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Quantifying and modeling methane from the North Sea region with ICON-ART

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The release of greenhouse gases (GHG) like CH_4 into the atmosphere plays a key role in driving the climate change. With the optimization of atmospheric chemistry climate models, the accuracy in assessing future scenarios is improved, which is an important factor in our efforts to mitigate climate change.

Within this work we introduce the WALLACE workflow, a method for the quantification and adjustment of wrong or missing emissions in well-established GHG-inventories, which are used as input data in atmospheric chemistry transport or climate models. The overall goal of WALLACE is to highlight emission hotspots and it therefore includes spatiotemporal proxy data and a selection algorithm. For the North Sea as a show case region we apply WALLACE to quantify methane emission fluxes of oil and gas platforms. The adjusted emissions are implemented as pointsources into our model and idealized simulations are performed to derive their impact on the spatial distribution of methane and its global and regional budget. Additionally, we take a look at the anti-correlation between methane and its main sink in the atmosphere, the hydroxyl radical (OH), which is implemented as a simple OH-chemistry mechanism into the model. This work makes a new and innovative contribution to achieve an accurate quantification of environmentally harmful gases – in particular CH_4 - that drive man-made climate change.

In conjunction with WALLACE we use the global model ICON-ART (ICOsahedral Nonhydrostatic model - Aerosols and Reactive Trace gases). ART is an online-coupled model extension for ICON that includes chemical gases and aerosols. One aim of the model is the simulation of interactions between the trace substances and the state of the atmosphere by coupling the spatiotemporal evolution of tracers with atmospheric processes, thus testing the impact of WALLACE-adjusted emissions on the CH_4 distribution in the atmosphere.