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Initial results of detected methane emissions from landfills in the Los Angeles Basin during the COMEX campaign by the Methane Airborne MAPper (MAMAP) instrument and a greenhouse gas in-situ analyser

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Methane (CH4) is the second most important anthropogenic greenhouse gas beside carbon dioxide (CO_2). Significant contributors to the global methane budget are fugitive emissions from landfills.
Due to the growing world population, it is expected that the amount of waste and, therefore, waste disposal sites will increase in number and size in parts of the world, often adjacent growing megacities.
Besides bottom-up modelling, a variety of ground based methods (e.g., flux chambers, trace gases, radial plume mapping, etc.) have been used to estimate (top-down) these fugitive emissions. Because landfills usually are large, sometimes with significant topographic relief, vary temporally, and leak/emit heterogeneously across their surface area, assessing total emission strength by ground-based techniques is often difficult.

In this work, we show how airborne based remote sensing measurements of the column-averaged dry air mole fraction of CH4 can be utilized to estimate fugitive emissions from landfills in an urban environment by a mass balance approach. Subsequently, these emission rates are compared to airborne in-situ horizontal cross section measurements of CH4 taken within the planetary boundary layer (PBL) upwind and downwind of the landfill at different altitudes immediately after the remote sensing measurements were finished.
Additional necessary parameters (e.g., wind direction, wind speed, aerosols, dew point temperature, etc.) for the data inversion are provided by a standard instrumentation suite for atmospheric measurements aboard the aircraft, and nearby ground-based weather stations.

These measurements were part of the CO_2 and Methane EXperiment (COMEX), which was executed during the summer 2014 in California and was co-funded by the European Space Agency (ESA) and the National Aeronautics and Space Administration (NASA). The remote sensing measurements were taken by the Methane Airborne MAPper (MAMAP) developed and operated by the University of Bremen and the German Research Center for Geoscience (GFZ) in Potsdam. The in-situ measurements were obtained by a greenhouse gas (GHG) in-situ analyser operated by NASA's Ames Research Center (ARC). Both instruments were installed aboard a DHC-6 Twin Otter aircraft operated by the Center for Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS).

Initial results – including estimated fugitive emission rates - will be presented for the landfill Olinda Alpha in Brea, Orange County, Los Angeles Basin, California, which was overflown on four different days during the COMEX field campaign in late summer 2014.