

Drought, and the development of a Local Maize Yield Index for crop insurance in Malawi

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under

FAO/TC World Bank allocation



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Basic Principles in the FAO Approach

- Subsidizing weather-indexed crop insurance for small, poor farmers
- Applies to large numbers, wide areas
- Provides quick, early and partial indemnity for immediate action
- Not a large emergency reserve fund
- A quick disbursement mechanism – relatively small amounts

Pre-Requisites

- Statistical significance of the weather index
- Objectively verifiable indicators
- Real advantage of early over late payment
- Partial indemnity makes premiums affordable
- Subscribers control the allocation of the payment, based on a broadly accepted plan of action

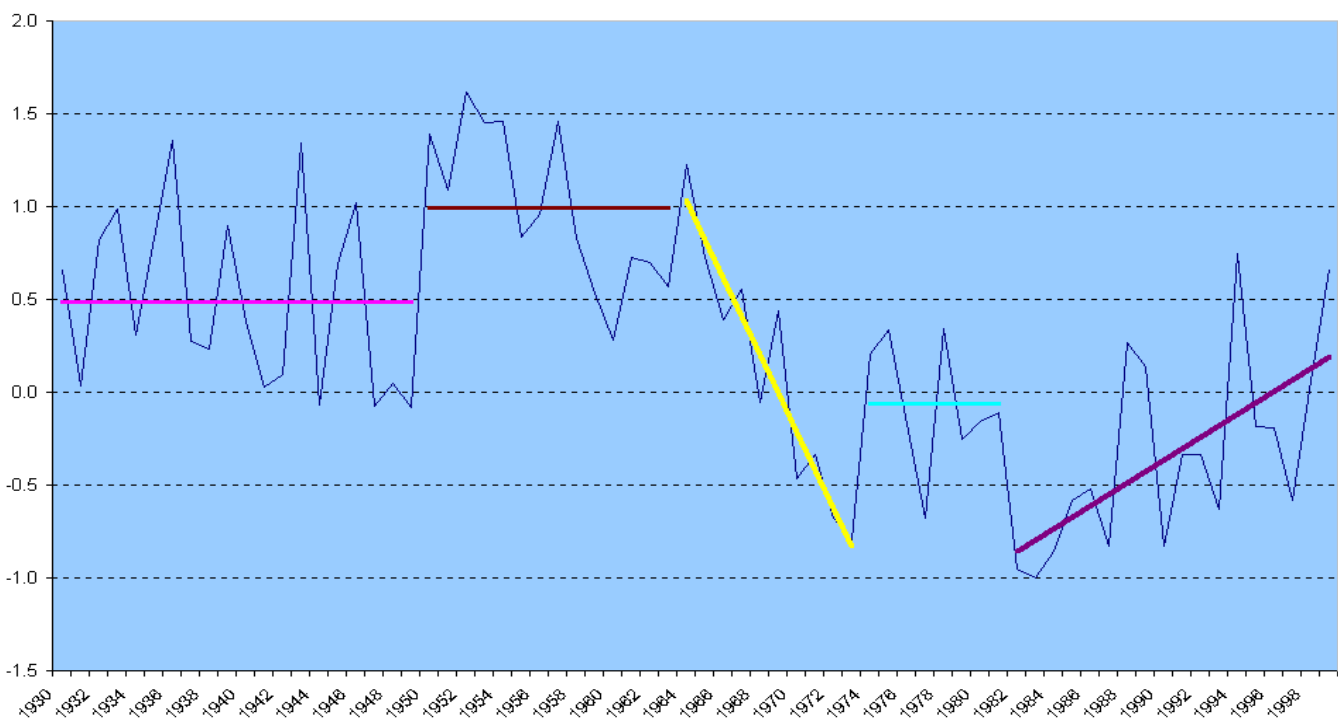
Persistence in maize yields in Ukiriguru

(S. lake Victoria)

