Geophysical Research Abstracts
Vol. 21, EGU2019-8331, 2019
EGU General Assembly 2019

A new numerical model for understanding free and dissolved gas dynamics in the water column

Pär Jansson (1), Bénédicte Ferré (1), Anna Silyakova (1), Knut Ola Dølven (1), and Anders Omstedt (2)

(1) UiT, The Arctic University of Tromsø, Department of Geoscience, CAGE, Tromsø, Norway (per.g.jansson@uit.no), (2) Department of Marine Sciences, University of Gothenburg, Box 460, SE-405 30 Göteborg, Sweden

We present a new marine two-phase gas model in one dimension (M2PG1), resolving interaction between the free and dissolved gas phases, and the gas propagation through the water body towards the atmosphere. Rising, dissolution and exsolution of a wide size-range of bubbles comprising several gas species are modelled simultaneously with the evolution of the aqueous gas concentrations.
Applied in a well-known Arctic Ocean methane seepage location, M2PG1 showed good agreement with acoustically derived bubble rise heights and in-situ sampled methane concentration profiles. A sensitivity analysis suggests that transfer velocity parameterizations and bubble sizes play major roles in the redistribution of gases in the water column, whereas temperature and salinity play minor roles.
M2PG1 is an efficient and easy-to-use tool, which may be used to predict the dynamics of any system of gas species in different aquatic environments. To date, Nitrogen, Oxygen, Carbon dioxide, Methane and Argon gases are included in the model, which can be expanded to include other gas species. The structure and functionality of M2PG1 make it suitable for many two-phase gas applications. For example, coupling of M2PG1 with lake- and ocean circulation models will enable prediction of the ultimate fate of methane seeping from the seafloor, the geographic and temporal distribution of its transfer to the atmosphere, and its effect on the aquatic environment in terms of oxygen depletion and acidification.
This research is part of the Centre for Arctic Gas Hydrate, Environment and Climate (CAGE) and is supported by the Research Council of Norway through its Centres of Excellence funding scheme grant No. 223259 and UiT.