



Climate impacts Group



UNIVERSITY OF LEEDS

Addressing uncertainty in model input and evaluation data

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EUPORIAS



SPECS

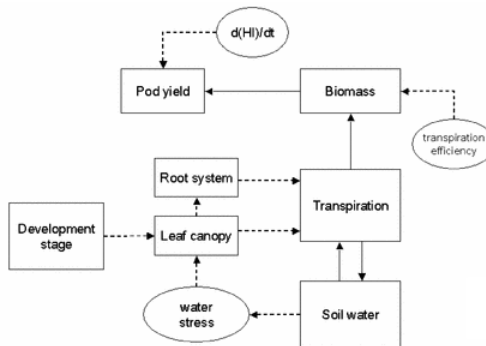
Introduction

- Weather data
- Observations
 - Seasonal forecasts
 - Climate projections

- Management practices
- **Planting and harvesting windows**
 - Fertilizer application
 - Level of irrigation

Soil data

- Crop model
- Equations
 - Parameter values



- Model output
- **Simulated yields**

- Observations
- **Observed yields**

Crop calendars - Introduction

- Widely used data sets such as Sacks et al (2010) tend to have just one planting and harvesting window per country.
- This is inadequate for regions where there is within-country variation in cropping seasons.
- Automated procedures may not give realistic results

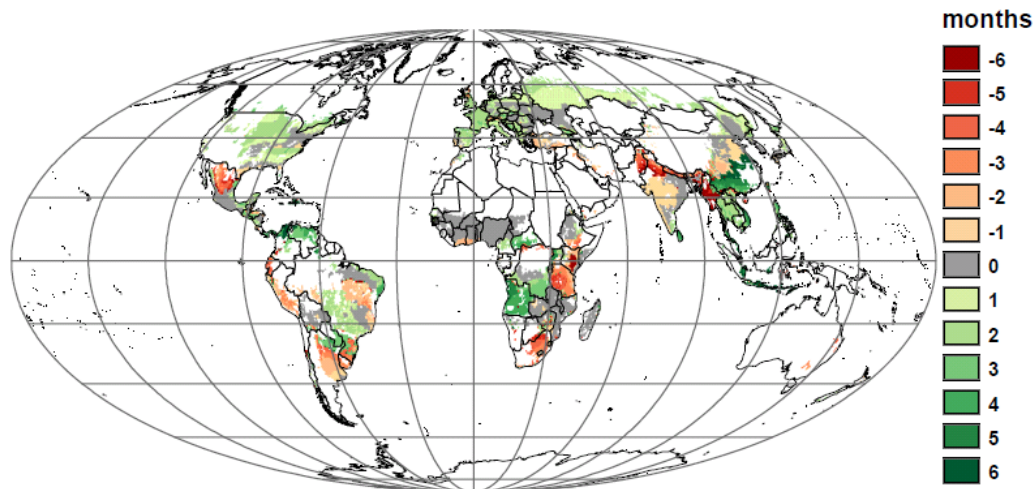


Figure: Difference between simulated and observed planting dates for maize (Waha et al 2012).

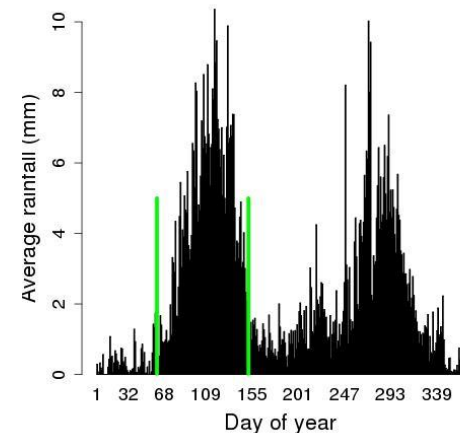
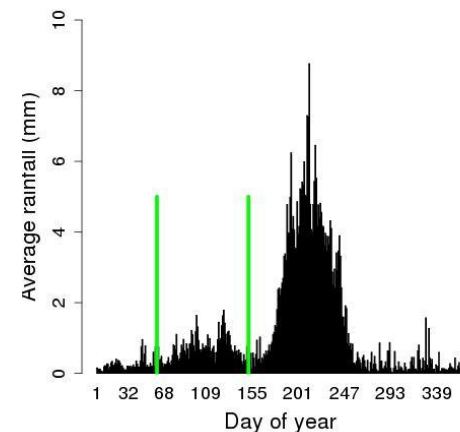
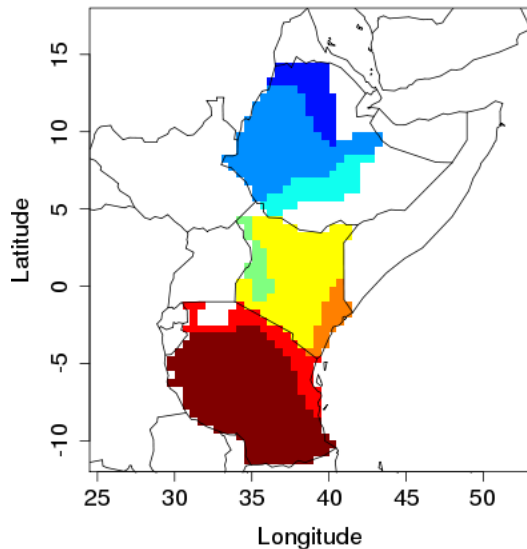


Figure: Seasonal cycle of rainfall for two example grid cells in Ethiopia. Green lines show Sacks planting window.

