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Review

Potential for an underwater glider component as part of the Global Ocean Observing System

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ABSTRACT

The contributions of autonomous underwater gliders as an observing platform in the *in-situ* global ocean observing system (GOOS) are investigated. The assessment is done in two ways: First, the existing *in-situ* observing platforms contributing to GOOS (floats, surface drifters, moorings, research/commercial ships) are characterized in terms of their current capabilities in sampling key physical and bio-geochemical oceanic processes. Next the gliders' capabilities are evaluated in the context of key applications. This includes an evaluation of 140 references presented in the peer-reviewed literature.

It is found that GOOS has adequate coverage of sampling in the open ocean for several physical processes. There is a lack of data in the present GOOS in the transition regions between the open ocean and shelf seas. However, most of the documented scientific glider applications operate in this region, suggesting that a sustained glider component in the GOOS could fill that gap.

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Glider data are included for routine product generation (e.g. alerts, maps). Other noteworthy process-oriented applications where gliders are important survey tools include local sampling of the (sub)mesoscale, sampling in shallow coastal areas, measurements in hazardous environments, and operational monitoring. In most cases, the glider studies address investigations and monitoring of processes across multiple disciplines, making use of the ease to implement a wide range of sensors to gliders. The maturity of glider operations, the wide range of applications that map onto growing GOOS regional needs, and the maturity of glider data flow all justify the formal implementation of gliders into the GOOS. Remaining challenges include the execution of coordinated multinational missions in a sustained mode as well as considering capacity-building aspects in glider operations as well as glider data use.

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1. Introduction

Since first prototype testing in the early nineties (Simonetti, 1992) underwater gliders have been rapidly taking up an important role in ocean observing and research (see Testor et al., 2010 and Rudnick, 2015 for a comprehensive overview). This rapid transition towards a widely used observing platform can first of all be attributed to the fact that glider observations provide critical data for many applications. Historically, gliders have been used most frequently by scientists to observe particular oceanographic processes. Increasing interest of navies from different countries on the operations on coastal waters for naval operations (e.g. Renaud, 2003) has contributed to the rapid development of glider technology as well. Underwater gliders use a buoyancy engine to survey the ocean interior along saw-tooth paths. Their operation times are typically of up to several months, depending on battery capacity and sampling configuration. Glider manufacturers and users have implemented a wide range of sensors on the platform and various physical and biogeochemical parameters can be recorded, many of them accessible in near real time.

Testor et al. (2010) gave a review of requirements and challenges of a global coordination for efficient use of underwater gliders. One of the recommendations was the establishment of a global glider system as an extension of the Global Ocean Observing System (GOOS). This idea is further elaborated in the assessment presented here, that benefits from a consolidation of national glider activities, namely the pan-European glider infrastructure design project, Gliders for Research, Ocean