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First retrievals of carbon tetrafluoride (CF4) from ground-based FTIR measurements: production and analysis of the two-decadal time series above the Jungfraujoch

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Carbon tetrafluoride (CF4 or PFC-14) is a potent greenhouse gas that is almost 7400 times more effective (100-yr horizon) than CO2 on a per molecule basis (IPCC, 2007). This high global warming potential, coming from its medium absorbance combined with a very long atmospheric lifetime (>50000 years; Ravishankara et al., 1993), makes CF4 a key species among the various greenhouse gases targeted by the Kyoto Protocol. In the Northern hemisphere, current atmospheric CF4 concentrations are close to 78 pptv, with a large fraction (around 35 pptv, Mühle et al., 2010) coming from natural processes like lithospheric emissions (Harnisch and Eisenhauer, 1998). In addition, CF4 has been used increasingly since the eighties in electronic and semiconductors industry. The primary aluminum production processes have also been clearly identified as an important anthropogenic source of CF4 emissions. The partitioning between these two main sources is however problematic, principally due to lacking or incomplete CF4 emission factors from inventories performed in industrial fields (e.g. International Aluminum Institute, 2009).

Recent in situ ground level measurements of CF4 in the Northern hemisphere (Khalil et al., 2003; Mühle et al., 2010) or remotely from space (Rinsland et al., 2006) have indicated a significant slowdown in the increase rate of atmospheric CF4. This probably results from measures adopted by the aluminum industry aiming at the reduction of the frequency and duration of “anode effects” and therefore of related PFCs emissions (International Aluminum Institute, 2009).

The present contribution reports on the long-term evolution (1990-2010) of the atmospheric carbon tetrafluoride total vertical abundance derived from ground-based Fourier transform infrared (FTIR) solar spectroscopy observations around 1285 cm-1 at the Jungfraujoch (46.5°N, 8.0°E, 3580m asl) and compares our findings with results available in the literature. To our knowledge, no equivalent time series (i.e. based on ground-based FTIR technique) has been published to date.

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