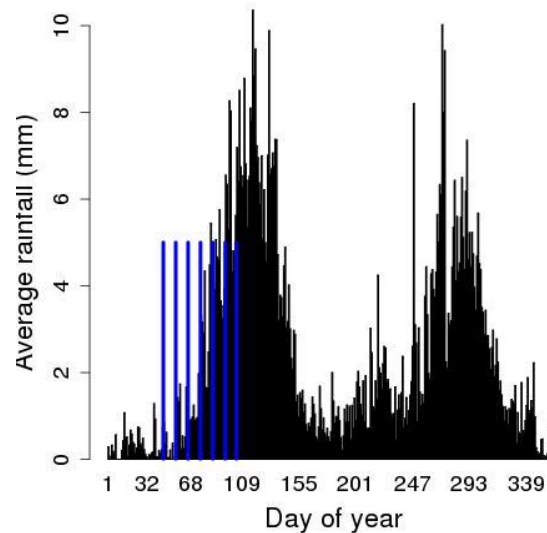
Crop calendars - Protocol

Protocol to define realistic planting windows, harvest windows (and therefore suitable varieties) for rain-fed cropping regions:

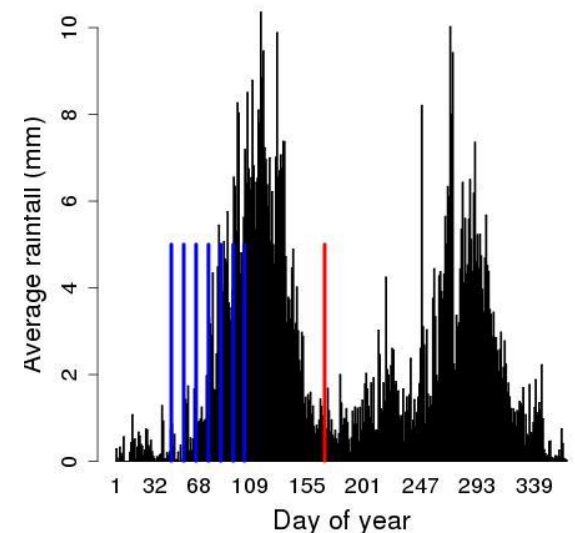
1. Study area -> regions



2. Planting windows



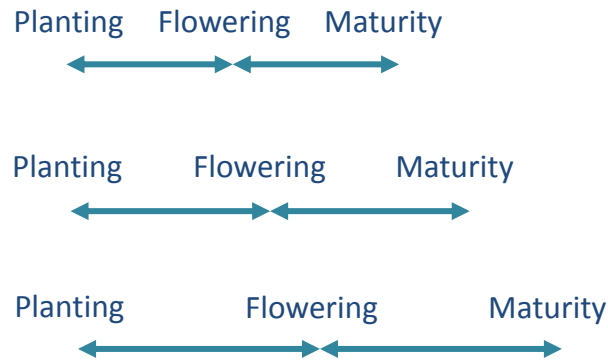
3. End of season ≈ harvest



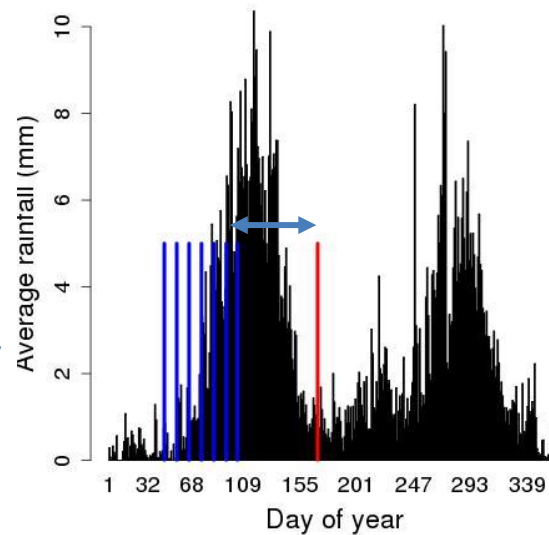
Crop calendars - Protocol

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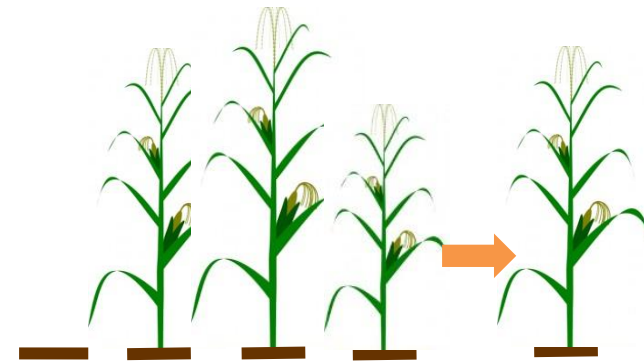
4. Define varieties



5. Select varieties



6. Simulate yields



Crop calendars - Evaluation

Maize yields were simulated at the Melkassa research station in Ethiopia using the GLAM crop model with:

