



TU WIEN
DEPARTMENT OF GEODESY
AND GEOINFORMATION
RESEARCH GROUP
MICROWAVE REMOTE SENSING

Satellite soil moisture for yield prediction in water limited regions

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**Disaster Risk Financing
& Insurance Program**



Drought monitoring and vegetation impact

Monitoring and impact assessment often done with crop models and meteorological data



Rainfall

Driver of crop development
Excludes evaporation



Soil Moisture

Missing link...?



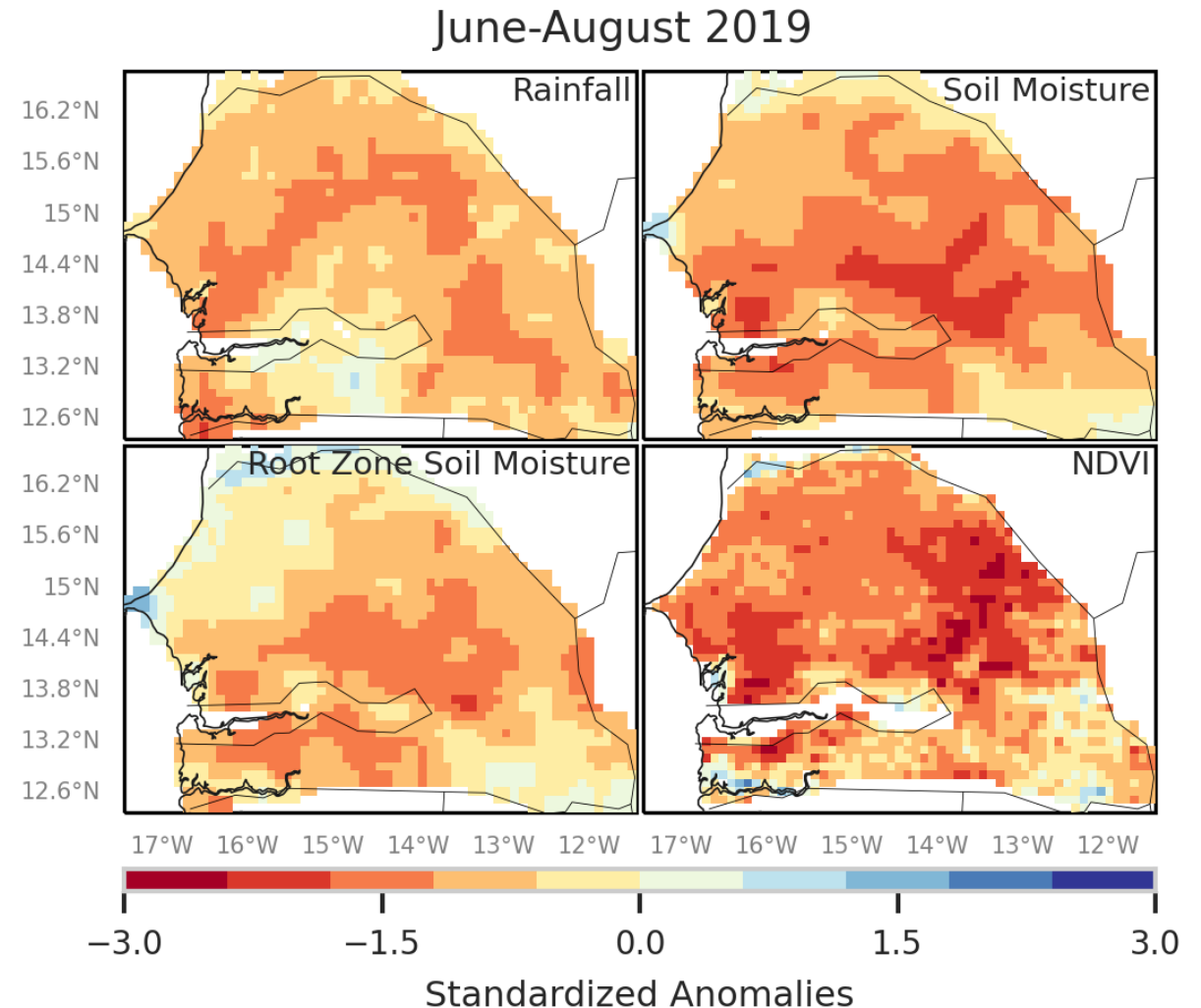
NDVI

Indicator of crop development
Late response

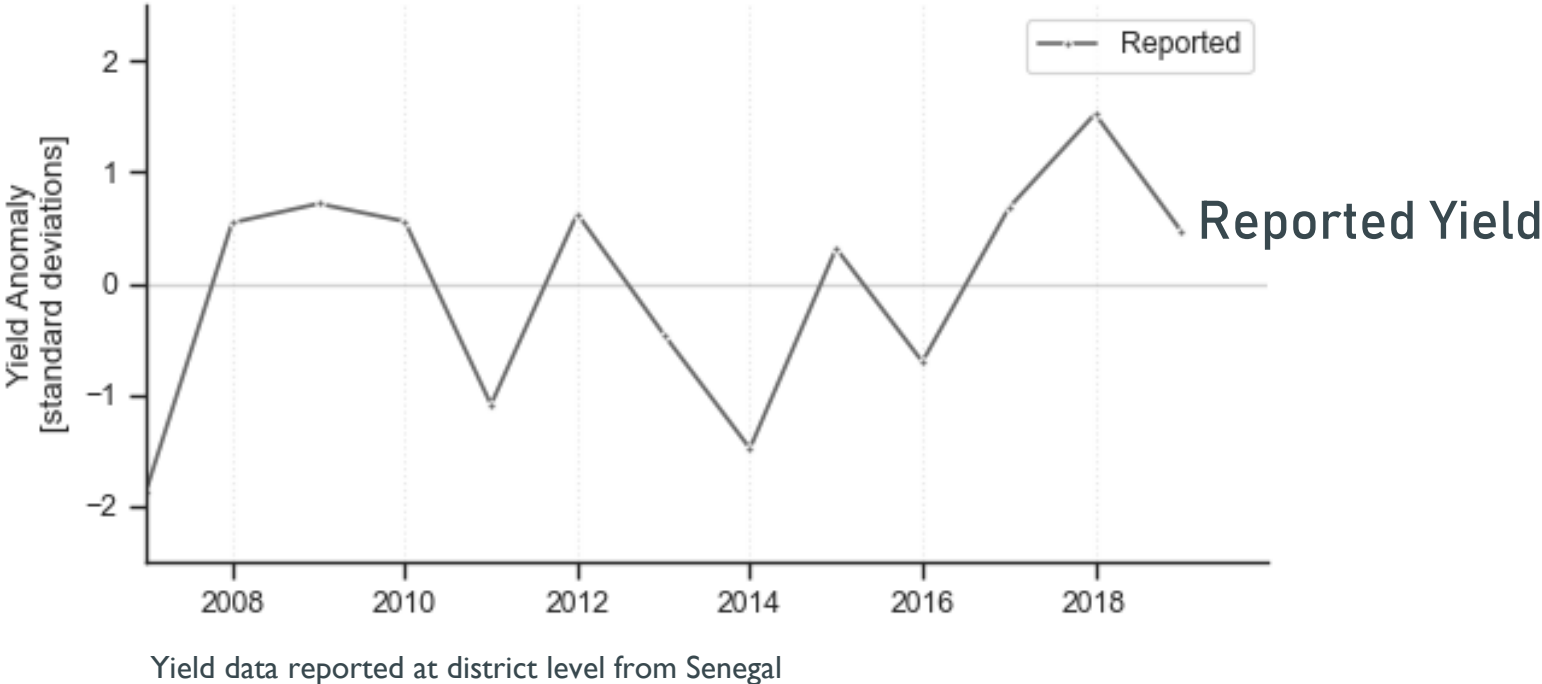
Datasets and pre-processing

Can we use satellite observations for drought assessment and early warning?

- Precipitation
 - Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) 0.05°
- **Soil Moisture**
 - HSAF Surface Soil Moisture 12.5km
 - ESA CCI Soil Moisture 0.25°
- **Root Zone Soil Moisture**
 - Copernicus Global Land Service 0.1°
- Copernicus Global Land Service NDVI
 - 1km



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Yield early warning

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Use early season satellite data to model spatial and temporal variability in yield anomalies



