

VERTICAL AIRCRAFT PROFILES OVER EUROPE

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ABSTRACT

Regular vertical profiles over Europe were set up in 2001 as part of the AEROCARB and Carboeurope-IP projects at five locations: Griffin (56°36'N, 3°47'W, Scotland), Orléans (47°50'N, 2°30'E, France), Schauinsland (47°55'N, 7°55'E, Germany), Hegyhatsal (46°57'N, 16°39'E, Hungary), and Bialystok (53.20°N, 22.75°E, Poland). The objective of the program is to measure CO₂, CH₄, N₂O, SF₆, CO, ¹³C and ¹⁸O in CO₂ vertical profiles at a bi-weekly frequency using air samples taken up at several levels from 100m up to 3000 m above the ground surface. One liter flasks are sampled on board small aircraft using a standardised protocol. The samples are analysed at three laboratories (LSCE, MPI-BGC, IUP-UHEI) which are linked through regular intercomparison exercises. We have characterised for each site the CO₂ seasonal cycles within the atmospheric boundary layer (ABL: 14 to 20 ppm) and the free troposphere (FT: 10 to 13 ppm). From these signals we have calculated the difference between ABL and FT, known as the CO₂ 'jump', which will be compared to the simulations from atmospheric transport models. We have also calculated the offset between each airborne sampling site and the time series from Mace Head observatory, used as a maritime reference. For CO₂, the wintertime offsets at the lowest level of the average vertical profiles are ranging from 0 ppm in Scotland up to 10 ppm in all continental sites. Depending of the site the positive offset due to emissions from anthropogenic and biospheric processes may extend up to 300 to 1500 m agl. In summertime we observe a negative gradient in most of the sites with a typical decrease of 5 ppm between 2000m and 100m agl. The average vertical gradients will be compared to the output of atmospheric models, and will be analysed with regards to the other trace gas (CO, CH₄, and CO₂ isotopes).