



Greenhouse Gas Observation  
& Climate-Smart Agriculture

ICOS |  
INTEGRATED  
CARBON  
OBSERVATION  
SYSTEM

THÜNEN

# Designing a feasible and representative research infrastructure network for GHG observations in Africa (SEACRIFOG)



Dr. Emmanuel SALMON, ICOS  
GEO-XV – Kyoto 京都 – 29.10.2018

 @SEACRIFOG



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# SEACRIFOG: The partners

7 European countries

14 African countries

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# SEACRIFOG: The rationale

- EU & Africa
- Research Infrastructures
- Food Security
- GHG Emissions



THE AFRICA-EU PARTNERSHIP  
LE PARTENARIAT AFRIQUE-UE



## Also keep in mind

- Urbanization
- Biodiversity
- Partnership



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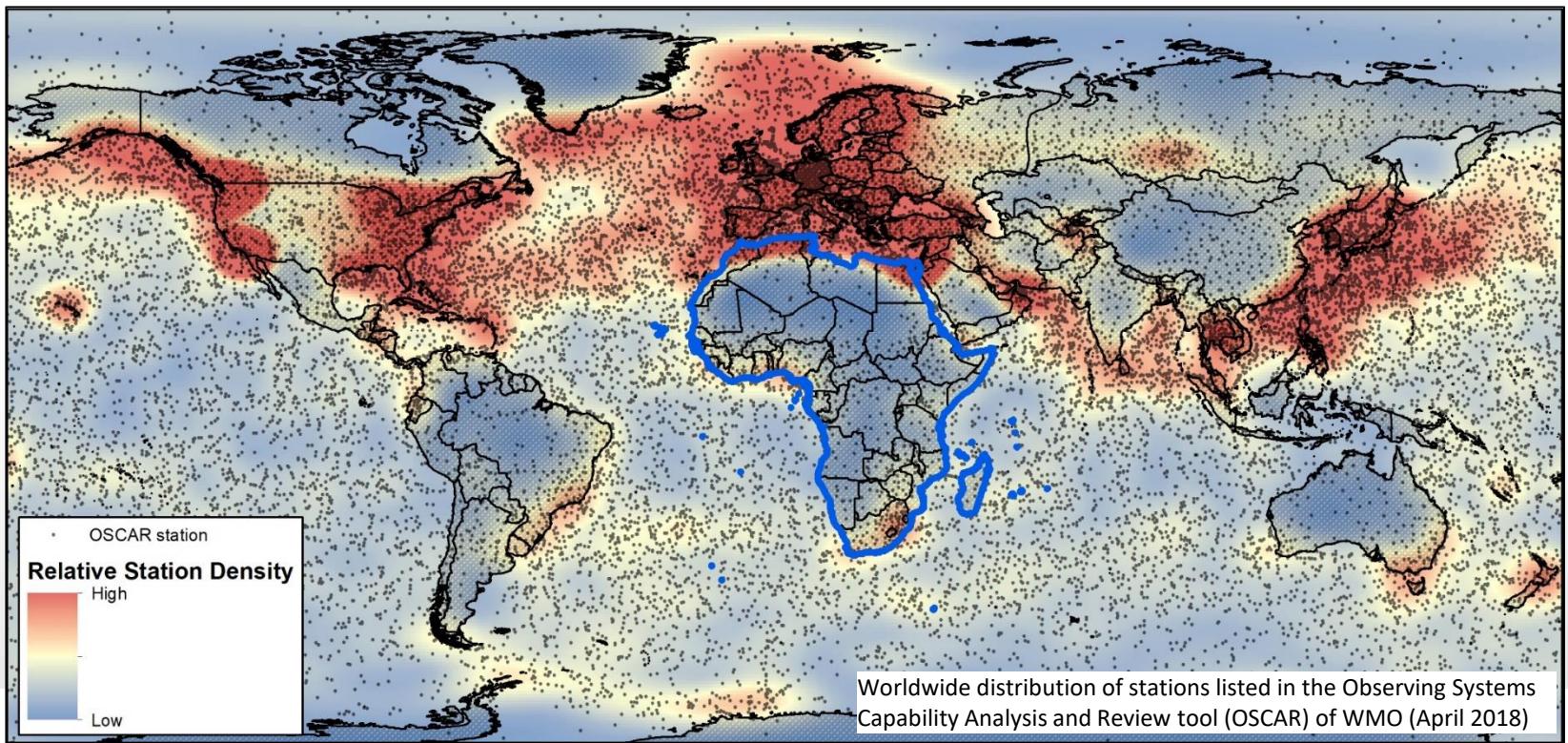
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# SEACRIFOG: The starting point