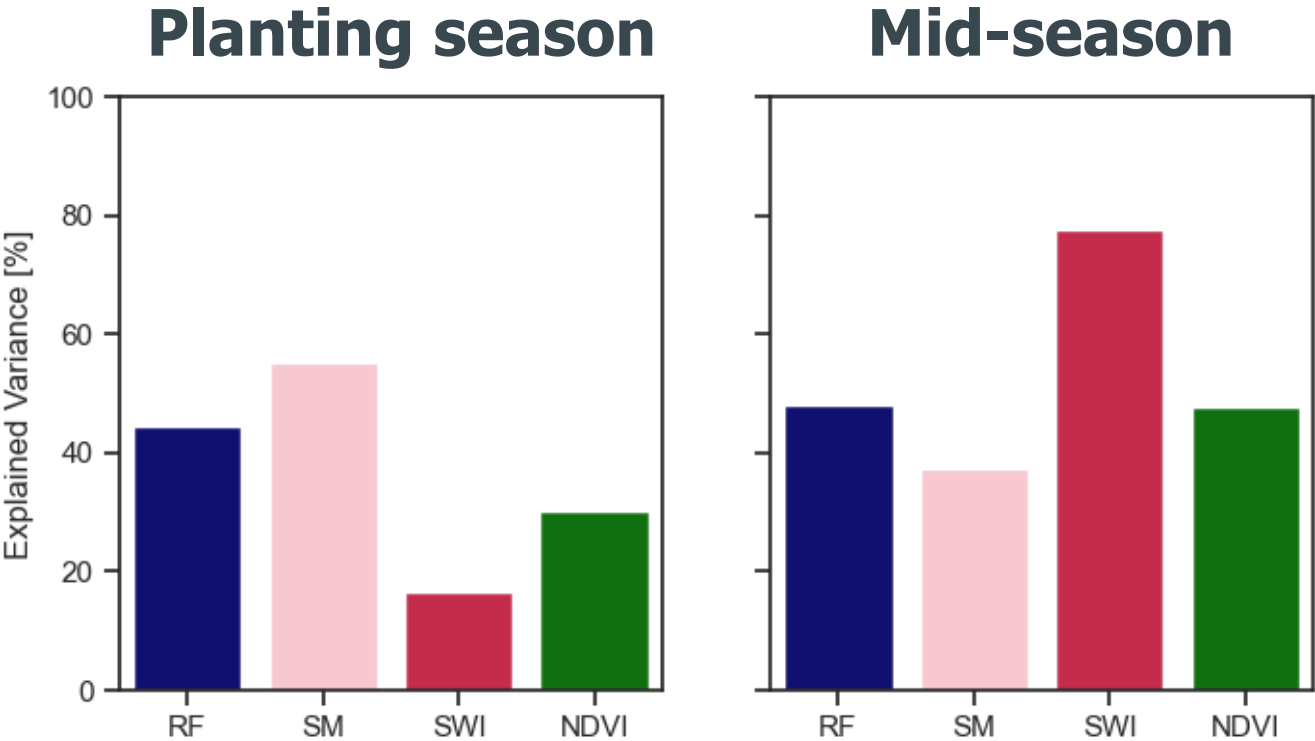
Source: FAS/GMA/IPAD

With two input scenarios:

1. Satellite based rainfall and NDVI
2. Satellite based rainfall, **soil moisture, root zone soil moisture and NDVI**

Sensitivity of observations to yield

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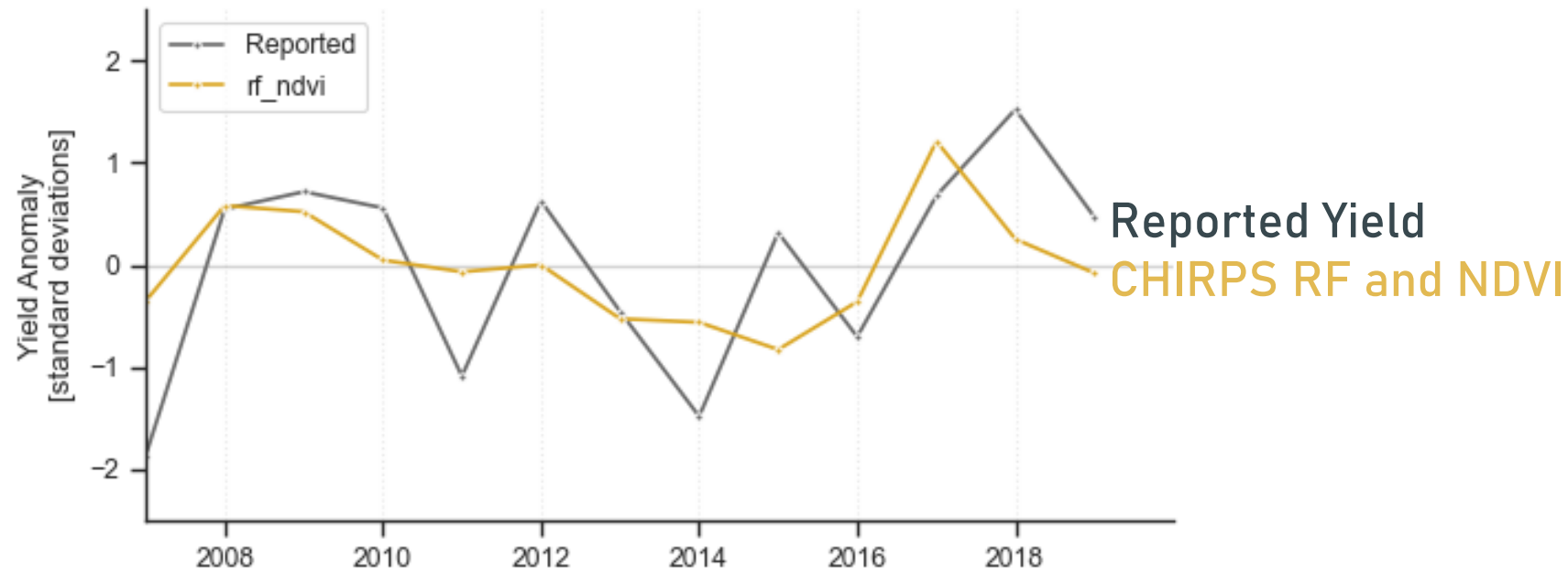
Explained variance in end of season yield for rainfall, soil moisture, root zone soil moisture and NDVI using EO data from the planting season (may-july) or mid-season (july-October).

