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Using a Remotely Piloted Vehicle to Investigate the Southern Tropical Methane Anomaly

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A major deployment of a substantial Remotely Piloted Vehicle (RPV) is planned for 2014 to aid investigation of anomalous methane sources in the tropics.

Tropical methane sources account for nearly two-fifths of the global budget (∼200Tg/yr), and are the main contributor to annual variability in the atmospheric methane growth rate (Bousquet 2006). In 2010, arguably the largest single excursion in the global methane record, since detailed NOAA records began in 1983, occurred in the tropics. This Southern Tropical Methane growth anomaly continued through 2012. Yet in contrast to Arctic sources, it has had little attention. Such anomalies are one of the most direct "fingerprints" of short-term biogeochemical feedbacks onto climate and, as such, represent a key science target.

An integrated programme of observations, field campaigns and modeling studies will be undertaken in 2014 to investigate the anomaly and its wider Southern Tropical setting. As part of this effort Bristol's Rotomotion SR 200 RPV helicopter, equipped with a gas grab-sampling system developed at the University of Birmingham, will be deployed on Ascension Island in the South Atlantic Ocean for two intensive field campaigns of 14 days each. To aid differentiation between wetland and biomass burning sources, gas samples will be analyzed for for CH_4 using the high-precision RHUL Cavity Ring Down Spectrometer already installed at Ascension Island, with selected samples sent for $\delta^{13}C_{CH4}$ analysis at Egham, UK.

The SR 200 RPV has a 121cc 9hp Gasoline 2-stroke Engine, a 3m diameter rotor, a dry weight of 25 kg, a maximum additional payload capacity of 22.7 kg, and a maximum flight duration of 5 hours (Rotomotion, 2011). It is capable of sampling at pressures above 700 hPa. Flights will be coordinated with the local RAF and the Administrator and are envisaged to include 10 days of measurements with 4 daily ascents.

The grab-sampler payload will primarily consist of 6 Tedlar bags, a valve switching system, a DC pump, and sampling inlet. The inlet will project forwards and include a chemical drier. A low cost, lightweight ARM processor will control the sampling system, poll the autopilot for positional data, and record sampling parameters. The system is designed to either automatically sample predefined volumes of air at designated altitudes, or be manually operated via surface telemetry. A typical 2hr sortie would comprise ascent to above the trade wind inversion, with subsequent pauses for grab-sampling at several levels on the way down.

References

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