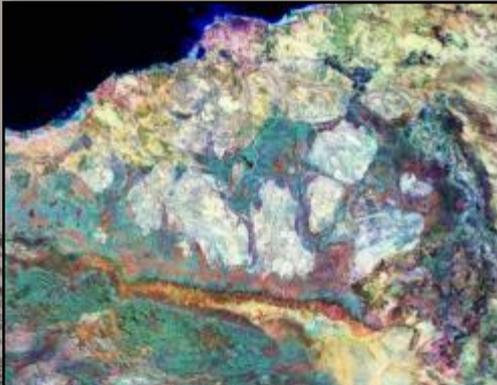


# Earth Observation: the Last Mile



Freek van der Meer – UT - ITC





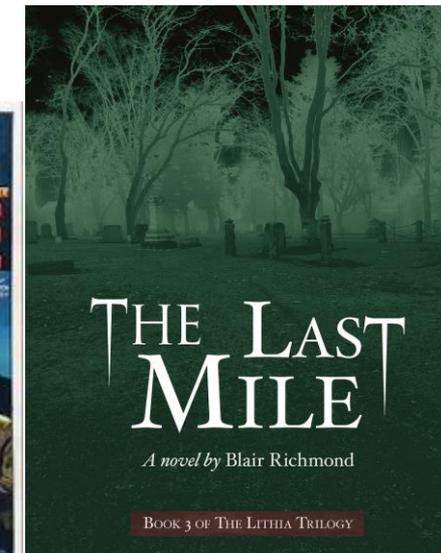
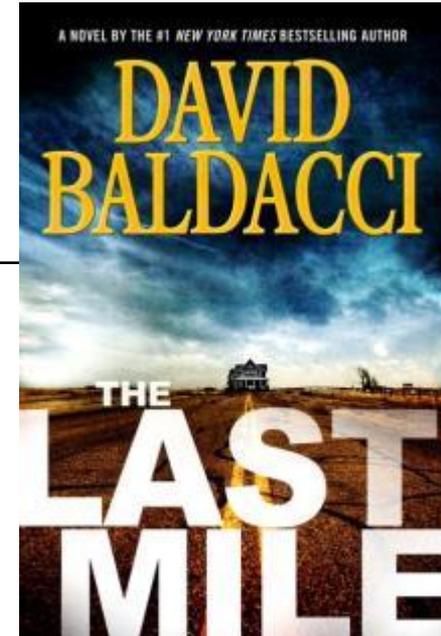
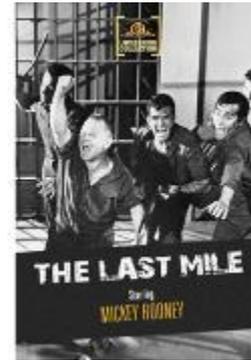
# THE LAST MILE

## IN EARTH OBSERVATION

---

- Bring EO data products to the people (end user)
- EO firmly embedded in policy making and governance
- EO and market development: entrepreneurial
- EO new products; data continuity
- EO used in a longterm sustainable way

Capacity building – capacity development is key!



The last mile is the common colloquialism referring to the portion of the telecommunications network chain that physically reaches the end-user's premises - Wikipedia

# Het is vandaag half bewolkt en er valt veel regen in Enschede (Wijzig standaardlocatie)



Uitgebreide weersverwachting voor Enschede

Buienverwachting in Enschede



Bekijk de regenradar voor Enschede

**zoover**  
superdeal

Van zonzakantie tot stedentrip  
Pak je koffer en vertrek!

Boek nu

Weerbericht **Nederland**: Weekend aan de frisse kant

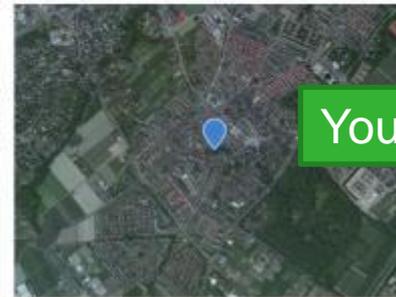


# Mobile apps: SenseAir in NASA space apps competition

SenseAir: Develop an app or platform to crowd-source information for comparing changes in environmental factors, such as temperature, relative humidity, air pollution, with occurrence of symptoms of allergies and respiratory diseases.



