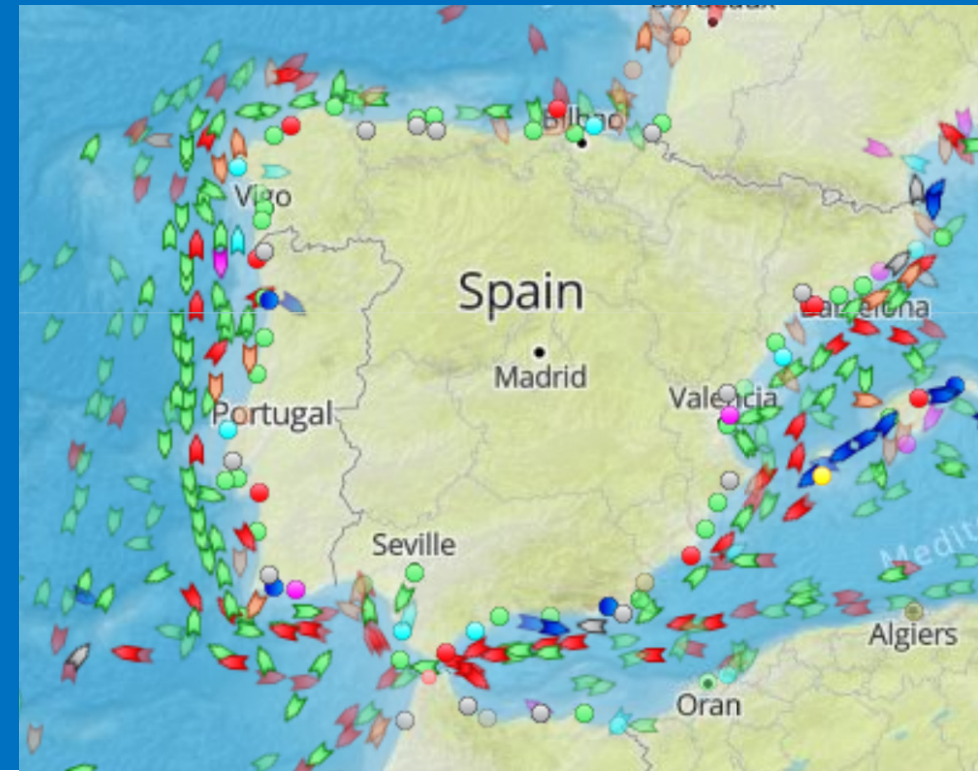
THE CHALLENGE

Huge changes are taking place in the governance of the oceans. The implementation of the UNCLOS agreement is creating new rules in what concerns the national responsibility for **large areas of the seafloor**.



THE CHALLENGE

Maritime transportation is continuously increasing as the most cost-effective solution for international trade, creating **virtual ocean highways**.



THE CHALLENGE

Growing energy demands, and the need to decarbonize the economy are leading to the installation of **large power systems** close to the coasts, **competing with the traditional uses** of the ocean, like fisheries or leisure



THE CHALLENGE

During the XX Century marine management was mainly based on a project-by-project or permit - by permit approach, with **no explicit incorporation of the interplay** between the different values in stake.



THE CHALLENGE

Marine spatial planning (MSP) is emerging as a tool to support the implementation of an ecosystem approach to marine management, supporting ocean governance. It intends to provide **legal certainty and predictability** for the public and the private use of the ocean and help to quantify the consequences of alternative management strategies.



THE CHALLENGE

The development of GIS-based MSP is growing fast but it is still strongly constrained by **large gaps in baseline data**, time and space heterogeneity between the different data sources, and the limitation of the physical, chemical and biological models to reflect natural processes.

