Telemetry Solutions for Realtime Data from Mooring Arrays

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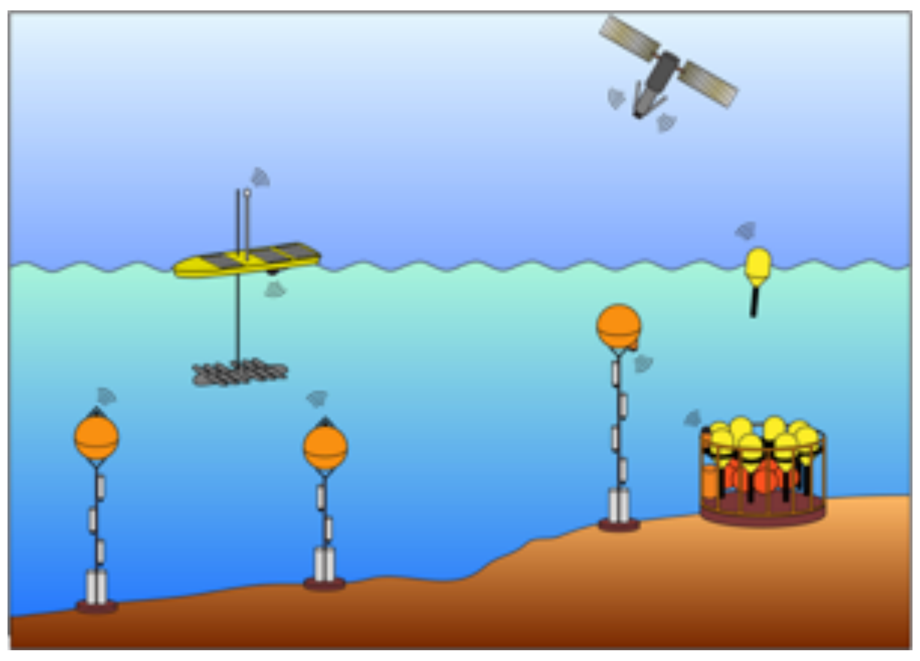
Introduction

Data from the RAPID 26°N mooring array are retrieved when the array is serviced, currently once every 18 months. Some studies have suggested that data from the array may have value for forecasting on seasonal and inter-annual time scales, but for this more frequent data retrieval is required. To address this need, two telemetry systems have been developed at the National Oceanography Centre.



Common to Both Systems

Both systems use the same mooring controller housed in a syntactic float. The mooring controller retrieves data from the moored instruments using inductive telemetry before compressing and forwarding it to a nearby lander or surface Wave Glider through an acoustic modem either pointing downwards for the lander system or upwards for the Wave Glider system. Inductive swivels connect the mooring wires to the float whilst maintaining an electrical connection through the wire and allowing rotation of the mooring.

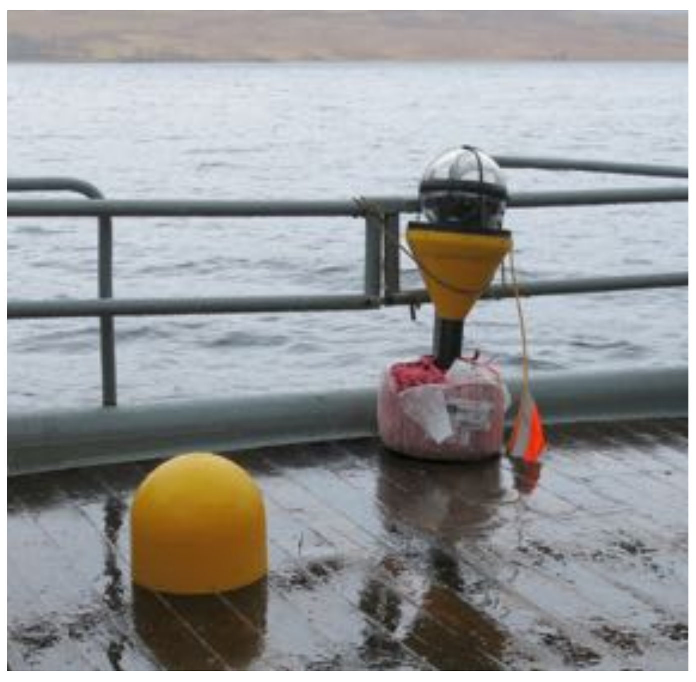
The mooring controller housed in a syntactic float with a Benthos acoustic modem, Inductive Cable Coupler and inductive swivel.

MYRTLE-X Lander Based Telemetry System

Previous development work focused on a lander-based system with pop-up data pods. Following field trials and a partially successful 18-month deployment on the RAPID array in 2015 this system has had a design review resulting in new electronics and firmware.

The lander periodically releases expendable data-pods that surface and transmit data to shore through the Iridium satellite network. The lander frame is recovered at the end of the deployment after dropping a ballast weight.