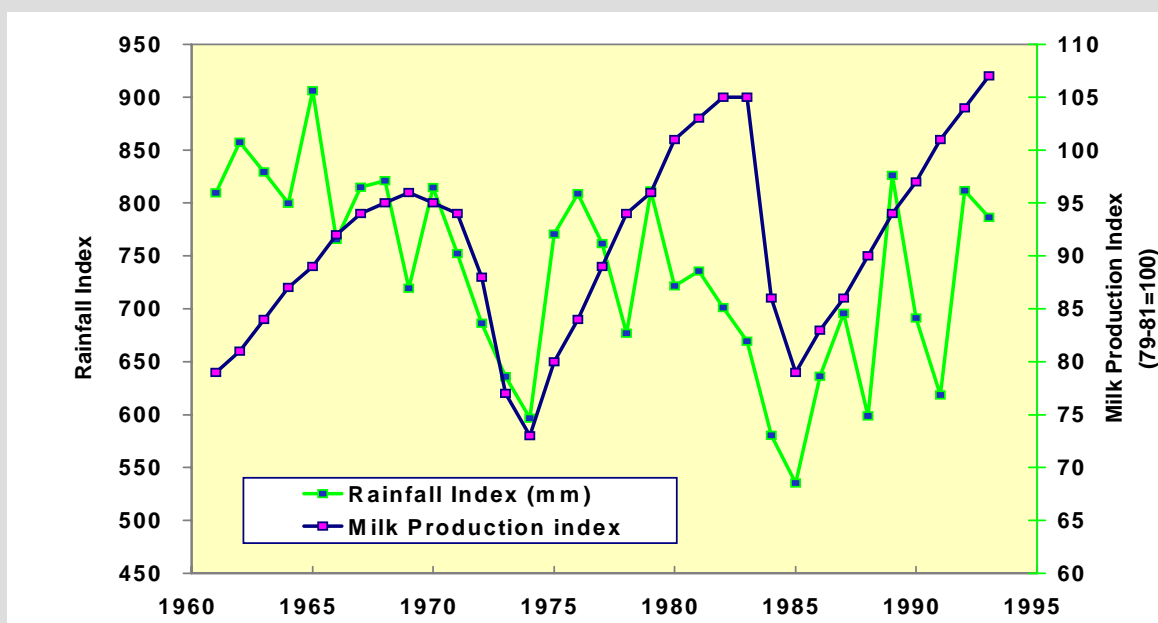
Year	i + 1				Quartile
	Q1	Q2	Q3		
i	0.348	0.174	0.272	0.206	Q1
	0.305	0.158	0.196	0.341	Q2
	0.107	0.429	0.321	0.143	Q3
	0.242	0.192	0.162	0.404	

Source: Gommès, 1985

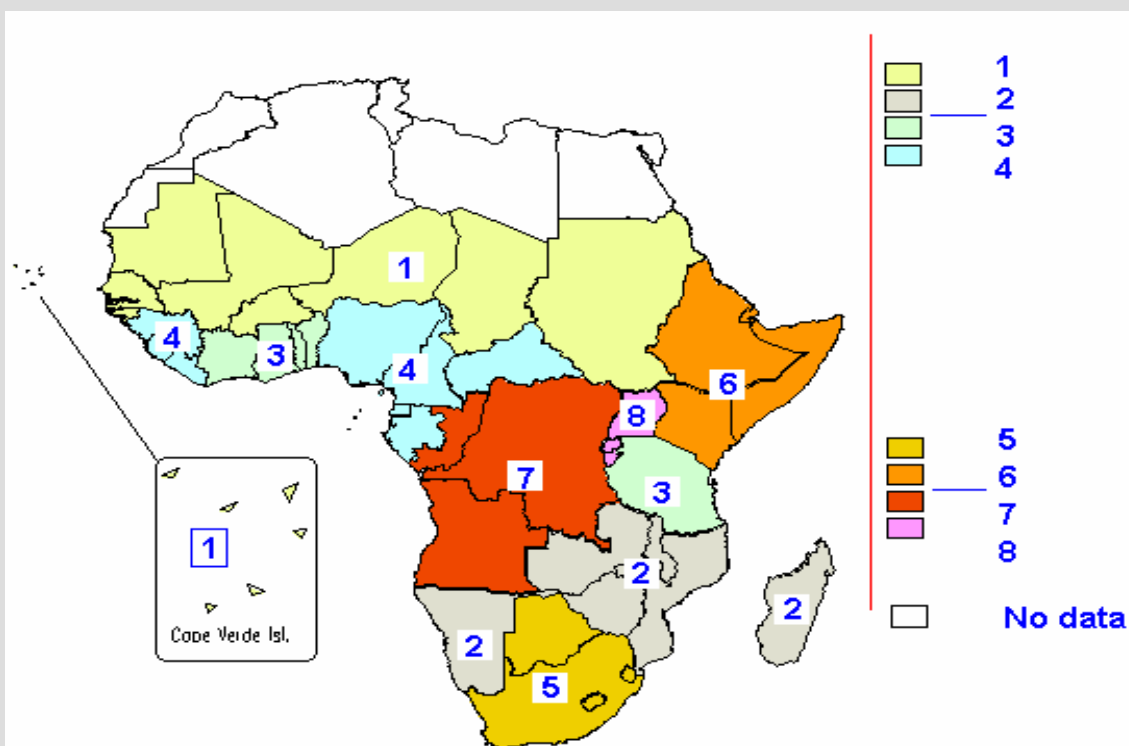
Statistically significant rainfall trends in the Sahel



