

Exploiting two-way satellite telemetry to optimize Argo float sampling

Authors: Pierre-Marie Poulain (OGS), Jon Turton (UKMO), Serge Le Reste / Xavier André (IFREMER).

Description of the new technology and its importance for science and applications and E-AIMS experiment:

Satellite communication systems (Iridium and Argos-3) have recently been improved to provide a wider band (more data can be transmitted) and two-way capabilities (the downlink can be used to change the float cycling and sampling characteristics). Within the E-AIMS project, the Iridium and Argos-3 satellite links are being exploited in order to optimize the observational efficiency of the Argo floats (better geographical coverage, higher vertical resolution, more cost-effective data, longer operating lifetimes, etc.) so that they can provide a sustainable support to Copernicus marine services. Floats with improved satellite systems are tested at sea (in the tropical North Atlantic and Mediterranean Sea) and their performances are evaluated.

Results: Two Sea-Bird Navis floats with Iridium transmission were deployed by UKMO in the tropical North Atlantic, near the Canaries, during the Atlantic Meridional Transect cruise in autumn 2013. Two Iridium Apex floats and an Iridium MetOcean Nova float were also deployed in the same area. Tests of the satellite downlink to change the mission profile have been held back while issues with the data processing from non-E-AIMS floats transmitting high resolution data were addressed by BODC, these issues will be resolved by the move to Argo NetCDF v3 in early 2015. In December 2014 the two Iridium Apex floats were successfully switched from a 10 day cycle at low resolution (~60 profile levels) to 5-day cycling with high resolution (2 dbar) profiling. Having validated this change, a similar mission modification has been applied to the 2 SeaBird Navis floats in January 2015. As both the Iridium Apex and Navis floats use the same controller, the procedure for each is the same: to put an updated mission configuration file into the float directory on the host server, the updated file being downloaded to the floats after their profiles have been transmitted. Once the mission change to the Navis floats has been validated, the next planned test will be to re-program the floats to surface in the early afternoon to maximize the likelihood of observing near surface stratification."

OGS purchased two NKE Arvor floats with Argos-3 telemetry. The floats were initially programmed as follows: 2 days cycles, parking at 350 m, maximum profiling depth at 2000 m, sampling every 2 m from surface to 100 m, and every 30 m from 100 to 2000 m. The first Arvor float with Argos-3 telemetry was deployed in the eastern Alboran Sea in collaboration with CSIC during the ALBOREX campaign on-board the SOCIB research vessel. IFREMER is monitoring the float behaviour in terms of transmission performance. The float was deployed on 25 May 2014 (Fig. 1) and it drifted eastward towards the Algerian waters (Fig. 2). After deployment, the transmission of the dataset was done in one satellite pass, as expected. But after each transmission, the float was unexpectedly set in a backup mode, intended to recover the latest ephemerides and the location of the float. This behaviour led to a time spent at surface of a few hours after each profile. To solve this problem, the float was reset using the Argos-3 downlink on 19 June 2014. Since the reset, the transmission performance is very satisfying: all profiles dataset (~110 CTD) are transmitted in only one satellite pass, in about 3 minutes! In comparison, a float fitted with the Argos-2 system requires 10 hours in the Mediterranean Sea. Moreover, the cycling period of 2 days was successfully changed to 5 days using the Argos-3 downlink (starting on 24 July 2014). The second float will be deployed in the eastern Mediterranean (Levantine Basin) in early 2015. The main goals are to reduce time at surface in order to lower the theft risks and to reduce the probability of stranding/beaching on the shores, to remotely control the float which is important in sea areas where bathymetry is variable, and to allow high vertical sampling.

Conclusion: Conclusions will be drawn during the second-half of the E-AIMS project when all the float tests will be finished and the use of the satellite downlink commands will be assessed.

Figures:



Fig. 1. Arvor with Argos-3 telemetry being deployed in the eastern Alboran Sea on 25 May 2013 from R/V SOCIB.



Fig. 2. Trajectory of the Arvor with Argos-3 until 11 June 2014 showing eastward motion.