A 4D Visualization of Unaccounted Global Methane Emissions from Gas Platforms in the North Sea

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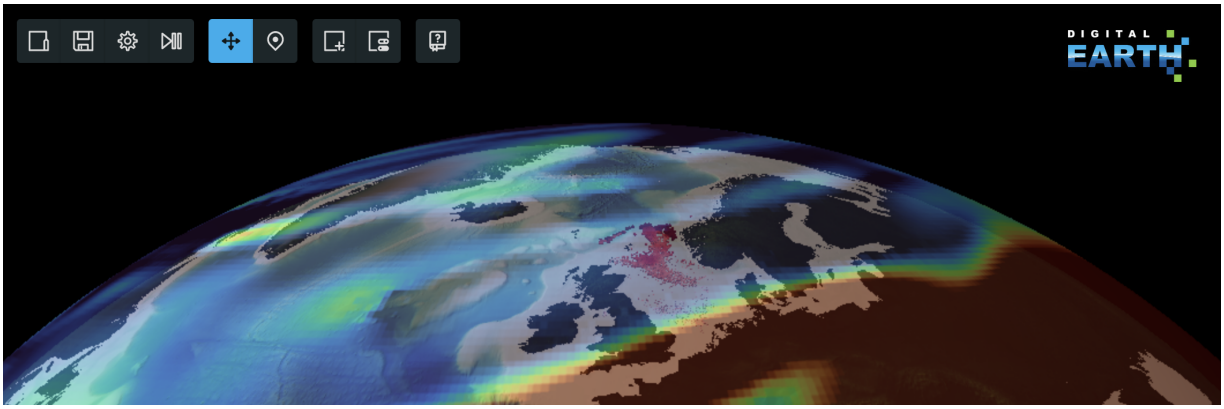

Figure 1: Methane emissions anomaly in the Northern Hemisphere .

ABSTRACT

Methane (CH_4) is the second most important greenhouse gas after CO_2 affecting global warming. Various sources (e.g. fossil fuel production) and sinks determine its global and regional budget and due to its long lifetime in the atmosphere methane can be transported over long distances.
Disused and active offshore platforms can emit methane in amounts that are difficult to quantify. In addition, explorations of the sea floor in the North Sea showed a release of methane near the boreholes of oil and gas producing platforms. The basis of this study is the established emission database EDGAR (Emission Database for Global Atmospheric Research), an inventory that includes methane emission fluxes in the North Sea region. While methane emission fluxes in the EDGAR inventory and platform locations are matching for most of the oil platforms, almost all of the gas platform sources are missing in the database. We developed a method for estimating the missing emission sources based on the EDGAR inventory where the known locations of gas platforms are included in the model as additional point sources.
In this study the global model ICON-ART (ICOsahedral Nonhydrostatic model - Aerosols and Reactive Trace gases) was used. 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. ICON-ART sensitivity simulations are performed with inserted and adjusted sources to access their influence on the methane and OH-radical distribution on regional (North Sea) and global scales.
The resulting dataset covers the entire globe across 90 vertical levels for a total time frame of 1 year. It has a spatial resolution of 0.5°and a temporal resolution of 12 hours. Additionally the vertical grids span from ground level to 70 km into the atmosphere. The simulation data is contained in multiple NetCDF files with a total size of about 4Tb. A second dataset consists of the geographical location of the 914 gas platforms in the North Sea. Individual latitudes range between 55°N and 72°N, the longitudes between -4°E and 8°E.
Individual gas platform positions are plotted in a 3D globe using the Digital Earth Viewer and the methane grids are displayed on top of them. For the first couple of weeks the effects of the unaccounted methane emissions at ground level remain confined to the immediate proximity of the sources. This changes quickly as the time advances: after the first months, the anomaly begins to be evident across all meridians and by the end of calculation time frame, it is visible well into the Southern Hemisphere.
With this visualisation we wish to show how small methodological inaccuracies can have a global impact in emission databases like EDGAR, rising awareness for the need of a thorough examination of these kind of resources.

Index Terms: Human-centered computing—Visualization—Visualization application domains—Scientific visualization; Human-centered computing—Visualization—Visualization application domains—Geographic visualization

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