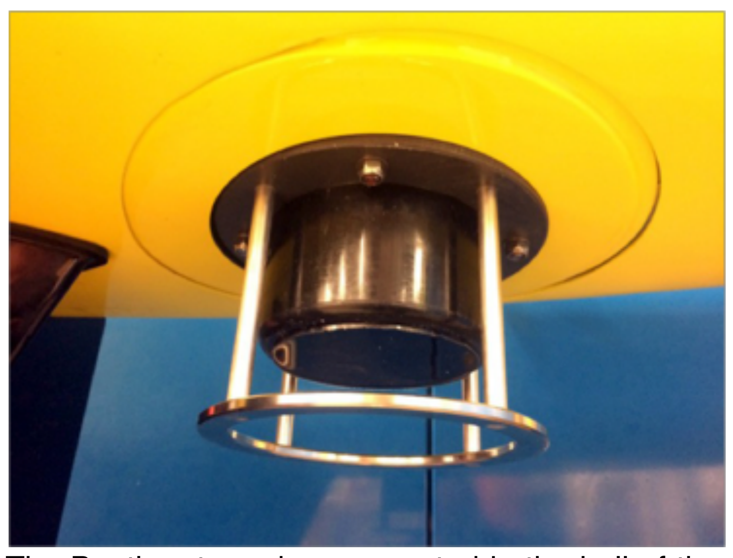
The MYRTLE-X lander after recovery from trials. The electronics are housed in glass spheres at the bottom with some unreleased data pods still attached at the top. Frame buoyancy is provided by 17" glass spheres around the middle.



A data pod stood in a coil of rope after recovery during trials. The plastic hard hat has been removed, showing the glass sphere housing the electronics.

Wave Glider Based Telemetry System

Deployment of the Wave Glider *Sennen* from Taliarte Harbour, Gran Canaria. Assistance from, and photo courtesy of, PLOCAN staff



The Benthos transducer mounted in the hull of the Wave Glider

The Wave Glider payload electronics are loosely based on the Hotspot system designed by engineers at MBARI with updates for use with the SV3 Wave Glider. (MBARI Hotspot: 10.1109/OCEANS-Genova.2015.7271243). Electronics in a payload box drive an acoustic modem mounted in the hull of the Wave Glider. The payload has its own standalone Iridium modem that can be operated separately from the main Wave Glider communications. Power is supplied to the payload and modem through the Wave Glider solar panels and rechargeable batteries.

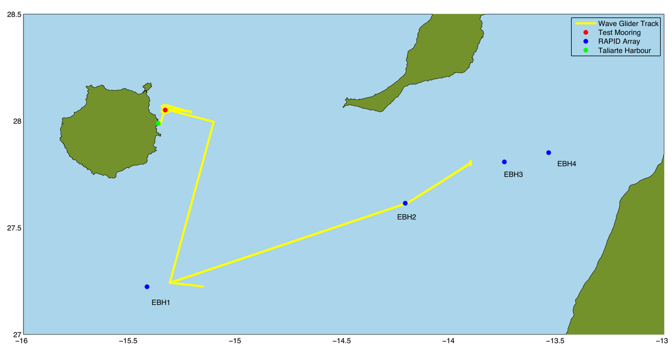
The Wave Glider is piloted to the mooring site where it initiates the acoustic download of data from the mooring controller and then transmits it to shore via satellite. The Wave Glider also collects other variables whilst underway such as surface CTD and meteorological data.

Spring 2018 Field Trials

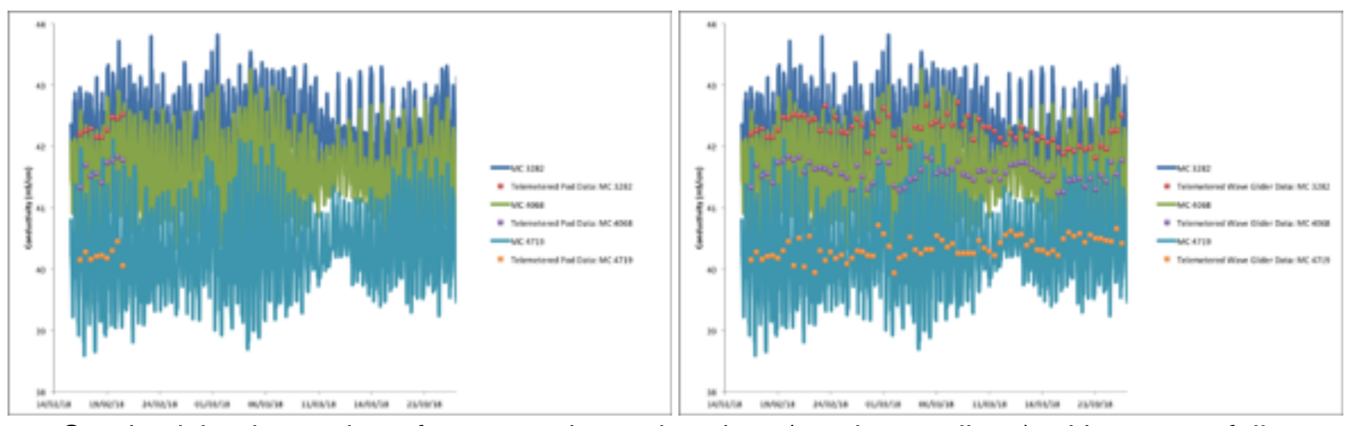
In February 2018 we deployed a test mooring and the MYRTLE-X lander offshore of Gran Canaria with assistance from staff from PLOCAN.

