

Master's thesis project in gas flux measurements using drones.

Development of a drone based hydrocarbon sensor for gas flux measurements from oil and gas production



Figure 1. Left: The Chalmers IGPS solar occultation flux method which today is a European standard how to measure diffuse gas leakages of volatile hydrocarbons. Right: The Chalmers drone used to carry various sensors that will be applied in this project.

Background

Chalmers has developed several unique mobile optical remote sensing techniques for quantification of diffuse gas emissions from for instance industries, farming and volcanoes. These techniques are becoming a standard on how to measure diffuse gas emissions of volatile hydrocarbons (alkanes, alkenes, alcohols etc) and are for instance being used for instance in California, China and Europe.

See: <https://sverigesradio.se/sida/artikel.aspx?programid=104&artikel=7066876>

During recent years the development of drones, and applications using drones, have had a strong increase. So far the main focus has been of photography and filming but also the use of drones as carriers of other measurement devices are currently being developed. At the division for Microwave and Optical Remote Sensing we are presently testing measurement strategies using drones for volcanic gas emissions and ship emissions and in this work we want to expand this into measuring volatile hydrocarbon emissions from oil industry and oil and gas production. Such a sensor would complement the optical techniques in terms of spatial coverage and ability to quickly find leaks.

What is the project about?

The main work will be focused on developing a small sensor system for measuring gaseous hydrocarbons and that will be carried on a drone.

The main objectives of the work are:

- Design and build the sensor system for volatile hydrocarbons, based on a previous system that measures SO_2 . The work includes, design, hardware, programming, calibrations.
- Adaption on a drone (already existing).
- Develop analysis software that can calculate the measured gas flux based geo coded drone measurements.
- Test and validate the system by measuring emissions from several Swedish refineries and petro chemical industries and compare to the Solar Occultation Flux method.
- Possibly test and adapt several sensors including black carbon sensors (for flaring), ammonia from farming.
- Data analysis, and reporting.

In this master you will get in depth understanding of a small sensors and how these can be applied on drones, both of these technique-areas are rapidly growing within environmental monitoring and other applications.

Requirements

- some experience from building hardware
- programming experience (matlab, python and C, arduino/rpi).
- ability to solve practical problems
- interest to do field-work

Supervisor

Professor Johan Mellqvist, Microwave and Optical Remote sensing
Department of Space, Earth and Environment Chalmers
Hörsalsvägen 11, Tel: 7724855, 070 3088777
Email: johan.mellqvist@chalmers.se