- Sacks information
- The new protocol

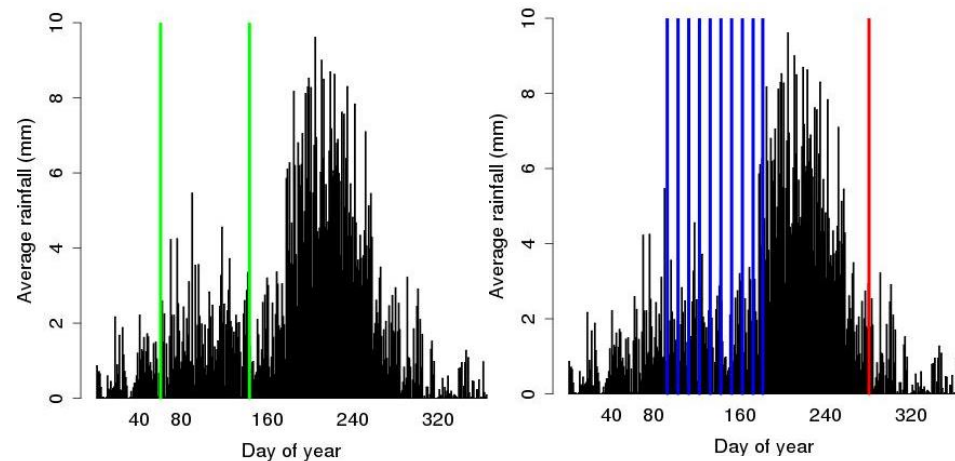
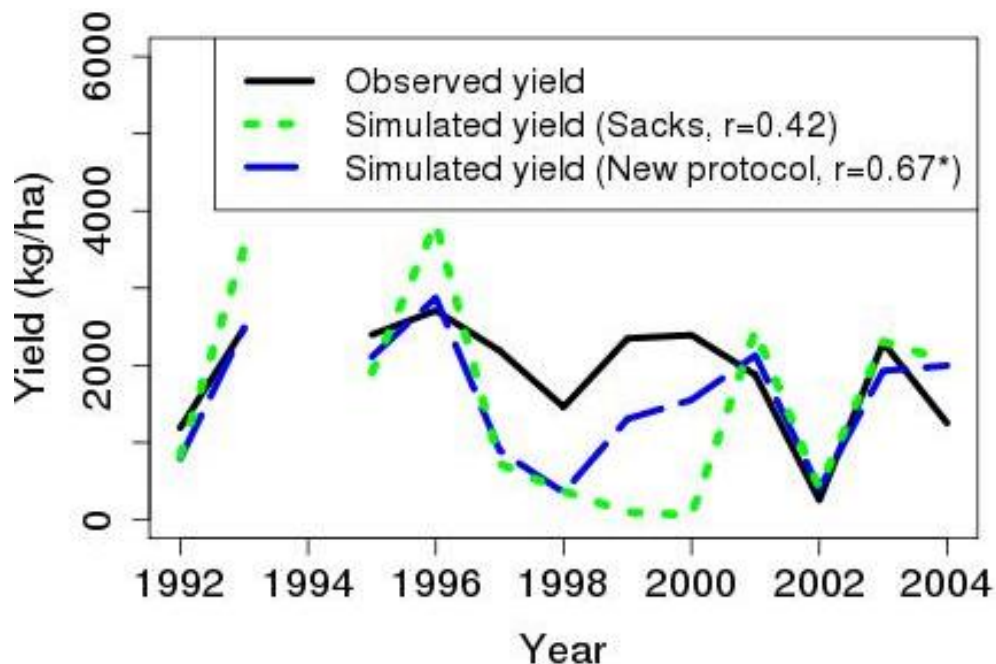
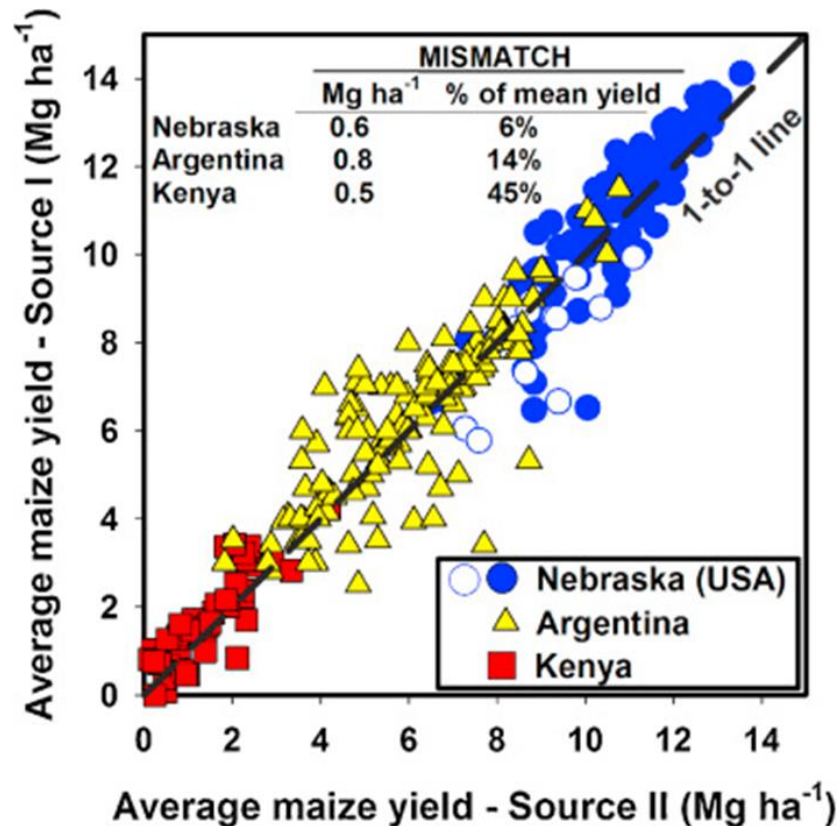


Figure: Seasonal cycle of rainfall at Melkassa. Green lines show Sacks planting window. Blue lines show 10-day planting windows. Red line shows average end of rainy season.

- The correlation using the Sacks information is not statistically significant
- The correlation using the new protocol is statistically significant

Observed yields - Introduction

- There are often problems with the data



Grassini et al (2015)

Observed yields - Introduction

Observed maize yield data for Kenya:

- National data
 - FAOstat
- Province level data
 - CountryStat
 - Kenyan ministry of agriculture
- District level data
 - Kenyan ministry of agriculture