Animal production and climate in the Sahel



Groups based on RFI profiles

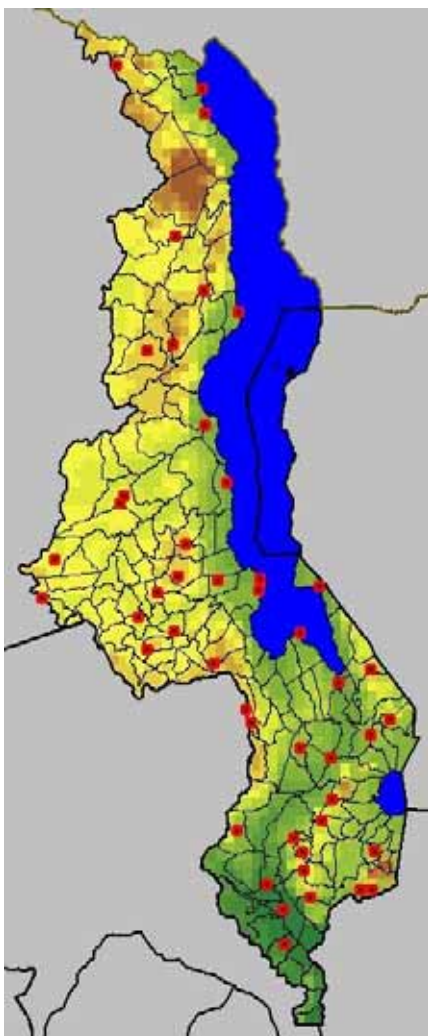


A weather index for maize crop insurance should be...

