

European Emissions of Chlorodifluoromethane (HCFC-22) Based on High Frequency Atmospheric Measurements and a Bayesian Inversion Method

M. Maione¹, F. Graziosi¹, J. Arduini¹, U. Giostra¹, F. Furlani¹, S.A. Montzka², A. Stohl³, S. Doherty⁴ and P. Bonasoni⁵

¹University of Urbino, Department of Basic Sciences and Foundations, Urbino, Italy; +39 0722 303314, E-mail: michela.maione@uniurb.it

²NOAA Earth System Research Laboratory, Boulder, CO 80305

³Norwegian Institute for Air Research (NILU), Oslo, Norway

⁴University of Bristol, School of Chemistry, Bristol, United Kingdom

⁵Institute of Atmospheric Sciences and Climate, National Research Council, Bologna, Italy

HCFC-22 (CHClF_2) is a stratospheric ozone depleting substance and a powerful greenhouse gas primarily used in refrigeration and air conditioning systems as interim replacement for Chlorofluorocarbons. Combining atmospheric observations conducted at two European sites (Mace Head and Monte Cimone) with a Bayesian inversion technique, we estimated fluxes of HCFC-22 from the European geographic domain and from eight macro-areas within it, over an 11-year period from January 2002 to December 2012. We estimated that the maximum in European emissions was in 2003 ($37.8 \pm 4.1 \text{ Gg yr}^{-1}$), and the minimum in 2012 ($12.2 \pm 1.9 \text{ Gg yr}^{-1}$), with some years in between (2008 and 2010) in which the steady decreasing trend was interrupted. Background values of HCFC-22 as measured by the two European stations are still increasing with an overall trend of ca 7.0 ppt yr^{-1} . However, within such an increasing trend, changes in the growth rate acceleration are observed after 2008, when a slow-down in the acceleration occurred. The high spatial-temporal resolution of our estimates allowed us to identify a possible seasonal cycle in HCFC-22 emissions, when regions facing the Mediterranean basin were considered separately from the rest of Europe, with emissions in the warmer months ca 25% higher than those occurring in the colder months. Finally, we estimated the extent to which banks will contribute to the total European emissions of HCFC-22.

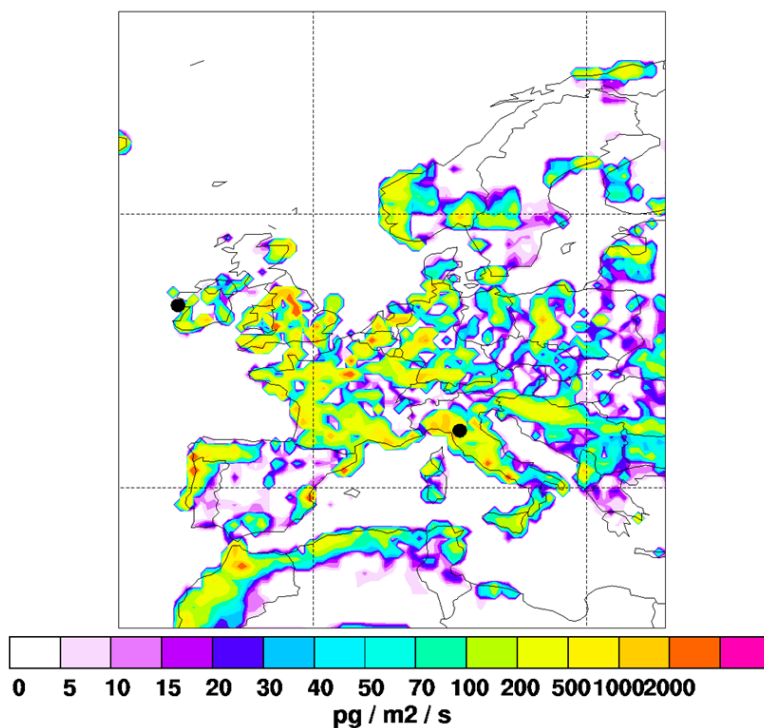


Figure 1. A posteriori emissions of HCFC-22 from the European geographic domain in 2007. The two measurement stations are marked with a black dot.