

Image: JAGO-Team, GEOMAR

2

How do marine communities respond to man-made changes?

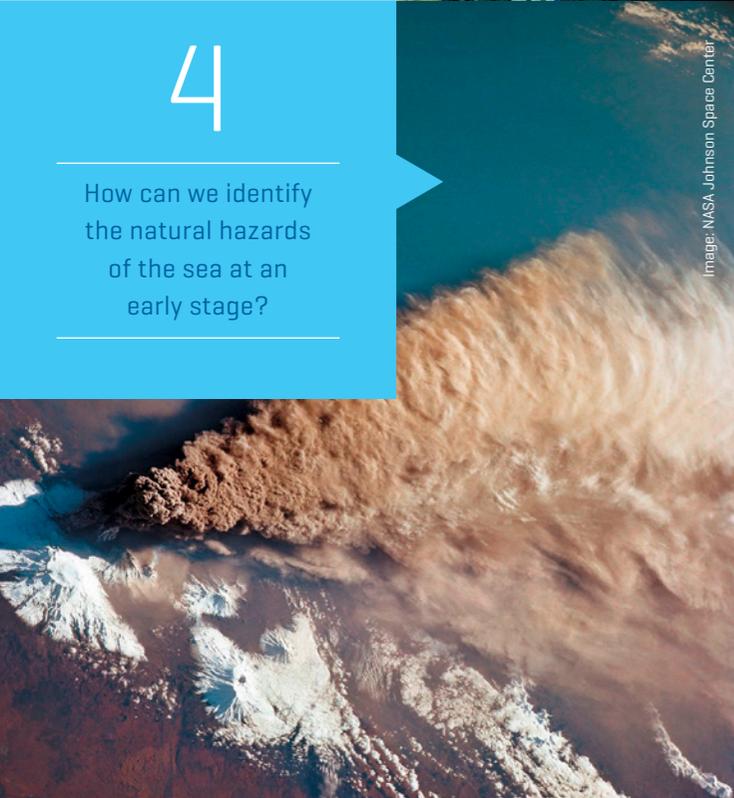


Image: NASA Johnson Space Center

4

How can we identify the natural hazards of the sea at an early stage?

### GEOMAR IN NUMBERS

- 80** million euro annual budget, including **25** million euros of project funding
- 1000** employees from more than 40 different countries
- 500** days at sea per year, of which 50 percent is on large research vessels
- 400** scientific articles in international journals per year
- 3** research vessels (ALKOR, LITTORINA, POLARFUCHS)
- 4** deep-sea underwater vehicles (ROV KIEL 6000, ROV PHOCA, AUV AYSS, VIATOR)
- 1** manned research submersible (JAGO)
- 11** underwater gliders (one of the largest glider fleets in Europe)
- 4** sea surface wave gliders
- 10** deep-sea landers
- 10** offshore mesocosms (KOSMOS)
- 100** ocean bottom seismometers (OBS)
- 35** geodetic seafloor transponder
- 6** onshore benthocosms
- 1** 3D seismic system (P-CABLE)

Image: M. Schmidt-Aursch

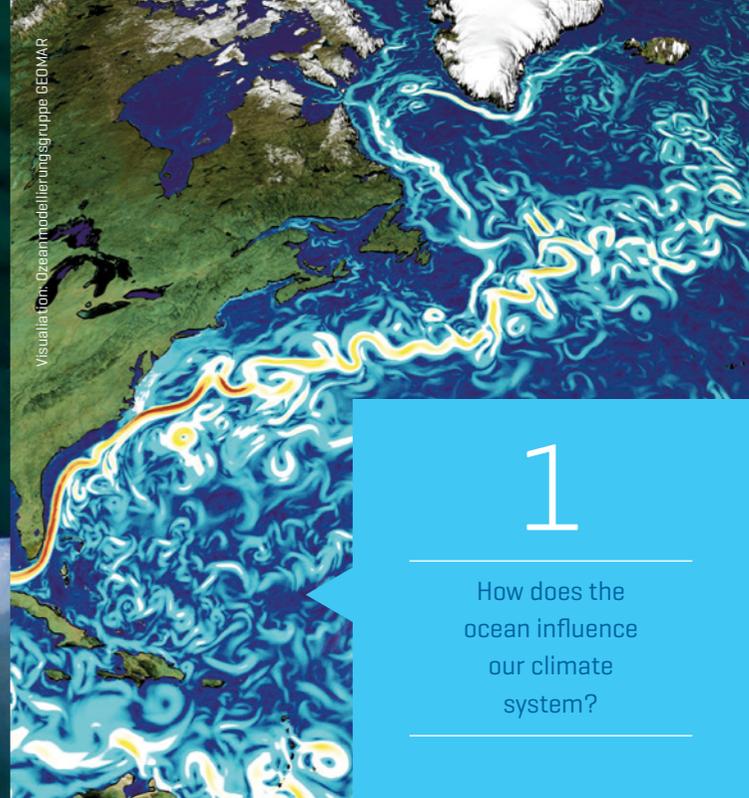
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Image: Björn Henke