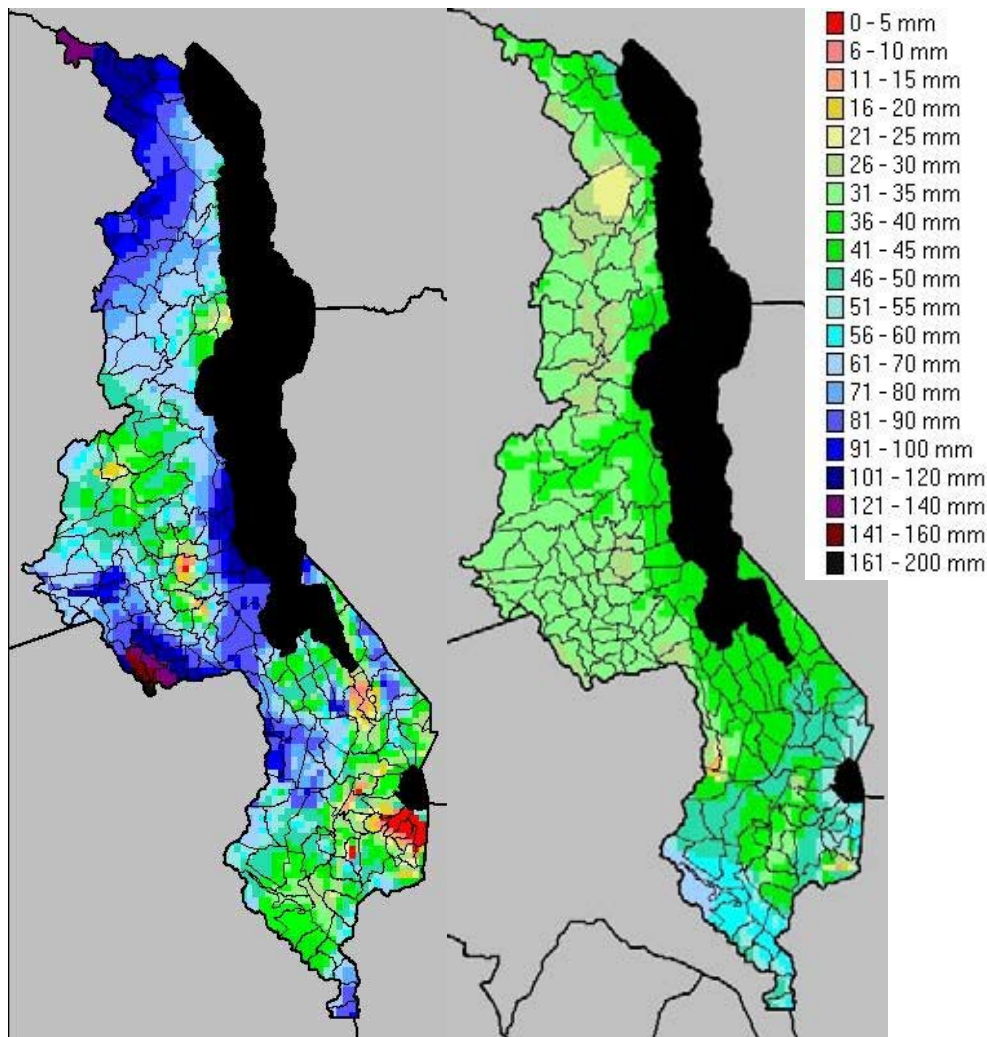
- available throughout the country
- tamper-resistant: potential beneficiaries cannot manipulate the yield index;
- objective: the methodology is repeatable by anyone who has access to the basic data
- well correlated with yields reported by agricultural statistics
- robustness *vis-à-vis* missing data
- agronomically sound
- publicly available

Overall methodology (1)

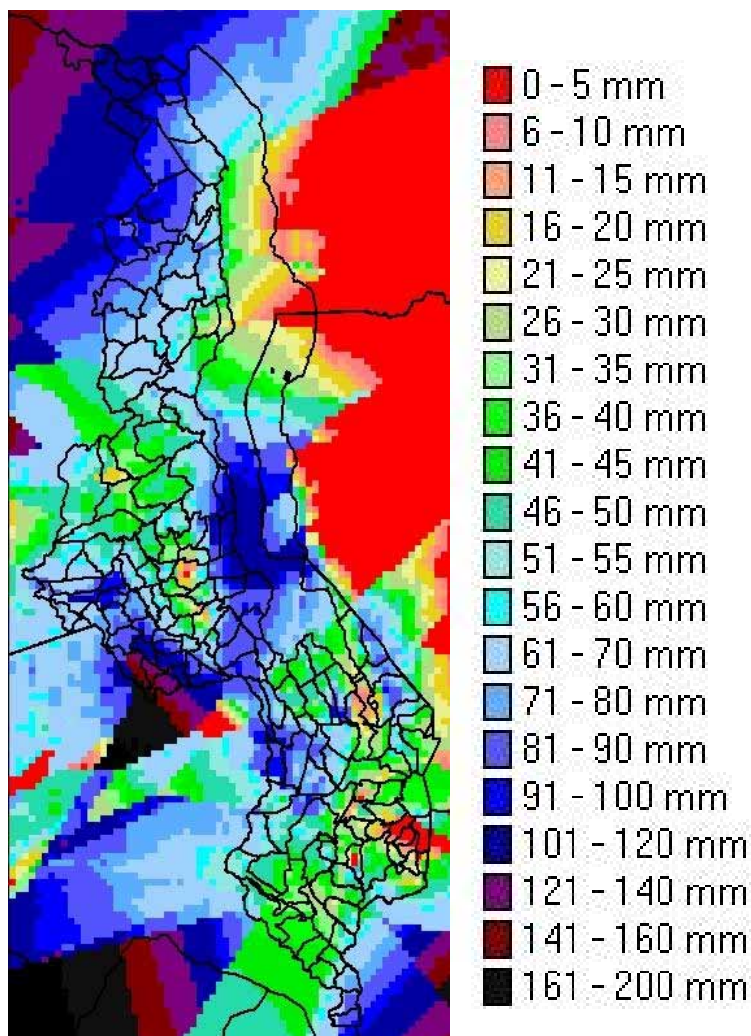
- to reduce dependence of index from individual point weather data, gridding of 10-daily rainfall and of PET (46 stations with data between 1961 and 2005: 1100 “images”)
- Development of simplified PET method to avoid problems with missing radiation data
- Trend analysis of weather data (re 1991/92 El Niño)
- Calibration of planting dates against actual EPA planting dates (1995-1998)
- Calculation of water balance parameters with AgroMetShell



