
MUG-OBS, HydrOBS & Halios-BBOBS; New versatile and instrumentation approaches for monitoring in geophysics using submarine autonomous platforms

Yann Hello*^{†1}, Jean-Yves Royer², Diane Rivet¹, Sarah Bazin², Philippe Charvis¹, Manuk Yegikyan³, and Philippe Olivier³

¹Géoazur – Institut National des Sciences de l’Univers : UMR7329, Observatoire de la Côte d’Azur, Université Côte d’Azur, COMUE Université Côte d’Azur (2015 - 2019), Centre National de la Recherche Scientifique : UMR7329, Institut de Recherche pour le Développement : UR082, COMUE Université Côte d’Azur (2015 - 2019), COMUE Université Côte d’Azur (2015 - 2019), COMUE Université Côte d’Azur (2015-2019), COMUE Université Côte d’Azur (2015-2019) – France

²Geo-Ocean – Université de Bretagne Sud, Institut français de Recherche pour l’Exploitation de la Mer, Université de Brest, Centre National de la Recherche Scientifique – France

³OSEAN S.A.S [Le Pradet] – Osean – France

Abstract

MUG-OBS

Deploying long-term autonomous instrument is a real challenge, in term of autonomy control, and retrieving data for quality control. MUG-OBS is a well proofed multi-parameters platform deployed in its geophysics version for more than 6 years now south of Nice. With 4 years autonomy MUG-OBS is a free falling Multiparameter Ocean Bottom System which carry a lot of sort of sensor types. Rated 6000m Mug-OBS is designed to resist a trawling. All the components are non-corrosive such polyethylene, titanium and buoyancy is ensured by syntactic foam. Equipped in standard version with a 120s Trillium compact OBS, a Tri-axial accelerometer, an absolute and a differential pressure gauges associated with an hydrophone, MUG-OBS has an autonomy of 48 months, The seismometer is encapsulated in a central well established by four panels of the main structure to protect it from sea current convection and is decoupled from main chassis. Acoustic communications with the surface-ship provide

*Speaker

[†]Corresponding author: yann.hello@geoazur.unice.fr

control over all functionalities at deployment and a health bulletin on demand at any visit. Main parameters for acquisition can be changed by acoustics command from surface at any time. Once at the bottom, release for the main sensor installation is programmed on a timer but controlled by the tilt of the OBS. If the tilt is too important based on programmed limits, sensor will not release automatically, but this can be forced by acoustic command after returning the tilt information to the boat operator. The system has two components: a data logger, able to communicate with a surface-ship, and six messengers, releasable on demand to retrieve the data.

The MUG-OBS main data logger combines a low-power microprocessor, A/D-32 bit converters, a 10⁻⁸ real-time clock and large SD card storage. Lithium batteries provide 4 years of autonomy. The 6 shuttles, encapsulated in 13" glass spheres, have the same CPU board and clock as the main station. Communications and data transfer from the data logger to the shuttles is wireless (1Mbit/s digital inductive through water). Data are duplicated once per day on shuttles N and N+1 for redundancy. Data logger has multiple analog inputs and can thus sample and digitize analog data from many other types of sensors and EOM. The data logger has also some internal sensors: humidity, temperature, pressure (depth), and tri-axial inclinometers. For most of applications, the acquisition clock must be synchronized and its drift precisely measured. To this end, prior to their release by acoustic command, the shuttles synchronize with the master clock. When surfacing, they (as the main unit) automatically determine the clock drift from the GPS time. The masterclock drift since its synchronization at deployment can thus be monitored over time at every shuttle release until its final recovery. Main unit sends its position by Iridium satellite in case of an unexpected ascent such caused by a possible trawling if deployed in shallow water. Shuttles and main unit are located on the sea-surface by AIS and Flash light. Shuttles are switched off with an external magnet. A non-specialist can thus easily handle a shuttle recovery from a (small) ship of opportunity.

HYDROBS

Deploying sensors along mooring lines is the most common method to collect data in the water column; they are generally autonomous and accessing the data requires to recover the mooring line. Inspired by MUG-OBS, HYDROBS deployed in the water column with a long-autonomy (up to 4 years) takes up all main features such the improved and versatile data logger, acoustic communication, automatic clock drift calculation, surface localization and 3 messengers, filling a gap between real-time mooring systems and classical autonomous moorings. It is designed for long-term monitoring in geophysics, oceanography, or marine chemistry. The data logger has 4 channels and can thus sample and digitize analog data from 4 sensors, or can log data from stand-alone sensors mounted on the mooring line through serial connections (CTD, ADCP, chemical analyses, . . .). HYDROBS was initially designed for long-term passive acoustic monitoring, but was successfully tested with a CTD logger. The system (a data logger main unit, able to communicate with a surface-ship, and three messengers) is mounted on a classical mooring line, with an expandable weight at the sea-bottom to maintain the mooring, an acoustic release to free the mooring line for recovery, a line adjustable to the water depth, and an immersed buoy, holding the acquisition system and messengers. The buoy maintains all sensors at a constant depth and will bring the mooring line to the surface for recovery.

Halios-BBOBS

Include the same features than Halios, our new BroadBand OBS can accept on its 4 input channels any kind of signal as low as from an hydrophone or larger from other type of a seismometer or/and accelerometer. Tri-axial geophones unit (4.5 Hz) can replace the seismometer and will extend the lifespan for the instrument. In addition, Halios comes with all communication features that the others (health bulletin, installation diagnostics, automatic clock drift calibration at surface etc...) and surface positioning. Halios's life time is 1.5 years with a 120s Trillium OBS compact. Halios can also be connected to a cable (electro-optical) like for the Revosima - Marmor project. The standard clock can be replaced by a CSAC for better accuracy and an acoustic modem allows to retrieve data any time. Thus these choices

will reduce the life time of the OBS.