Performance test of a mobile fossil fuel CO_2 monitoring station developed in ATOMKI

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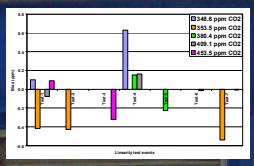
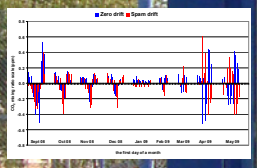
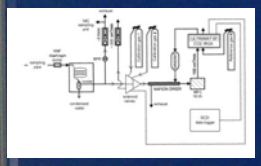
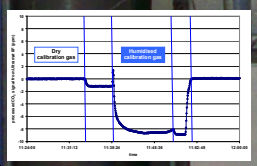
Mixing ratio of CO_2 is measured at 3 m above the ground by the monitoring station. Air is pumped through a 9.5-mm-diameter plastic tube (PFA, Swagelok) to a CO_2 analyser located in a container box. Container box (Containex) is 1.5 m wide, 1.2 m deep and 2.2 m high, designed as a mobile measuring room which is field deployable, only electric power is required. A 15 micron pore size stainless steel Tee-Type (Swagelok) particle filter is located at the inlet of the sampler tube. Diaphragm pump (KNF) is used to draw air continuously through the sampling tube from monitoring level at flow rate of ~ 3 L/min.



The analyser measures the CO_2 mixing ratio in the sample gas in every 3 seconds. Output data are registered by a data logger developed for this application (SCD data logger, Special Control Devices). The overall uncertainty of our atmospheric CO_2 mixing ratio measurements is < 1 ppm (< 0.3 % of measured level). This level of error is acceptable for our fossil fuel CO_2 calculations as the uncertainty of the other required parameter radiocarbon content of atmospheric CO_2 is usually 0.3-0.5%. Figure 2. shows a photo of the developed field deployable fossil fuel CO_2 monitoring station in the backyard of Atomki.







The air at 5 psig overpressure enters a glass trap for liquid water that is cooled in a regular household refrigerator (BPR), to dry the air to a dew point of 3°-4°C. Liquid water is forced out through an orifice at the bottom of the trap. The air sample inlet tube and the standard gases (Linde Hungary) are connected to miniature solenoid valves in a manifold which are normally closed and controlled by the CO_2 analyser, which selects which gas is sampled. The air leaving the manifold through its common outlet is further dried to a dew point of about -25°C by passage through a 360-cmlong Nafion drier (Permapure), so that the water vapour interference and dilution effect are <0.1 ppm equivalent CO_2.

Analysis is carried out using a non-dispersive infrared gas analyser (IRGA) Ultramat 6F which is a specialised model for field applications by Siemens. A constant sample flow rate of 300 cm3/min is maintained by a mass flow controller (MFC, Aalborg). The reference cell of the CO_2 analyzer is continuously flushed with a compressed reference gas of 350 ppm CO_2 in synthetic air (Messer Hungarogáz). The typically used calibration cycle is 2 hours, consisting of a zero-point calibration and a span calibration. Each calibration is consisting of 2 min flushing and 20 sec signal integration. The usual change of the response function is below 0.2 ppm after 2 hours following a previous calibration.