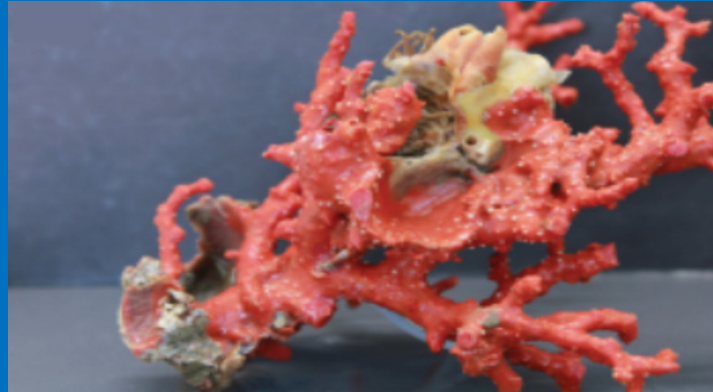


Habitats EUNIS

A4.27_PT1:	Jardins de gorgónias com [Parazoanthus axinellae] e esponjas
A3.24_PT2:	[Bolma rugosa] e [Myriapora truncata] em associação com [Lithophyllum incrustans]
A3.24_PT3:	[Anemonia sulcata] e [Paracentrotus lividus] em associação com [Dictyota dichotoma]
A5.23_PT4:	[Ophiura spp.] em areia fina do infralitoral
A5.25_PT5:	[Ophiura texturata] e comunidades de caranguejos eremita em areia fina do circalitoral
A5.34_PT6:	[Ophiocomina nigra] e [Suberites domuncula] em vasa fina do circalitoral
A5.13:	Sedimento grosseiro do infralitoral
A5.13:	Vasa fina do circalitoral

THE CHALLENGE

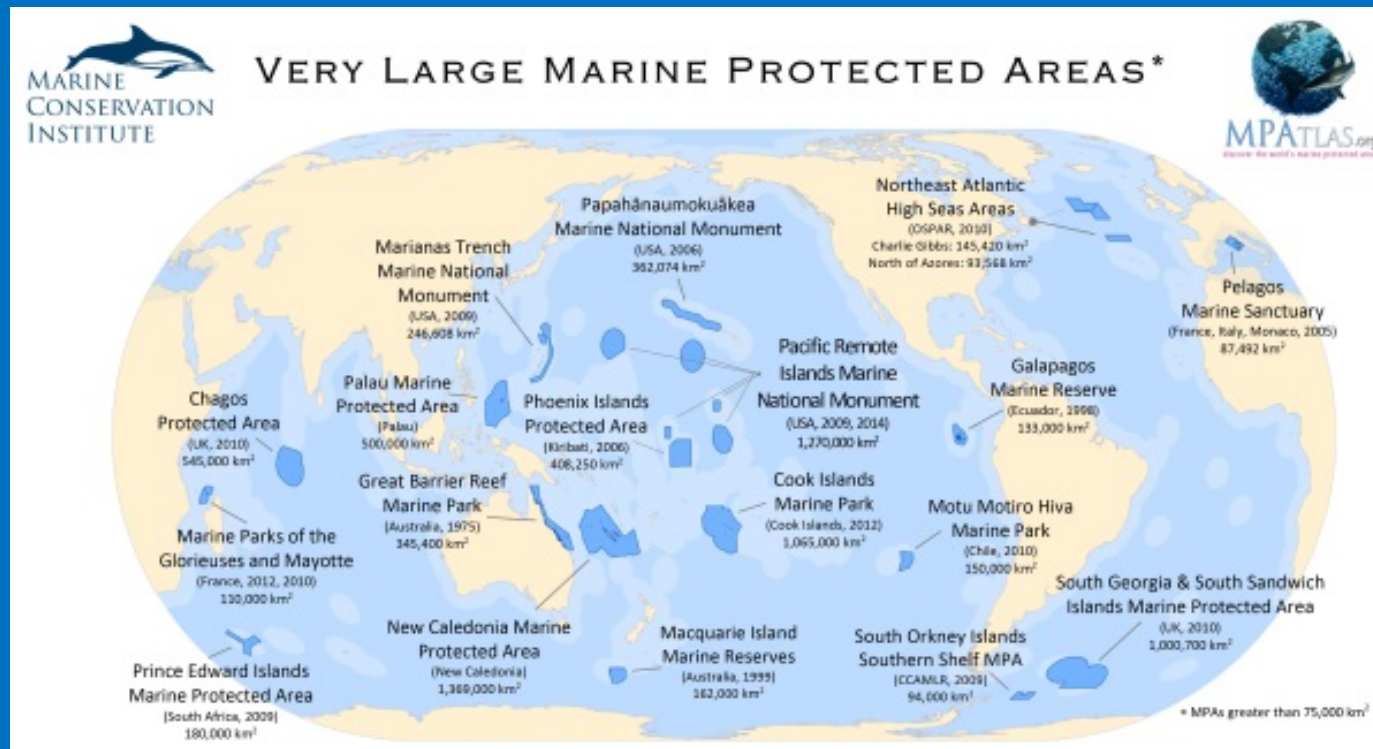
Economic and social constraints are also a major question in the decision process and its **trade-off with the environmental values** is dependent on political strategies. While we are not able to mathematically model the complexity of socio-environmental systems, management decisions cannot be reduced to algorithms to be applied by IT systems.