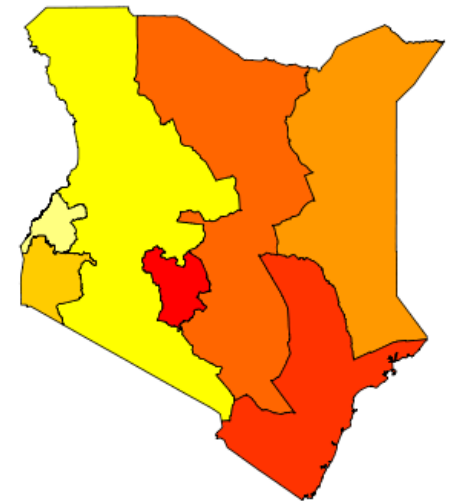
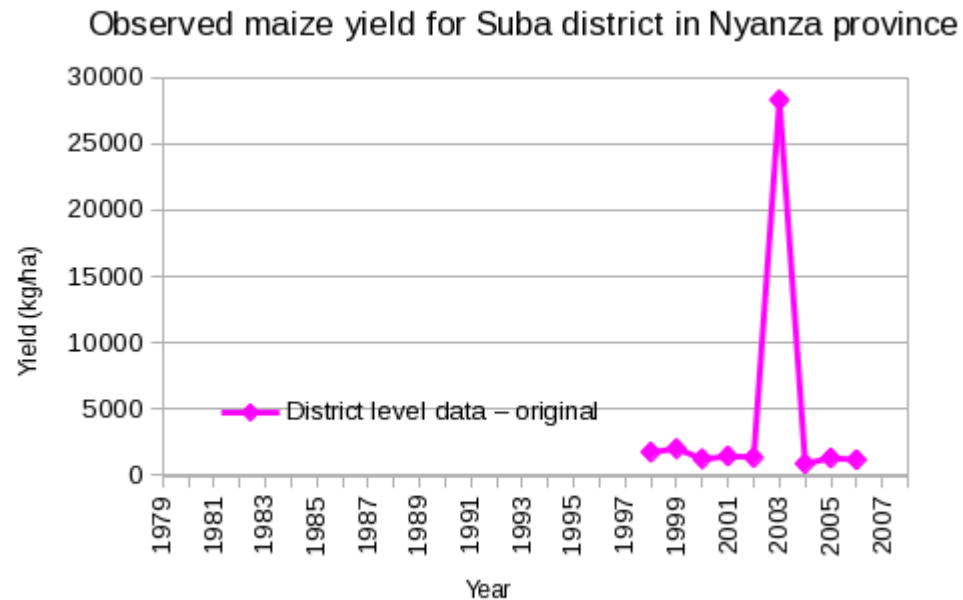


Figure: Provinces in Kenya

Observed yields - Protocol

1. Identify clearly unrealistic yields (yields > threshold)

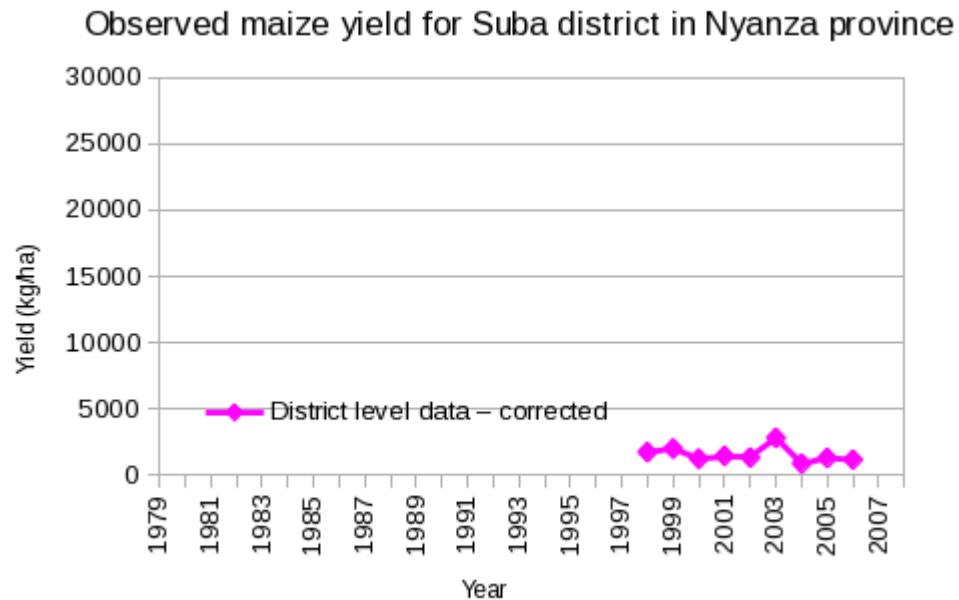
If possible correct the data point, if not remove.



Observed yields - Protocol

1. Identify clearly unrealistic yields (yields > threshold)

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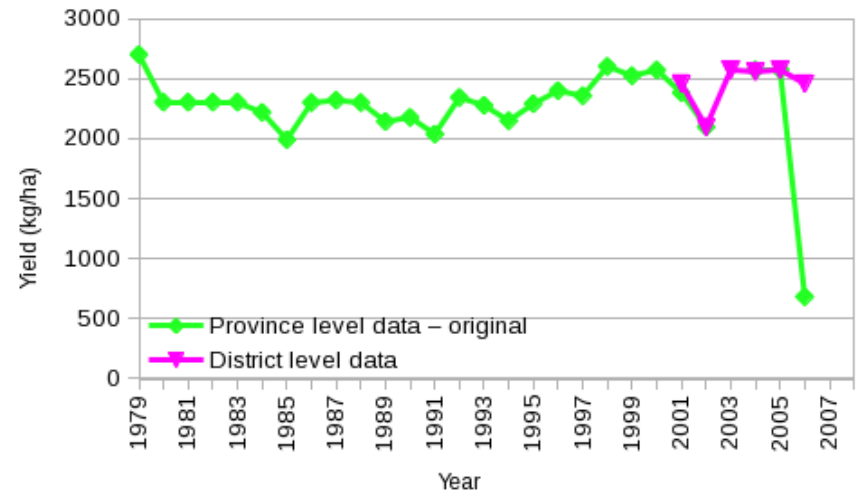
Observed yields - Protocol

