The BONUS-GOODHOPE Project: a French Initiative for an International Oceanographic Cooperative Programme in the Southern Ocean during the International Polar Year

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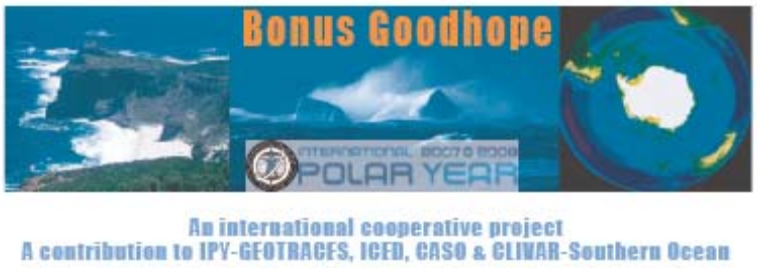
In the framework of the International Polar Year (IPY), BONUS-GOODHOPE is a multidisciplinary oceanographic project that proposes to examine the interactions between circulation, biogeochemistry and geochemistry in the Atlantic sector of the Southern Ocean (SO) and its exchanges with the Indo-Atlantic of the continental margin south of Africa.



The main objective of the BONUS-GOODHOPE project is to better understand the exchanges, ventilation and pathways of the water masses, as well as the biogeochemical cycles, that impact the climate not only in the SO but also at a global scale. The region south of Africa is a key region for the global circulation where waters originating from the SO, the Indian, the Pacific and the Atlantic oceans meet to constitute what could be the major route of the return branch of the global thermohaline circulation (Fig. 4).

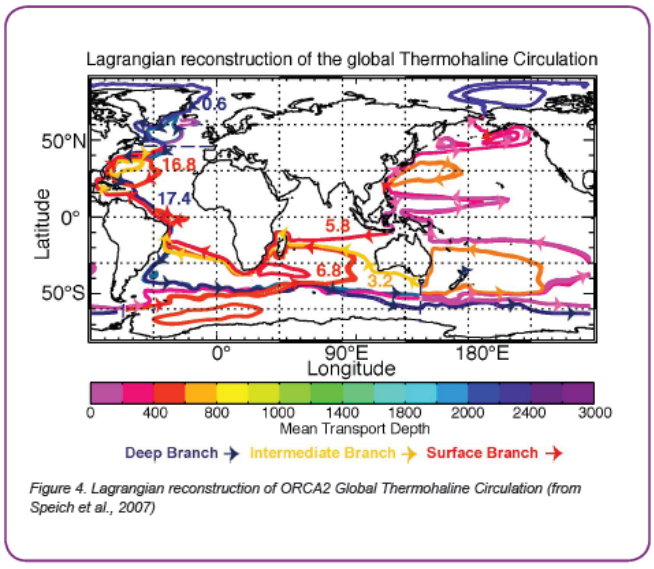


Figure 4. Lagrangian reconstruction of ORCA2 Global Thermohaline Circulation (from Speich et al., 2007)

The transport of heat, salts and biogeochemical parameters from this region have major impacts on the global physical and biogeochemical budgets, hence on the stability of the climate. Despite this recognized role, the mechanisms by which the transport takes place, as well as the exchanges that occur between the SO and the south-eastern Atlantic are poorly understood. One of the important processes implies nonlinear dynamics which are responsible for the formation and the westward ejection of Agulhas Current eddies. The interaction between the Agulhas Current and the continental margin may also constitute an important source of trace elements, isotopes and biogeochemical parameters to the south-eastern Atlantic. Another important process is the formation of the Subantarctic Mode Water and the Antarctic Intermediate Water that flow northwards from the Antarctic Circumpolar Current (ACC). These waters are critical for the thermohaline ocean circulation and biogeochemical cycles (Sarmiento et al., 2004). Furthermore they provide a mechanism for uptake and transport of anthropogenic carbon dioxide (Caldeira and Duffy, 2000). There is also an eastward flow in the ACC which includes several permanent frontal systems that are boundaries between water masses and separate distinct oceanic regions. Inter-frontal regions can be distinguished by their biogeochemical meridian gradients in surface waters that are likely to be associated with gradients of primary production, plankton assemblages and efficiency of the biological carbon pump.

