Environmental impacts and risks of deep-sea mining (MiningImpact 2)

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In Short

- study regional connectivity of species in the deep-sea and their resilience to the sediment impacts.
- numerical simulation of different monitoring concepts and strategies for deep-sea mining operations in order to reduce the environmental impacts.
- to explore the constraints of the ecosystem recovery by comparing the model results and the measurements obtained from the visit of impacted and non-impacted regions after 2 years.
- to investigate the change of transport paths caused by variable ocean currents due to ENSO oscillation.

For economical reasons, particularly an anticipated lack of metal resources in the near future, deep-sea mining has attracted a remarkable attention during the last two decades. Of great interest are, for example, manganese nodules that are found on the ocean floor at deep ocean. Possible future industrial mining of manganese nodules would exert a significant pressure on the seafloor marine life. Benthic communities are strongly adapted to stable conditions in the deep sea. Due to the deep-ocean bottom disturbances the suspended sediment plume and its deposition can potentially cause significant harm to the deep-sea ecosystem. This project aims at assessing the long-term impacts of polymetallic nodule mining on the deep-sea environment by investigating the largely unknown hydrodynamic and sediment transport behavior in the deep-ocean environment. To reliably predict the sediment transport and the spreading of a sediment plume in the deep sea, numerical modeling with a series of precise input parameters is required. Most of the modeling knowledge of deep-sea sediment transport is due to a few studies that were carried out in different regions of Pacific Ocean [2]. Despite of a comprehensive modeling approaches in these studies, some knowledge gaps i.e. considering the flocculation process and its impact on the faith of sediment deposition [3] will be addressed in our study. The MiningImpact 2 project independently seeks to study and comprehensively monitor in real time the environmental impact of an industrial trial to mine manganese nodules on the seafloor [1]. The specific focus of our project is to check the model against the monitoring results of the plume dispersal and sediment deposition on the seabed after the trial mining. In order to investigate the sediment deposition and disperson, a version of the MITgcm coupled to a sediment module will be used. The model solves the Boussinesq and hydrostatic form of Navier-Stokes equation on a regular Cartesian grid [4]. A multiple one-way nesting approach (the horizontal resolution varies from 3 km over 300m to 100m) is applied in this study. This approach allows us to investigate the local processes at high resolution without neglecting the influence of the larger-scale ocean hydrodynamics. The lateral boundary condition over the entire water column are obtained from the Hybrid Coordinate Ocean Model (HYCOM).

WWW

https://www.marum.de

More Information

[1] `https://www.jpi-oceans.eu/`

[2] J. Jankowski and W. Zielke, *Deep Sea Research Part II* **48**, 3487–3521 (2001).

[3] J.C. Winterwerp, *Journal of Hydraulic research* **36**, 309–326 (1998).

[4] J. Marshall, A. Adcroft, C. Hill, L. Perelman, C. Heisey *Journal of geophysical research* **102**, 5753–5767 (1997).

Project Partners

MARUM, GEOMAR, NIOZ

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