2. Identify questionable data points:

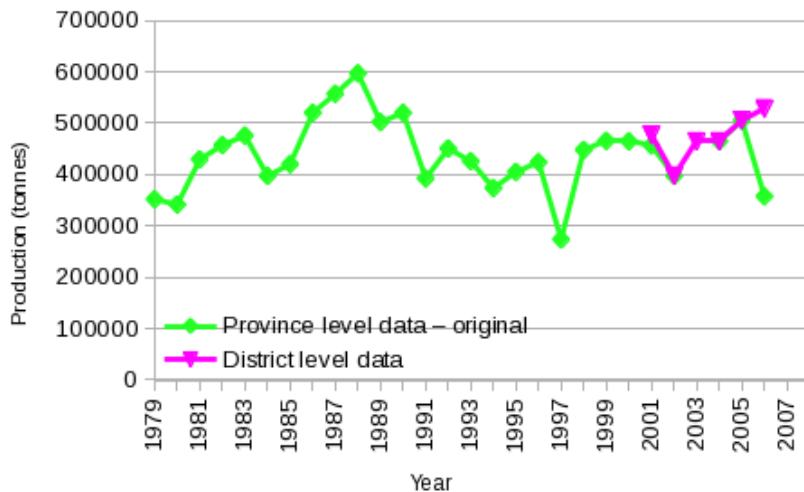
- Identical yields in consecutive years
- Yields more than x standard deviations away from mean

Decide if data point is incorrect. If so correct or remove.

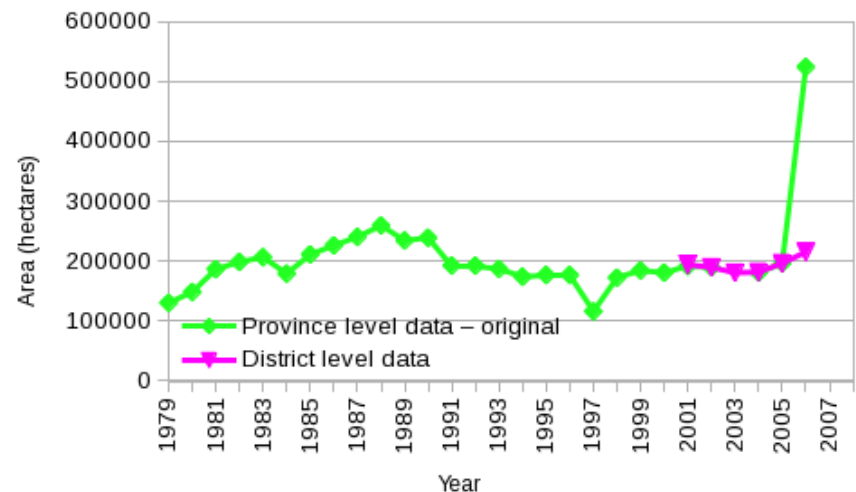
Observed maize yield for Western province in Kenya



Observed maize production for Western province in Kenya



Observed maize area for Western province in Kenya

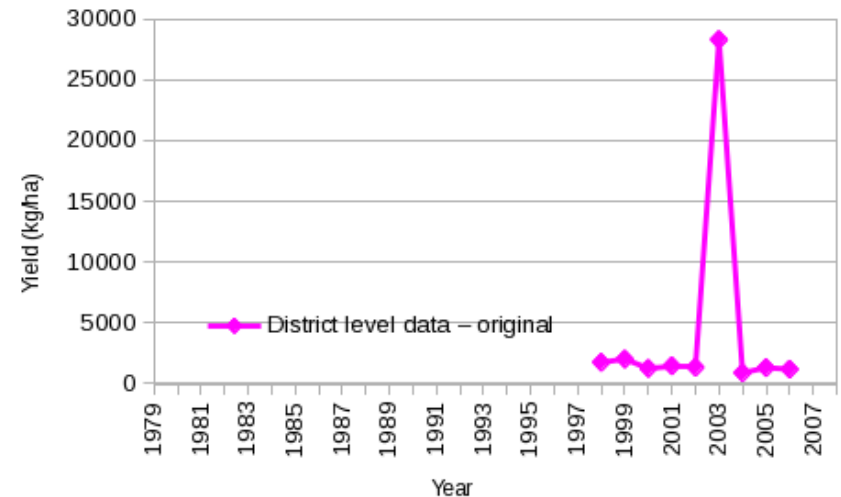


Observed yields - Protocol

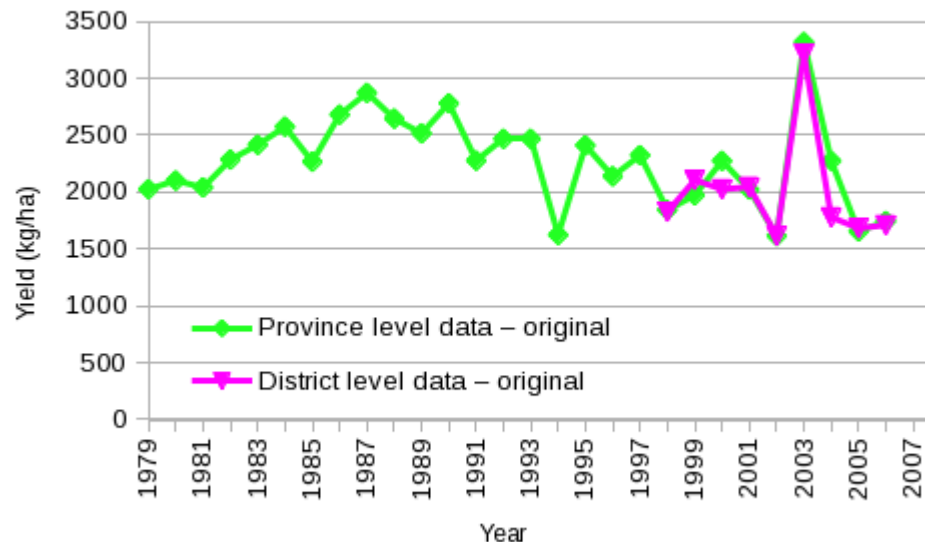
3. Carry corrections to finer scale data through to larger scale data.

