

First IAGOS-CORE and IAGOS-CARIBIC Greenhouse Gas Observations from Commercial Airliners

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Within the framework of IAGOS-ERI (In-service Aircraft for a Global Observing System - European Research Infrastructure), a cavity ring-down spectroscopy (CRDS)-based measurement system for the autonomous measurement of the greenhouse gases (GHGs) CO₂ and CH₄, as well as CO and water vapor was deployed on a Lufthansa Airbus A330 for the first time starting September 2018 with the aim to provide regular en-route measurements. A similar system has also been deployed in the IAGOS-CARIBIC (Civil Aircraft for the Regular Investigation of the atmosphere Based on an Instrument Container) onboard a Lufthansa Airbus A340 starting in 2018.

The IAGOS-CORE rack integrated in the avionics bay of several Airbus A330 and A340 contains all necessary provisions for installing fully-automated instruments for the measurement of ozone, and carbon monoxide (Package 1), humidity (ICH) and cloud particles (BCP). Package2d (P2d) for greenhouse gas measurements is one of four additional Package 2 options, of which only one can be installed at a time in a given aircraft, provided that Package 1 is installed which is necessary for data transmission. The P2d system uses components of a commercially-available CRDS instrument (G2401-m, Picarro Inc.). To enable robust and autonomous operation of the IAGOS-CORE GHG package over six-month deployment periods, numerous technical issues had to be addressed. This includes an inlet system providing ram-pressure to allow for operation to ceiling altitude without a sample compression pump, and the use of a two-standard, in-flight calibration system to allow for trace gas measurements to be fully traceable to WMO calibration scales.

The first deployments on a Lufthansa A330 showed minor problems related to accurate temperature control, a prerequisite for accurate measurements. These initial problems were addressed by modifications of the power management in order to improve temperature control and were included in a minor change of the supplemental type certification (STC) of Package 2 for Airbus A330 and A340 aircraft.

First IAGOS GHG data will be presented, and the availability of GHG data to the research community will be discussed. Future deployments on aircraft from further airlines providing regular, long-term GHG observations covering major parts of the globe will also be explained.

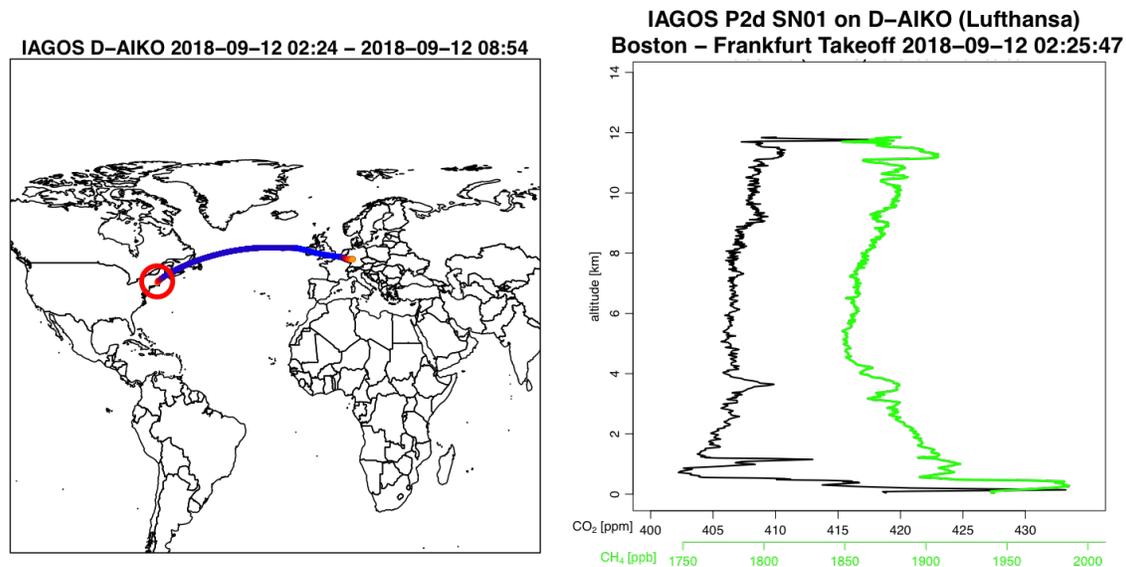


Figure 1. First data provided by P2d-SN01 during the ascent out of Boston Logan airport on September 12, 2018. A clear enhancement of the greenhouse gases CO₂ and CH₄ can be seen near the surface, also around 11.5 km altitude.