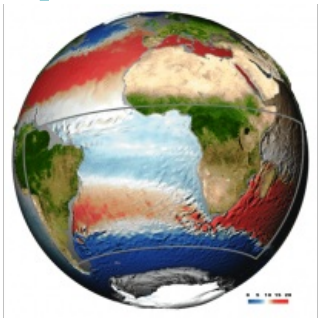
Reconstruction of Ocean Current Behaviour around the Cape of Good Hope



The Agulhas Current near the Cape of Good Hope at the southern tip of Africa plays a key role in the system of global ocean currents. For the first time, using a combination of various computer models and existing observations, oceanographers at GEOMAR Helmholtz Centre for Ocean Research Kiel have been able to reconstruct the behaviour of the Agulhas Current since 1870. The study appears in the international journal '*Nature Communications*'.

Similar to a global conveyor belt, heat energy is transported by major ocean currents throughout the world's oceans. A portion of this circulation, the Gulf Stream system, for example, provides the relatively mild climate to northern Europe. However, the details of the conveyor belt indicate that it consists of many individual components that are subject to constant fluctuations which are related in many different ways. One of the key areas is the southern tip of Africa, where the Agulhas Current from the Indian Ocean meets the Atlantic Ocean. Oceanographers at GEOMAR Helmholtz Centre for Ocean Research Kiel, together with colleagues from the USA and Great Britain, were able to reconstruct the behaviour of this current system since 1870. Prof. Dr. Arne Biastoch from GEOMAR is lead author of the study in *Nature Communications*.

Powerful Ocean Current

The Agulhas Current is one of the world's most powerful ocean currents. Each second it transports up to 70 million cubic metres of warm, saline water southward along the southern African coast in the Indian Ocean. South of Africa, the flow abruptly turns and retroflects back into the Indian Ocean. Some portion of the water masses, however, separates from the main stream and forms huge vortices which drift westward into the Atlantic. These eddies have diameters of up to 200 kilometres and reach down to more than 1,000m depth. In previous studies the researchers were able to demonstrate that they are an important source of warm, salty water in the Atlantic.

Since the Agulhas current system is highly dynamic and these eddies are not a permanent feature, any in-situ measurements are extremely difficult. According to Dr. Jonathan Durgadoo, co-author of the study, no long time series of data exist for either the Agulhas or the Agulhas Rings. In order to still be able to take a look at the history of the Agulhas Current and its rings, the experts involved have combined simulations of the ocean and the atmosphere of several computer models with existing measurements. Sea surface temperatures have been measured since the 19th century - first using buckets lowered from ships, currently by satellite data. For the computer simulations, the team went back to high-resolution models. The computational effort of these modern requires even the most powerful supercomputers, including those in Kiel and Stuttgart, to run for several months.

Transport Water Affected by Wind Systems

All models showed a similar relationship between sea surface temperatures and the amount of warm water that enters the Atlantic via the Agulhas Rings. The long reconstruction also showed that the transport of watermasses into the Atlantic is affected by the wind systems over the Southern Ocean. Future studies are needed to demonstrate the influence these variations may have on the strength of the global conveyor belt.