* This can correct hidden errors in the data *

Observed maize yield for Suba district in Nyanza province



Observed maize yield for Nyanza province in Kenya

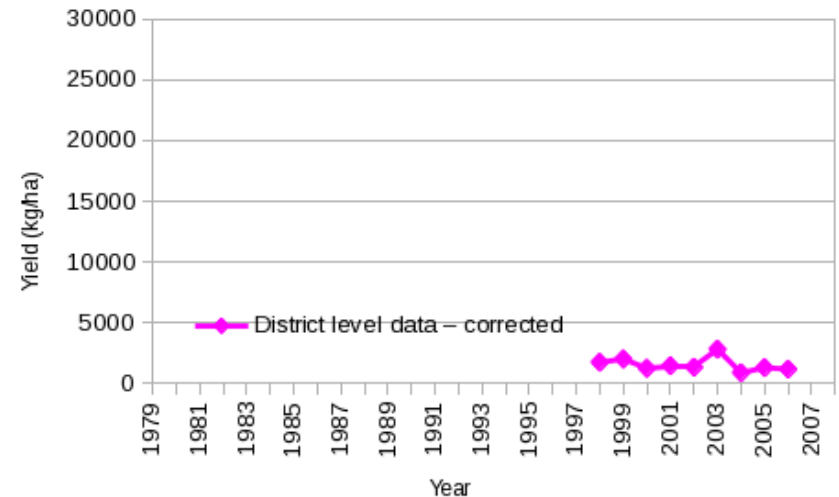


Observed yields - Protocol

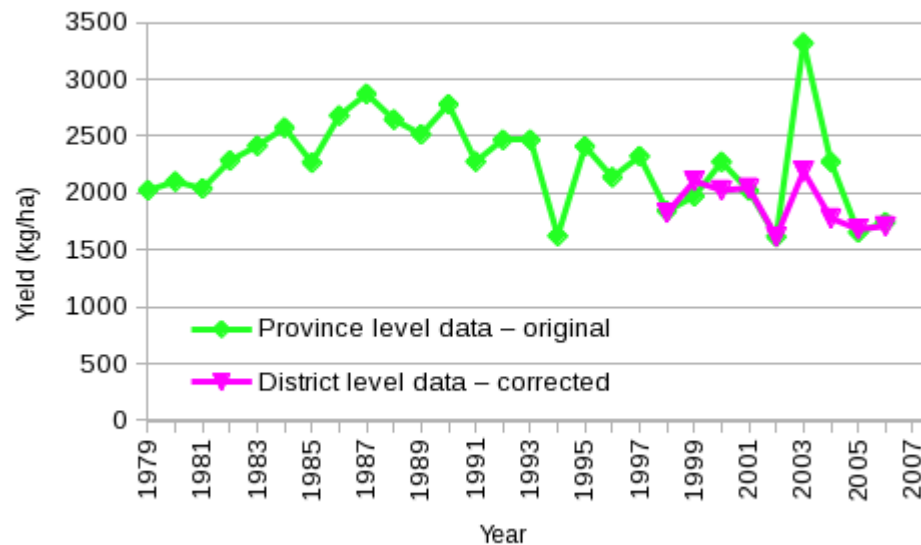
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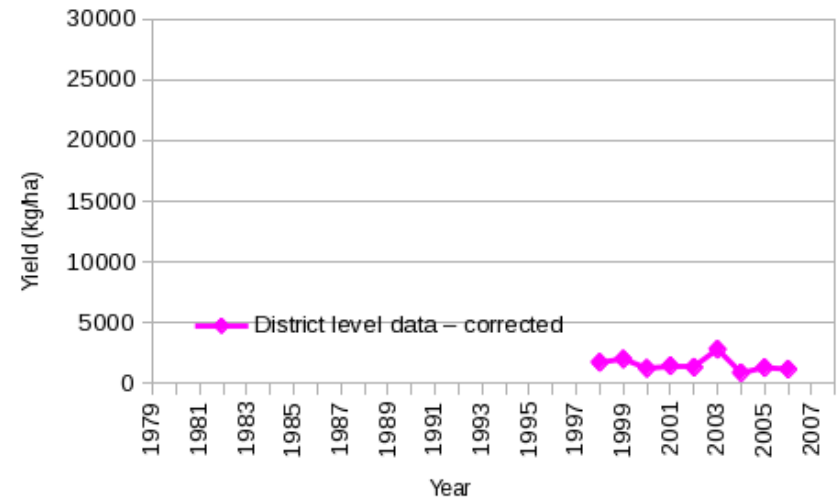