Global observation of climate-relevant variables

→ Major gaps in Africa → Large uncertainty of GHG fluxes and budget → Need for long-term, RI-type solution



# SEACRIFOG: The main questions

**What needs to / can be observed across the African continent to serve the purpose of food security?**

→ Ideal and mandatory set of observational variables

**What are the gaps & needs in terms of infrastructure?**

→ Inventory of existing and planned networks

**What are the gaps & needs in terms of data?**

→ Assessment of available data (spatial & temporal coverage, quality, sustainability...)

**What are the relevant methodological protocols?**

→ Interoperability and harmonization

→ Define minimum requirements

→ Adopt existing protocols where possible, modify where necessary

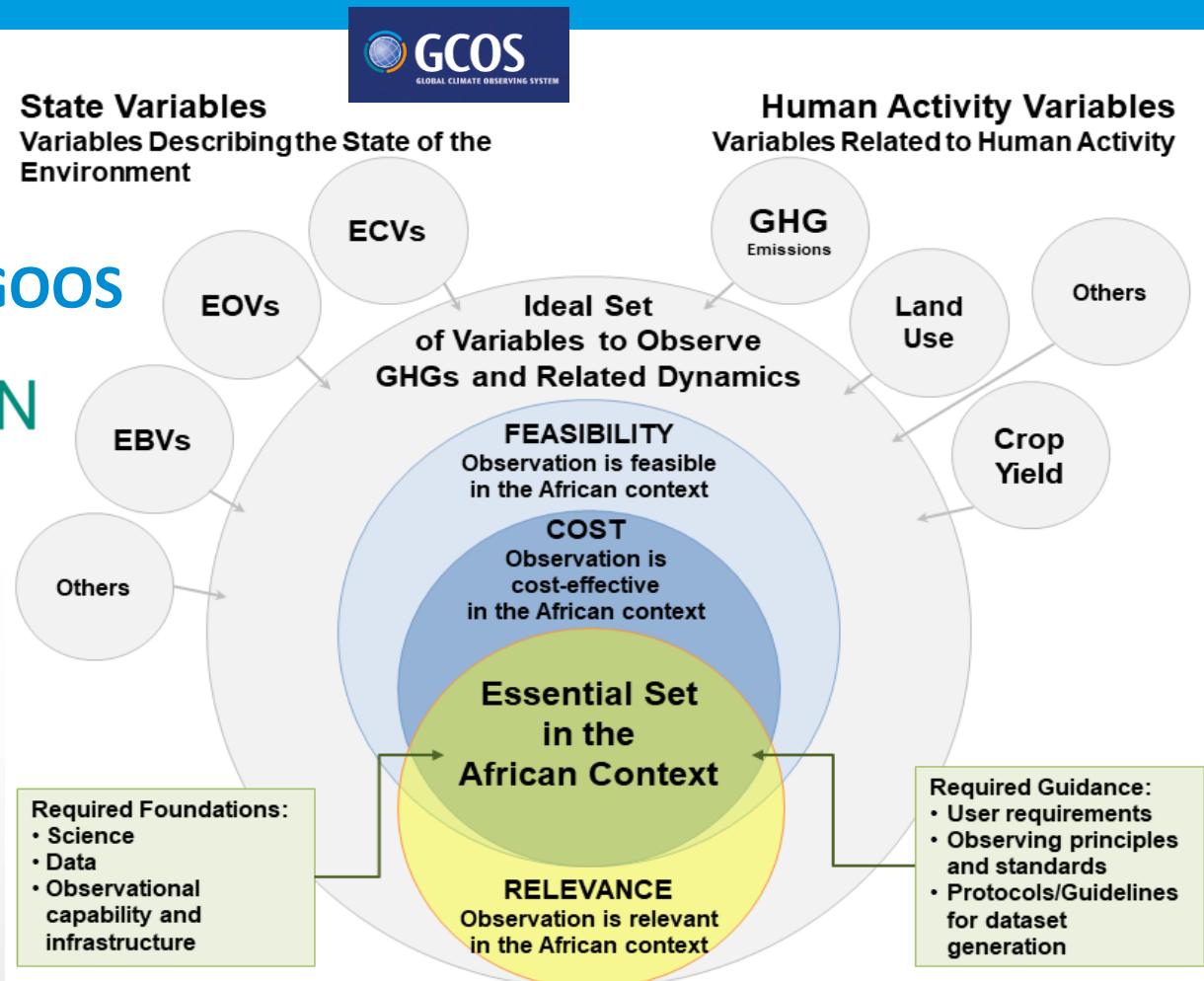
**Design of a continental observational network, tailored to African requirements and addressing food security issues**