Nevertheless, there is an **increase role for spatially-explicit systems as the backbone of the marine management decision systems.**

THE OPPORTUNITY

The on-going international initiative to define significant Marine Protected Areas is the opportunity to put extra emphasis on the development of spatially explicit systems as the basic infrastructure for adaptive management and public participation.



Major differences exist between spatial planning on land and spatial planning on sea. Differences relate with:

- the true three-dimensional nature of marine environment,
- the different level of scientific knowledge concerning interrelationships between ecosystems and between them and the highly variable ocean environment,
- the stronger interconnection between ecosystems forced by the ocean circulation,
- the difficulty of maintaining long term monitoring strategies, and
- the large time scales of most processes
- satellite platforms are limited to surface observations.

TERRITORIAL MANAGEMENT OF OCEAN

The fast development of **spatially-explicit systems** for territorial management was fostered by the possibility of such systems to visualize the consequences of alternative management policies, and the associated uncertainties.

They are the **only realistic approach** to develop awareness from the citizens and, ultimately, to enforce public policies.

TERRITORIAL MANAGEMENT OF OCEAN

The use of spatial analysis techniques for territorial management in land is a well-established approach. It is expectable that **the same approach** could be extended from shore to the coastal areas and, ultimately, to the deep ocean.

ILLUMINATING THE OCEAN

One of the crucial differences between territorial management on land and in the ocean concerns the **different level of awareness** of the consequences of management decisions.

The ocean **cannot be directly visualized by humans** as is the case of forests or coastal areas; actions taken on a specific place have fast consequences on distant spots.

This gives increased role to **sophisticated spatial representation** that will replace the direct visualization of the marine landscape.

PRESSURES AND FEED-BACKS

One of the advantages of spatially-explicit systems to support marine spatial planning is the **possibility to analyze alternative management scenarios**.

Properly parameterized, such a system can allow a robust evaluation of the **sensitivity of the environment to pressures**, incorporate information concerning the frequency of their occurrence, and consider multiple pressures with complex feedbacks acting at the same time and referring either to space-based concepts (e.g. habitats) or to moving agents (e.g. populations).

PRESSURES AND FEED-BACKS

Lets consider for example the three main pressures identified by Stelzenmüller et al., (2010) for studies conducted in the North Sea: demersal fishing, hydrocarbon industry, and aggregate dredging.

They have different spatial and temporal impacts, complex exploration patterns and large unknowns on the connection between actions and effects.

PRESSURES AND FEED-BACKS

Habitat mapping is missing in the majority of the ocean space. Scientific knowledge is focused on a few “hot spots”, critical species or interactions.

Socio-economic data are lacking even in rich and well organized countries. Therefore, pragmatism led to the development of systems with a limited focus or a specific area.