HELMHOLTZ  
RESEARCH FOR GRAND CHALLENGES



From the Deep Sea  
to the Atmosphere  
GEOMAR Helmholtz Centre  
for Ocean Research Kiel



Visualization: Oceanmodellierungsgruppe GEOMAR

1

How does the ocean influence our climate system?

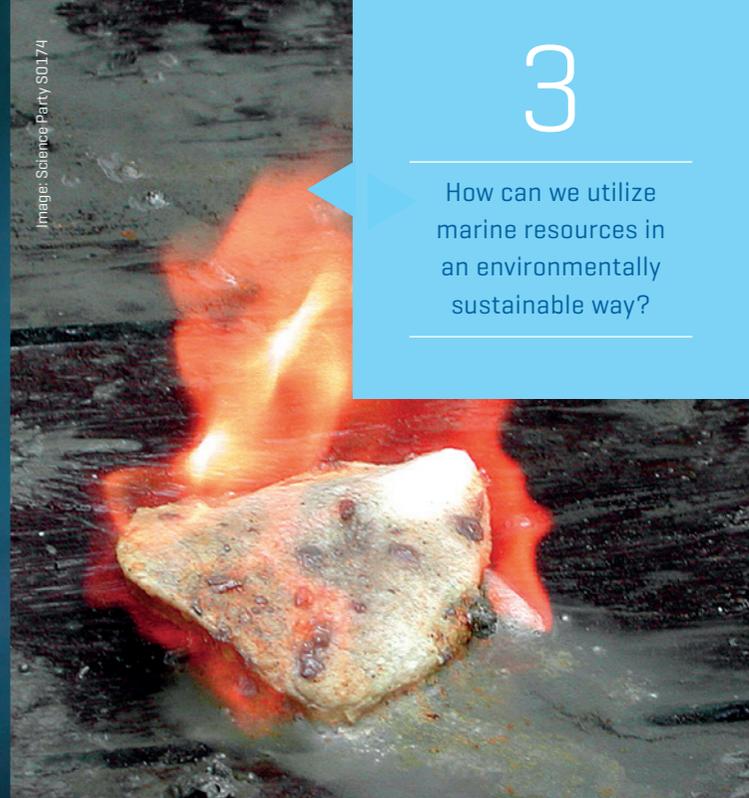


Image: Science Party S0174

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How can we utilize marine resources in an environmentally sustainable way?

## AN OVERVIEW OF GEOMAR

### GEOMAR Helmholtz Centre for Ocean Research Kiel

is one of the world's leading institutes in the field of marine sciences. The institute investigates the chemical, physical, biological and geological processes of the seafloor, oceans and ocean margins and their interactions with the atmosphere. With this focus, GEOMAR covers a unique spectrum of research in Germany.

GEOMAR's four research divisions are Ocean Circulation and Climate Dynamics, Marine Biogeochemistry, Marine Ecology and Dynamics of the Ocean Floor. GEOMAR works closely with the University of Kiel in the education of young scientists and is also internationally networked through cooperation programs. Special programs for students and teachers aim at awakening interest in marine sciences at an early stage.

