Tropentag, September 11-13, 2024, hybrid conference

"Exploring opportunities …
for managing natural resources and a better life for all"

How earth observation closes the gap between *in situ* greenhouse gas measurements and regional earth system modelling in West Africa

Verena Huber Garcia[1], Frank Thonfeld[1], Jonas Meier[1], Kenneth Aidoo[2], Ferdinand Tornyie[2], Souleymane Sy[3], Jan Bliefernicht[3], Harald Kunstmann[3], Ursula Gessner[1]

[1] *German Aerospace Center (DLR), German Remote Sensing Data Center (DFD), Germany*
[2] *United Nations University, Institute for Natural Resources in Africa, Ghana*
[3] *University of Augsburg, Institute of Geography, Germany*

Abstract

West Africa has contributed little to global greenhouse gas (GHG) emissions. However, it is already severely affected by climate change through rising temperatures and shifting precipitation patterns. At the same time, it is experiencing one of the fastest population growth rates worldwide. As a consequence, land degradation is proceeding, the competition for land is rising whereas yields are expected to decline. Meanwhile, the intensification of land use is emitting more GHGs, again. The aim of the CONCERT project is therefore to identify opportunities for a win-win land use mosaic that a) ensures food security, b) reduces GHG emissions and land degradation, and c) mitigates climate change. To accomplish this, the existing meteorological and GHG observation network in West Africa has been extended and upgraded within the project focus region of northern Ghana. The *in situ* measurements are the basis for estimating and projecting GHG emission budgets at the country and regional scale using a fully coupled regional Earth System Model (ESM) tailored to West Africa. For closing the gap between point scale and large-scale modelling, precise information on vegetation parameters at various spatial scales and updated high-resolution land cover and vegetation maps are needed. While Earth Observation can provide valuable datasets on vegetation dynamics, freely available global products often lack the necessary spatial and temporal resolution over West Africa. Within the CONCERT project, we therefore focus on assessing and enhancing existing biophysical parameter time series, generating new time series at higher resolution, and updating land use and land cover maps. A particular emphasis is placed on evaluating leaf area index (LAI) time series and filling gaps caused by cloud cover during the rainy season. On the one hand, we provide a high-resolution Sentinel^{-2} based LAI product at a 20 m resolution. On the other hand, the Copernicus 300 m LAI product was enhanced and provided to the modelers. By aggregating the high-resolution LAI to the lower resolution, a statistically robust validation of the 300 m LAI is achieved. This enables assessing the scalability of the modelled GHG emissions to the whole study area

Keywords: Earth observation, greenhouse gases, LAI, time series, West Africa

Contact Address: Jonas Meier, German Aerospace Center (DLR), Earth Observation Center, Muenchener Strasse 20, 82234 Wessling, Germany, e-mail: jonas.meier@dlr.de