Awards Locations Challenges A



Your personal health app

Made in Noordwijk Netherlands

from the minds of



How they did it

## THE CHALLENGE: AIRCHECK

EARTH

Develop an app or platform to crowd-source information for comparing changes in environmental factors, such as temperature, relative

Source: [www.itc.nl](http://www.itc.nl)



**SENSE AIR**

Follow @SenseAirbiz



SHORTLISTED in Global Top 25 "Peoples Choice Award" NASA Space Apps 2016



Winner "Peoples Choice Award" Regional NASA Space Apps 2016 Noordwijk, Netherlands



# INTRODUCTION TO THE UNIVERSITY OF TWENTE

# HIGH TECH HUMAN TOUCH

- Societal impact: making a real difference
- Synergy: excellence in combinations
- Entrepreneurship and innovation
- Internationalization: tomorrow's global citizens.

# UNIVERSITY OF TWENTE

- An entrepreneurial campus university established in 1961
- More than 10,000 students
- 3,300 staff members

# UT IN ONE SLIDE

## Five faculties

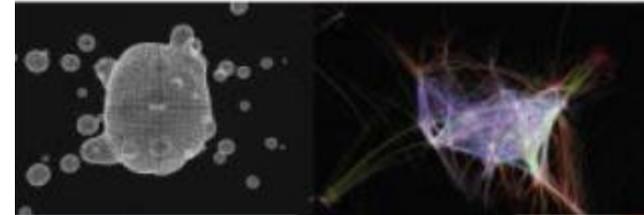
- **BMS** Behavioural, Management and Social sciences
- **CTW** Engineering Technology
- **EWI** Electrical Engineering, Mathematics and Computer Science
- **TNW** Science and Technology
- **ITC** Geo-Information Science and Earth Observation

## Four research institutes

- **CTIT** Centre for Telematics and Information Technology
- **IGS** Institute for Innovation and Governance Studies
- **MESA+** Institute for Nanotechnology
- **MIRA** Institute for Biomedical Technology and Technical Medicine

## Virtual institutes

- Twente Graduate School (MSc+PhD)
- ATLAS “university college”



A photograph of a large, multi-story university building with a red-tiled roof and many windows. The building is set against a blue sky with light clouds. In the foreground, there are green hedges and some trees with yellow leaves. A black text box is overlaid on the left side of the image.

# ITC FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION

Source: ITC corporate presentation

UNIVERSITY  
OF TWENTE.  
FACULTY ITC



## About ITC

- **Established:** 1950 - Appeal by UN in framework of official development assistance - ODA
- **Aim:** Build capacity for economic development in developing world
- **Main instrument:** Postgraduate education and training, research, project services
- **Main field of science:** earth observation, geoinformation science applied to problem-solving in earth sciences, natural and water resources and urban studies
- **Achievements**
  - 23 000 alumni (predominantly) mid-career professionals

# ITC ALUMNI

Total students 1950-2013 22,527  
 Total countries 1950-2013 177

Asia	9,750
Africa	6,917
Europe	3,453
America	2,220
Australia & Oceania	187



COURSE PARTICIPANTS 1950-2013  
 ORIGIN OF ITC STUDENTS, EXCLUDING EXTRAMURAL AND PHD

UNIVERSITY OF TWENTE.  
 FACULTY ITC



UNIVERSITY OF TWENTE.



Source: ITC corporate presentation



A satellite view of Earth at night, showing a dense network of city lights across the continent of North America. A satellite with solar panels is visible in the upper left corner, orbiting the planet. The background is the dark void of space.

# APPLICATION

- food security
- water management
- urban planning
- land administration
- disaster management
- strengthening civil society
- earth sciences
- environmental management and biodiversity

Source: ITC corporate presentation



## WHAT IS ITC AIMING TO ACHIEVE IN 2020

---



- **Regional training networks** where ITC acts as a knowledge broker
- ITC will develop state of the art education (**blended learning**) that will train the future generation of Geo-information and Earth Observation
- ITC MSc and PhD programs will fulfill real **societal demands** and appeal to the individual
- ITC will focus on the '**last mile**' in order to embed Earth Observation firmly in society
- ITC will train students in **entrepreneurial** skills and support setting up their own **business** as professional



training

data

GIS/R training course,  
Geological Survey Cyprus, 1994.