GEOMAR is a member of the Helmholtz Association of German Research Centres, and a leading participant in national and international strategic partnerships, such as the German Alliance for Marine Research (DAM), the German Marine Research Consortium (KDM), the German Climate Consortium (DKK), the European Marine Board and the Partnership for Observation of the Global Oceans (POGO).

### Infrastructure

GEOMAR has a modern and efficient research infrastructure. This includes three own research vessels, the only manned German research submersible JAGO, and the unmanned deep-sea robots KIEL 6000, PHOCA, ABYSS and VIATOR. Furthermore, GEOMAR has excellent equipment in the field of isotope and trace element analysis, access to supercomputers and one of the largest marine science libraries in Germany.



Continuous measurements by floats have allowed the collection of vast amounts of ocean data in only ten years – more than was ever attained by all ship-based expeditions before. Image: M. Müller, GEOMAR



Mesocosms are giant test tubes. They are small, isolated worlds in the sea, in which the reactions of marine ecosystems to global change can be studied. Image: M. Nicolai, GEOMAR



Recovery of a carbonate block: carbonates allow to reconstruct the former presence of methane and methane hydrates in the seafloor. Image: B. Grundmann



Geophysical investigations with the research vessel METEOR in the Strait of Messina during an eruption of the volcano Etna. Image: S. Krastel-Gudegast, Kiel University

## MAJOR RESEARCH TOPICS

### 1 The Role of the Ocean in Climate Change

The ocean is the long-term memory of our climate, controlling variations in climate over time-scales that range from a few months to millions of years. With respect to anthropogenic aspects of climate change GEOMAR's research focuses on regional variations in the impacts of climate change and on abrupt changes in the climate.

### 2 Human Impact on Marine Ecosystems

Human activities affect marine ecosystems as a result of pollution, overfishing, the introduction of invasive species, and acidification, which all impact on the marine food web and may lead to largely unknown consequences for the biodiversity and survival of marine life forms.

### 3 Biological, Mineral and Energy Resources

The oceans offer enormous potential for new resources: natural marine substances, mineral resources, and gas hydrates on the seafloor could complement, and possibly replace, certain land-based occurrences. Comprehensive interdisciplinary investigations are required in order to enable a well-balanced assessment to be made of the potential provided by these marine resources, as well as the risks involved in their exploitation.

### 4 Plate Tectonics and Marine Hazards

Dynamic processes beneath the seafloor can cause natural hazards [such as earthquakes, landslides, tsunamis, and volcanic eruptions] that affect people living in coastal areas. A better understanding of the processes involved in the movement of tectonic plates is required in order to assess these hazards and to identify the early warning signals that precede such natural disasters.

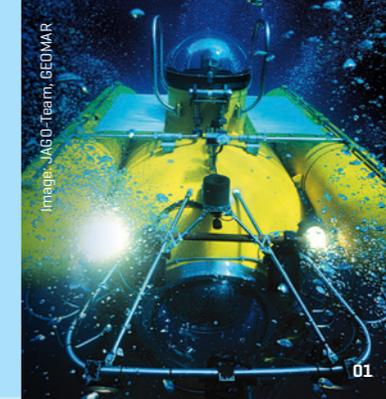


Image: JAGO-Team, GEOMAR



Image: B. Grundmann



Image: J. Steffén, GEOMAR



Image: Kröger/Dorfmüller, CAU Kiel



Image: M. Nicolai, GEOMAR

**01** The manned research submersible JAGO explores the ocean up a depth of 4000 metres.

**02** With the capability of diving to depths of up to 6,000 meters, ROV KIEL 6000 can reach 95 percent of the global sea floor.

**03** GEOMAR's public aquarium invites its visitors to join a short expedition into the multi-faceted seas of our planet. Seals are also kept in a large outdoor facility on the water's edge, where they can be observed both above and beneath the water's surface. The feeding of the seals is a big attraction for visitors of all ages.

**04** GEOMAR cooperates closely with the Kiel University in the education of future marine scientists. Bachelor curricula include "Physics of the Earth System: Meteorology – Oceanography – Geophysics" and internationally oriented Master courses such as "Climate Physics: Meteorology and Physical Oceanography" and "Biological Oceanography."

**05** GEOMAR's research vessel ALKOR in Kiel fjord.