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Time series and trends of tropospheric halocarbons in the Mediterranean

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Measurement of halocarbons in the troposphere is becoming an important task in the climate change investigations because, despite of their low mixing ratios, they have high global warming potentials. Ozone depleting chlorofluorocarbons (CFCs) production has been definitively phased out by 1996 according to the Montreal Protocol (1987) and its Amendaments. The species designed as replacements of CFCs are the partially halogenated hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). Both classes of compounds have low or null ozone depleting potentials (ODPs) and shorter lifetimes than CFCs but may contribute significantly to the greenhouse effect because of their long-wave radiation absorption. While the concentration of CFCs in the troposphere is beginning to slow down in response to reduced global emissions, the level of their replacement compounds is rapidly increasing.

In this work we discuss halocompound measurements recorded at the remote site of Lampedusa Island(35.5˚N, 12.6˚E), in the Mediterranean sea. Measurements of CFC-11 and CFC-12 atmospheric mixing ratios were started at Lampedusa ENEA station in 1996. The technique used for analysis is conventional gas chromatography with electron capture detection (GC-ECD). Depending upon the atmospheric lifetimes and the rapidity at which the emissions are curtailed the decreasing trend of CFC-11 and CFC-12 follows different behaviours. As reported in literature the concentration of CFC-11 (lifetime= 50 years) were at maximum around 1993 and then started to slow down. The CFC-11 mixing ratio observed at Lampedusa since January 1997 is decreasing at a rate of about 1.0 ppt/yr and is now at a level of 250.0 ppt. In contrast

CFC-12, having a longer lifetime (102 years), was slowly increasing until the end of 2002 and then decreasing in the last 4 years at a rate of 0.3 ppt/yr. The actual mixing ratio value recorded at Lampedusa ranges around 530 ppt.

Since December 2003 several CFC r eplacement compounds (HCFC-22, HFC-134a, HCFC-141b, HCFC-142b and SF_6), are monitored at Lampedusa ENEA station. Samples are collected weekly in 6L stainless steel canisters and then shipped to the ENEA Casaccia Laboratory (Rome), where they are analysed by gas chromatography-mass spectrometry (GC-MS). According to the data reported by other global monitoring stations of greenhouse gases, all halocompounds, except for HCFC-141b, show a linear increasing trend. The growth rates recorded for SF_6, HCFC-22, HFC-134a and HCFC-142b during the period 2004-2006 are 0.02, 0.7, 0.6 and 0.1 ppt/yr respectively. The HCFC-141b mixing ratio remains stable around 20.0 ppt.

Preliminary combined analysis of backward airmass trajectories (HYSPLIT model) and HCFC-141b weekly time series shows that anomalous high mixing ratio values correspond to airmasses originating from North-Western Europe.