→ **The SEACRIFOG Tool**



# SEACRIFOG: The Essential Variables 1/2

**Top-down approach:**  
Drivers of anthropogenic climate forcing



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# SEACRIFOG: The Essential Variables 2/2

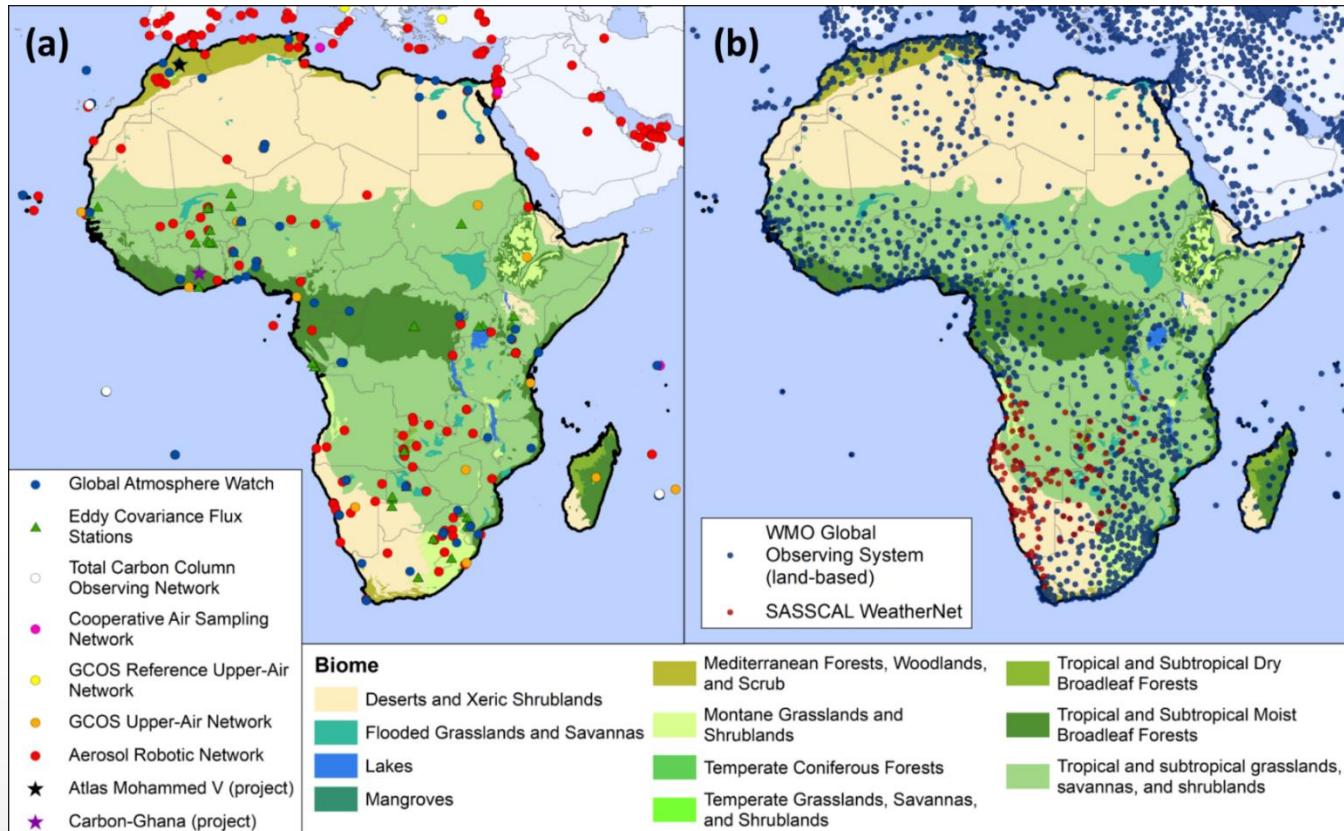
→ 58

Essential Biodiversity Variables	Essential Climate Variables	Reported Anthropogenic GHG emissions	Anthropic Factors
	<ul style="list-style-type: none"> <li>• Land Cover (81)</li> <li>• Ecosystem Function - Net Primary Production (48)</li> <li>• Ecosystem Structure (45)</li> </ul>	<ul style="list-style-type: none"> <li>• Above-ground biomass (82) incl. litter (36)</li> <li>• Albedo (66)</li> <li>• Fire (79)</li> <li>• FAPAR (67)</li> <li>• Glaciers (32)</li> <li>• Groundwater (56)</li> <li>• Ice sheets and ice shelves (41)</li> <li>• Inland water extent (69)</li> <li>• Land surface temperature (72)</li> <li>• Latent and sensible heat fluxes (45)</li> <li>• Leaf Area Index (74)</li> <li>• Permafrost (15)</li> <li>• River Discharge (55)</li> <li>• Snow (46)</li> <li>• Soil Organic Carbon (56)</li> <li>• Soil Moisture (65)</li> <li>• Precipitation (surface) (84)</li> <li>• Pressure (surface) (67)</li> <li>• Surface wind speed and direction (72)</li> <li>• Atmospheric temperature at surface (88)</li> <li>• Water vapor (surface) (71)</li> <li>• Earth radiation budget (upper air) (54)</li> <li>• Lightning (36)</li> <li>• Temperature (upper air) (44)</li> <li>• Water vapor (upper air) (49)</li> <li>• Wind speed and direction (upper air) (42)</li> <li>• Aerosols properties (50)</li> <li>• Carbon dioxide, methane and nitrous oxide tropospheric mixing ratio (63)</li> <li>• Cloud cover fraction (38)</li> <li>• Ozone (47)</li> <li>• Precursors (supporting the Aerosol and Ozone ECVs) (33)</li> </ul>	<ul style="list-style-type: none"> <li>• Land use/land use change (84)</li> <li>• Human population (93)</li> <li>• Economic development (81)</li> <li>• Livestock population (73)</li> <li>• Crop yield (78) by type</li> <li>• Agricultural management (58) <ul style="list-style-type: none"> <li>◦ Area of Ploughed Land</li> <li>◦ Manure Management</li> <li>◦ Fertilizer Application</li> <li>◦ Irrigation</li> </ul> </li> </ul>