Two timed pod releases from the lander were successful. Four days of valid mooring data and a set of dummy data were transmitted before the system suffered a problem: the lander controller got stuck in a software loop preventing the acoustic transfer of data. This loop was accidentally triggered by communicating with the lander modem from the Wave Glider - which would not normally happen in an operational deployment. The code has however been modified to prevent this bug reoccurring in the future.

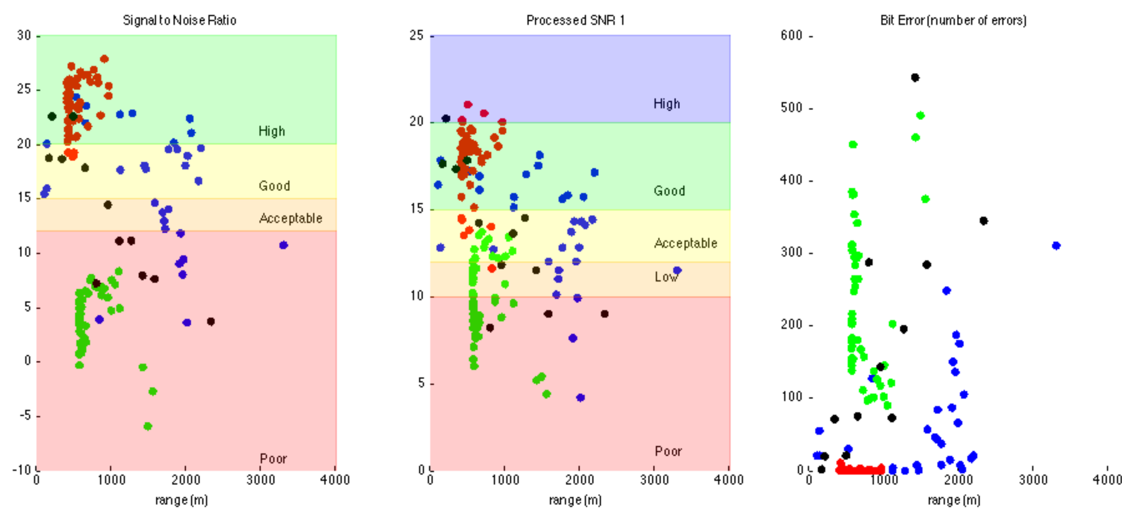
The Wave Glider was deployed a few days after the mooring and visited the site several times over the next four weeks. Data were acoustically retrieved from the mooring and downloaded from the Wave Glider to shore. The Wave Glider was then sent out to the site of some of the RAPID array moorings to give experience with the vehicle performance before returning to the test mooring site and repeating a full download of data from the mooring.



Trackplot of the Wave Glider during trials, including positions of the test mooring and RAPID array moorings



Conductivity timeseries of recovered mooring data (continuous lines) with successfully telemetered data overlaid (12-hour averages shown as single points). Left panel shows MYRTLE-X telemetered data, right panel shows Wave Glider telemetered data.



Acoustic modem diagnostics from the Wave Glider trials versus horizontal range from mooring. Left panel = signal-to-noise ratio with bandings (high, good, acceptable and poor) based on values stated in Benthos manual. Middle panel = Processed signal-to-noise ratio once the modem has made adjustments for the acoustic conditions. Right panel = number of bits received that didn't match test message - this can be accounted for with error checking and repeat transmissions during normal acoustic transmissions. Blue, black and red dots = communications with mooring modem on different days, green = communications with lander modem. The lander modem was set to a much lower transmit power than the mooring modem which explains the poorer acoustic performance.

Future Plans

The Wave Glider system is ready for an operational deployment, and the MYRTLE-X system will be ready after bench-testing of the updated firmware. We intend to deploy both systems on the RAPID array in Autumn 2018, with the Wave Glider system used at the Eastern Boundary on mooring EBH3. Strong surface currents in the Western Boundary would be difficult for piloting the Wave Glider, so the MYRTLE-X system will be used here where it will return data from the most important RAPID mooring, WB2. The Wave Glider will be deployed from Gran Canaria visiting the EBH3 mooring during a 1-2 week deployment before recovery. This could be repeated through the year to update the telemetered timeseries as required.

The MYRTLE-X system has a higher capital outlay but much lower running costs whereas the Wave Glider system is cheaper to purchase (especially if using multiple moorings with one vehicle), but has much higher day-to-day piloting and Iridium airtime costs. Both systems could be expanded to other moorings in the future with the MYRTLE-X system being suitable for use on the remote Mid-Atlantic Ridge moorings which would take several months to reach with a Wave Glider. The Wave Glider system could be used to travel to several moorings in the Eastern Boundary if each is equipped with a mooring controller.