Observed yields - Protocol

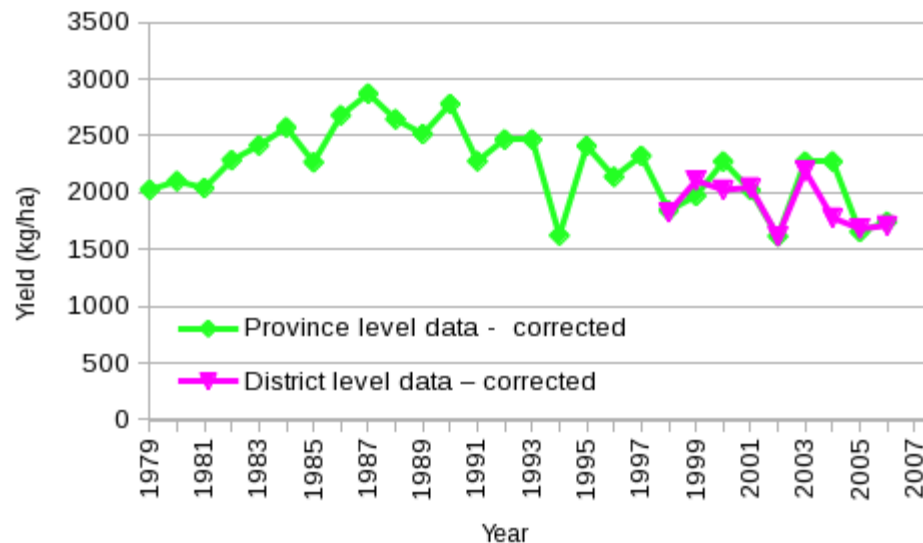
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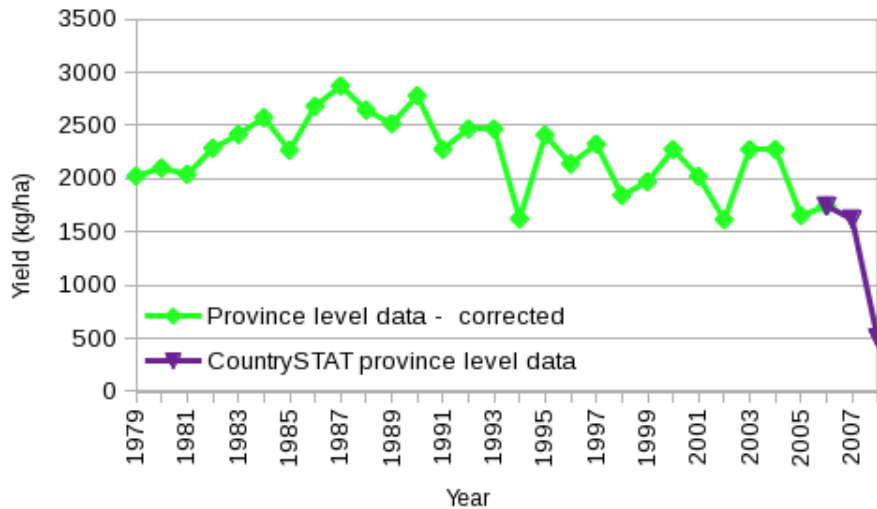
Observed maize yield for Nyanza province in Kenya



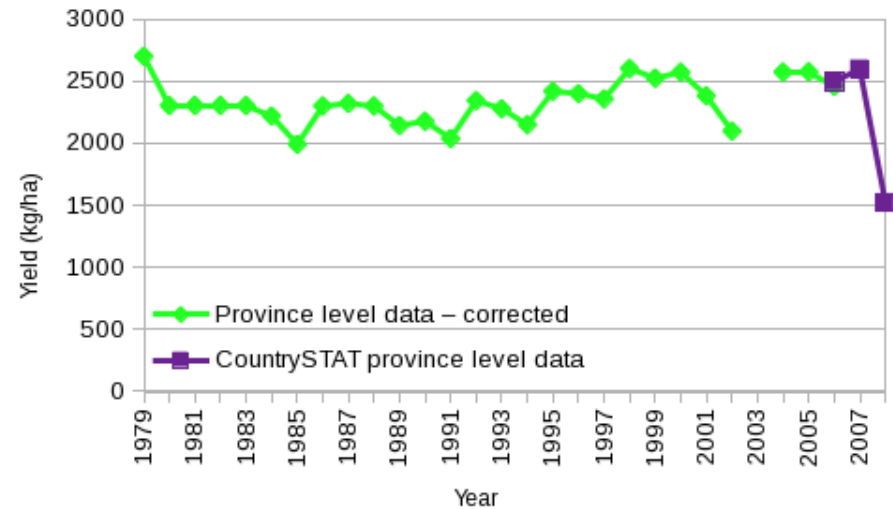
Observed yields - Protocol

- Combine data sets that are on the same scale to produce longer yield time series IF data sets are in agreement during the period of overlap

