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Aircraft mass balance estimate of methane emissions from offshore gas facilities in the Southern North Sea

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Atmospheric methane (CH_4) concentrations have more than doubled since the beginning of the industrial era, making methane the second most important anthropogenic greenhouse gas after carbon dioxide (CO_2). Fossil fuel extraction is one of the major anthropogenic methane sources as it is estimated to account for 22 % of global CH_4 emissions. However, studies indicate that inventories underestimate emissions arising from the oil and gas industry.

In two airborne field campaigns carried out in spring 2018 and 2019 offshore gas facilities in the Southern North Sea were probed. A total of nine research flights were conducted to characterize platform emissions. The Twin Otter research aircraft, operated by the British Antarctic Survey, was equipped with a high-precision 10 Hz analyzer (Picarro) to continuously measure CH_4 and CO_2. In order to identify fossil fuel emissions ethane (C_2H_6) was simultaneously measured with a 1 Hz TILDAS instrument (Aerodyne Research, Inc). On offshore oil and gas platforms methane is emitted by leakage, venting or flaring. To catch the methane plume, stacked transects were flown downwind of single platforms or platform complexes.

Methane fluxes were calculated for six British and four Dutch facilities using the mass balance method. Correlations with C_2H_6 and CO_2 were found with the latter indicating partly combusted methane from flaring. Uncertainties of fluxes arise mainly due to uncertainty of the wind measurement and the plume height. The calculated fluxes were compared to emissions reported to inventories (UK National Atmospheric Emissions Inventory (NAEI), UK Environmental and Emissions Monitoring System database (EEMS), Scarpelli inventory (2016)) and individually reported emissions from Dutch operators.