PRESS RELEASE
ENVRIplus project

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HUNTING OF METHANE TRANSFER FROM THE SEAFLOOR TO THE ATMOPSHERE IN THE BLACK SEA BY COMBINING EUROPEAN RESEARCH INFRASTRUCTURES

Scientists from four different research infrastructures in Europe combined forces for a joint expedition in the Black Sea. They studied methane transfer from the sediment up to the atmosphere. The process is crucial to understand in order to improve current predictions of climate change.

Methane is a major greenhouse gas emitted from both natural and human-activity sources. In a warming climate, methane emissions from continental margins, *i.e.* the portion of the continental margin that transitions from the shore out towards to ocean, have a potential to significantly increase the amount of greenhouse gases. However, in what way exactly is the methane being injected from the sea bottom sediments through the water to the atmosphere, remains still poorly understood.

To study this further, an interdisciplinary marine expedition relying on four European Research Infrastructures was organized. The main goal of the expedition funded by the EU project ENVRIplus, was to measure methane transfer across the marine and atmosphere interfaces. The fate of methane released from the seafloor is a topic of scientific debate: although methane is vital for the development of chemosynthetic communities encountered at the seafloor, a large volume of it released into the water column is lethal for some of them and may contribute to the ocean acidification, as well as to global warming if a significant amount bypass the water mass.

The expedition took place from 1st to 8th of April 2019 in the Romanian sector of the Black Sea. It involved 20 scientists, and combined the expertise and technologies of four European Research Infrastructures: European Multidisciplinary Seafloor and water-column Observatory-EMSO, Integrated Carbon Observation System- ICOS, European Aerosol, Clouds, and Trace gases Research Infrastructure- ACTRIS, and an alliance of European research fleets-EuroFleets.

The research infrastructures developed a joint monitoring strategy for methane quantification at various levels. Starting from the sediments and moving across the sediment/seawater interface, the water column and finally up to the atmosphere, the whole system has been investigated for a holistic understanding of the fate of the methane. The Black Sea hosts a large number of vigorous methane-rich seeps from the continental shelf to the deepest parts of it, making it an ideal site for investigating the fate of marine methane.

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State-of-the art observations to assess the marine methane source

The methodology applied involved sampling of geologic materials, together with *in situ* measurements of the hydrosphere and atmosphere. Acoustic surveys of the water column over two methane-seep clusters have been performed to map their extent and evaluate the release of free methane, *i.e.* gas bubbles, by the GEOMAR Helmholtz Centre for Ocean Research (Kiel, Germany). A seafloor observatory developed by the National Institute of Geophysics and Volcanology- INGV laboratory (PalermoItaly) has been deployed close to a selected seep for a five day monitoring period, and then left on the seafloor for a longterm monitoring after the campaign. Gas-charged sediment as well as a seawater over the entire water column have been sampled by the French Research Institute for Exploitation of the Sea- Ifremer (Brest, France) and INGV for laboratory measurements of methane content and isotopic composition. In addition, real-time *in situ* methane measurements were carried out through the investigated water mass using three different instruments: two *in situ* spectrometers (SubOcean, a membrane inlet laser spectrometer of the Institute of Environmental Geosciences- IGE/ CNRS (Grenoble, France), and Gaspard, an in situ mass spectrometer of Ifremer) and a commercial sensor. Simultaneously, continuous measurements of methane and its main isotopes in the atmosphere were carried out by the Laboratoire des sciences du climat et de l'environnement- LSCE (Paris, France) with fast and high performance Picarro analyzers.

The resulting data will be used to (1) compare the state-of-the-art sensors used by different Research Infrastructures, (2) develop an optimized strategy for quantifying and monitoring methane fluxes across the interfaces from the seafloor and the atmosphere, and (3) assess to which extent methane is leaking out from the ocean and to be able to quantify and predict its feedback into climate change.

Captured moments during the ENVRI Methane cruise showing the participants at work, deploying their instrumentations (credit photos: Mia Schumacher-Geomar)

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