



RESEARCH NETWORK FOR INVESTIGATING THE AMAZONIAN CARBON BUDGET FROM SPACE

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The tropics are of key importance for the global carbon cycle and future climate mainly because tropical forests store large amounts of carbon and thus this carbon can potentially be released rapidly. Tropical ecosystems are also particularly precious ecosystems from a biodiversity perspective. The tropics are currently not only witnessing a changing climate, but are also subject to rapid external environmental change due to fast population growth and economic development causing extensive deforestation and urbanization. However we still do not even know with certainty whether the tropics are a net carbon source or sink.

Integral constraints on the state of tropical land regions are provided by greenhouse gas (GHG) balances (CO_2 , CH_4 , N_2O) of the troposphere over these regions. However for large parts of the tropics, notably Africa and Southeast Asia, comprehensive greenhouse gas observations are still lacking. For the Amazon region such measurements are being regularly measured by IPEN, lead by L. V. Gatti with aircraft at four locations since 2009 as part of the NERC AMAZONICA consortium project led by M. Gloor (University of Leeds) and by FAPESP grant led by H. R. Rocha (University of São Paulo) "Carbon tracker and water availability: Controls of land use and climate changes": A potential alternative to in-situ greenhouse gas observations are retrievals from satellite. Satellites are now observing these regions, however the accuracy of the retrievals remains highly uncertain and there is a pressing need to assess these properly.

The overarching objective of this project is to evaluate the feasibility of remotely sensing greenhouse gas concentrations for purpose of GHG flux monitoring



Figure 1. Map of existing and proposed aircraft sites. Currently routine aircraft observations are carried out at RBA, TAB, ALF and SAN. We will carry out flights at RBA until 8km height and at Salinópolis. Also show is the location of the existing ground-based column measurements at Paramaribo and the planned site at Manaus and the standard sampling pattern of GOSAT (red circles)

over Amazonia and eventually the tropics. This is to be achieved by joining space-based greenhouse gas observations efforts and community with the ongoing joint UK/Brazilian atmospheric GHG observation program (Surface/aircraft) by a team of leading experts from the UK and Brazil in all relevant areas such as satellite remote sensing, in-situ observations, transport and inverse modeling. If the feasibility of remote sensing of greenhouse gas concentrations is confirmed over the Amazon basin it can then be expanded to the rest of tropical land regions.

OBJECTIVES

Our specific objectives are:

1. Establish a network of Brazilian and UK researchers from relevant key areas (*in situ* observations, remote sensing and carbon cycle science) expanding on existing collaborations between UK and Brazilian institutions.
2. Adapt the necessary modeling and retrieval tools for combining *in situ* and remotely sensed greenhouse gas data based on the tools that have been developed for NERC NCEO and the AMAZONICA project.
3. Conduct a pilot study based on intensive on-ground and airborne measurements and GHG satellite observations (CO₂ and CH₄ columns from GOSAT and CO from MOPITT and IASI) to establish the consistency of remote sensing based greenhouse gas measurements over the Amazon with the *in-situ* measurements from the AMAZONICA project and new ground-based column observations and establish the accuracy of the remotely sensed data.
4. Develop a medium- to longer-term strategy based on the initial pilot study and consultation with the UK and Brazilian research community for greenhouse gas monitoring from space.
5. Evaluate possibilities to extend the approach pan-tropically.

RELATED PUBLICATIONS

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