Source: van der Meer

- **Human resource development**, the process of equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively.
- **Organizational development**, the elaboration of management structures, processes and procedures, not only within organizations but also the management of relationships between the different organizations and sectors (public, private and community).
- **Institutional and legal framework development**, making legal and regulatory changes to enable organizations, institutions and agencies at all levels



	PURPOSE	FOCUS
CAPACITY BUILDING FOR GEOINFORMATICS	Human resources development	Supply of technical and professional personnel
	Organisational strengthening	Strengthen the management capacity of organisations
	Institutional strengthening	Strengthen the capacity for inter-agency coordination

## NEW Dimensions to Capacity Development

- The government to government or country to country dimension considering that in a globalizing world countries cannot maintain to operate as stand-alone entities.
- The cross cutting dimension of the government and academic sector against the private sector->'entrepreneurs'
- South South->trilateral collaboration



# Our Earth Observation Knowledge domain Is getting connected to society and other Geo technologies



Rapid acceptance and users  
Of geospatial data  
applications  
and technologies



robo-fly, developed at Harvard, weight < 1g





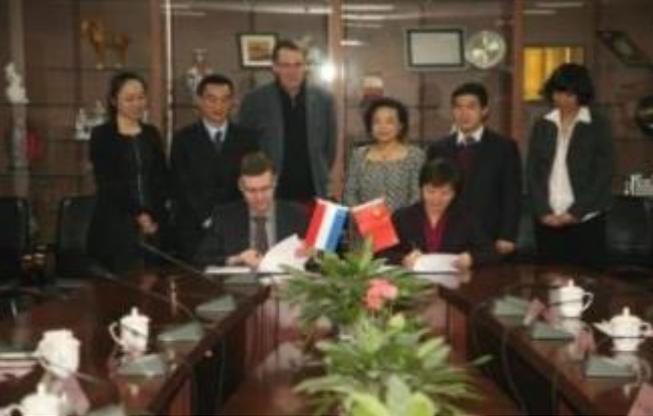
Source: Veldkamp DIES lecture 201

Only an estimated 1 % of global population is estimated to be a global citizen. They all have to operate in a local context

# INTERNATIONALIZATION IMPLIES COMBINING GLOBAL AND LOCAL CONTEXTS

---

- Cultural and context specificity
- Sustainable collaboration
- Network and teamwork on location
- Experimentation together



