



GCRI INTERVIEW

Prof. Dr. Martin Visbeck

Head of the Research Unit, Physical Oceanography, GEOMAR - Helmholtz Centre for Ocean Research Kiel

What is the effect of climate change on the state of oceans today?

Science distinguishes human climate change from natural climate change (sometimes referred to as climate variability). The addition of CO₂ and other gases to the Earth's atmosphere alters its radiative balance. On average, less heat is able to 'escape' the planet and the planet begins to warm. Today we can show that 90 percent of that additional heat in the Earth's system is warming the ocean. More than half of that energy is located in the upper 1,000 meters of the ocean, but almost half of the warming has already reached the deep sea. A warming ocean expands and that expansion causes the sea level to rise. Global sea level rise is measured by satellite systems. However, in the last decade, the sea level has risen twice as fast as a warming ocean could explain. The melting of land-based glaciers and ice sheets is providing significant extra runoff water to the ocean. A warming ocean and atmosphere change ocean circulation and wind patterns. Today, those changes are still small, but the expectation is that they will grow with time. Increasing levels of CO₂ in the atmosphere cause increasing gas transfer of CO₂ from the atmosphere to the ocean. The CO₂ dissolves in the ocean water and changes its chemistry. The pH drops and the ocean becomes more acidic. This process – called ocean acidification – is expected to worsen in the future. Many other secondary effects exist, including a slower uptake of oxygen because the solubility of warm water is lower than that of cold water. Together with a more active marine ecosystem in a warmer climate, the level of dissolved oxygen will be reduced. We call this ocean deoxygenation.

Why is the biodiversity of marine ecosystems so important?

From a human perspective, the ocean provides many services that are important for human survival. It provides 50 percent of the oxygen we breathe, 90 percent of long distance transport, and 95 percent of telecommunications. Half of the global population is dependent on marine food, which constitutes roughly 20 percent of their protein diet. Fish and algae both depend on a healthy and productive ecosystem and research shows that a more diverse ecosystem is more resilient to change and stress. The

protection of marine biodiversity is one of the measures necessary for maintaining a healthy and productive marine ecosystem.

Where are GEOMAR's research vessels located? What type of research is being conducted on these vessels?

GEOMAR scientists have access to a German fleet of research vessels. The fleet is owned by the German government and operated by different institutes on behalf of the research community. We operate an ice breaker (Polarstern), two ocean vessels (Sonne and Meteor), and several regionally operating vessels (Merian, Poseidon, Alkor, and Heinke). All vessels are designed as multipurpose ships that can support a wide range of marine science. That includes hydrographic measurements of the physical, chemical, and biological properties of the ocean. They also conduct sea floor observations and seismic imaging as well as provide support for an increasing range of autonomous vehicles including a drifter, profiling floats, glider, propelled autonomous vehicles, and moored observatories. We look at changes in water mass properties, circulation, and the ocean's biogeochemistry as well as further explore the discovery of new species and geological sea floor properties. We are interested in discovering the deep ocean and understanding the oceans' role in climate dynamics and the marine ecosystem. We are exploring new ways to use ocean resources in a more just and sustainable manner.