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OBSERVING OCEAN CURRENTS ON THE SCOTTISH CONTINENTAL SHELF USING WAVE GLIDERS

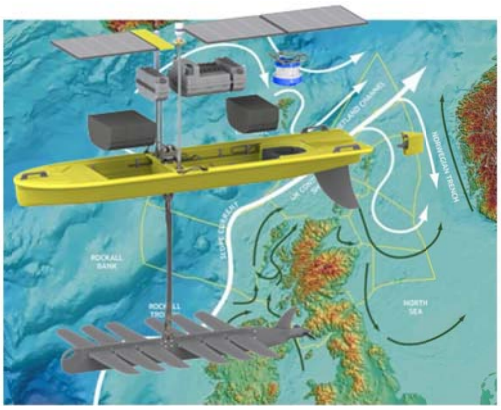
MASSMO (Marine Autonomous Systems in Support of Marine Observations) is a five-year research programme in UK waters using new Marine Autonomous Systems technologies (Wynn, 2019). As part of the third mission in this programme, MASSMO-3, in September 2016, three Wave Gliders were deployed northwest of Scotland.

In this study, the quality of the data from these Wave Gliders is analysed, as well as the Wave Glider's ability to determine the tidal movements in an area, and the water volume transport across a section. For this, the data from the Wave Gliders, a tidal model, and from a hydrodynamic model (AMM7) are used. Furthermore, the circulation on the Scottish Continental Shelf (SCS) is investigated using data from the hydrodynamic model, and data from the ADCP on the Wave Glider. Finally, transport variability along the main pathway of Atlantic water, from the edge of the UK Continental Shelf into the North Sea, is studied, also using data from a hydrodynamic model.

To determine the data quality, the statistical methods Root-Mean Square Error (RMSE) and correlation are used, as well as a tidal analysis. The Wave Glider was able to reproduce the M2 tide with an error of 1-3 cm s^{-1} (6-15%), and a correlation of 0.98-0.99. The tidal analysis showed a difference of 1-2 cm s^{-1} for the major and minor axis of the tidal ellipses, 2° for the inclination, and a lag of approximately 25 minutes for the 12.42 hour M2 tidal cycle.

The AMM7 and Wave Glider data were used to calculate the transport across a part of the Wave Glider track. The Wave Glider gave a transport of 0.95 Sv (1 Sv = 10^6 m^3 s^{-1}), the AMM7 data gave a mean transport of 1.1 Sv, with a variability of 0.25 Sv. Therefore, the Wave Glider transport is slightly lower, but within the variability of the AMM7 data. Finally, the transport across several sections on the shelf was calculated and analysed. An increase between the most southern section and the more northern sections was seen, likely caused by an Atlantic Inflow. Furthermore, most of the transport originated from the Scottish Coastal Current and the North Atlantic Current. Variations in transport were caused by wind forces.

This study showed that Wave Gliders are able to distinguish the M2 tide, and can be used to calculate the transport across sections. Wave Gliders can therefore be used to improve the understanding of shelf transport. It is recommended to do further research, with longer deployment times.



R. Wynn (2019), Massmo. *FOCUS, p. 6-7*

Figure 2Circulation on the Scottish Continental Shelf. The Scottish Coastal Current is represented by the green arrows near the coast. The Atlantic Inflow is the white arrow towards the slope current just above Scotland.

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