

CIESM panel research infrastructures

JTS, October 2013

1) Thank you:

I want to thank the CIESM team for organising this Open Access Infrastructures panel and for giving me the opportunity to present it. We have four excellent speakers and presentations ahead, but before, I would like to make a short introduction on some personal thoughts on the role of the new marine infrastructures and on how, I believe, they are changing our vision of the oceans, the coasts, and the marine ecosystem.

2) A journey with a friend:

For this, I would like to ask you to join me for a journey on today's oceanography and the role of infrastructures. A journey with my friend John, who is a scientist but from another discipline to whom I would be introducing our work in oceanography and discussing our approaches. Let's therefore start our discussion with John, first trying to explain to him our goal.

3) Our Goal:

Our goal is to understand how the ocean works, how the marine ecosystem works. And we do this as scientists, to both increase our knowledge (curiosity driven) and also to be able to advance towards more reliable, science-based management of our options costs and marine resources (society driven).

This sounds very exciting my friend just said. I imagine you have baseline data to manage such an important issue for our society. Oh, well, I would say this is precisely one of our problems. We do not really have baseline data. We do have data at different places, but unfortunately the series are in many cases not long enough to establish the natural variability, identify cycles and obtain reliable baseline data. Oh well my friend would say, this is really a big challenge that you have!

I imagine, he said, that then, at least, you have synoptic data to tell you how the ocean state is now, and at different times. Oh well, this is another of our major difficulties, because the classical observing platforms, the oceanographic ships (which are as you know, 24/7 labs), obviously take a certain time to monitor large areas, and as a result data collected are not really synoptic.

John it is interesting that the two issues that you have raised, the need for long time series in order to get baseline data, and the importance of synoptic monitoring to really know the state of the ocean today, are right now two of the major issues or better I would say, challenges in today's oceanography.

4) The system:

Because we cannot overlook that we work with a very complex system that changes continuously, interacting at a wide variety of scales, from the millimetres and seconds that characterise turbulent motions (such as mixed layer deepening for example) to kilometres and decades that characterise climatic variability (thermohaline circulation). I usually quote Einstein who said "things have to be made as simple as possible but not simpler". The risk of over simplification and trying to advance too fast is today a very significant danger. I think we need more thinking, We need more careful thinking. Harry Bryden was saying something very similar in a 2012 paper from the Royal Society. I will come back to this point in a minute.

Okay then, we are convinced that the systems complex but at the same time in the journey with my friend Jon, it is also important to all be able to show and explain what we have done so far, what are the major advances from the last decade.

5) The large oceanic scale:

In the last 10 years, we have concentrated on the study of the large open ocean scales. The ARGO program is international initiative that launched more than 3000 profiling floats in the open ocean, a very successful program that together with satellite altimetry helped us to establish the ocean circulation today. But we do not live in the open ocean we live close to the Coast which is a much more difficult and even more complex environment.

6) The new technologies:

But today we have new technologies. New technologies have actually today allowed a twofold paradigm change. I am talking about new technologies such as underwater autonomous gliders, underwater cables or coastal HF radars among others, technologies that now allow us to resolve the mesoscale and even the submesoscale structures, the eddies and the associated ecosystem response. We can therefore now monitor the ocean, the coastal ocean at the right scale. There are already good examples internationally of the success of these new monitoring initiatives such as IMOS in Australia and Venus/Neptune in Canada.

7) Paradigm changes:

The first paradigm change is in ocean observation: from single platform observing systems, the oceanographic ships, to multi platform integrated observing networks. As John Delaney was recently pointing out in Nature: "A single ship can only be in one place at one time. Now, we need to be present in multiple places in multiple times".

The second paradigm change is in data availability: the data are today available in quasi real time (and they are quality controlled), not only for the scientist involved in the acquisition (as was the case before in the oceanographic cruises) but also for other scientist the whole society through Internet. Of course there are problems

but this is a very clear trend: multi-platform observing and forecasting systems are step by step being developed and implemented in the coastal areas.

8) The challenges:

The real challenge for the next decade is integration. We need to establish key or choke control points at well defined locations that will allow us to better understand how the coastal ocean changes and at the same time they will also allow us to more closely address the numerical models performances. As Carl Wunsch says, “today, models are becoming untestable”, and the new technologies can certainly help to fill this gap between observations and numerical models. And this is again fully in line with another paper from Harry Bryden in the Royal Society also in 2012 where he indicated that in the last decade, we have been able to establish the ocean circulation. The challenge for the next decade is to establish the ocean variability at inter-annual to decadal timescales.

The Rapid Array in the Atlantic has provided a very nice example of this approach by showing that in 2009, a 30% decrease in average current strength reduced the heat transport for the North Atlantic being potentially related with the 5 following “lousy summers” in northern Europe. No one single model has ever reproduced a 30% decrease in one year, and no observations had ever recorded such a change either.

Bryden also insisted on the importance of more careful analysis of all the data. Because we all know that we have a problem of going too fast. This is actually in line with the Economist issue of early October 2013 where the front cover was “How science goes wrong”. Inside this issue a more detailed paper was actually showing that in biotechnology half of the published research cannot be replicated. And this is really bad. Again we need more time, more thinking and less “salami” science.

9) Summary:

In summary, it is time for a new oceanography where multiplatform and integrated observing systems already are playing a key role. A more careful oceanography, more thoughtful as Bryden suggests. The challenge is integration. The challenge is

- to monitor the variability now at the small scales, mesoscale to weeks to
- resolve the sub-basin and seasonal and inter-annual variability and by this,
- establish the decadal variability, understand the biases and correct them.

In other words, now we are reversing focus, from large to small scales. The technology is here and society is actually requesting this change.

So this is a new oceanography, strongly linked to marine infrastructures and the Mediterranean community can take the lead on this. We are actually leading a number of key elements of today's oceanography:

- Operational oceanography,
- Climate studies
- Ecosystem changes
- New technologies and multi-platform integration
- Data management and data availability (real time/MyOcean and delay mode/Seadatanet).

So in conclusion to my friend, I think we are ready. I believe we are ready and marine infrastructures already play a new role contributing to address science state of the art questions, enhancing technology development and responding to society needs.

It is time for a new oceanography, more open for and to society.