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The effect of land restoration on cloud cover in West Africa

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Over the past years, many land restoration projects, including natural regeneration and tree planting, have been implemented in West Africa to combat land degradation. In addition, land restoration is often used to increase biodiversity or as a climate change mitigation measure through carbon sequestration. However, as land restoration can also affect the local climate more directly through biogeophysical processes, some projects propose a new use: implement land restoration to alter the water cycle, increase rainfall and water availability, and make regions less vulnerable to climate change.

In general, vegetation can increase cloud cover (and rainfall) through changes in evapotranspiration and moisture availability for cloud formation. At the same time, the albedo and surface roughness can affect the heat fluxes required for convection. Previous research has tried to unravel these general relations between vegetation and cloud cover. Yet, it is currently unknow to what extend land restoration projects, which usually have a limited spatial extend, can affect cloud cover in West Africa.

In this study, we use observational remote sensing data to study the relations between vegetation and cloud cover in the context of land restoration. The Meteosat Second Generation (MSG) satellite provides 20 years of data at a 15 minute temporal resolution. Yet, the spatial resolution of 3 km of the available MSG cloud cover products is relatively coarse to study convective clouds over small vegetated areas. Instead, we apply a statistical algorithm to calculate cloud cover from the MSG High Resolution Visible (HRV) band, in order to obtain cloud cover data on a 1 km resolution. Using this method, we can provide high resolution observational evidence of cloud cover-vegetation relationships across West Africa.

Preliminary results show that in Nigeria and Benin, cloud cover frequency is higher in areas with a high vegetation cover than in surrounding areas with a lower vegetation cover. With

this study, we provide insight into whether land restoration projects can be used to increase cloud cover and adapt to the negative consequences of global climate change.

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