On the ground  
local cooperation  
  
It is teamwork

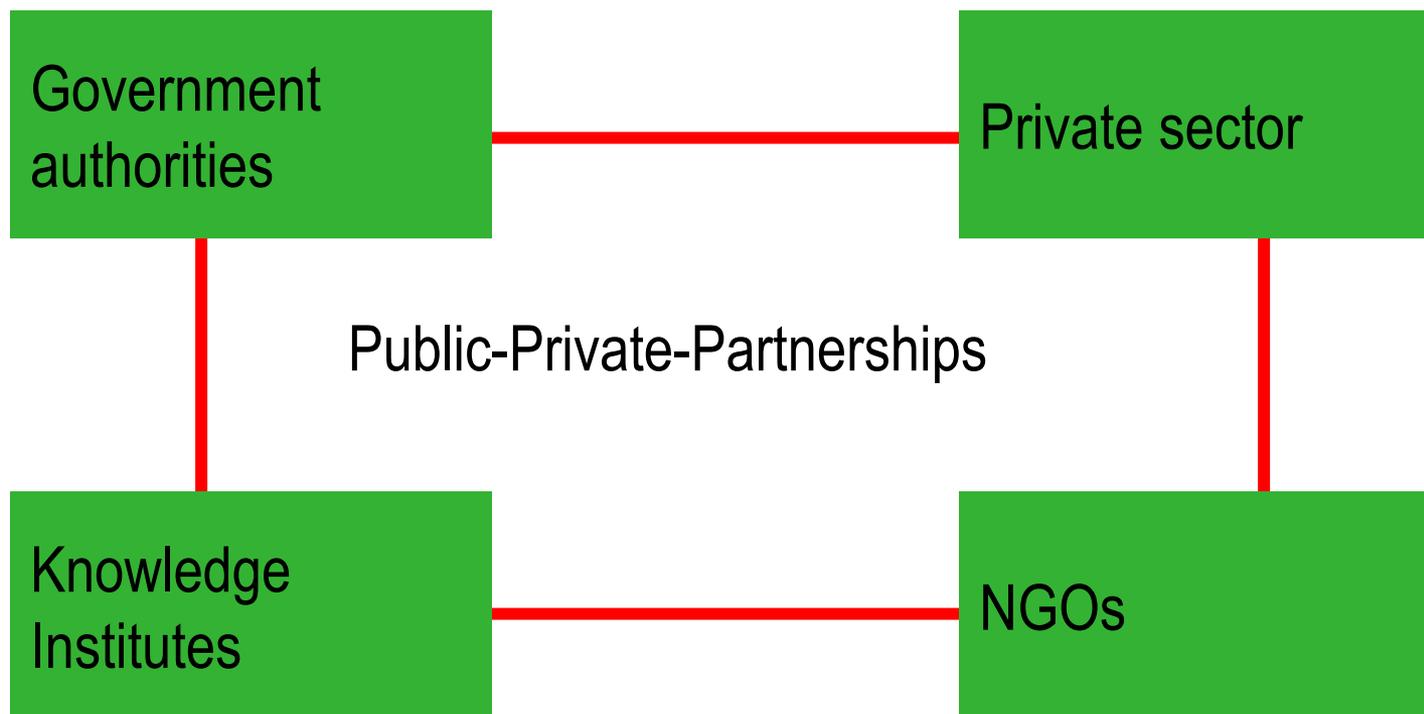


# Long term collaboration should be sustainable addressing the 3P's

---



## Working on grand challenges





## New trends in EO: the opportunity

- **Availability** → many more satellites: e.g. EC Copernicus, small sat constellations
- **Accessibility** → ICT, the Cloud
- **Adaptability** → standards, adaptable usage (GIS/mobile)
- **Affordability** → free/low cost data, lower cost value adding
- **Acceptability** → fit-to-purpose, increased quality level



## Challenges to overcome

- **Last mile:** delivery to, communications with the user
- **Usability:** creating (direct) impact for user
- **Information chain:**  
from provider (high tech) – user (bottom of pyramid)
- **Organization:** public-private partnership, cultural, IPR
- **Finance:** investments
- **Sustainability:** business model, license to operate



# Drought : *the silent threat to the rural economy*

- *the immediate victim of Drought*



- 70% of population ( 900 millions) depend on Agril.
- 68% of net sown area(142.2 M ha) is drought prone
- 50% of drought prone is severe in nature

*Unemployment*



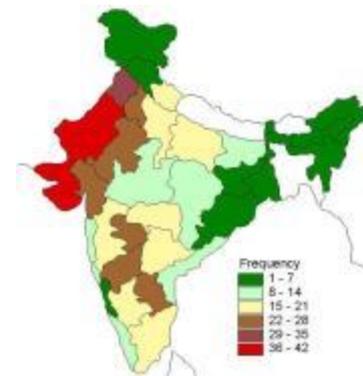
*Cattle - Starvation*



*Fodder Shortage*



*Drinking  
Water Shortage*

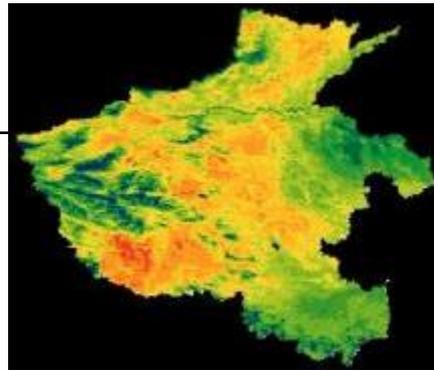
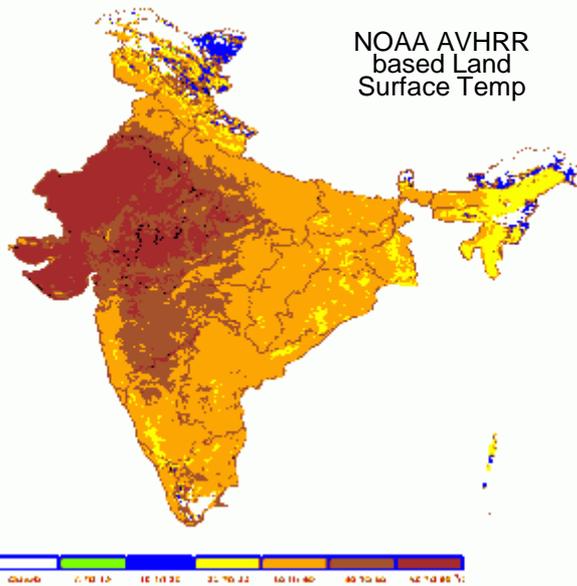


