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Paradigm change in ocean studies: multi-platform observing and forecasting integrated approach in response to science and society needs

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The last 20 years of ocean research have allowed a description of the state of the large-scale ocean circulation. However, it is also well known that there is no such thing as an ocean state and that the ocean varies a wide range of spatial and temporal scales. More recently, in the last 10 years, new monitoring and modelling technologies have emerged allowing quasi real time observation and forecasting of the ocean at regional and local scales. Theses new technologies are key components of recent observing & forecasting systems being progressively implemented in many regional seas and coastal areas of the world oceans. As a result, new capabilities to characterise the ocean state and more important, its variability at small spatial and temporal scales, exists today in many cases in quasi-real time. Examples of relevance for society can be cited, among others our capabilities to detect and understand long-term climatic changes and also our capabilities to better constrain our forecasting capabilities of the coastal ocean circulation at temporal scales from sub-seasonal to inter-annual and spatial from regional to meso and submesoscale.

The Mediterranean Sea is a well-known laboratory ocean where meso and submesoscale features can be ideally observed and studied as shown by the key contributions from projects such as Perseus, CMEMS, Jericonext, among others. The challenge for the next 10 years is the integration of theses technologies and multiplatform observing and forecasting systems to (a) monitor the variability at small scales mesoscale/weeks) in order (b) to resolve the sub-basin/seasonal and inter-annual variability and by this (c) establish the decadal variability, understand the associated biases and correct them. In other words, the new observing systems now allow a major change in our focus of ocean observation, now from small to large scales. Recent studies from SOCIB -www.socib.es- have shown the importance of this new small to large-scale multi-platform approach in ocean observation. Three examples from the integration capabilities of SOCIB facilities will be presented and discussed. First the quasi-continuous high frequency glider monitoring of the Ibiza Channel since 2011, an important biodiversity hot spot and a ‘choke’ point in the Western Mediterranean circulation, has allowed us to reveal a high frequency variability in the North-South exchanges, with very significant changes (0.8 – 0.9 Sv) occurring over periods of days to week of the same order as the previously known seasonal cycle. HF radar data and model results have also contributed more recently to better describe and understand the variability at small scales. Second, the Alborex/Perseus project multi-platform experiment (e.g., RV catamaran, 2 gliders, 25 drifters, 3 Argo type profilers & satellite data) that focused on submesoscale processes and ecosystem response and carried out in the Alborán Sea in May 2014. Glider results showed significant chlorophyll subduction in areas adjacent to the steep density front with patterns related to vertical motion. Initial dynamical interpretations will be presented. Third and final, I will discuss the key relevance of the data centre to guarantee data interoperability, quality control, availability and distribution for this new approach to ocean observation and forecasting to be really efficient in responding to key scientific state of the art priorities, enhancing technology development and responding to society needs.