ABB MEASUREMENT & ANALYTICS | ARTICLE

Enhancing understanding of greenhouse gas sources

Los Gatos Research (LGR)

Climate scientists have concluded that they need much more information to improve their understanding of methane emissions from many important sources. NASA and the European Space Agency (ESA) have joined forces to help rectify this situation.

Measurement made easy

Enhancing understanding of greenhouse gas sources

Introduction

The aim of their joint mission is to untangle and more accurately quantify natural and man-made sources of greenhouse gasses in the atmosphere. NASA's part in the joint mission is called the CO_2 and Methane EXperiment (COMEX) campaign.

This campaign combines two distinct remote sensing approaches:

- imaging spectroscopy with relatively broad spectral resolution but fine spatial resolution

and

- non-imaging spectroscopy at moderate spectral resolution

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CarbonSat mission

ESA is preparing a mission called CarbonSat proposed by the University of Bremen in Germany, as well as by European greenhouse gas experts, for the agency's next Earth Explorer satellite. The University of Bremen is supplying a non-imaging spectrometer called MAMAP (Methane Airborne MAPper). The collaborative effort with NASA is expected to show how ESA's CarbonSat satellite mission could identify sources and movement of carbon dioxide and methane from above, while coordinating measurements with ground-based efforts.

Several analyzers from Los Gatos Research, a member of the ABB Group, have been successfully deployed as a major part of the ongoing NASA-funded COMEX project. The LGR instruments are installed in aircraft and cars for measurements of several trace gases in the troposphere and on the surface. The COMEX mission makes use of LGR's new ground-breaking Ultraportable Greenhouse Gas Analyzer that reports measurements of methane, carbon dioxide and water vapor simultaneously in a package that is compact and crushproof. These portable analyzers are small enough to be installed in aircraft and the trunk of a car.

LGR analyzers use a unique laser absorption technology called Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS). This patented fourth-generation approach delivers excellent performance while remaining relatively insensitive to internal alignment of optical components and to variations in local temperature and pressure, critical for airborne and mobile deployments.

A joint NASA/ESA campaign recently took measurements in the San Joaquin Valley and around Los Angeles in California. These areas contain oil refineries, farms and landfill sites, all of which release methane into the atmosphere. Measurements were taken from above in a Twin Otter aircraft, simulating those from the satellite. Researchers compared this data to other measurements taken by a second aircraft and on the ground near the source of emissions.