Such systems must be viewed as “preliminary”. Future developments must be rooted on solid science, dense baseline data, efficient monitoring strategies and, most importantly, scrutiny by organizations and citizens.

COMPETING NEEDS

The use of spatially-explicit marine management tools is seen as a key factor to reduce conflicts between competing management goals, decrease incompatibilities between different uses, and ensure the long-term stability of the marine system.

However, its true implementation asks for significant progresses in the knowledge of the ocean environment, the capacity to monitor main environmental deep sea processes, the resolution of conflicts between incompatible uses of the ocean and the development of complex economic and ecological assessment tools to support the participation of stakeholders in the decision processes.

GIS-like technologies are a core part of this effort

DISPLAY VS DECISION MAKING

There is a **distinction between technological tools to display** observations, scientific interpretations or regulatory instruments, and organize public participation, **from technological tools needed to support the action** of planners in the establishment of these regulatory instruments.

Display capabilities must be able to allow stakeholders a virtual view of the processes taking place in the deep ocean

Tools for decision making are often based on the use of multi-criteria evaluation (MCE) techniques that must also take into consideration data incompleteness and limitations of available models.

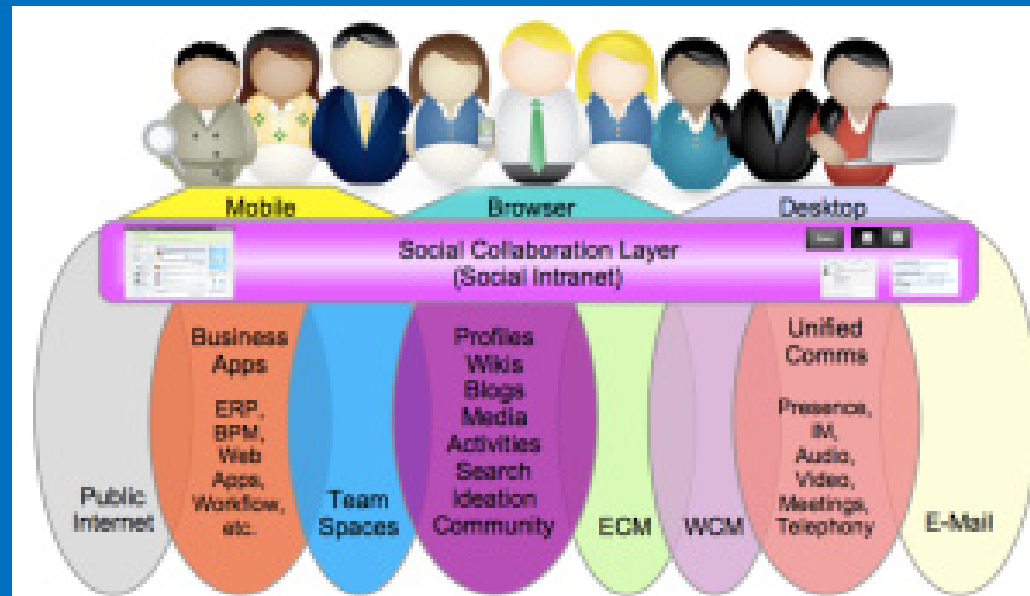
PARTICIPATORY PLATFORMS

Well informed planning strategies can be ineffective if citizens are not involved in all phases of understanding, planning and enforcing.