Elevation
map with
46 weather
stations



Sample
 rain (l.)
 and
 PET (r.)
 grids for
 dekad 1
 of
 January
 2005



About the
 relevance of
 data from
 neighbourin
 g
 countries...

Overall methodology (2)

- Water balance computed on 0.05 degree grid
- Selection of explanatory variables through principal components analysis
- Calibration against 1350 EPA yields between 1995 and 2005 (yields display NO technology trend)



Water balance summary file	c:\program files\agrometshell 1.50\example06\southern africa_1991_st		...
Name of IDA reference image	c:\program files\agrometshell 1.50\example01\southern_africa.img		...
Missing value in input file	-999		

Altitude	<input type="checkbox"/> Water Excess (Initial)	<input checked="" type="checkbox"/>
Water Holding Capacity	<input type="checkbox"/> Water Excess (Vegetative)	<input checked="" type="checkbox"/>
Initial Water Storage	<input type="checkbox"/> Water Excess (Flowering)	<input checked="" type="checkbox"/>
Percentage Effective Rainfall	<input type="checkbox"/> Water Excess (Ripening)	<input checked="" type="checkbox"/>
Planting Dekad	<input type="checkbox"/> Water Deficit (Initial)	<input checked="" type="checkbox"/>
Cycle Length	<input type="checkbox"/> Water Deficit (Vegetative)	<input checked="" type="checkbox"/>
Total Water Requirement	<input type="checkbox"/> Water Deficit (Flowering)	<input checked="" type="checkbox"/>
Final Index	<input checked="" type="checkbox"/> Water Deficit (Ripening)	<input checked="" type="checkbox"/>
Normal Index	<input type="checkbox"/> Actual Evapotranspiration (Initial)	<input checked="" type="checkbox"/>
Last Index	<input checked="" type="checkbox"/> Actual Evapotranspiration (Vegetative)	<input checked="" type="checkbox"/>
Water Excess (Total)	<input checked="" type="checkbox"/> Actual Evapotranspiration (Flowering)	<input checked="" type="checkbox"/>
Water Deficit (Total)	<input checked="" type="checkbox"/> Actual Evapotranspiration (Ripening)	<input checked="" type="checkbox"/>
Actual Evapotranspiration (Total)	<input checked="" type="checkbox"/>	
Percentage Available Data	<input type="checkbox"/>	

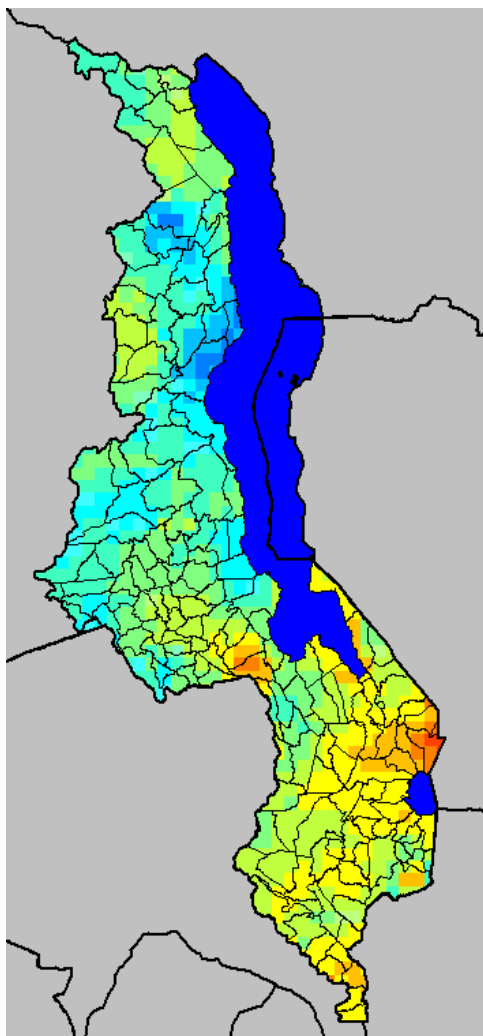
View images?