The scarcity of direct observation has greatly hampered our understanding of this environment, its functioning and dynamics. To improve this understanding BONUS-GOODHOPE is based on the coupling of the physics, with the biogeochemistry in the water column, the atmosphere and the sediments; the study of trace elements and isotopes that are tracers of terrigenous sources, of water-masses circulation and ventilation, of biogeochemical processes and that can serve to quantify the particulate export fluxes to deep waters (Fig. 5). This scientific approach will serve to develop models that encompass configurations at large and regional scales, idealized modelling, and simulations using trace elements and isotopes. This project, based on a 5-year research program(2007-2011) includes two oceanographic cruises, a large-scale cruise from Cape Town, South Africa to the southern frontier of the ACC (~57°S) aboard the French RV *Marion Dufresne II* during the austral summer 2008, and a meso-scale cruise within the Agulhas Bank ideally one year later. This French initiative includes 27 international laboratories and more than 100 participants.

This project joins with other international oceanographic cruises during the IPY 2007-08 to carry out intensive studies of circulation and biogeochemical

cycles in the SO. This collaborative and synoptic effort will provide an unique picture of the Southern Ocean.

BONUS-GOODHOPE has been endorsed by the International Scientific Committee of the IPY (EoI#584), and stands under three lead IPY-activities (GEOTRACES, ICED, CASO). Its objectives are also relevant to International Programs like GEOTRACES, IMBER and CLIVAR-SO.

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Web-site:
http://www.univ-brest.fr/IUEM/BONUS-GOODHOPE/

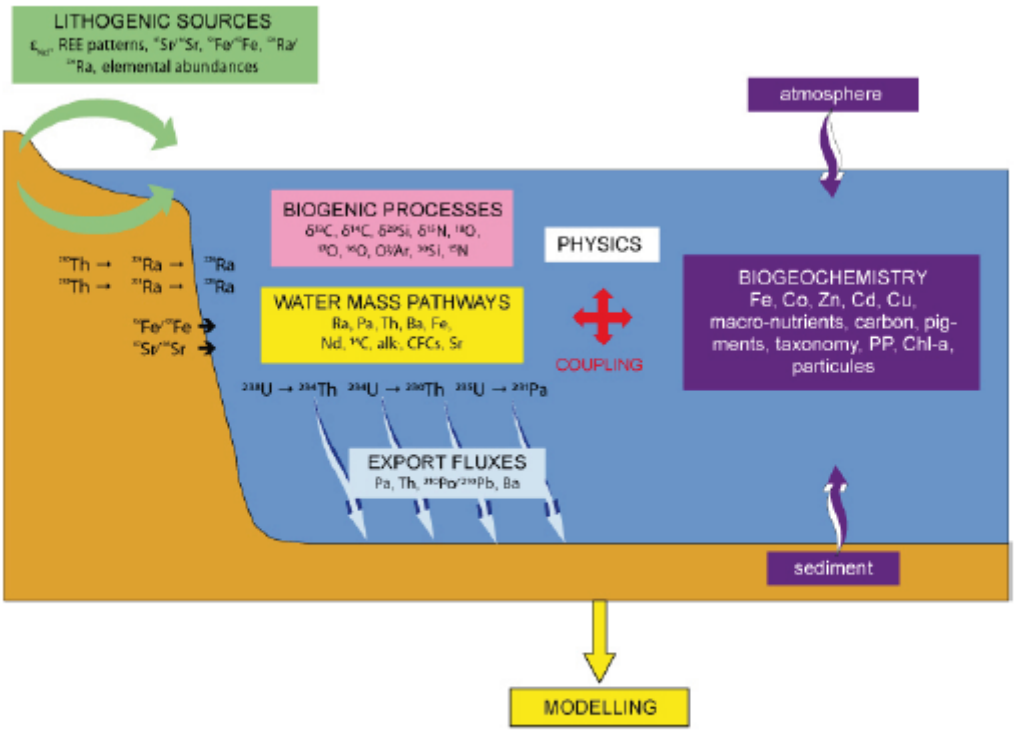

Figure 5. Scientific approach of the IPY BONUS-GOODHOPE project in the Southern Ocean and south-eastern Atlantic.

References
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