Satellite soil moisture for drought risk insurance

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Motivation

Can we improve drought monitoring and yield prediction using satellite data?

Challenge 1: Basis Risk

Drought insurance based on precipitation and temperature are subject to errors related to distance to the nearest weather station or pixel size of the dataset. This may lead to missing payouts.

Challenge 2: Used Indicators

Meteorological indicators: Satellite and station rainfall and temperature Excludes evaporation and runoff. Depends on station network density. Vegetation indicator: Satellite Normalized Difference Vegetation Index (NDVI) Affected by cloud cover Late indicator of stress

Solution: Use Soil Moisture

Direct indicator of soil water deficiencies and thus directly related to plant available water. Can be retrieved from satellite data.

Drought monitoring for Food Security

With drought monitoring we want to identify areas where crop growth is affected by drought: which product shows the best correspondence to vegetation indicator NDVI?

Take Home Message 1

Compared to rainfall spatial patterns of soil moisture correspond better to NDVI, providing reliable information on drought.

Early warning: Yield Deficiency Prediction

We want to predict future yield deficiencies as early and as accurate as possible (start of season) in order to take early action and provide reliable drought risk insurance.

Millet, Senegal

Take Home Message 2

Satellite soil moisture and NDVI improve predictions of end-of-season yield deficiencies compared to using rainfall and NDVI. Also for other crops in Senegal. And compare better to end-of-season FAO reported yield

Method: Detrended and standardized yield and EO datasets. Multiple linear regression using rainfall or soil moisture with NDVI from July (start of season) to predict yield.