

# **Studies of Central and South Atlantic Ocean Circulation and Sea Level Variability**

## **Supervisors**

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## **Funding**

NERC studentship – fully funded.

## **Background**

While the North Atlantic is monitored and modelled intensively, the Central and South Atlantic have in the past received comparatively little attention in spite of containing their own interesting western boundary systems (Brazil and Malvinas Currents), major equatorial currents, important upwelling areas (Benguela Current and West African coastal currents and Equatorial currents), and connection in the south to the Antarctic Circumpolar Current system. However, the Atlantic coastlines of Africa and South America are now better instrumented with sea level stations than they have been for many years (thanks partly to NOC efforts), most Atlantic islands have operational stations, and there are adequate sea level networks in Brazil, Uruguay and Argentina. Other relevant oceanographic data (sea level and hydrographic) are now available for the open ocean from PIRATA moorings on and near the Equator, Argo floats, satellite radar altimetry and other forms of remote sensing.

## **Aims and Objectives**

This study will integrate information from measurements and models in order to learn more of the main modes of ocean circulation change in this enormous region. For example, a first task could be to investigate whether and how the ENSO (El Niño-Southern Oscillation) and PSA (Pacific South American) atmospheric modes influence the ocean circulation in the South Atlantic. This aspect of the work would take advantage of experience of research just completed at NOC and UoL (Hibbert et al. 2010).

With regard to the SW Atlantic, for which we have a particular interest, the project could build on work at the British Antarctic Survey (BAS) on ENSO impact on sea surface temperature (SST) in the region (Meredith et al. 2008), our own studies of sea level and SST around the Falklands (Woodworth et al. 2010), and others' studies of the Malvinas Current (Vivier and Provost 1999).

Further north, in the equatorial areas, the project could take advantage of the sea level data sets collected in Africa, of sea levels collected at central Atlantic islands and of hydrographic data from equatorial moorings (PIRATA project) to learn more of the modes of ocean circulation variability in the central and South Atlantic (cf. Andrew et al. 2006).

Finally, we know from our previous work that there are ‘teleconnections’ between the tropical and Southern Oceans due to both oceanic and atmospheric (even stratospheric) circulation links. Therefore, given our now good latitudinal coverage of sea level and other data, further investigations of tropical-polar connections in the South Atlantic might be opportune.

In other words, it is to be expected that a number of lines of research should become apparent from a year of integrated study of available data sets, the common objectives being demonstration of main modes of variability and conclusions on whether they can be reproduced successfully by models.

The study will take advantage of a number of NOC and UoL efforts in recent years:

- It will include a thorough analysis of NOC South Atlantic and recent African tide gauge data, the latter in particular being under-exploited so far
- It will benefit from NOC numerical modelling links with UoL, by using in particular the outputs from a 50-year global model run assimilating Met Office hydrography undertaken for NOC as part of the NERC Sea Level 500 project.
- It will benefit from coastal and deep ocean modelling undertaken by colleagues at the University of Sao Paulo (USP), Brazil
- It will employ data sets of both open ocean and coastal altimetry, the latter obtained via the NOC COASTALT project
- It will make maximum use of other NOC expertise in Argo and remote sensing
- It will continue our excellent collaborations with BAS and USP. We have an Memorandum of Understanding with USP and possibilities for study exchange visits are possible

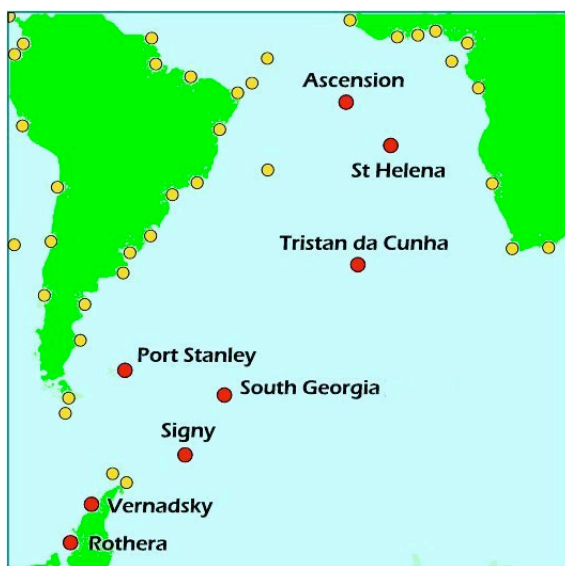
## **Workplan**

The first year will consist of the following activities: academic training in oceanography; becoming familiar with the data sets referred to above; literature review; selection and start on selected topics for study. The second and third years will involve intensive study and, should results allow, attendance at suitable conferences and investigation of publication of research findings. A particular focus in the third year must be towards completion of a thesis which meets the academic requirements of UoL.

## Training Provided

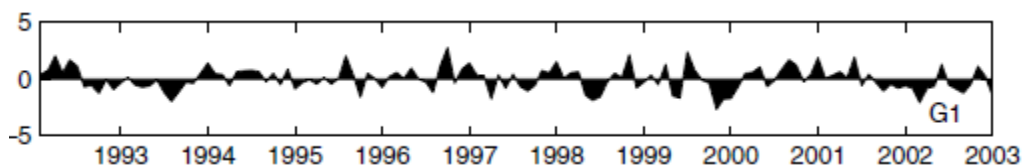
The student will be supervised at NOC by Angela Hibbert and Simon Holgate with some input from Philip Woodworth. These three people have an excellent overview of most of the observational and modelling data sets available for study. The essential research links with the UoL will be provided through Harry Leach.

The student will participate in the training programme of the UoL School of Environmental Sciences as well as appropriate courses offered by NOC. The project will provide experience in the analysis of a range of oceanographic data types, with a particular focus on sea level data from tide gauges and satellite altimetry.



*Figure left:* Red dots indicate the NOC sea level stations in the South Atlantic while yellow ones show those of other countries.

*Figure below:* This shows a time series of coherent sea level variability around the Antarctic continent sea level stations. It can be interpreted as showing an index of variability in the transport of the Antarctic Circumpolar Current (from Hibbert et al. 2010).



## Your Necessary Qualifications

Applicants should possess, or expect to graduate with a first class or upper 2<sup>nd</sup> class degree in a numerate science, such as physics, mathematics or physical oceanography. However, previous oceanographic knowledge is not essential. At least some exposure to computer programming is required. Funding for this studentship is restricted to UK and

EU nationals who fulfil NERC's eligibility requirements. More information is available from the NERC website: <http://www.nerc.ac.uk/funding/available/postgrad/eligibility.asp>

## References

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