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## **Measurements at the pulse of the upwelling system METEOR expedition investigates changes in one of the most productive ocean regions**

**27.04.2023/Walvis Bay/Kiel.** During the peak of the Benguela Niños, oceanic heat waves off the coast of West Africa, the research vessel METEOR visits for one of the world's most productive ocean regions: In the upwelling area off Angola and Namibia, an international team of researchers led by Dr Marcus Dengler from GEOMAR Helmholtz Centre for Ocean Research Kiel investigates changes in upwelling processes and related consequences for marine life. In cooperation with African partner institutions, ocean observation as well as modelling and data analysis will be further expanded in the region in order to jointly address societal relevant research questions.

A highly productive ecosystem off the coast of West Africa is the basis for the economic and societal development of neighbouring countries: In the upwelling area, cold and nutrient-rich waters reach the surface from the depths and boost productivity along the food web – from phytoplankton to populations of fish and other marine life. At the same time, this ocean region is important for regulating the global climate on the one hand and is strongly affected by climate change on the other: Rising temperatures, ocean acidification and loss of oxygen can already be observed. Furthermore, the ocean in this region is a strong source of greenhouse gases such as methane and nitrous oxide, also known as laughing gas. The seasonal cycle of upwelling and its interannual variability can also be affected by climate change: In some years, oceanic heat waves similar to the El Niño phenomenon in the Equatorial Pacific occur off Angola and Namibia. The so called “Benguela Niños” have a strong impact on local climate and marine life. Since 2000, however, these temperature fluctuations seem to be less pronounced than in previous years.

The expedition M189 with the German research vessel METEOR will help to better understand coastal upwelling and its variability and will expand the local ocean observing system. The expedition is taking place within the frame of the joint project “Benguela Niños: Physical processes and long-term variability” (BANINO) funded by the German Federal Ministry of Education and Research (BMBF) and the European Union-funded project “Tropical and South Atlantic climate-based marine ecosystem predictions for sustainable management” (TRIATLAS). It is led by Dr. Marcus Dengler, Physical Oceanographer at GEOMAR Helmholtz Centre for Ocean Research Kiel.

“Our measurements are intended to elucidate the physical processes that are important for coastal upwelling, greenhouse gas emissions and biological productivity”, explains Dr Dengler. “This includes wind as well as tide-generated internal waves and mixing caused by these waves, coastally trapped waves, freshwater inputs from rivers and precipitation, as well as processes at the boundary between the cold and fresh Benguela Current and the warmer, saltier and nutrient-rich Angola Current.”

The expedition's biogeochemical studies focus on the production and emissions of greenhouse gases and the interactions between nitrogen and sulphur cycles under oxygen-poor conditions. “In the ocean, greenhouse gases such as methane and nitrous oxide are mainly formed under oxygen-poor conditions. Through the collaboration of physical and chemical oceanography as well as microbial ecology, we aim to provide the most comprehensive work programme possible, allowing new insights into the variability of greenhouse gas production in the region”, says Damian L. Arévalo-

Martínez from Radboud University in the Netherlands, who is leading the biogeochemistry team on board.

The month-long cruise will take place at a time when upwelling is weakest, especially off Angola, but when the most Benguela Niños and the largest interannual temperature variability have been recorded so far. Benguela Niños are predominantly caused by internal propagating Kelvin Waves that are created by wind variations in the distant western equatorial Atlantic. In addition, local wind changes and freshwater fluxes contribute to the generation of these oceanic heat waves. During Benguela Niños, heavy rainfall occurs in otherwise very dry southwest Africa and the migration of fish trying to escape the warmer ocean temperatures threatens the food security of the coastal countries.

During the research cruise, the scientists will service and redeploy moorings for long-term measurements of currents, hydrography and biological parameters. Shipborne and autonomous hydrographic, turbulence and biogeochemical measurements will be taken and data of currents in the water column and surface concentrations of greenhouse gases will continuously be recorded. The observations will also contribute to the improve ocean and Earth system models which may lead to more accurate predictions of future changes of our climate ocean and climate.

The scientific programme was elaborated in close cooperation with African partner institutions, including the Angolan Nacional de Investigação Pesqueira and the Namibian National Marine Information and Research Centre in order to strengthen cooperation in the region and develop local expertise in ocean observation, modelling and data analysis.

**Expedition METEOR 189:**

16 April 2023 – 13 May 2023

Port of departure and destination: Walvis Bay, Namibia

**Links:**

[https://banino.geomar.de/index\\_en.html](https://banino.geomar.de/index_en.html) Benguela Niños: Physical processes and long-term variability (BANINO)

<https://triatlas.w.uib.no> Tropical and South Atlantic climate-based marine ecosystem predictions for sustainable management (TRIATLAS)

[https://www.fona.de/en/measures/international-cooperation/spaces\\_ii.php](https://www.fona.de/en/measures/international-cooperation/spaces_ii.php) Science Partnerships for the Adaptation to Complex Earth System Processes in Southern Africa (SPACES)

<https://www.geomar.de/en/discover/ocean-and-climate/climate-change-in-the-ocean/upwelling>

GEOMAR Discover: The Impacts of Climate Change on Coastal Upwelling Areas

<https://www.lfd.uni-hamburg.de/meteor.html> Weekly Reports M189

<https://www.geomar.de/en/research/expeditions/detail-view/exp/363319?cHash=8e8702fa4dd6d1488965fe0b13854d4f>

Expedition M189 in the GEOMAR expedition portal

**Images:**

Images are available for download at <http://www.geomar.de/n8935-e>

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