Observed maize yield for Nyanza province in Kenya

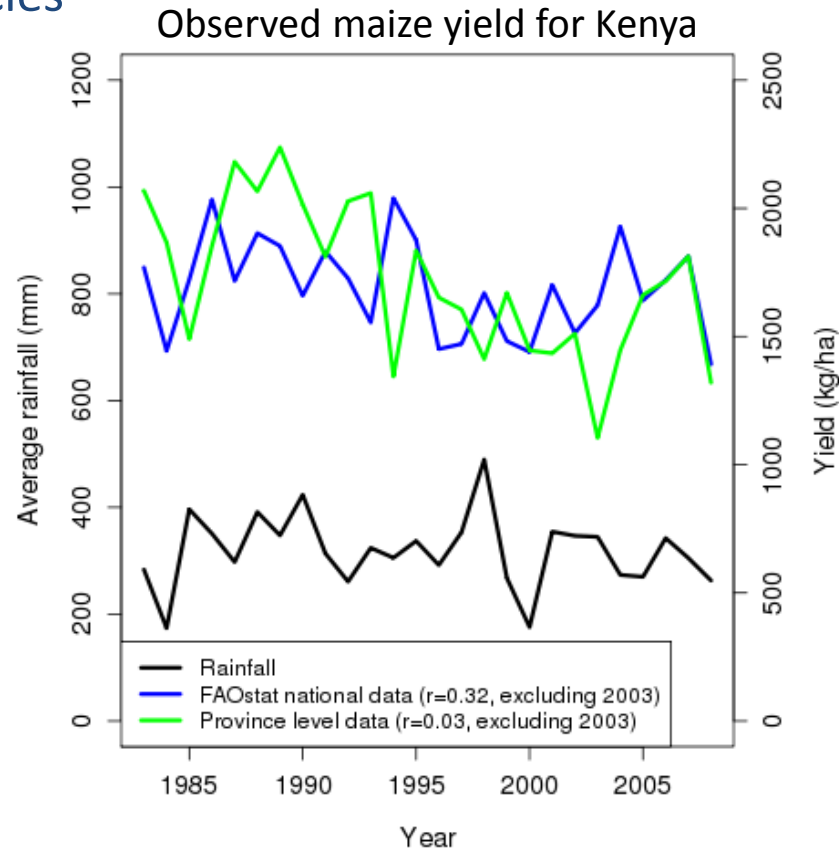


Observed maize yield for Western province in Kenya



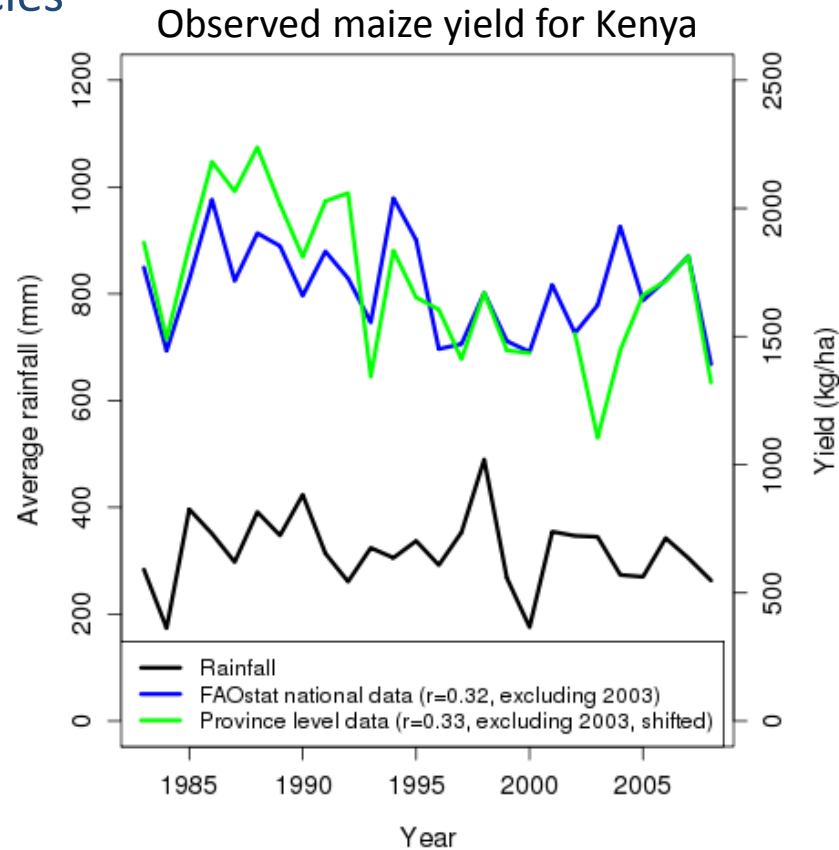
Observed yields - Protocol

5. Compare aggregated finer scale data to larger scale data to identify inconsistencies



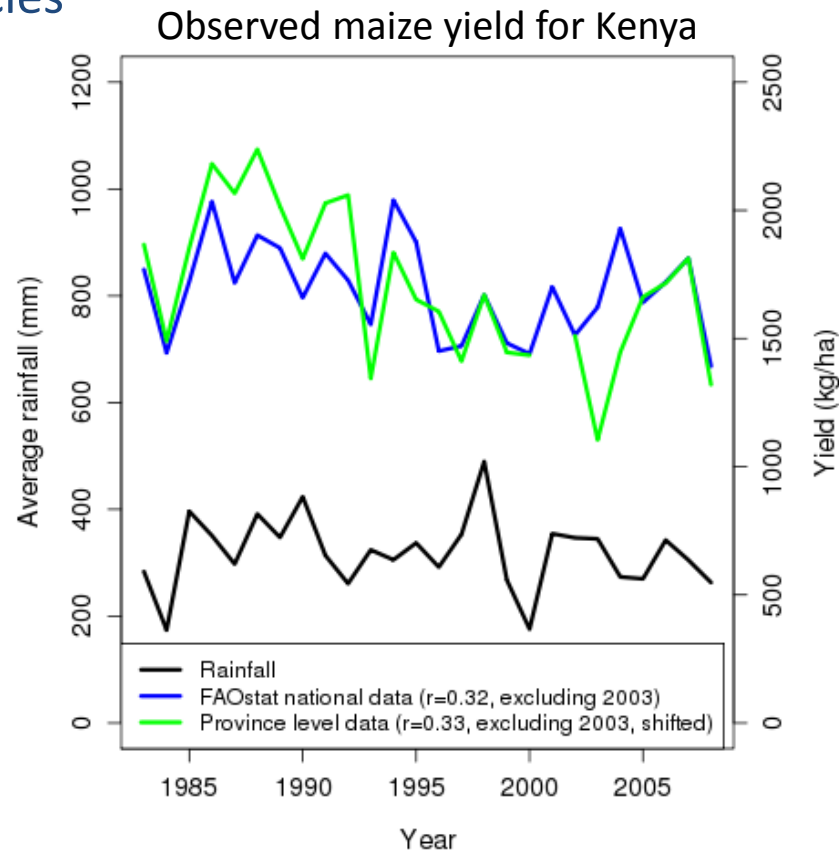
Observed yields - Protocol

5. Compare aggregated finer scale data to larger scale data to identify inconsistencies



Observed yields - Protocol

5. Compare aggregated finer scale data to larger scale data to identify inconsistencies



6. Compare the simulated yields to each different observed yield data set

Conclusions

- Errors/uncertainty in model input data and observed yield data can be large
- Often not enough information to fully quantify this uncertainty
⇒ Make the best use of the data that is available
- New protocol for defining realistic planting windows and crop varieties in rain-fed areas
- New protocol for cleaning observed yield data and starting to account for uncertainty
- We need a coordinated effort to clean up historical yield data
- We need improved collection of new data

