

OCCI Final Project Report

Establishing Long-term Ocean-atmospheric Observations on Cape Verde

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Summary

We joined European colleagues in establishing an ocean time-series program off Cape Verde Island. These waters are among the “dustiest” on earth. Our goal was to see how seasonal inputs of Saharan dust impacted upper ocean food webs and carbon transport on sinking particles to the deep sea. We successfully trained Cape Verde scientists to collect samples for thorium-234, a chemical proxy for particle flux, and the results show significant particle flux in this area.

Questionnaire

What were the primary questions you were trying to address with this research? (Or, if more appropriate, was there a hypothesis or theory that you were trying to prove or disprove?)

Our goal was to see how seasonal inputs of Saharan dust impacted upper ocean food webs and carbon transport on sinking particles to the deep sea.

What have you discovered or learned that you didn't know before you started this work?

We have established a set of sampling protocols so that in the future, scientists on Cape Verde can continue to collect material for us to study the cycling of marine particles in the upper ocean. These efforts have led thus far to two complete thorium-234 profiles (our proxy for particle flux), so it is premature to make an assessment of the annual cycle of particle flux.

What is the significance of your findings for others working in this field of inquiry and for the broader scientific community?

The biological pump is a name used for the combined processes that regulate the uptake of carbon by marine algae and the transport of carbon from the surface ocean to the deep sea. If the biological pump changes in its intensity (i.e. how much carbon) or efficiency (i.e. how deep is sinks), this would impact atmospheric CO₂ and hence climate.

What is the significance of this research for society?

The selection of Cape Verde was important due to the unusually high dust inputs. This has implications for upper ocean biology, and hence the transfer of carbon to the deep sea, which in part determines the ability of the ocean to sequester carbon, and thus regulate atmospheric CO₂ and hence climate. If climate change brings higher dust inputs, more of the ocean is expected to behave like the waters off Cape Verde, which are warm and experience high dust loading, so it is important to study this site as a model of possible future changes to the biological pump.

What were the most unusual or unexpected results and opportunities in this investigation?

The results are just coming in from the time-series collection, we can't speculate on unusual results.

What were the greatest challenges and difficulties?

It has been difficult to establish the ship board capabilities for time-series sampling on Cape Verde. This took longer than expected and was out of our hands due to issues related to outfitting a small research vessel, the RV Islandia, and equipping it with sampling gear.

When and where was this investigation conducted? (For instance, did you conduct new field research, or was this a new analysis of existing data?).

Field research was conducted in September 2008 on the RV Oceanus, and March 2009 on the RV Islandia operated out of Cape Verde. In addition, samples from two other Islandia cruises this spring were collected and sent to WHOI for thorium-234 analyses. We hope this sampling continues in the fall/winter, and have also been made an offer by Doug Wallace and German colleagues for the collection of samples on our behalf this winter, since the Islandia is limited in its capabilities in rough weather and there currently are ship problems that need to be fixed.

What were the key tools or instruments you used to conduct this research?

CTD/Rosette water sampling for radionuclides, including thorium-234.

Is this research part of a larger project or program?

In 2007, we wrote and were later successful at receiving NSF OCE support for a related study "Sources of Iron to the Eastern Tropical Atlantic: Does the Continental Margin Supplement Saharan Dust?" (\$500K). Pheobe Lam is lead PI on this project. This project included a cruise on the Oceanus across the Atlantic in 2008 that was used to train Cape Verde scientists on our methods, and the transect also allows us to study the marine particle cycle between Cape Verde and the African coast.

What are your next steps?

We are continuing the time-series sampling both on TENATSO cruises and with German scientists (Doug Wallace). The equipment and supplies funded by this project should allow for up to 10-12 sample sets to be collected, and it is this seasonal record that we hope to generate to understand how this system changes over an annual cycle with variable dust inputs.

Have you published findings or web pages related to this research? Please provide a citation, reprint, and web link (when available).

We do not yet have a complete data set for publication, but we have participated and shared data at an initial research workshop in January 2007 on Cape Verde, and during the March 2009 visit

Background and other details at our web site-

<http://cafethorium.whoi.edu/website/projects/tenatso.html>