OK Cancel Help

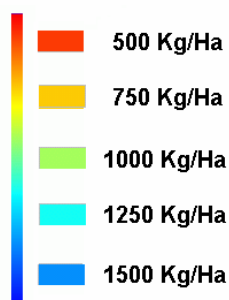
AMS: value added output variables

Definition of final forecasting variables

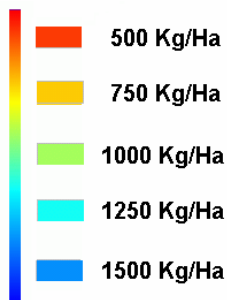
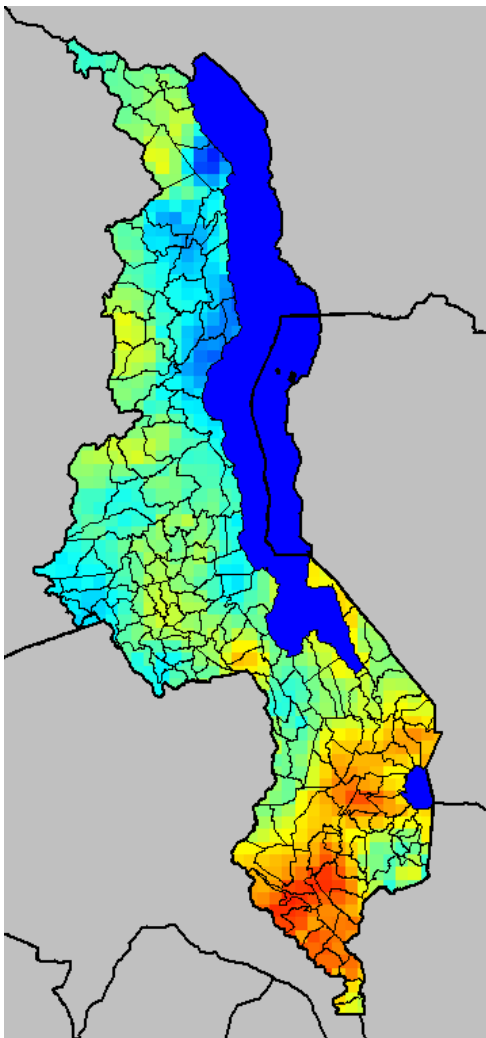
	Intercept	0.00000
Average local yield	Yavg	0.93242
Total water deficit over crop cycle (negative)	DEFtot	1.81576
Total excess water over crop cycle	WEXtot	-0.17464
Actual evapotranspiration during vegetative phase	ETAveg	2.35743
Water deficit during vegetative phase	DEFveg	-26.50667



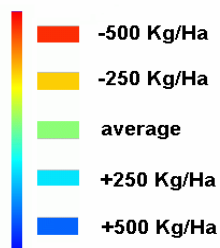
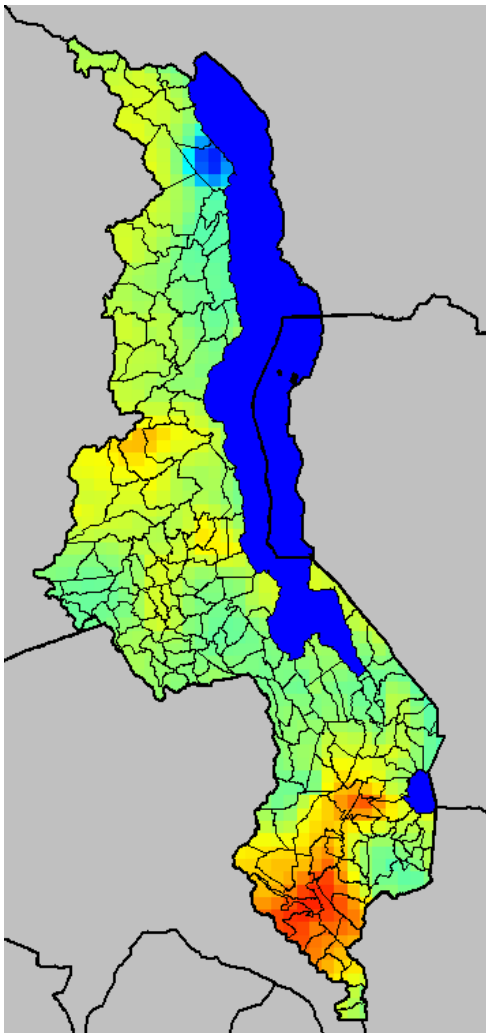
Average local maize yield (1995-2005)