Essential Ocean Variables	Ancillary/Other Variables		
<ul style="list-style-type: none"> <li>• Particulate Matter (38)</li> <li>• Dissolved Organic Carbon (39)</li> <li>• Fish Abundance and Distribution (53)</li> <li>• Zoo- (44) and Phytoplankton (48) Biomass and Diversity</li> <li>• Marine turtle, bird and mammal abundance (47)</li> <li>• Marine Habitat Properties (57)</li> </ul>	<ul style="list-style-type: none"> <li>• Ocean Surface Heat Flux (50)</li> <li>• Sea Level (84)</li> <li>• <b>Sea Surface Temperature (85)</b></li> <li>• Sea State (55)</li> <li>• <b>Sea Surface Salinity (66)</b></li> <li>• Sea Ice (49)</li> <li>• <b>Stable Carbon Isotopes (25)</b></li> <li>• Subsurface Currents (32)</li> <li>• Subsurface Salinity (52)</li> <li>• Subsurface Temperature (57)</li> <li>• Surface Stress (47)</li> <li>• <b>Inorganic Carbon (54)</b></li> <li>• Nitrous Oxide (45)</li> <li>• Nutrients (56)</li> <li>• Ocean Color (65)</li> <li>• Oxygen (68)</li> <li>• Transient Tracers (18)</li> </ul>	<ul style="list-style-type: none"> <li>• Net radiation (SW/LW) at surface (73)</li> <li>• Below-ground biomass (44)</li> <li>• Dimethyl Sulfide (Oceanic)</li> <li>• Atmospheric /Planetary Boundary Layer (21)</li> <li>• Biosphere-Atmosphere GHG flux <ul style="list-style-type: none"> <li>◦ CO<sub>2</sub> (55) – Net Ecosystem Exchange</li> <li>◦ N<sub>2</sub>O (48)</li> <li>◦ CH<sub>4</sub> (51)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Topography (84)</li> <li>• <b>Surface roughness (60)</b></li> <li>• Ground/soil heat flux (48)</li> <li>• <b>Soil type (75)</b></li> <li>• Soil quality/health (58)</li> <li>• Dissolved organic (30) and inorganic (26) carbon (terrestrial)</li> <li>• Atmospheric nitrogen deposition (39)</li> <li>• <b>Infiltration (45) and Runoff (54)</b></li> <li>• Evapotranspiration</li> <li>• Wild herbivores</li> </ul>

