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Long term observations of halogenated greenhouse gases in a European continental background station for assessing atmospheric trends, annual growth rates and emission sources

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Climate altering halocarbons are continuously monitored at the atmospheric research station “O. Vittori” located on the top of Monte Cimone, Northern Apennines, Italy (2165 m asl), in the frame of the SOGE (System for Observation of halogenated Greenhouse gases in Europe) network, an integrated system based on a combination of observations and models aimed at assessing atmospheric trends, annual growth rates and at estimating European halocarbon emissions. The use of such a top-down approach is useful to ascertain compliance to International Protocols regulating production/emission of halogenated greenhouse gases. Establishing the baseline is essential both for estimating annual growth rates and because back attribution techniques are based on the clear identification of “above the background” data. That is particularly challenging in a Station like Monte Cimone characterised by a complex meteorological and source field. The approach proposed is based on the identification of the lowest concentration values in a given temporal range to which a Δc representing variation due to instrumental error is added. Trends are evaluated by using a non-linear regression function, able to take into account both annual and seasonal variation. In order to identify source, regions baseline data are subtracted from the full data set and an inversion modelling cascade, which makes use of MM5 model to reproduce meteorological fields and of FLEXPART to simulate tracer dispersion, is used to find the best emissions map that fits the observations.