Yield deficiency indicator

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Predicted yield anomaly from:

I. Planting season satellite based rainfall and NDVI

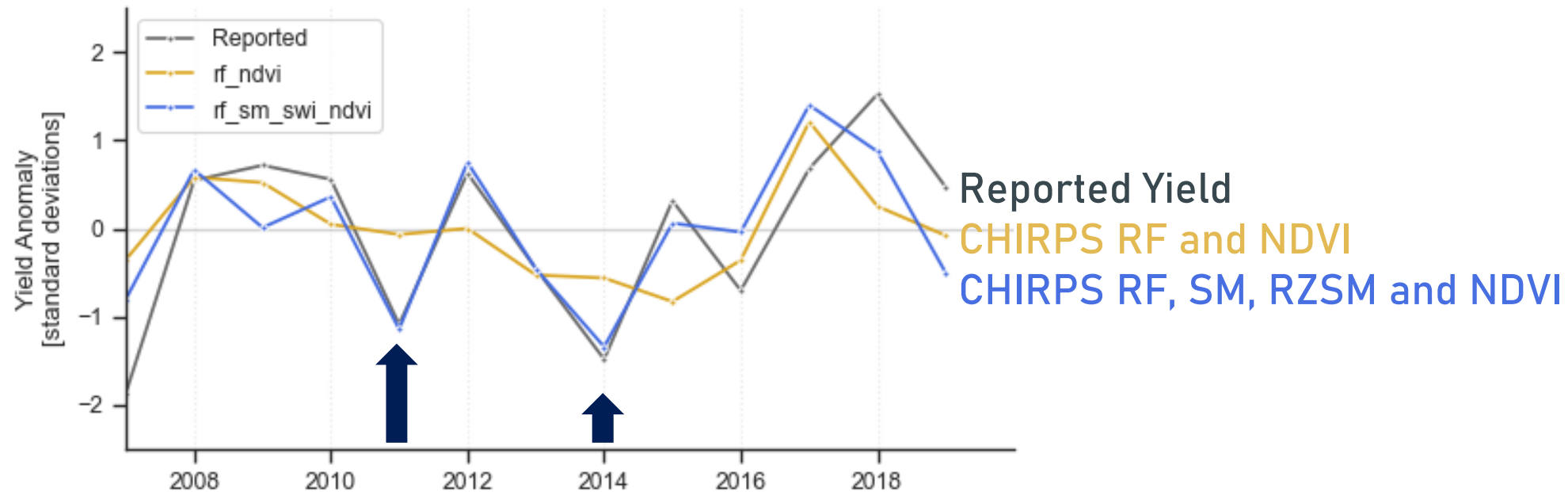


