FluxSense

Volatile organic hydrocarbons which leak into the atmosphere cause formation of photochemical smog, which has considerable negative impact on our environment. There is therefore environmental legislation pushing the industries to decrease their emissions. A large portion of the gaseous hydrocarbon leakages from industry occur in a diffuse way from thousands of release points, for instance from valves and pumps, or around the rim of oil tanks. Such emissions are very difficult to locate and to quantify.

FluxSense is utilizing a world unique remote sensing method named SOF (Solar Occultation Flux) to locate and quantify the diffuse hydrocarbon emissions from industry. The method is considerably more cost effective than traditional techniques and it is based on measuring infrared intensity spectra of the sun from a mobile platform. From these spectra the average amount of hydrocarbons along the pathlength of the solarlight can be retrieved, utilizing that gaseous species absorb the infrared light in an unique way. The technique is today used at most of the swedish refineries to estimate their annual emissions.

Techniqual description

The SOF method is a newly patented technique to derive fluxes from various sources. The method is based on recording broadband infrared or UV/visible spectra of the sun with a low-resolution spectrometer which is connected to a solar tracker. The latter is a mirror device that tracks the sun and reflects the light into the spectrometer independent of its position.

From the solar spectra it is possible to retrieve the path averaged concentration (molec·cm^{-2}) of a large number of species absorbing the radiation along the light path of the sun, for instance aldehydes ammonia, ethylene, CO, ethylene-oxide, HF, HCl, methane, NO_2, SO_2, propane, propylene, terpenes, and vinyl-chloride. In order to obtain the flux from a particular source, the instrument is positioned on a car which is driven in such as way that the detected solar light traverses across the actual emission plume. The flux is then obtained as the integrated sum of the retrieved path averaged concentrations, multiplied by the wind speed. Applications already demonstrated are: flux measurements from farming, flares, refineries, volcanoes and ships and leakage search. Detection limits down to 0.5 mg·m^2 can be achieved which corresponds to measuring a point source of 0.5 kg·h^{-1} at a distance of 50 m with an accuracy of better than 3%.

Fig. 1. The SOF instrument positioned in a VW transporter. The device in the lower figure tracks the sun.

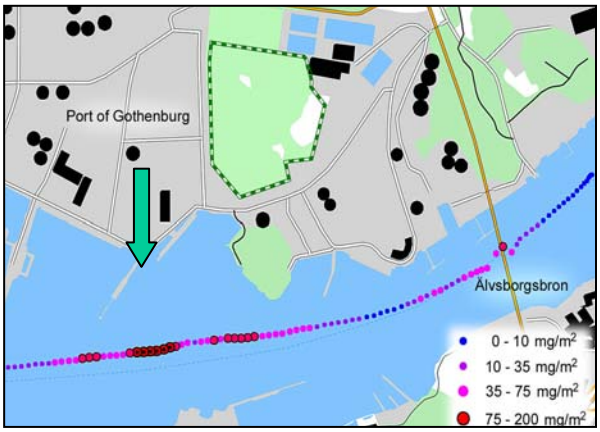

Fig. 2. Example of volatile hydrocarbon measurements in the emission plume of Göteborg harbor and Shell refinery. The measurements were conducted on a ship. The colored dots correspond to measurements of the hydrocarbon column abundance above the ship. The green arrow indicates the wind direction.

FluxSense AB is a spin-off company derived from optical remote sensing research conducted at Chalmers University of Technology in Göteborg. This research corresponds to more than 20 years of experience in working with state-of the art remote sensing techniques for probing the atmosphere (DOAS, DIAL, FTIR) and quantifying fluxes of pollutants from various sources. The main activities in FluxSense are: providing instruments and consultant services for leak search and estimation of diffuse industrial emissions.

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