Methane emission estimates for Ireland using a Bayesian Atmospheric Inversion

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Optimised top-down approaches with inverse modelling, combining atmospheric transport model output and observational data, are designed to verify and improve the bottom-up based emission inventories. Within the IMPLICIT project, funded by the Irish Environmental Protection Agency, such a system is being tested and implemented by the National University of Ireland, Galway. IMPLICIT aims at improving the Irish national capacities to estimate and verify national methane emission inventories and, in the long term, to extend it to a larger number of greenhouse gases. The system of choice is the Bayesian inversion framework FLEXINVERT, in its newest version (2). FLEXINVERT optimises the surface-to-atmosphere fluxes of an atmospheric species using ambient concentrations together with source receptor sensitivities obtained through an atmospheric transport model. Although both spatial and temporal resolutions are flexible in this system, most of its applications so far have been at a continental scale. In this study, however, FLEXINVERT2 is tested and implemented with a high resolution domain over Ireland and northern/central Europe for the year 2012. The resulting methane flux estimates, with varying resolutions and using different sets of observational data to constrain the inversion, are compared against a high resolution (1 km) emission inventory.