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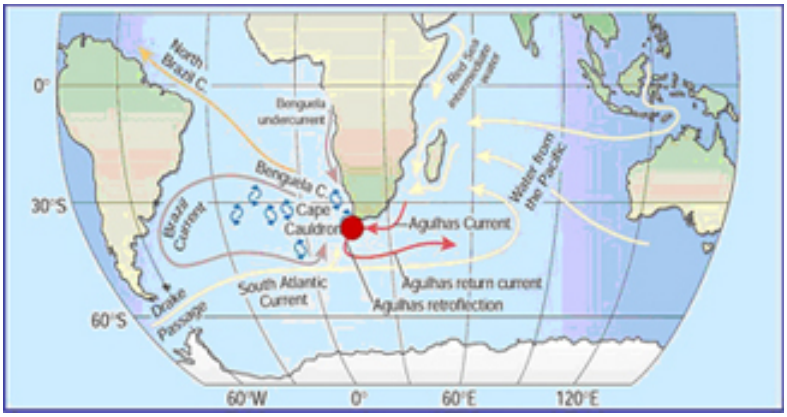
The Agulhas Current may influence climate in Europe



The PhD project presented by Gema Martínez-Méndez from the Institute of Environmental Science and Technology (ICTA) at the UAB focuses on the Agulhas Current and the ensuing warm water transports from the tropical Indian Ocean to the southern tip of Africa. The data generated provide for the first time evidence in support of the hypothesis that the Agulhas water "leakage" into the Atlantic can affect the climate in Europe. Measurements in the ocean so far have not permitted to test if a connection between the Agulhas Current around South Africa and the climate in Europe indeed exists. ICTA researcher Gema Martínez-Méndez recently received an award for her presentation in the fall meeting of the American Geophysical Union (AGU).

Her PhD thesis "Surface and Deep Circulation off South Africa: Agulhas Leakage Influence on the Meridional Overturning Circulation During the Last 345 kyr" presented data on a major ocean current in the southern hemisphere, the Agulhas Current, which transports warm waters from the tropical Indian Ocean to the southern tip of Africa. These new data profiles are not yet fully exploited and need to be implemented in global ocean models. But they do provide for the first time robust evidence in support of the hypothesis that the Agulhas water "leakage" into the Atlantic contributes to the strength of the Atlantic Ocean circulation at large, and the Gulf Stream in particular and therefore can stabilise or destabilise climate in Europe. This knowledge will

improve predictive capabilities which aim to project future climate developments in the North Atlantic region under global climate warming scenarios, such as those employed by the Intergovernmental Panel on Climate Change (IPCC).

The Agulhas Current influences rainfall patterns and weather systems in southern Africa. A part of the warm waters are transported around South Africa into the South Atlantic and influence the ocean circulation of the entire Atlantic Ocean. Climate models predict that the amount of this water "leakage" from the Indian Ocean into the Atlantic may in fact strengthen or weaken the Gulf Stream in the North Atlantic with consequences for climate in Europe, including the Iberian Peninsula. Measurements in the ocean so far have not permitted to test if a connection between the Agulhas Current around South Africa and the climate in Europe indeed exists.

For her project, Martínez-Méndez used stable isotope gas mass spectrometry and inductively coupled plasma mass spectrometry to analyse isotopic and chemical components in the sediments underneath the Agulhas Current which document variations of this current in the past. The data profiles document that systematic changes occurred in the Agulhas Current which were directly connected with global climate changes. A combination of temperature sensitive isotopes and trace elements which are preserved in the shells of marine micro-plankton indicate that under cold climatic conditions such as the ice ages, when the rest of the world dramatically cooled, the influence of the Agulhas Current strengthened and the oceans around South Africa warmed. Ocean warming is documented also by the high abundance of tropical plankton which was preserved in the seafloor sediments. When global climate began to warm at the end of cold periods, the Agulhas Current initially became stronger and then abruptly weakened to assume a strength similar to that of today.

The implications from this research are that the flow of water coming from the tropical Indian Ocean can occasionally form a warm water pool at the southern tip of Africa. Under appropriate conditions, this water is abruptly released into the Atlantic Ocean. Because these waters also have high concentrations of salt they ultimately stimulate a density anomaly in the South Atlantic which triggers internal waves in the deep water and ultimately influence the Gulf Stream in the north.

This past December, Gema Martínez-Méndez presented the results of her PhD project at the General Assembly Fall Meeting of the AGU in San Francisco. The conference was attended by more than 12,000 researchers from the Earth Sciences worldwide representing a diverse range of expertise such as geophysics, meteorology, geochemistry, glaciology, oceanography and climatology. Out of over 16,000 research presentations, ICTA researcher Gema Martínez-Méndez's paper was chosen as one of the best student presentations and she was awarded with the 2008 AGU Fall Meeting Outstanding Student Presentation Award.

Gema Martínez-Méndez holds a degree in Marine Sciences from the University of Vigo, a European Masters from Kiel University in Germany and she received her PhD in Environmental Sciences in September 2008 from ICTA at the Universitat Autònoma de Barcelona. Her PhD project was embedded in the marine climatology projects "Transecto climático interhemisférico: comprensión de los cambios oceanográficos y climáticos rápidos en Iberia durante los dos últimos ciclos glaciales-interglaciales (TRANSCLIM)" and "Clima Ibérico y Circulación Meridional

Atlántica (CIMERA)". Both are funded by the Spanish Ministry for Science and Innovation and directed by Dr Rainer Zahn, ICREA research professor at the UAB Department of Geology.

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References

Martínez-Méndez, G. Surface and Deep Circulation off South Africa: Agulhas Leakage Influence on the Meridional Overturning Circulation During the Last 345 kyr. Directed by Rainer Zahn on 29th september 2008.

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