New RV Belgica

Specific call for research proposals 2021

DEHEAT

Natural analogues and system-scale modeling of marine enhanced silicate weathering

DURATION
15/12/2021 - 15/03/2026

BUDGET
€ 999 530

PROJECT DESCRIPTION

Global climate change is one of the biggest global challenges of the 21st century and urgently requires ambitious, transformative, and collective action to limit global warming. This can be achieved either by preventing emissions of carbon dioxide (CO_2) and other greenhouse gases to the atmosphere ("conventional mitigation") or by actively removing CO_2 from the atmosphere ("negative emissions"). However, to reach the Paris climate goal and limit global warming below 2°C, we will need to rely on negative emission technologies (NETs, also called Carbon Dioxide Removal technologies, CDR). A promising NET approach is Enhanced Silicate Weathering (ESW). ESW makes use of the natural weathering reaction, whereby silicate dissolution consumes atmospheric CO_2. The core idea of ESW is to distribute silicate minerals in environments that are characterized by high weathering rates, thus enhancing the uptake of atmospheric CO_2 by increasing the alkalinity of the ocean. Here, we aim at examining, for the first time, the feasibility of ESW under marine conditions, taking advantage of the coastal ocean as a large-scale, natural biogeochemical reactor. One important research question pertains to the efficiency of marine ESW in stimulating oceanic CO_2 uptake by increasing alkalinity in the coastal ocean. A second critical issue concerns the potential side-effects (both positive and negative) on marine ecosystems, including the enhanced availability of silicate and the potential release of iron and trace elements. To address these critical knowledge gaps, we will apply an innovative, fully integrated model-data approach combining RV Belgica field campaigns with state-of-the-art numerical models. Specifically, we will:

(I) quantify the sediment geochemistry and mineralogy of natural analogues for ESW
(II) develop and apply process-based local diagenetic models to quantify benthic weathering rates and benthic-pelagic exchange fluxes
(III) design a large-scale virtual field trial to assess the efficiency and full environmental impact of applying ESW as NET on the North Sea scale.

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Research outcomes will include new field studies of silicate-rich sediments, novel models of sedimentary silicate weathering, and scenario-based regional scale assessment of the impact of ESW on North Sea biogeochemical functioning. These results will be valorised through a combination of research papers, conference presentations and public outreach. DEHEAT will not only provide important quantitative information on ESW in the marine environment but also the first system-scale assessment of marine ESW as a NET. The scenario-based virtual analysis will further augment the direct value of the proposed unique RV Belgica field observations. Together, they will a major step towards science-based decision-making on the application of NETs and will put Belgium firmly at the forefront of marine coastal ESW research, while at the same time training a new generation of scientists with interdisciplinary skills sets required to tackle climate change related challenges.

CONTACT INFORMATION

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