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Regional air pollution from oil rig emissions observed during the airborne APSOWA-DACCIWA campaign

Vanessa Brocchi (1), Gisèle Krysztofiak (1), Valéry Catoire (1), Greta Stratmann (2), Daniel Sauer (2), Hans Schlager (2), Konrad Deetz (3), Guillaume Dayma (4), and Francesco Contino (5)

(1) Université Orléans, Orléans, France, (2) Institut für Physik der Atmosphäre, Deutsches Zentrum für Luft und Raumfahrt, Oberpfaffenhofen, Germany, (3) Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research, Karlsruhe, Germany, (4) Institut de Combustion, Aérothermique, Réactivité et Environnement (ICARE), CNRS – Université Orléans, Orléans, France, (5) Vrije Universiteit Brussel, Department of Mechanical Engineering, Bruxelles, Belgium

In the framework of the European DACCIWA (Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa) project, the airborne study APSOWA (Atmospheric Pollution from Shipping and Oil platforms of West Africa) was conducted in July 2016 to study emissions from oil rigs and maritime traffic in the Gulf of Guinea. The measurements were performed during four flights of about 3-4 hours including meandering transects through emission plumes in the planetary boundary layer (around 300 m asl) off the coast of West Africa from Ivory Coast to Togo.

Several instruments have been used on-board the DLR Falcon-20, providing measurements of the O_3, CO, NO_2, SO_2 and aerosol contents and meteorological parameters to fingerprint different sources of local air pollution. Our study is focused on the floating production storage and offloading (FPSO) vessel Kwame Nkrumah operating in the Jubilee oil fields off the coast of Ghana. The two flights performed in the vicinity of the platform present simultaneous sudden increases of O_3, NO_2 and aerosols. Unlike what can be found in flaring emission inventories, no increase in SO_2 has been detected and an increase in CO is observed only during one of the two flights. By using a combustion chemistry code, the trace gases emitted by the flame were studied mainly in order to explain the production of CO depending on the flight.

Surface emission fluxes from the platform were estimated by combining the measurements with a nested-grid regional scale Lagrangian particle dispersion model (FLEXPART). A simplified inverse method was used and iterated until the modelling output and aircraft observations converge. The estimated fluxes of CO and NO_2 are compared to the regional inventory of Deetz and Vogel, 2017.