Joint Press Release
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Home run for the RV Maria S. Merian: Research vessel sets off towards the Baltic Sea ice for the "Deep Baltic" mission

From February 25 to March 23, 2021, a team of physicists and geologists from Warnemünde, Kiel and Szczecin will be underway in the northern Baltic Sea to investigate the dynamics of winterly deep water circulation. Besides recording the current hydrodynamic conditions near and under the sea ice of the Gulf of Bothnia, the program includes sedimentological and geophysical studies to investigate sediment erosion and deposition characteristics induced by deep-water movement. A further aim is to reconstruct the history of deep water circulation in the northern Baltic Sea during Holocene climate variations recorded in older sediments.

The effect is well known from freshwater lakes: while cooling down in winter, the water at the surface becomes heavier and sinks. At the bottom, it displaces deep water that was depleted of oxygen during the summer. This does not happen in the Baltic Sea, between the Danish island of Funen in the west and the Swedish island of Aland in the northeast, because of salt water at the bottom that enters the Baltic Sea via the Danish Belts and Sounds and is filling the deeper basins because it is heavier than the brackish Baltic Sea water. The cooling surface water cannot become dense enough to displace this saltier water. In the Gulf of Bothnia, between Sweden and Finland, the situation is different: Here, the salinity of the Baltic Sea water is generally very low, facilitating winter convection that reaches greater depths. For this reason, the northern basins of the Baltic Sea do not suffer from permanent oxygen deficiency, unlike the central basins.

In recent years, there have been increasing indications that these events also have positive effects on the sub-basins of the Gotland Sea that connect to the south. This is an exciting finding, because the "dead zones" at the bottom of the central Baltic Sea remain one of the biggest environmental problems of the Baltic Sea, not only because they increasingly restrict the habitat for higher life, but also because the lack of oxygen mobilizes nutrients from the sediments and thus further drives eutrophication. If it turns out to be true that the winter convection in the Bothnian Sea also has an impact on the deep waters of the central Baltic Sea, existing model conceptions of the Baltic Sea's hydrographic and biochemical balance will have to be revised.

Chief scientist Ralph Schneider, Professor of Geology at the Centre for Interdisciplinary Marine Sciences (KMS) at Kiel University, explains the research approach of cruise MSM99: "Our team consists of oceanographers, ecosystem modellers, sedimentologists and geophysicists. Using the broadest possible range of methods, we want to understand the present, decipher the past, and thus improve our models to the point where they can tell us how climate change will affect these processes."

Among his colleagues on board are physical oceanographers from the Leibniz Institute for Baltic Sea Research Warnemünde (IOW). They want to record how deep-water formation develops as precisely as possible and what the physical and geochemical boundary conditions are. Among other things, they are working with microstructure sensors under the ice and launching moorings with instruments continuously

measuring hydrographic conditions for one year. In addition, the so-called CTD probe is used to repeatedly measure how the temperature and salinity distribution in the water body changes along the cruise route. “These measurements are essential for us to be able to adjust our ecosystem models to the new findings,” explains Thomas Neumann, who conducts ecosystem modelling at the IOW.

However, in order to be able to take an unobstructed look into the past, sedimentologists and geophysicists must work together to find the positions where meaningful sediment cores can be obtained. “Deep water circulation creates very characteristic sediment pattern,” explains Matthias Moros, geologist at the IOW. “But we can only discover them with the help of sediment acoustics, which allow us to see into the seafloor, so to speak. In the end, it depends on the ‘right’ cores whether we can tell how the deep circulation developed during the Holocene.”

Nearly 100 voyages and 15 years ago, the Maria S. Merian also set out on its maiden scientific voyage to the northern Baltic Sea to prove its ice strengthening capabilities. The so-called Bottenwiek is still mostly ice-covered every winter. This is no problem for the Maria S. Merian: She is an ice capable research vessel and can break through sea ice up to 50 cm in thickness in the Baltic Sea. She thus guides the researchers safely to the areas of operation and also enables them to work on the ice.

The 99th voyage of the Maria S. Merian, like all current research voyages, is operated under strong protection against the Corona pandemic and was only made possible by the seamless hygiene concept of the Briese shipping company. The voyage begins and ends in Emden. Beforehand, all passengers will be tested for Covid-19 and will only board the ship after four days of isolation and new test

The participants of the MSM99 cruise will report regularly about their work on the blogportals of the IOW and Kiel University:

www.io-warnemuende.de/rv-merian-msm99-2021.html

www.oceanblogs.org

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The ice capable research vessel “Maria S. Merian”

The approximately 95-meter-long research vessel "Maria S. Merian" was commissioned in Warnemünde on February 9, 2006, and is suitable for operations in the Atlantic to the ice edge, for the North Sea and Baltic Sea, and also for voyages to the equator.

Homeport of the "Maria S. Merian" is Rostock. Owner is the state of Mecklenburg-Vorpommern. The "Maria S. Merian" normally has room for 23 researchers and 23 crew members. More information about the Maria S. Merian:

https://www.ldf.uni-hamburg.de/en/merian/technisches/dokumente-tech-merian/handbuch-merian-eng.pdf

Ice edge research vessel Maria S. Merian (Photo: T. Neumann, IOW)