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A toolbox for glider data processing and management

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HIGHLIGHTS

- The SOCIB Glider Toolbox covers all the glider data management process, from raw files to final product in NetCDF.
- It works both for real-time and delayed mode data, for two of the most used glider types.
- It solves most of the time-consuming issues that users have to face when processing glider data.

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ABSTRACT

We present a complete set of freely available MATLAB/Octave scripts called the SOCIB Glider Toolbox (https://github.com/socib/glider_toolbox). This new toolbox automates glider data processing functions, including thermal lag correction, quality control and graphical outputs. While the scientific value of the glider platform has been proven, the experience for the glider data user is far from perfect or routine. Over the last 10 years, ocean gliders have evolved such that they are now considered as a core component of multi-platform observing systems and multi-disciplinary process studies ; we now have a generic processing system that appropriately complements glider capability.

In an ideal world, a simple connection to a glider would provide oceanographic data ready for scientific application in an intuitive, familiar format; the reality has been somewhat different. Up till

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now users have faced several time-consuming tasks that prevent them from directly and efficiently extracting new oceanographic knowledge from the acquired data. The SOCIB glider toolbox covers all stages of the data management process, including: metadata aggregation, raw data download, data processing, data correction and the automatic generation of data products and figures. It is designed to be operated either in real-time or in delayed mode, and to process data from two of the most widely used and commercially exploited glider platforms, Slocum gliders and SeaGliders. The SOCIB glider toolbox is ready to accelerate glider data integration and promote oceanographic discovery.

1. Introduction

In recent years, gliders have emerged as an essential tool for oceanographic monitoring, thanks to their capacity to operate autonomously in all weather conditions, for missions up to several months, and with higher sampling resolution than generally obtained with research vessels. Glider vehicles are able to autonomously dive to typically up to 1000 m water depth and return to the surface navigating along a pre-determined sampling path, balancing buoyancy against lift for forward motion. Thanks to these characteristics, gliders have progressively become an integral component of the observational platforms available to ocean science, providing critical information for climate change research, improving forecasts through data assimilation (Shulman et al., 2009; Dobricic et al., 2010; Gangopadhyay et al., 2013), and now also providing in-situ data from the hurricane pathway to improve the prediction (Baltes et al., 2014). In the future glider missions could automatically adjust missions to reach locations that would optimally sample oceanic fields (Álvarez and Mourre, 2012; Mourre and Álvarez, 2012) leading to, for example, improved model forecasts. Gliders are also used in multi-platform studies, where their measurements are combined with those of other instruments, such as satellite altimeter (Bouffard et al., 2010, 2012; Ruiz et al., 2009) or high-frequency radar (Troupin et al., 2015) to improve the description of mesoscale features.

Notwithstanding these many advantages, autonomous platforms such as gliders, have not yet reached the same level of maturity as more traditional oceanographic monitoring platforms (where the "plug-in/plug-out" availability of data has become the norm) with well established data download, preprocessing, processing and quality control procedures. This implies that a newcomer to glider data analysis is exposed to a number of issues and time-consuming tasks that are not common when processing data from more traditional platforms. Gliders from different manufacturers generate data files with different formats, and software covering the whole data processing chain is not provided with these platforms. Generally, the data collected during a glider deployment are provided as a collection of files in binary and/or text format, separated either on a navigational segment basis (Teledyne Webb Research, 2014) or on an individual dive basis (Seaglider™, http://www.km.kongsberg.com), and although the conversion from binary to text files can be performed using manufacturer programs, this can be the limit of manufacturer supplied processing software. Consequently, there has not been a homogeneous and consistent method of preprocessing and processing the large quantities of raw glider data: output from the different manufacturer platforms, the different sensors and stored in either the navigation or science computer.

In the frame of European initiatives, efforts have been made towards a general improvement of the data processing step, namely through the work of EGO (Everyone's Gliding Observatories, www.ego-network.org), GROOM (Gliders for Research, Ocean Observation and Management, www.groom-fp7.eu) and JERICO (Towards a Joint European Research Infrastructure network for Coastal Observatories, www.jerico-fp7.eu). The main outcomes have been an enhanced collaboration between the various glider operators across Europe through sharing of knowledge and best practice, as