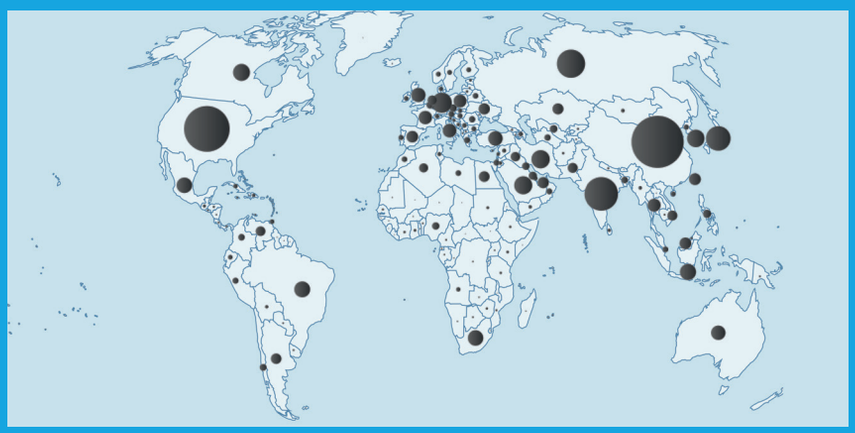
Greenhouse Gas Observation
& Climate-Smart Agriculture

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730995

TOWARDS LONG-TERM GREENHOUSE GAS OBSERVATION IN AFRICA

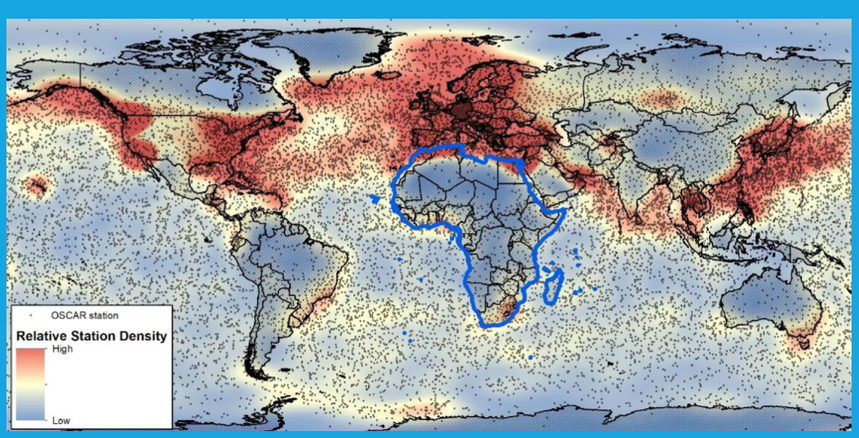
Africa is among the world's regions that are most vulnerable to the impacts of climate change (CC). The agricultural sector and consequently food security, are particularly threatened by the effects of CC. At the same time, the continent of Africa contributes least to global greenhouse gas (GHG) emissions. However, while the African GHG emissions are low compared to other continents, the emissions caused by land-use change are significant and steadily increasing. Furthermore, high population growth, economic development and rapid urbanization go hand in hand with increased GHG emissions.



CO_2-Territorial Emissions in 2016 (MtCo2), Global Carbon Project, Boden et al. (2017), UNFCCC (2017), BP (2017), USGS (2017)

At present, the role of the terrestrial biosphere on the sources and sinks of GHGs across Africa are not well understood or quantified, resulting in a high uncertainty regarding the African GHG budget. Reducing this uncertainty would not only enhance the ability of African countries to meet global reporting demands to the UNFCCC in line with the Paris Agreement, but also enable the development of appropriate CC mitigation and adaptation responses across Africa. In this regard, this information would enable the development of Climate-Smart Agriculture (CSA) practices which are crucial to enhance food security and livelihoods across Africa.

This objective, however, calls for the availability of systematic and accurate observations of the climate system. The African continent is not completely devoid of observational networks, but large parts of the available infrastructure have major limitations in terms of their ability to measure GHG dynamics in an appropriate manner. The SEACRIFOG project aims to address these gaps through the design of appropriate research infrastructures (RI).



