

Western European Emissions of CFC-11 and CFC-12 Inferred from Atmospheric Observations and Inverse Modelling

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The slowdown in CFC-11 emission decrease rates observed since 2013 on a global scale suggest that unreported emissions of this chemical, whose production is banned under the Montreal Protocol, are occurring. Studies aimed at evaluating emissions at the regional scale are important in order to close the CFC-11 global budget and identify/rule out possible source regions. Here we present the results of a study focused on western Europe, based on a combination of long-term, high-frequency, high-precision observations of CFC-11 and CFC-12 at four European sites embedded in the AGAGE network (Mace Head, IE; Tacolneston, UK; Jungfraujoch, CH and Monte Cimone, IT) and three independent inverse modelling systems.

Analysis of the Mace Head observational record from 1990 shows that the magnitude of the pollution events have dramatically declined from their peak in the very early 1990s. Western European emissions of CFC-11 and CFC-12 have been quantified for the period 2008–2017 and 2012–2017, respectively. CFC-11 emissions showed a decrease rate that is consistent with the bank decay rate, suggesting that no unreported emissions are occurring. As shown in Figure 1, an area in north western Europe, corresponding to Benelux, has been identified by the three models as the strongest source region.

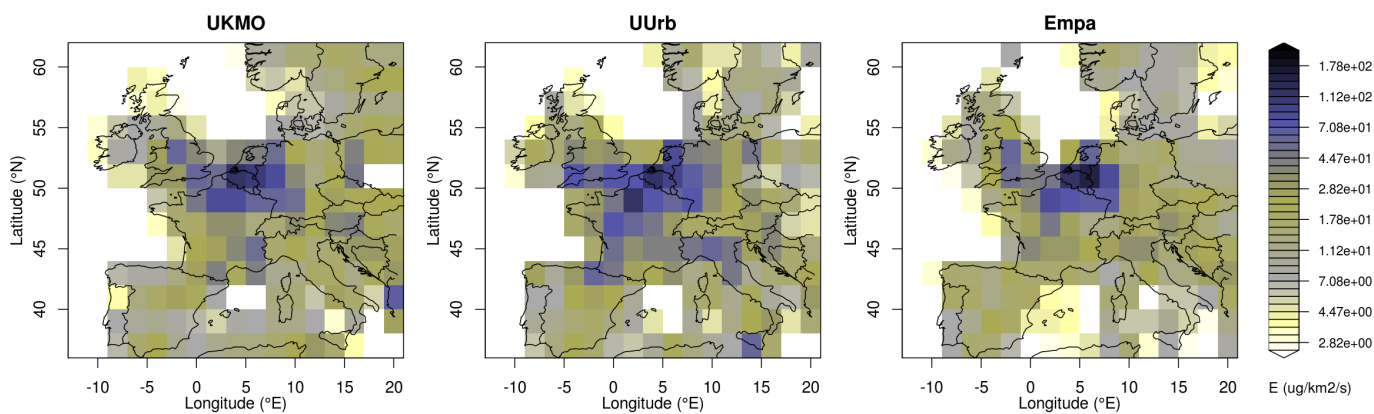


Figure 1. A-posteriori CFC-11 emissions from western Europe estimated through three different inverse modelling systems; UKMO (UK Met Office, Name-InTEM), Uurb (University of Urbino, Flexpart-Bayesian Inversions), Empa (Empa, Flexpart-Bayesian Inversion).