2005 yield index

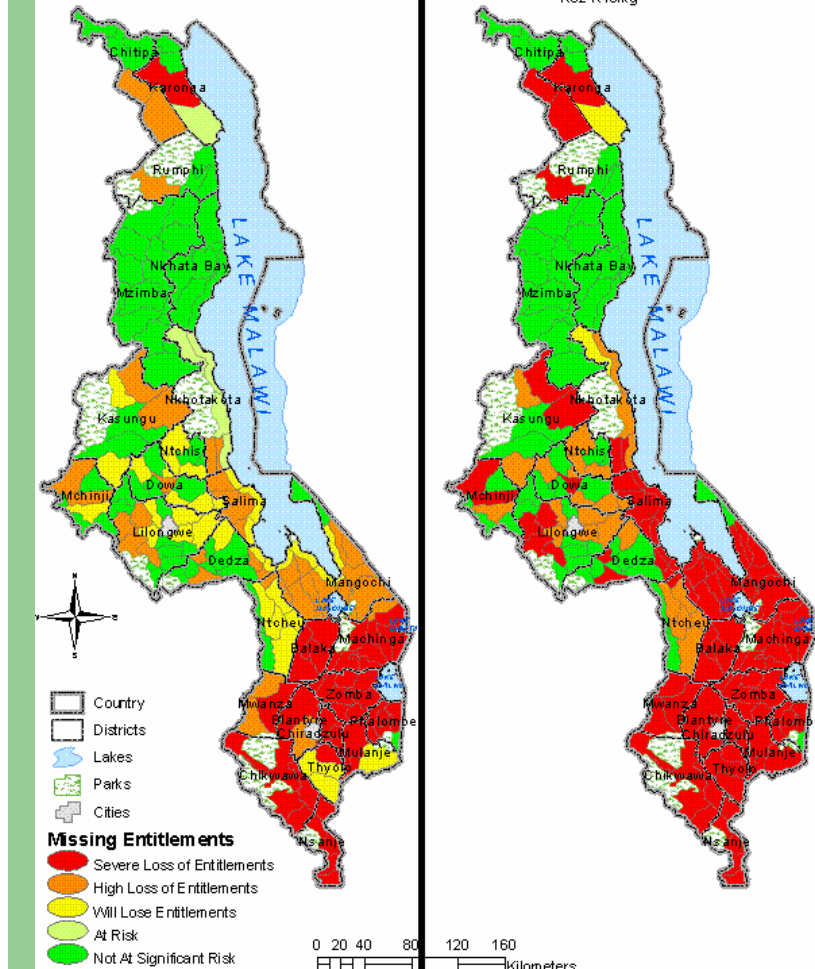


2005 yield index departure from expected value



Scenario 1: Maize prices adjusted at current average inflation rates
K19-K23/kg

Scenario 2: Maize landed in Blantyre at \$220/MT, consumer price adjusted for storage, distribution and 5% mark up
K32-K40/kg



Area at risk of food insecurity

Agricultural consumption year 2005-2006

Source: FAO/WFP

Potential derived products...

- above-below yield index threshold maps
- areas where current yield has a probability of exceedence of 70, 80 or 90 %
- best planting dates, or expected yield as a function of the time of planting
- calibration optimised to minimize false positives (which is different from minimizing SSDs!)
- build in crop prices and derive probabilities of "maize income maps"
- customized "insurance-AMS"

Conclusions

- The yield index satisfies all the desirable criteria for maize crop insurance in Malawi
- First estimates of Index can be provided at planting time and updated in real time throughout the season
- The index needs to be refined using criteria to be provided by insurance experts
- More specific products for crop insurance can be prepared