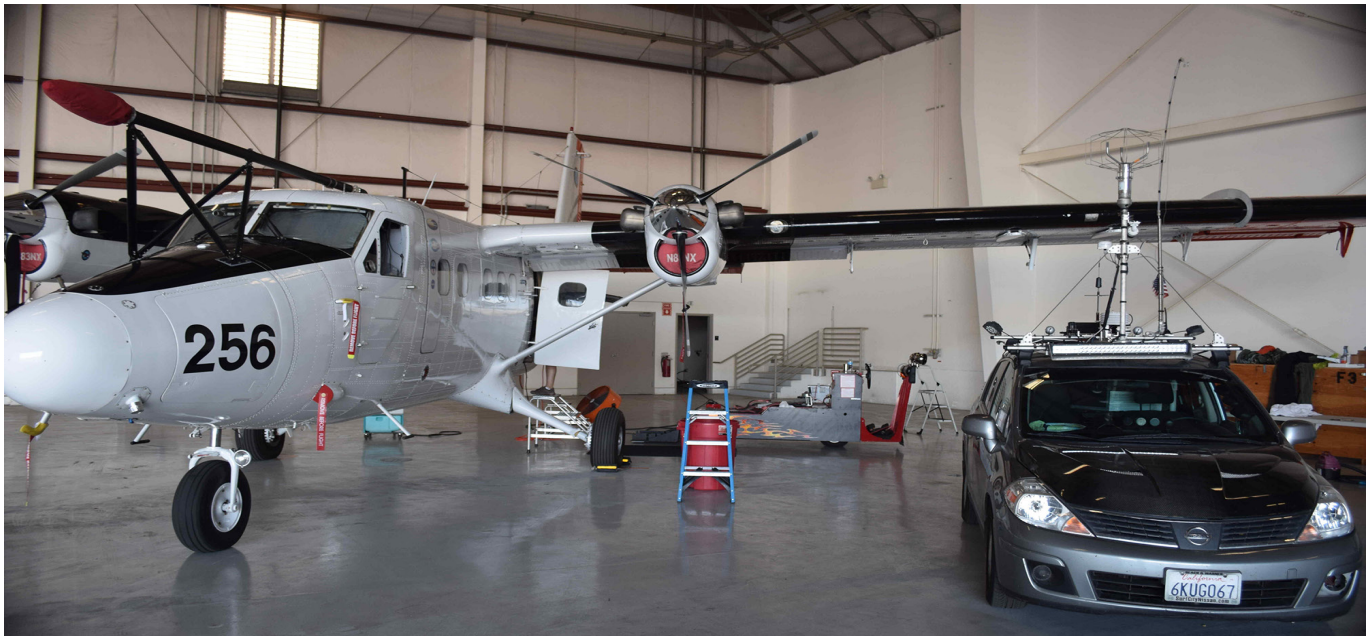

Figure. 1 COMEX instrumented Twin Otter aircraft and AMOG Surveyor

The Twin Otter aircraft supports a comprehensive science package for atmospheric measurements, including temperature, 3D winds, humidity and aerosols. Also, it flies the MAMAP spectrometer and two in-situ analyzers: one for methane and carbon dioxide and one for carbon dioxide and its isotopes. These analyzers use Cavity Ring-Down Spectrometry (CRDS) and LGR's Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS), respectively.

Measurements for supporting data on surface wind, greenhouse gas concentration and other variables are made by the AMOG Surveyor (AutoMObile greenhouse Gas), an instrumented car. AMOG provides data in real time to facilitate plume tracking and source identification. Its measurements include wind, air temperature, solar radiation, solar spectrum, humidity, pressure, altitude, GPS, vehicle velocity and heading and gas concentrations (methane, carbon dioxide, ammonia, nitrogen dioxide). The AMOG instrumented automobile houses multiple OA-ICOS analyzers made by Los Gatos Research.

Researchers expect that the combination of remote sensing and in-situ observations will provide a unique dataset to estimate the strength of methane emissions currently unknown. Aside from collecting important datasets to better estimate greenhouse gas emissions, data from the COMEX campaign will also demonstrate synergies between ESA's CarbonSat and next generation greenhouse gas sensors.

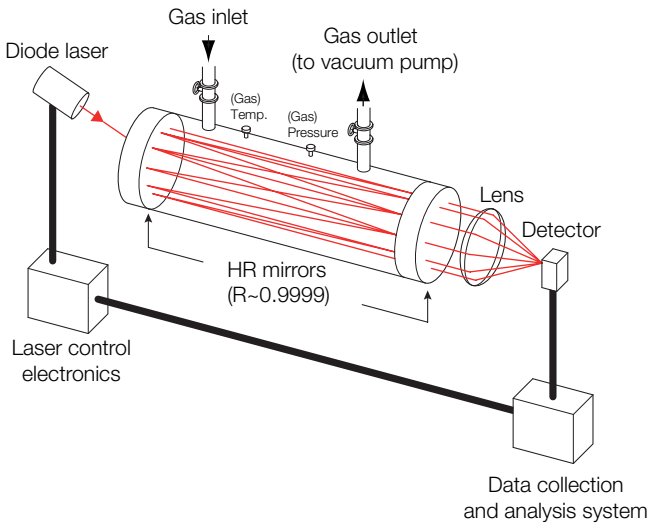

Figure. 2 Schematic diagram of LGR's patented Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS) technique for measurements of methane emissions.

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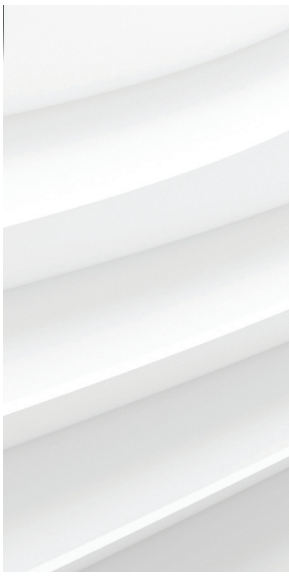

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