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Increasing the Confidence of African Carbon Cycle Assessments

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Scarcity of in situ measurements of greenhouse gas (GHG) fluxes hamper calibration and validation of assessments of carbon budgets in Africa. It limits essential studies of ecosystem function and ecosystem processes. The wide range reported net primary production (NPP) and gross primary production (GPP) for continental African is partly a function of the uncertainty originating from this data scarcity. GPP estimates, based on vegetation models and remote sensing based models, range from ∼17 to ∼40 Pg C yr^{-1} and NPP estimates roughly range from ∼7 to ∼20 Pg C yr^{-1} for continental Africa. According to the MOD17 product does Africa contribute about 23 % of the global GPP and about 25 % of the global NPP. These percentages have recently increased slightly.

Differences in modeled carbon use efficiency (i.e. the NPP/GPP ratio) further enhance the uncertainty caused by low spatial resolution driver data sets when deriving NPP from GPP. Current substantial uncertainty in vegetation productivity estimates for Africa (both magnitudes and carbon use efficiency) may be reduced by increased abundance and availability of in situ collected field data including meteorology, radiation, spectral properties, GHG fluxes as well as long term ecological field experiments.

Current measurements of GHGs fluxes in Africa are sparse and lacking impressive coordination. The European Fluxes Database Cluster includes ∼24 African sites with carbon flux data, most of them with a small amount of data in short time series. Large and diverse biomes such as the evergreen broad leafed forest are under-represented whereas savannas are slightly better represented. USA for example, with 171 flux site listed in FLUXNET has a flux site density of 17 sites per million km2, whereas Africa has density of 0.8 sites per million km2.

Increased and coordinated collection of data on fluxes of GHGs, ecosystem properties and processes, both through advanced micro meteorological measurements and through cost effective straightforward field experiments can contribute to reduce the uncertainty in quantification of the African carbon budget. Climatic adaptation of resource production systems such as agriculture, pastoralism, agroforestry and forestry, could also benefit from additional knowledge gained from local studies GHG fluxes, ecology, ecosystem services, plant physiology and management.

It seems reasonable that the COP21 funding enabling countries to adapt to the impacts of climate change also support measurements and data collection, hence providing a knowledge-based backing of adaptation to climate change in Africa.