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CH4 emission estimates from an active landfill site inferred from a combined approach of CFD modelling and in situ FTIR measurements

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Globally, the waste sector contributes to nearly a fifth of anthropogenic methane (CH_4) emitted to the atmosphere and is the second largest source of methane in the UK. In recent years great improvements to reduce those emissions have been achieved by installation of methane recovery systems at landfill sites and subsequently methane emissions reported in national emission inventories have been reduced. Nevertheless, methane emissions of landfills remain uncertain and quantification of emission fluxes is essential to verify reported emission inventories and to monitor changes in emissions.

We are presenting data from the deployment of an in situ FTIR (Fourier Transform Infrared Spectrometer, Ecotech) for continuous and simultaneous sampling of CO_2, CH_4, N_2O and CO with high time resolution of the order of minutes. During a two week field campaign at an operational landfill site in Eastern England in August 2014, measurements were taken within a radius of 320 m of the uncovered and active area of the landfill, which was still filled with new incoming waste. We have applied a computation fluid dynamics (CFD) model, constrained with local wind measurements and a detailed topographic map of the landfill site, to the in situ concentration data to calculate CH_4 fluxes of the active site. A mean daytime flux of 0.83 mg m^{-2} s^{-1} (53.26 kg h^{-1}) was calculated for the area of the active site. An additional source area was identified and incorporated into the CFD model, which resulted in higher total methane emissions of 75.97 kg h^{-1} for the combined emission areas. Our method of combining a CFD model to in situ data, in medium proximity of the source area, allows to distinguish between different emission areas and thereby provide more detailed information compared to bulk emission approaches.