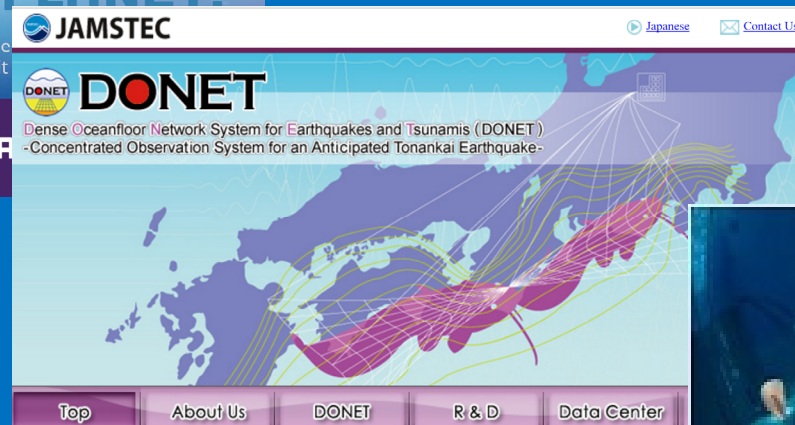
The 'human dimension' of this process asks for the **development of participatory platforms** able to cope with the scale, the complexity, and the impact of political decisions. Experts are no longer seen as the only actors of public policies, but at the most as moderators of the decision process.

PARTICIPATORY PLATFORMS

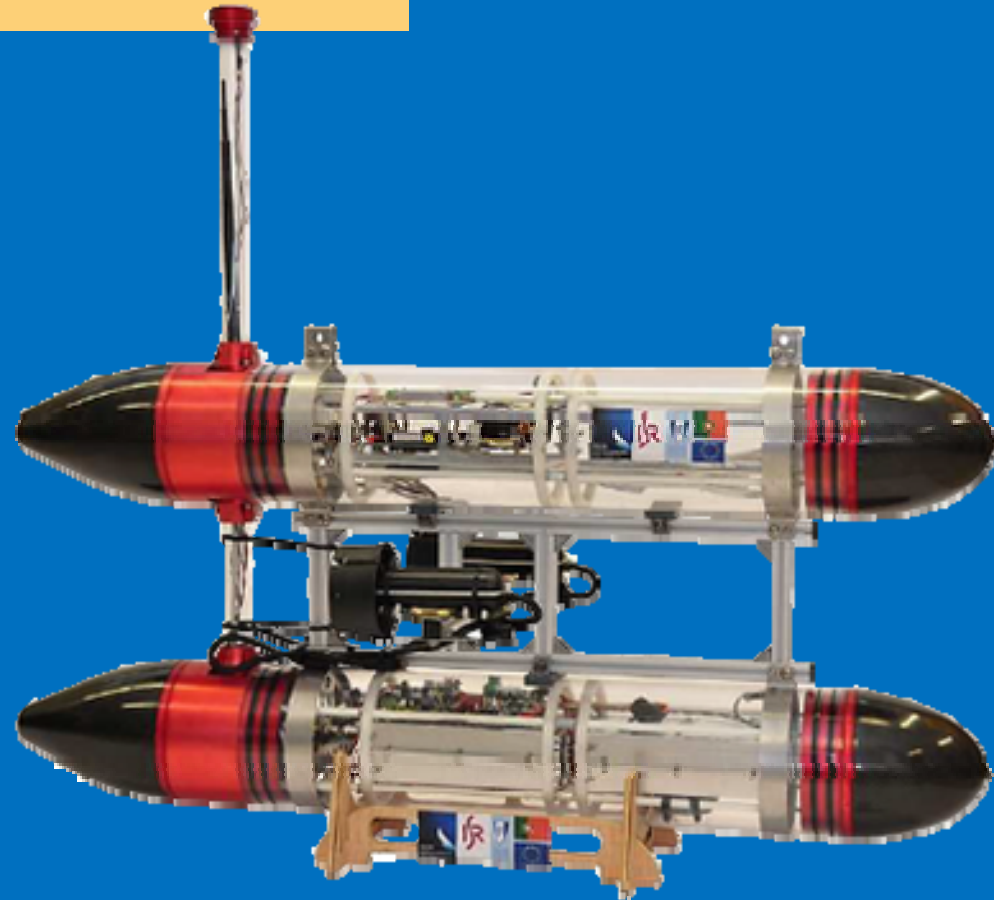
A participatory GIS platform must be able to provide both understandable and accessible information



