Objectives: The aim was to complete and extend the GEOTRACES-GEOSECS revisited section in the Western Atlantic initiated in 2011-2012 by filling the gap in the cobalt (Co) cycle along the Gulf Stream and in the northern subtropical gyre. The project also addressed new issues on the Co cycle by investigating its small size partitioning and its organic speciation.

Main results: With this 3D-lagrangian view of the Western Atlantic, both the role of the large scale circulation on the Co distribution in the deep and intermediate ocean, and the regional budgets of Co in surface waters were described in a unique way. It showed for the first time that the remineralization and the dilution due to mixing processes rather than scavenging onto setting particles are the two major pathways controlling the cycling of DCo in the intermediate and deep Western Atlantic (Dulaquais et al., 2014a). Furthermore, it demonstrated the essential role of Co, its regeneration and its organic speciation in the development of the cyanobacteria that abound the subtropical gyres (Dulaquais et al., 2014b; Dulaquais et al., in review). By re-assessing the parametrizations of the Co cycle, this work also showed that the Co budget was balanced on the scale of the Atlantic Ocean because of the transport from source regions at the high latitudes towards sink subtropical areas, while it was not on a regional scale because of the non-steady regime of the biogeochemical provinces (Dulaquais et al., 2014b). This work coupled with other sections conducted within the GEOTRACES programme allows to now developing 3D global model of the Co cycle (The GEOTRACES Group, 2015).
Future of the project: This comprehensive distribution of Co in the Western Atlantic is a strong contribution to the international GEOTRACES effort of global mapping of the oceans. It will serve to develop 3D regional and global models of the Co cycle to further understand the role of micronutrients in controlling the efficiency of the biological pump of carbon and other biogeochemical cycles. Among numerous factors, Co is indeed essential in understanding the production and the repartition of the cyanobacteria, including the diazotrophs.

Publications:

Communications:

PhD thesis:

Master thesis: