Postdoctoral and Early Career Researcher Exchange (PECRE) Final Report

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Techniques for investigating current circulation using direct signals from High Frequency Radar system

Background

For more than thirty years High Frequency (HF) Radar systems have extended and complemented the marine monitoring capabilities by offering a wider spatial coverage than *in-situ* observations. The Fair Isle Gap (FIG), between Orkney and Shetland archipelagos (Scotland, UK), is one of the major gateways for North Atlantic Current to flow into the Northern North Sea. This area was monitored by a HF radar system (5 MHz, CODAR) during the Brahan Project (September 2013 – September 2014). The HR radar system has been used as a novel method for monitoring spatial and temporal variability of tidal flow though the FIG. However, little is known about the quality of data collected and elaborated by the HF radar system and, consequently, about its tangible output in terms of current circulation.

Completed and expected outputs

1. North (v) and east (u) total **velocity components** have been investigated using a statistical analysis of observation\model (HF radar, Scottish Shelf Model) data against measurements (single point current meters and Acoustic wave and Current Profilers (AWAC).
2. An in depth investigation of the **direct assimilation** of (radial) data from the HF radar system was carried out. Here the aim is to highlight the potential limitations of the instrument and check the quality of the radial velocities. The maps of radial currents velocities coupled with their monthly patterns provide information of the system performance.
3. The **source of uncertainties** of the system, even if high in two specific period (September and October 2013), do not influence significantly the system operation.

Results were similar in terms of averaged velocities. However, the validation of radials was investigated in order to verify and eventually re-estimate the velocity field in areas where singularities appear.

4. A new challenging water **transport estimate** has been undertaken, where radials represent the unique source, confirming promising results. The novel method tends to be more detailed in terms of water volume budget over the area of study.

MASTS benefits

The auspicious collaboration between the Naval Postgraduate School (Monterey, California), the University of the Highlands and Islands and Marine Scotland Science positions MASTS as an enabler of the transfer of a specific know-how and skills, currently not available in Scotland. The internship enabled me to build expertise with the HF radar system and new techniques related to the vertical coherence of water circulation in the Scottish shelf. In this context, production and dissemination of consistent outcomes represents a unique opportunity for me, as an early career researcher, and MASTS to wisely collaborate for the future management of coastal and marine resources. During my internship I have paved the way for a future long term link between MASTS, as a marine research Scottish partner, and the Naval Postgraduate School.

Conference

My research was presented during the ASM 2018 as anticipation of the incoming collaboration with the Californian institute. I attended the AGU Fall Meting 2018 where I presented a poster with the up-to-date intern outcomes coupled with my previous work in collaboration with my supervisory team.

Acknowledgment

I am really grateful to MASTS for the financial and ethical support generously given to me. As an early career scientist it was valuable for me to lead an international collaboration with experts in the field of my research. This collaboration represented an incredible source of expertise, experience and skills that will be valuable through all my career.