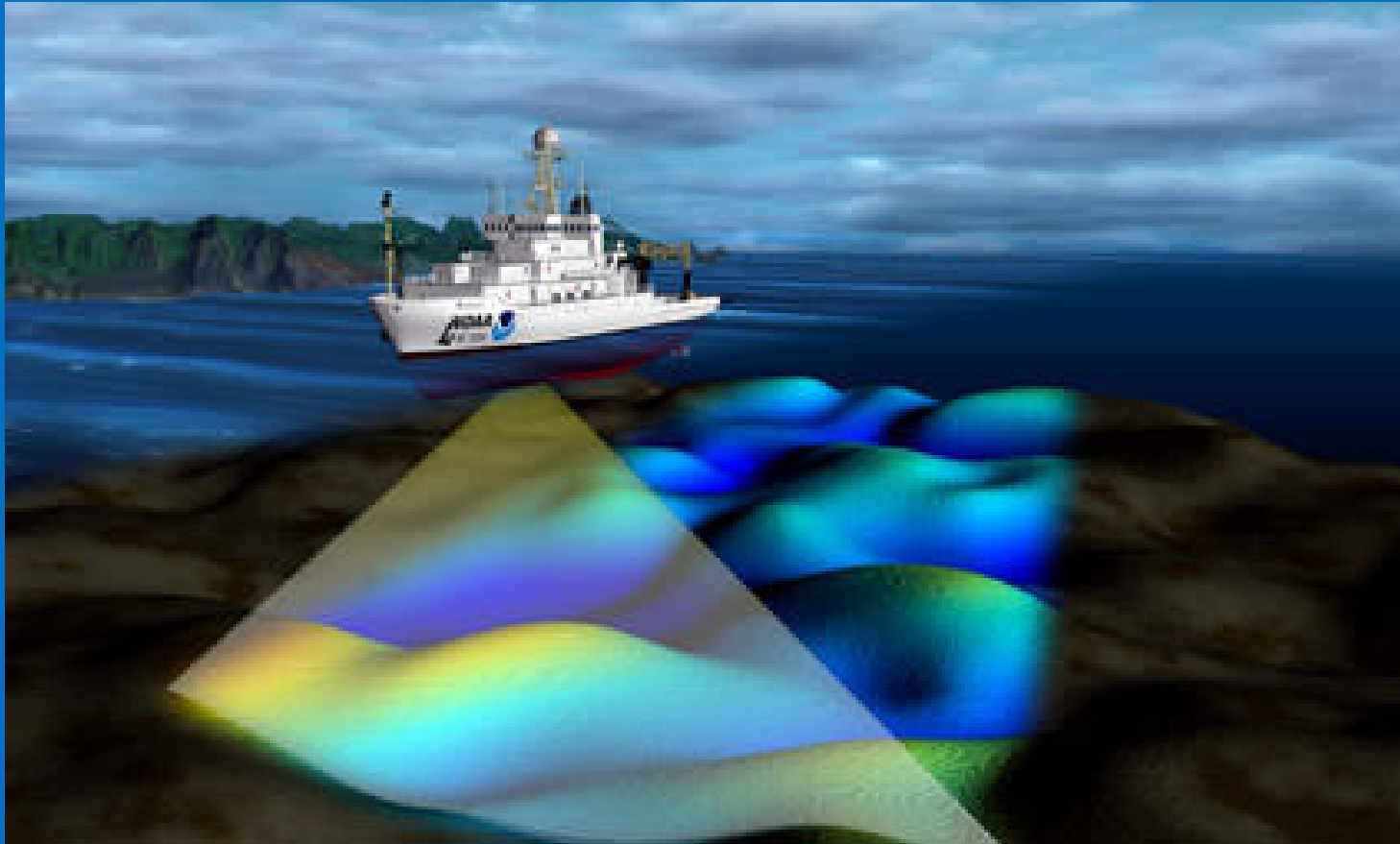
INTERNATIONAL INTEGRATION



INTEGRATION WITH SENSORS



ILLUMINATING THE OCEAN



THANK YOU !