Distribution of observation stations and networks on the globe (Lopez-Ballesteros et al., 2018)

MONITORING GREENHOUSE GASES TO ENHANCE CLIMATE-SMART AGRICULTURE PRACTICES

The goal of the SEACRIFOG project is to design an integrated network of RIs for the observation of GHGs, with the aim to develop and support appropriate mitigation and adaption responses, such as Climate-Smart Agriculture (CSA). SEACRIFOG aims to foster dialogues between inter-disciplinary parties across the political, scientific and societal domains, and to reinforce sustainable cooperation between African and European environmental RIs. The project tackles this challenge using three complementary approaches, combining a top-down, a bottom-up and a more practical, tailor-made approach.

Design for an integrated pan-African Research Infrastructure for GHG observations

Top-down	Bottom-up	Practical
Inventory & assessment of	**Selection of**	▸ Demonstration Case Cape Verde
▸ Drivers of climate forces	▸ SEACRIFOG essential variables	▸ SEACRIFOG Dialogue Platform
▸ Existing observational network	**Assessment of**	▸ Capacity building
▸ Available data Measurement protocols	▸ technical feasibility and costs	▸ Engagement of partners and funders
▸ CSA practices		

Stakeholder Interaction | Assessment of gaps and needs

Listening to the needs of the stakeholders

The European approach on GHG observation RIs cannot be simply transferred to Africa without the consideration of local conditions and needs. The design of an efficient GHG observation RI needs to be adapted and build on the existing capabilities, listening to stakeholders is key to gain information about them. The SEACRIFOG project organized stakeholder workshops in Kenya (May 2017), Ghana (June 2017) and Zambia (April 2018) which gave a valuable insight into the expectations of stakeholders towards the activities and outputs of the project.

Stakeholder event in Lusaka, Zambia © Meshach Shikabeta

A recurring concern relates to the sustainability and longevity of environmental observations as well as the availability, interoperability and accessibility of the data and metadata generated. Another expectation of the stakeholders is the use of a comprehensive approach to the problem, considering not only scientific, technological and ecological aspects, but also socio-economic dynamics. Joint networking is a key element of the success and the long-term sustainability of a RI.

Building on the existing capabilities

Africa is not lacking RIs or observational data, and the SEACRIFOG project will utilise the infrastructure that is already established.
The SEACRIFOG team undertook a survey of existing relevant observational networks including a gap analysis of the requirements to implement a fit-for-purpose system. To design a fully functional RI that can be used to assess the role of Africa in the CC paradigm, a review has been undertaken that collates all the variables needed to not only measure anthropogenic climate forcing, but to be able to understand and project, in addition to the most appropriate technology and associated methodologies with which to measure it.

Outlining the future

The review of the key variables required to capture short-term variability and long-term change in climatic and GHG dynamics across the atmospheric, terrestrial and marine domains in Africa has been carried out in consultation with relevant experts. From this review, the SEACRIFOG team has identified a comprehensive set of variables, and identified the availability, quality and coverage of the required data. The team compiled this metadata into a web-based tool (see references). The results show that, whereas meteorological data are available for most parts of Africa, data on terrestrial GHG fluxes are missing for large areas.
The team has also compiled a database of open-access measurement protocols based on the inventory of variables, to develop a standardized set of cross-domain measurement methodologies, aligned with international standards.
Currently the team is developing a digital framework for management of metadata and data focused on the identified variables. Such a framework will aim to increase guidance for participating networks and institutions, to define the standards for metadata and data sharing, as well as identify and integrate reference implementations.

Ensuring the implementation

Where possible, the digital framework produced by SEACRIFOG should make maximal use of existing resources, both from consortium members such as SASSCAL and SAEON, and from international resources such as the ILTER, DEIMS, GEOSS, etc.
The team is also establishing a SEACRIFOG Dialog Platform (SDP) involving high-level representatives of key organizations in Africa and in Europe. The SDP aims to bring together decision-makers, scientists, funders and NGOs to ensure that the results of the project will deliver what is needed to address Climate-Smart Agriculture issues and that the designed GHG observation network will be implemented under the best possible conditions.