Yield deficiency indicator

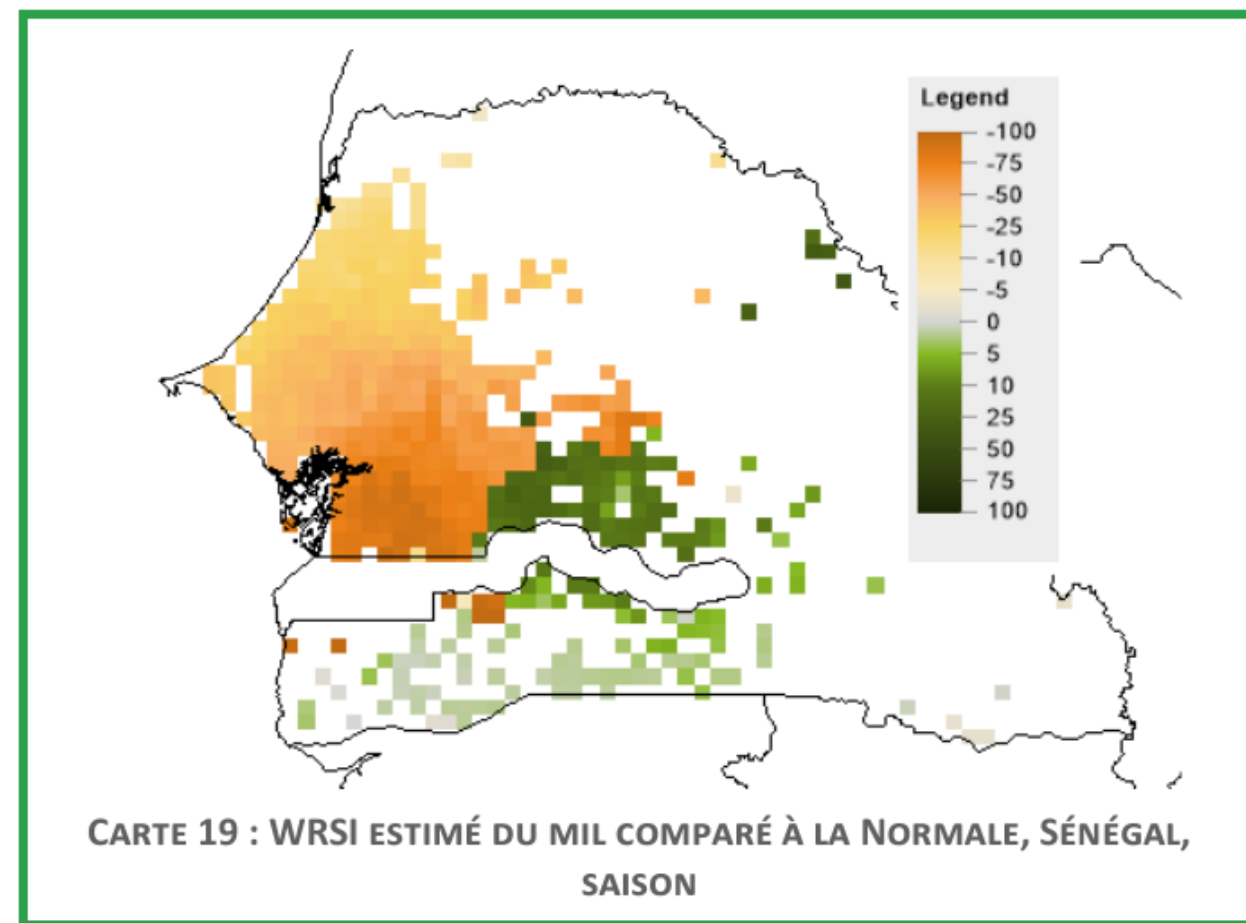
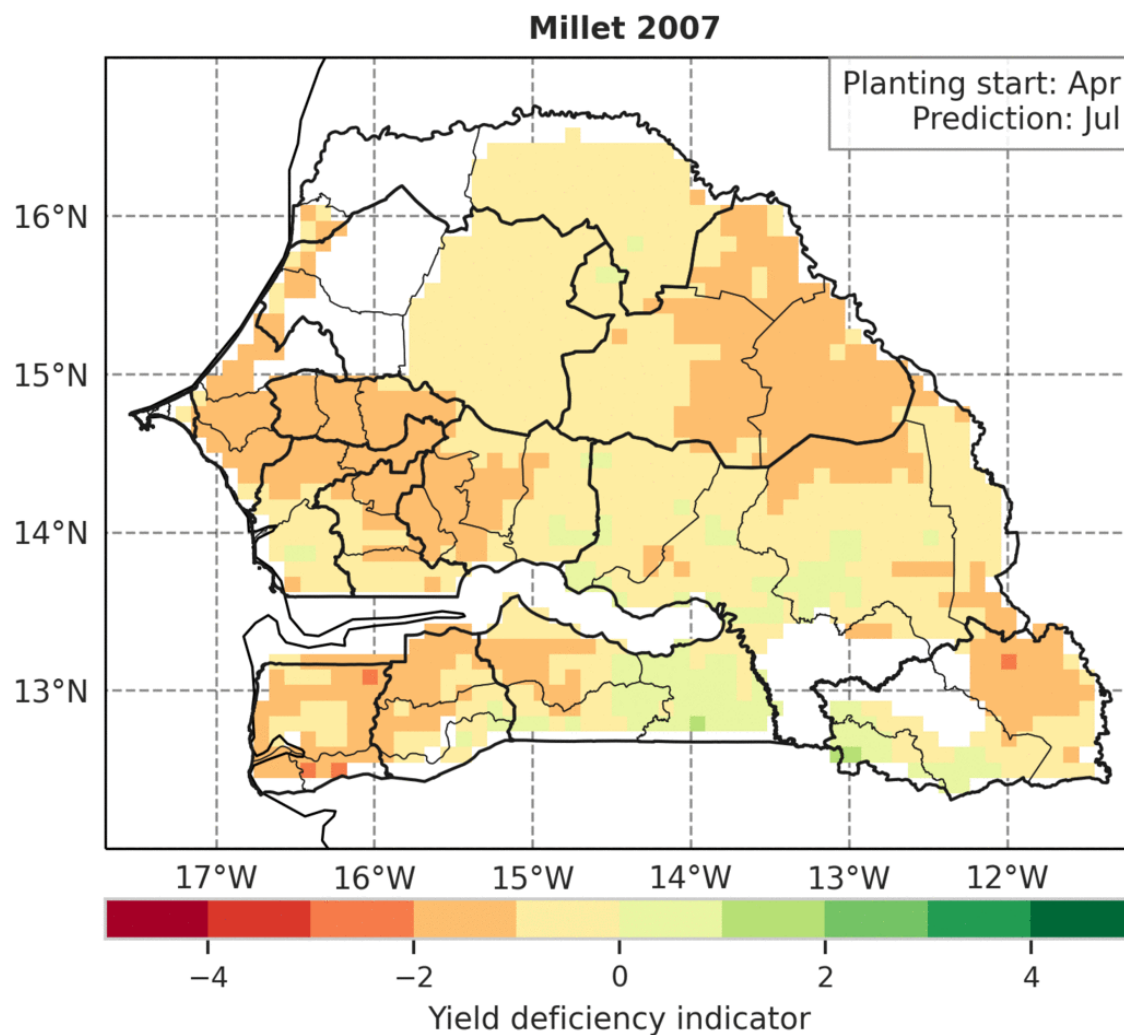
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Predicted yield anomaly from:

2. Planting season satellite based rainfall, **soil moisture**, **root zone soil moisture** and NDVI

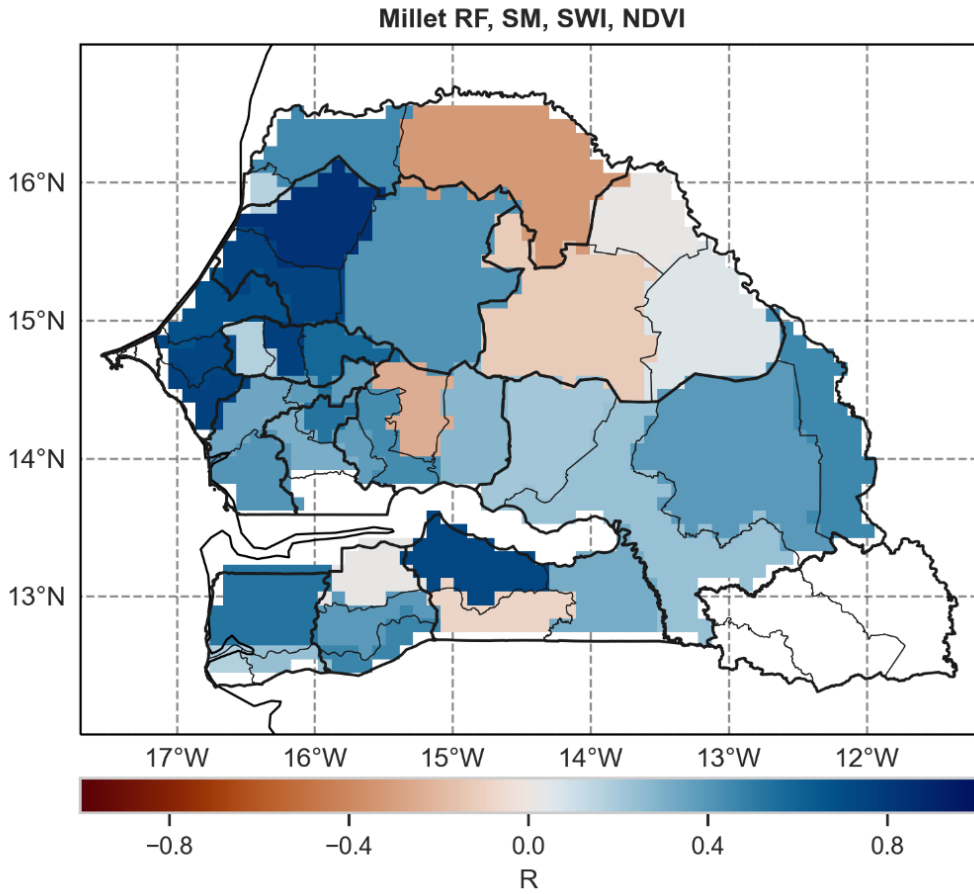
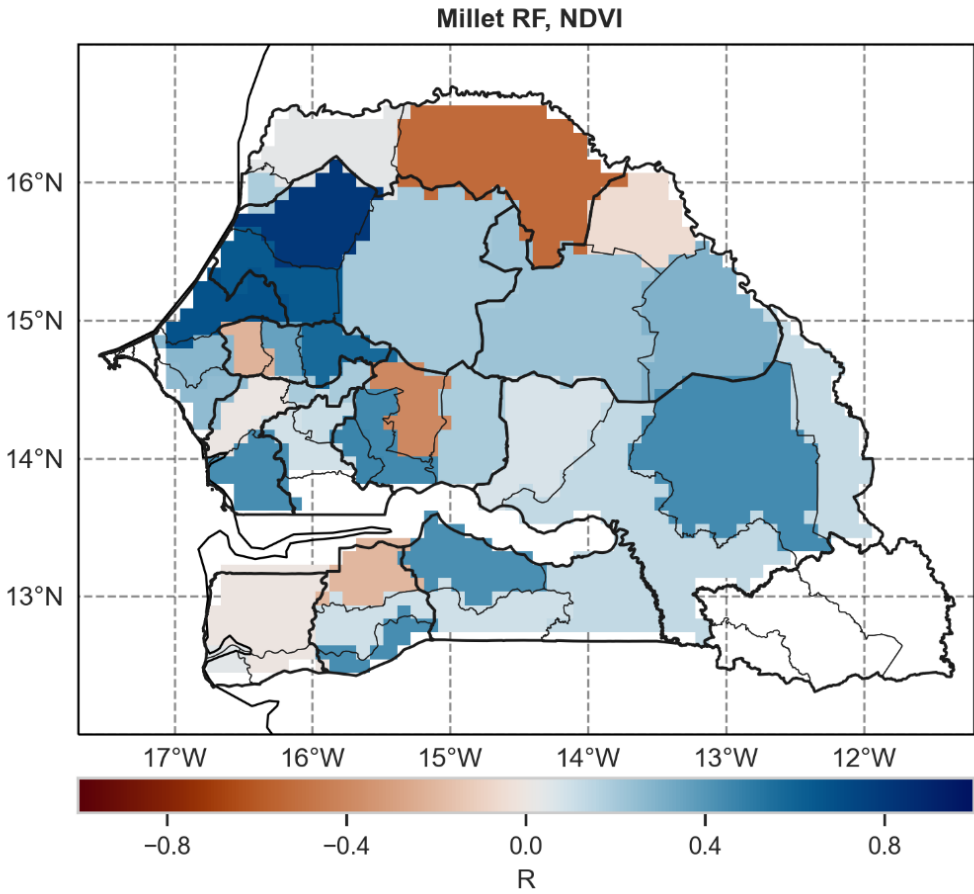


