

The Chapman conference “ The Agulhas system and its role in changing Ocean circulation, climate and marine ecosystems” was timely and held ‘on the spot’ in Stellenbosch, South Africa from 8-12 October 2012.

Recent results and insights have spurred a fast growing research activity into the Agulhas system by a wide-ranging set of disciplines. The resulting contributions to the conference generated a general feeling of excitement among the participants about the great diversity of ongoing research on the Agulhas Current system, including its role in global and regional climate, its potential influence on human origins in southern Africa, its link to the Madagascar phytoplankton bloom and the first South Atlantic hurricane (Catharina) that developed due to Agulhas-related warming of the South Atlantic over the past decades.

The conference was organized into 4 thematic sessions: the dynamics of the Agulhas Current under the boundary conditions of the present and the recent geologic past; the effects of the Current on regional weather, ecosystems, and fisheries; and the impact of the Agulhas Current system on the Atlantic Meridional Overturning Circulation (AMOC) and global climate. The conference attracted 108 participants from 20 different countries. 35 of them came from 7 African countries and 27 were PhD students. They covered the fields of climate modelling, physical and biological oceanography, marine ecology, paleoceanography, meteorology and marine and terrestrial paleoclimatology.

The growing interest in the Agulhas Current is related to its unique position in the World Ocean: at the southern tip of the African continent it abruptly loses its coastal boundary. The wind field over the Indian Ocean then forces part of it to ‘retroreflect’, i.e. describe a hairpin back into the Indian Ocean, while the remainder enters the Atlantic as so-called Agulhas Leakage. There a portion is thought to stimulate and stabilize the AMOC while another portion continues across the South Atlantic as the subtropical ‘super-gyre’. The redistribution over these branches of the thermohaline and wind-driven circulation depends on mixing processes in the Cape Basin that are still poorly known. In general, there is no simple rule to determine Agulhas leakage!

Most current climate models (incl. those used for IPCC scenarios) were shown to perform poorly in the Agulhas region: the simulated Agulhas separates and retroreflects too early leading to an unrealistically narrow Agulhas Ring corridor in the South Atlantic and too little mixing into the AMOC. As a consequence the characteristic high Atlantic salinities and the ‘salt advection feedback” are not simulated well.

There is currently limited quantitative observational evidence for the specific ‘global effects’ of a variable Agulhas Leakage. For longer time scales studies using paleo-proxy data profiles from marine sediment cores have found significant variability on glacial-interglacial but notably also fast, multi-centennial, timescales in the Agulhas Current. This variability is traced to the tip of Africa where the paleo-profiles record a series of recurrent Leakage events, eventually with maxima occurring during, or just prior to glacial terminations. The data

suggest that peak leakage maxima plausibly played a role in the re-establishment of a modern-type vigorous AMOC during interglacials.

The effort to trace the impacts of Agulhas Leakage on the changing global climate system at a range of timescales was identified as a next great challenge.

The Agulhas system was shown to have large impact on marine eco systems due to its high variability and abundance of mesoscale eddies and dipoles. Eddies affect the distributions of plankton and the largest top predators. They facilitate the northwards Sardine Run against the Agulhas Current flow and the recruitment of small pelagic fish. A South Madagascar 'Eddy raceway' was discovered that facilitates the connectivity between remote ecosystems.

Western boundary current extensions are "hot spots" for the release of heat into the atmosphere and for carbon dioxide uptake.

The Agulhas Hot Spot is the most prominent one in the Southern Hemisphere. It was shown to help maintain and anchor the 'Agulhas' storm track, which then feeds into the Southern Hemisphere westerly Polar Front Jet and the Mascarene High and affects regional weather patterns, including extreme rainfall events over South Africa.

Recommendations from the conference are to develop a system of sustained observations for the Agulhas system. The South West Indian Ocean Sustainable Ecosystem Alliance (WIOSEA) could serve as an integrating framework for sustained observations and strengthen the engagement of regional scientists.

Capacity building and training of technicians and scientists are essential to ensure sustainability. The Chapman conference was an important contribution to reach that goal.

**Acknowledgements.** The conference was realized jointly by the SCOR/WCRP/IAPSO (Scientific Committee on Oceanic Research / World Climate Research Program / International Association for the Physical Sciences of the Oceans) Working Group 136 on the Climatic Importance of the Greater Agulhas System.

Members and additional contributors were: Meghan Cronin, Francis Marsac, Graham Quartly, Tomoki Tozuka, Thomas Bornman, Ian Hall, Pierrick Penven, Herman Ridderinkhof. The local organizing committee was formed by Juliet Hermes, Michael Roberts and David Vousden. Indispensable support was given by AGU's Cynthia Wilcox.

Sponsors of the conference involved: AGU, NSF, ONR, NOAA, Nature Publishing Group, Thermoscientific, IAPSO, SCOR, PAGES, IRD France, UNESCO IOC Perth, IUGG, royal NIOZ and IMAU Utrecht University.

Wilhelmus P.M. de Ruijter, Institute for Marine and Atmospheric research  
Utrecht University, Princetonplein 5, 3584 CC Utrecht, The Netherlands; E-mail:  
[w.p.m.deruijter@uu.nl](mailto:w.p.m.deruijter@uu.nl);

Lisa Beal, Rosenstiel School of Marine and Atmospheric Science, University of Miami 4600 Rickenbacker Causeway, Miami, FL 33149, USA;

Arne Biastoch, GEOMAR Helmholtz-Zentrum für Ozeanforschung, Düsternbrooker Weg 20, 24105 Kiel, Germany;

Rainer Zahn, Institució Catalana de Recerca i Estudis Avançats, ICREA i Universitat Autònoma de Barcelona, Institut de Ciència i Tecnologia Ambientals Edifici Cn - Campus UAB, E-08193 Bellaterra (Cerdanyola), Spain