GHG-Measurement equipment for atmospheric measurements in Mindelo, Cape Verde © Elisa Grieco

Emissions from animal farming

Agriculture, especially animal farming, is estimated to be one of the biggest emission sources in Africa. So far, emissions from the agricultural sector are reported applying IPCC Tier I methodologies. More accurate data on emissions from agricultural practices under the specific African conditions, which are needed to develop climate-smart strategies and to use Tier II reporting, are often missing. In Kenya, the SEACRIFOG team is investigating and improving methods to measure, verify and, in the long term, lower emissions in animal farming without limiting production. The first results show that depending on feed, season and region, the real emissions can significantly differ from Tier I estimates.

Capacity-building

RIs for GHG observations in Africa need to be run by local people. Currently, individuals who are educated to do so, are few. SEACRIFOG is planning workshops and training sessions for local students in data collection and preparation to address this. Moreover, the project is developing strategies to strengthen tailored capacity building, based on outcomes of a case study on Cape Verde and West Africa.

KEY MESSAGES

- The observation of GHGs in Africa is key to increase our knowledge on the status of the role of the African continent in global climate change.
- A GHG observational RI in Africa needs to be developed based on the existing infrastructure, but adapted to the continents specific situation and using methods to define the emissions associated with farming practice in Africa.
- Effective GHG-observations help to develop appropriate CSA methods.
- There is a need to increase the number of people in Africa who are appropriately trained to install and maintain the RI required to measure GHG dynamics and to analyze the data produced in order to better inform the development of climate mitigation strategies.
- Potential future changes in emissions sources across Africa need to be considered in the design of a GHG observation RI.
- Stakeholder consultation is key for the design of Africa's GHG observation RI, moreover political support is essential for its development and long-term operation.

GHG-Measurement Station in Karoo, South Africa © Thünen Institut

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References and suggested sources

Articles: Lopéz-Ballesteros, A., J. Beck, A. Bombelli, E. Grieco, E. K. Lorencova, L. Merbold, C. Brummer, et al. „Towards a Feasible and Representative Pan-African Research Infrastructure Network for Ghg Observations.". Environmental Research Letters 13, no. 8 (Aug 2018).

Web: Global Carbon Project, "CO_2-Territorial Emissions in 2016 (MtCo2)", Data form Boden et al. (2017), UNFCCC (2017), BP (2017), USGS (2017). Retrieved 15.11.2018, form http://www.globalcarbonatlas.org/en/CO2-emissions

Beck, J. (2018). „The SEACRIFOG Collaborative inventory tool." Retrieved 14.11.2018, from https://seacrifog-tool.sasscal.org/.

Reports by SEACRIFOG: Beck, J. , Lopéz-Ballesteros, A., Omar, A., Johannessen, T., Skjelvan, I., Helmschrot, J. and Saunders, M. „D4.1 Identification of Key Variables for Climate Change Observation across Africa." 2018.

Fiedler, B., Fomba, K. W., Martins, A. and Körtzinger, A. „D6.2 Report on Results of the International Workshop on Marine and Atmospheric Science in West Africa." 2018.

Lorencová, E.K., Acosta, M., Grieco, E., Bombelli, A., Vačkářů, D., Pavelka, M., Salmon, E., Helmschrot, J., Beck, J., Bamba Sylla, M. and Jorch, V. „Milestone 3: Questionnaires on Users' Needs Completed and Analyzed." 2018.

Rodrigues, E., Fiedler, B., Martins, A. and Körtzinger, A. „D6.1 Workshop Report Seacrifog Stakeholder Dialogue - World Café Event at Oscm - Feb. 7th 2018." 2018.

Scholes, J., Beck, J. „D3.1 Climate System-Related Observation Networks in Africa, and the Variables Needed for a Comprehensive System." 2018