Spatial yield deficiency prediction made in July

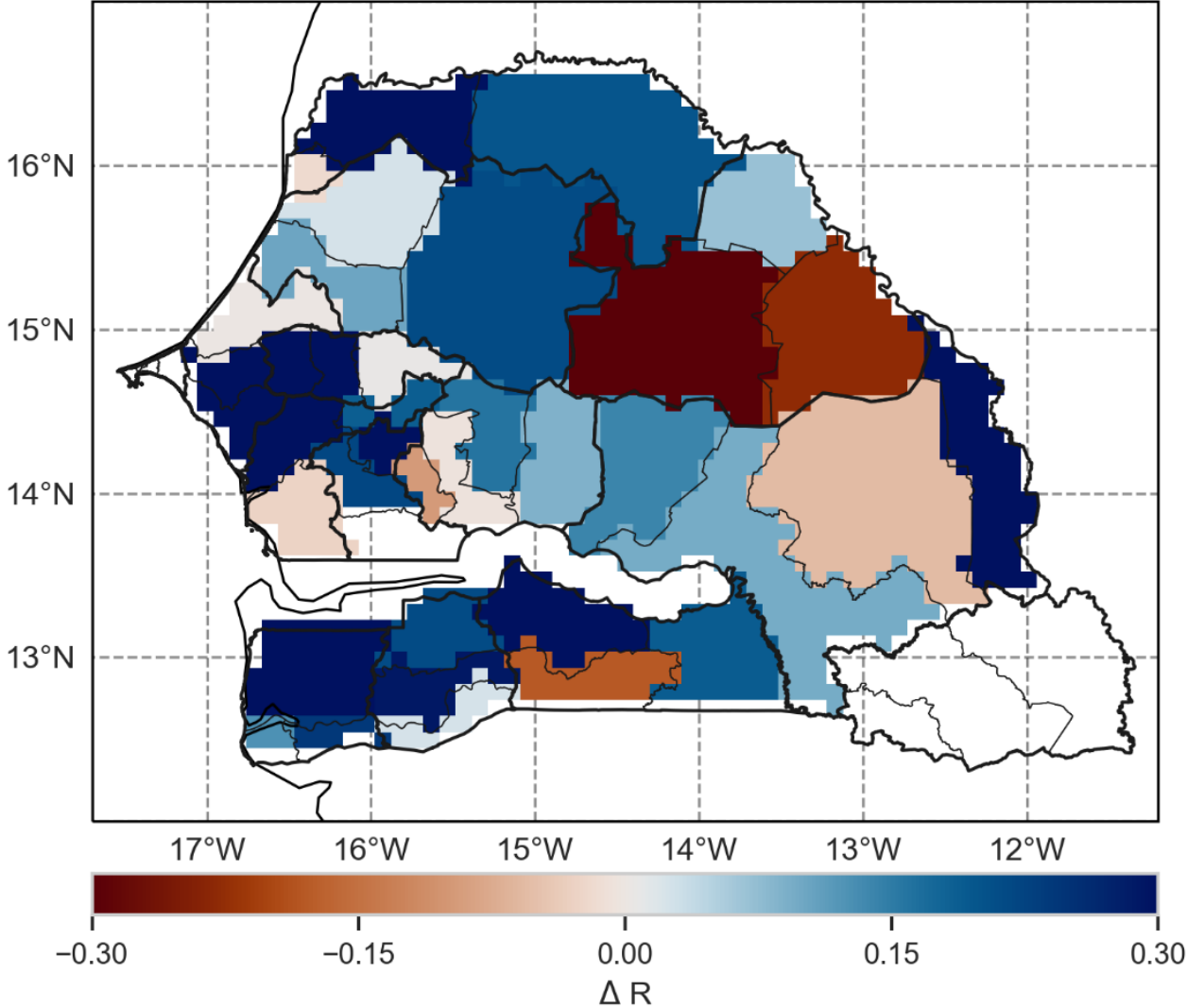


Water Requirement Satisfaction Indicator from African Risk View end of season report 2019

