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Research on the ocean's most productive areas Three new projects will investigate upwelling areas off Africa and South America

7 January 2019 / Kiel. In the eastern parts of the Atlantic and the Pacific Ocean, continuous upwelling of nutrient-rich deep water gives rise to extremely high biological productivity. How these upwelling areas will develop if wind systems shift due to climate change and the ocean gradually warms up is largely unknown. Three multi-institutional projects funded by the German Federal Ministry of Education and Research with a total of € 8.7 million will address these questions over the next three years. The GEOMAR Helmholtz Centre for Ocean Research Kiel will be responsible for the overarching coordination of the three projects.

Although they occupy less than two percent of the oceans, the coastal upwelling areas in the eastern parts of the Pacific and Atlantic Ocean are among the biologically most productive marine areas worldwide. They not only support a large biodiversity, but also provide 20 percent of the world's fish harvest. These regions therefore have an enormous societal and economic importance for the adjacent countries as well as for the global food supply. But can they still serve this function if the oceans continue to warm, acidify, and lose oxygen, and if the wind systems driving the upwelling will change?

Starting in January 2019, the Federal Ministry of Education and Research supports three joint projects under the overarching theme "Importance of climate change in coastal upwelling areas", which will investigate the coastal upwelling areas in the north- and south-eastern Atlantic as well as in the south-eastern Pacific. Two of these projects as well as the overarching activities will be coordinated at the GEOMAR Helmholtz Centre for Ocean Research Kiel. "The aim is to better understand the sensitivities of these areas to climate change in order to identify possible consequences at an early stage", explains Prof. Dr. Ulf Riebesell, who will coordinate the activities linking the three projects. They will receive a total funding of 8.7 million euros over a period of three years.

The coastal upwelling areas are all characterized by major ocean currents flowing parallel to the coast. In the south-eastern Atlantic this is the Benguela Current, in the north-eastern Atlantic the Canary Current and in the south-eastern Pacific the Humboldt Current. Driven by the trade winds, the currents move water masses towards the equator. Due to the Earth's rotation the surface waters are pushed off-shore. This leads to upwelling of cold, nutrient-rich deep water to the surface, which drives the high biological production.

One of the two joint projects coordinated by GEOMAR is called REEBUS (Role of Eddies for the Carbon Pump in Coastal upwelling Areas). "Based on observations we know that oceanic eddies play a central role in the physical, biogeochemical and biological properties of coastal upwelling areas", explains REEBUS coordinator Prof. Dr. Arne Körtzinger from GEOMAR. As part of the project, the scientists want to better understand eddies by applying a novel, multi-layered observational approach combined with process models.

The REEBUS team builds on prior work by the Kiel Collaborative Research Centre 754. "Fortunately, with the Ocean Science Centre Mindelo on the Cape Verde Islands, we have a

modern base for the planned field work in the area of the coastal upwelling area off West Africa”, emphasizes Professor Körtzinger. Three research expeditions in 2019 and 2020 led by GEOMAR will be the cornerstones of this project.

The second joint project CUSCO (Coastal Upwelling System in a Changing Ocean) coordinated by GEOMAR focuses on the upwelling area in the Humboldt Current off Peru. “Although it is the most productive of all coastal upwelling areas, it is completely unclear how biological productivity is related to the upwelling intensity. We want to better understand how this highly productive ecosystem reacts when the upwelling changes due to climate change”, says Professor Riebesell, who also coordinates CUSCO.

CUSCO relies mainly on an expedition with the German research vessel MARIA S. MERIAN, which is presently on-going off the coast of Peru. Another important research activity is a field experiment with the Kiel offshore mesocosm system (KOSMOS) from February to April 2020 in the coastal waters of Peru. In addition, computer simulations on different scales from specially adapted ecosystem models to regional simulations of physical and biogeochemical processes will be performed.

Jointly with REEBUS and CUSCO, the EVAR project coordinated by Prof. Dr. Heide Schulz-Vogt from the Leibniz Institute for Baltic Sea Research in Warnemünde (IOW) will focus primarily on the upwelling system of the Benguela Current. GEOMAR scientists are also involved in this project.

Links:

www.geomar.de GEOMAR Helmholtz Centre for Ocean Research Kiel

www.io-warnemuende.de Leibniz Institute for Baltic Sea Research Warnemünde

Images:

At www.geomar.de/n6279-e images are available for download.

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