

Tutorial 6: Proposal for a tutorial on “Mobile Autonomous Systems for environmental/acoustical monitoring” at the MTS/IEEE Oceans 2019 Conference (Marseille, France).

Abstract

Over the past decades mobile autonomous instruments have been increasingly used to collect oceanographic and acoustic data in the ocean. With the advent of satellite data telemetry and tracking, the technical development of sensors and the innovation in underwater acoustics, these platforms have become the paradigm for modern ocean monitoring, replacing/expanding the traditional data collection with research vessels. Nowadays thanks to these platforms, the oceans can be monitored on a broad variety of scales (from the sub mesoscale to the basin scale) continuously in time, even in harsh weather conditions.

Drifters, floats and gliders are examples of mobile autonomous oceanographic platforms. Buoys freely drifting at the surface (hereby called drifters) and tracked by satellite provide data on sea surface currents and temperature. They can also be fitted with sensors to measure atmospheric pressure, sea surface salinity, etc. Floats which change their volume/buoyancy to go up and down in the water column (hereby called profiling floats) and fitted with sensors to measure physical biogeochemical sea parameters are used by the thousands to monitor the ocean interior as part of the Argo international program. They are also drifting with the sea currents and can be used to study high-frequency ocean dynamics. Underwater gliding vehicles (or simply called gliders) also provide a way of sampling the ocean for long time periods. They are buoyancy driven and move in the ocean thanks to their wings. The absence of a propeller makes them energy efficient ensuring long endurance. They can be piloted to perform prescribed tracks in most sea areas.

A large variety of sensors have been already integrated on the above-mentioned platforms, ranging from hydrographic (CTD, ADCP), biogeochemical (fluorescence, turbulence...), optical (irradiance, backscatter...) and acoustical (fish tracker, ambient noise). A non-exhaustive list of possible applications is: oceanographic research, water quality monitoring, marine environment observation, pollution detection, marine mammals' presence detection, climate change research, defense and security.

The NATO STO CMRE is a leading institution specialized in mobile autonomous platforms operations and payload development. CMRE has been successfully operating a fleet of gliders in support of scientific research since 2010, in addition to using drifters and floats occasionally for specific projects.

This tutorial will review the current platform and sensing technology related to surface drifters, profiling floats and underwater gliders, and its future evolution. Some applications based on the collection of oceanographic and marine acoustic data will be discussed. Specific details on glider technology (including sensors) and glider navigation will also be given.