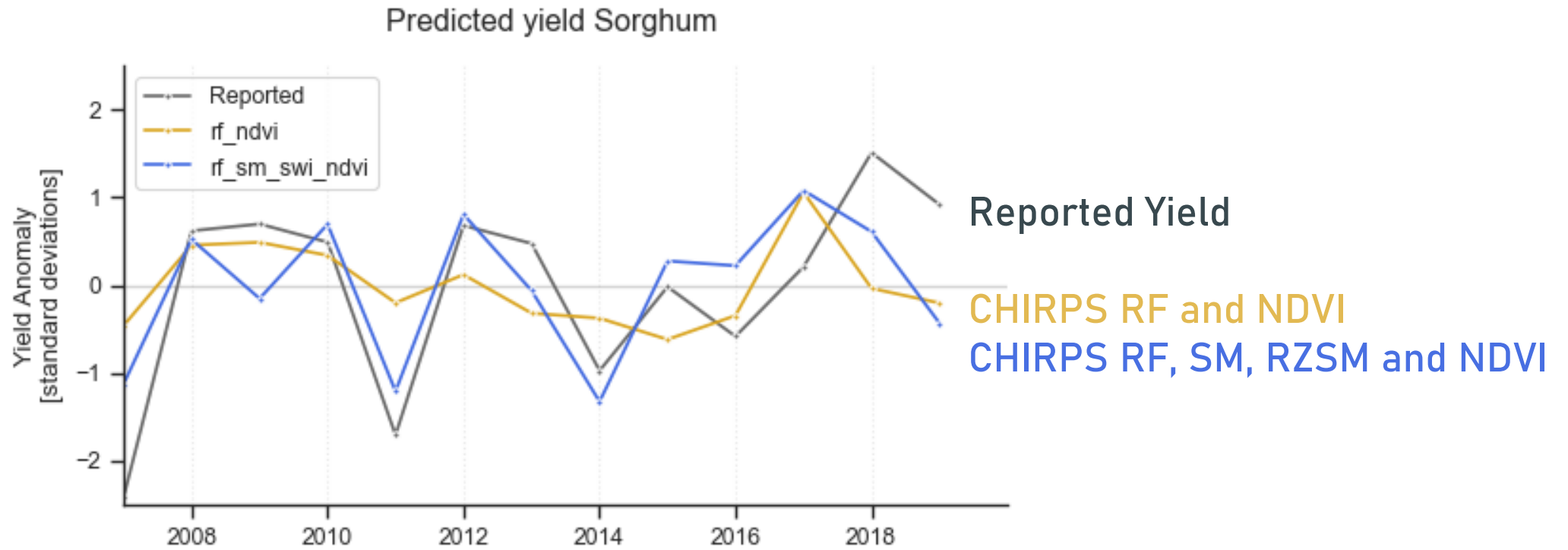
Coorespondence to province level yield



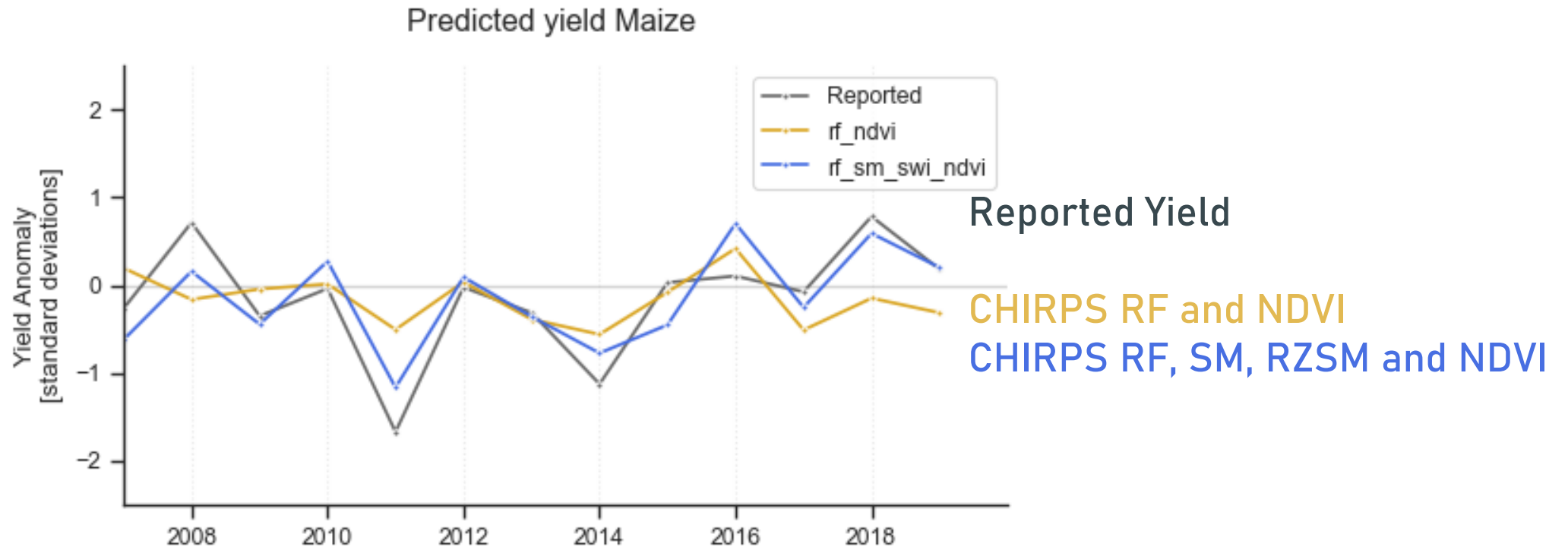
Improvement



Sorghum



Maize



Conclusions

- Reliable soil moisture during the growing season
 - Impact of sub-surface scattering during dry season
- Soil moisture is more capable of explaining yield variability early in the season
- Variations between districts