## Deliverable 4.1



# SEACRIFOG: The existing networks



Observational stations of selected networks and their relative density for (a) ground-based atmospheric and greenhouse gas, (b) ground-based meteorological observation on the African continent (from López Ballesteros et al., 2018).

## Deliverable 3.1



# SEACRIFOG: Stakeholder engagement

## 3 Regional Stakeholder Consultation Workshops:

72 participants, 33 organizations,  
16 countries

- Nairobi, Eastern Africa, 31.5.2017
- Sunyani, Western Africa, 16.6.2017
- Lusaka, Southern Africa, 18.4.2018



**Concern about data and metadata...**

availability, accessibility, usability, interoperability, resolution, format and quality

**... need for a comprehensive and collaborative approach:** considering not only scientific, technological and ecological issues, but also socio-economic dynamics  
**... to support the success and the long-term sustainability of a RI network.**



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# SEACRIFOG: Already available

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LETTER

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Towards a feasible and representative pan-African research infrastructure network for GHG observations

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<http://seacrifog-tool.sasscal.org>

- Report on users' needs (Elisa Grieco, elisa.grieco@cmcc.it)
- Literature analysis (Adéyèmi Chabi, chabi.a@wascal.org)
- Improved emission factors (Lutz Merbold, l.merbold@cgiar.org)
- Workshop Cabo Verde (Arne Kötzinger, akoertzinger@geomar.de)



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# SEACRIFOG: Under development / Next to come

- **Further improvement of SEACRIFOG tool**
  - assessment of data products (coverage & quality)
  - inventory / development of standardized protocols
  - diagnosis and planning tool for future RIs in Africa
- **Network design based on spatial optimization**
  - inverse modeling
- **SEACRIFOG Dialog Platform**
  - implementation, use, capacity-building...





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# ありがとうございます

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