Primary productivity in the Sahel region

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Scientific Background and Objectives

Title:

- A workflow for forecasting primary productivity and its determining climatic factors using remote sensing in the eastern Sahel region
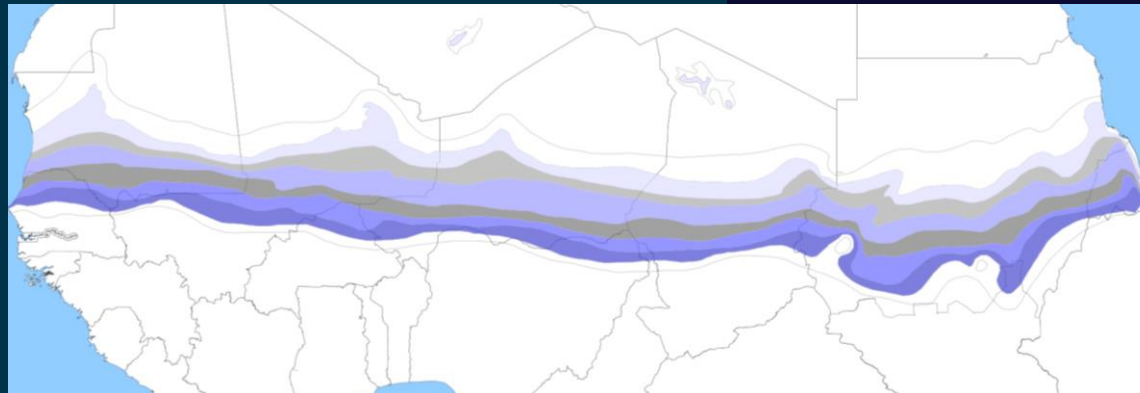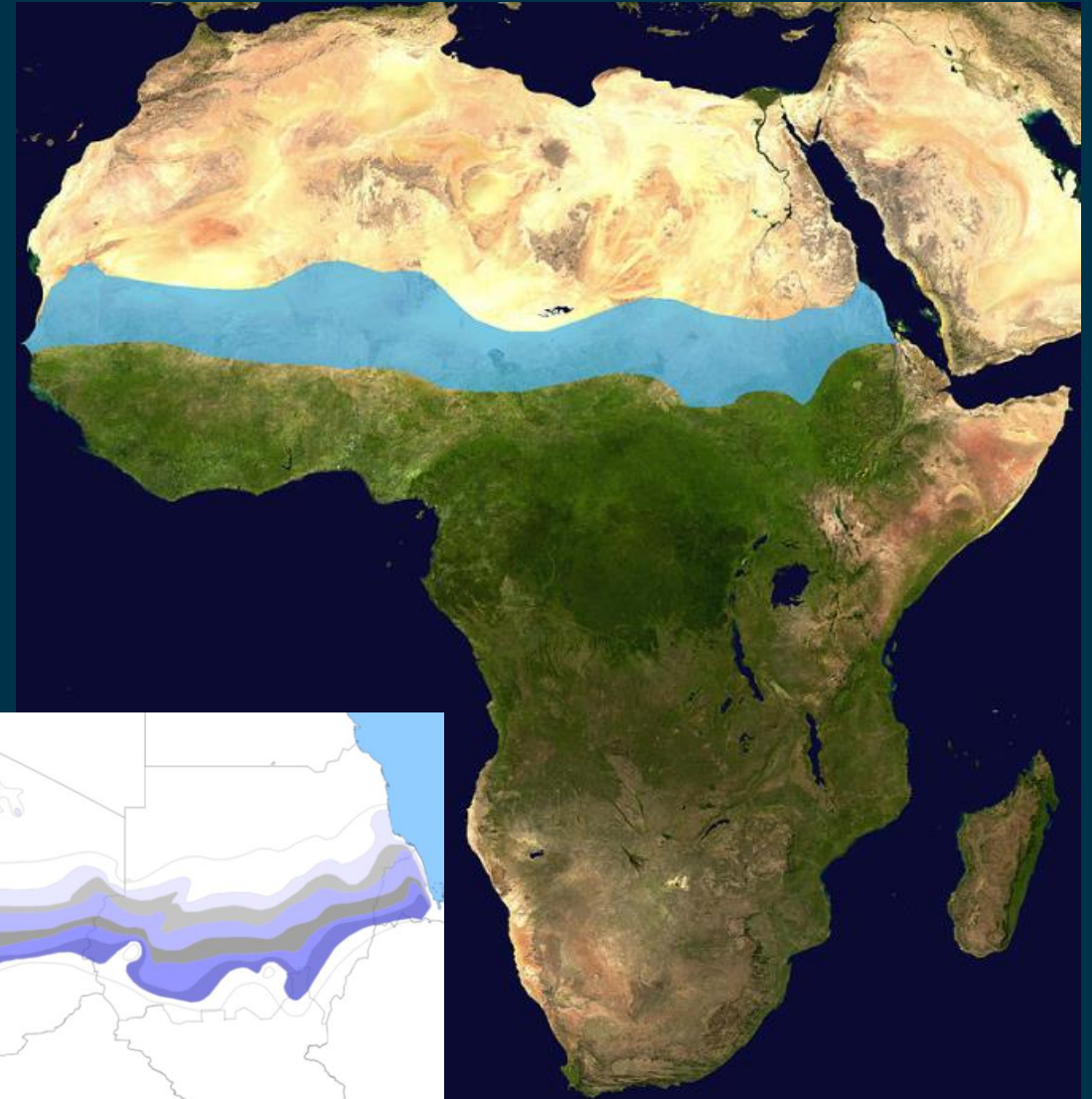
Background:

- This crucial sector of agriculture usually depends on the physical environment, and most importantly, the variability and distribution of rainfall. Therefore, primary productivity is vulnerable to climate-related hazards, and the crop yield is unreliable and hard to predict

Objectives:

- Understanding the spatiotemporal variation in primary productivity and its determining climatic factors can play a key role in promoting socio-political stability and protecting and restoring ecosystem services
- Such understanding should be exploited to forecast primary productivity and climatic factors to assist decision-makers, and subsistent farmers plan well in advance. Given the broad spatial coverage of the eastern Sahel, remote sensing and earth observation techniques have a great potential to forecast climate data and primary productivity in an objective and reliable manner.

Study Area

- The Sahel is a belt of arid and a semi-arid coast

- The region covers about 3.1 million km2 of land, with 407.4 million people.

- The annual rainfall pattern occurs between 100-600mm

- Temperatures range from 32° to 35° from April to July

- Despite the rainfall variability and persistent drought, rainfed agriculture and livestock are the primary sources of livelihood for 80–90 % of the population of the Sahel region

Research Outline

Data	Sensor / data portal	Temporal range
Soil moisture	Multiple microwave sensors; (http://www.esa-soilmoisture-cci.org)	1978 – 2021
Land Surface Temperature	Sentinel-3 SLSTR; (https://sentinels.copernicus.eu/web/sentinel/missions/sentinel-3/data-products/slstr)	2016 – 2021
Primary productivity	Vegetation Indices derived from Sentinel-2; (https://sentinel.esa.int/web/sentinel/sentinel-data-access)	2015 – 2021
Precipitation	CHIRPS; (https://www.chc.ucsb.edu/data/chirps)	1981 – 2021

Data sources

- Since the robustness of forecasting often relies on the volume of archival data, data with a long-term record are preferred for the project

Analysis workflow
- Different open software will be explored, such as R, Python and Google Earth Engine

Expected outputs
- The project addresses the primary productivity challenges and the existing capability gaps that most African users can experience when working with EO data

- Government officials responsible for such activities as the environment, agriculture and animal husbandry will directly benefit from the outputs of this project

- The research project explores a modelling framework to analyse the Spatio-temporal variations of primary productivity using freely available EO data and cloud computing to provide near real-time data for the eastern Sahel region. The up-to-date data on the dynamics of productivity will promote sustainable agriculture, terrestrial and forest ecosystems and thereby achieving the SDGs with respect to ending hunger and reducing conflicts

Project Team

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