# Emerging techniques for drought assessment/management

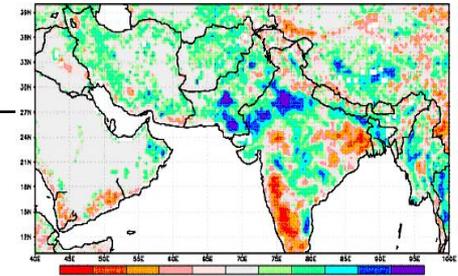
*Land Surface Temperature / Evapotranspiration / Soil moisture*

## Land Surface Temperature

- NOAA AVHRR
- TERRA/AQUA MODIS
- LANDSAT TM

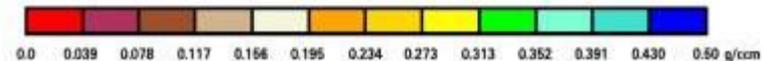
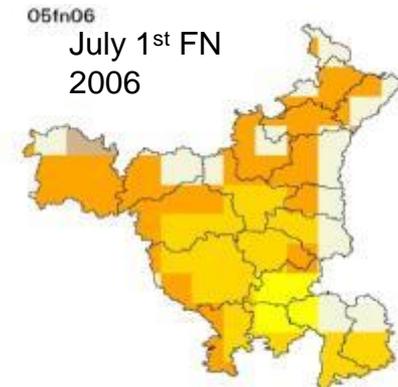
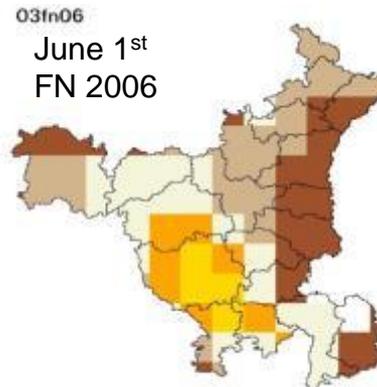


- Soil moisture is directly proportional to thermal inertia.

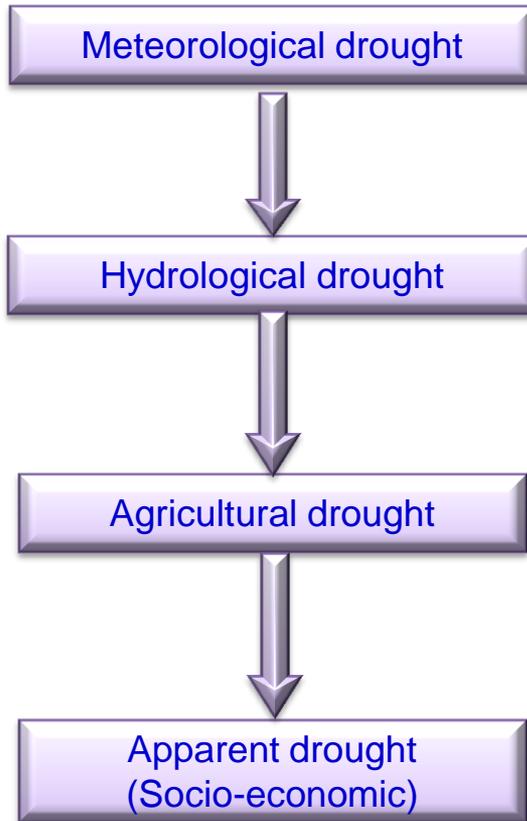


Soil Wetness Index (SWI) is the difference between the 85 GHz and 19 GHz channels data from the special Sensor Microwave/Imager (SSM/I) on the (DMSP) of the USA

## Soil Moisture from AMSR-E Over Haryana



# DROUGHT STAGE



- *Rainfall deficiency - actual rainfall, normal rainfall, dry spells*

*Water level in surface water*

- *Impact of Meteorological & Hydrological drought on agriculture depends on:*

Crop calendar

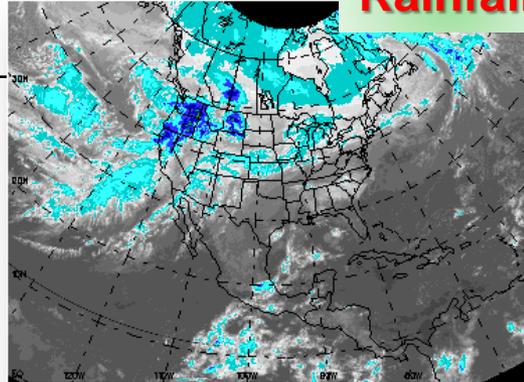
- Soil type
- Geomorphology
- Irrigation support

# Time as a classifier?

Time as a 'new' variable!

Time as a 'new' coordinate-axis!

**Rainfall**

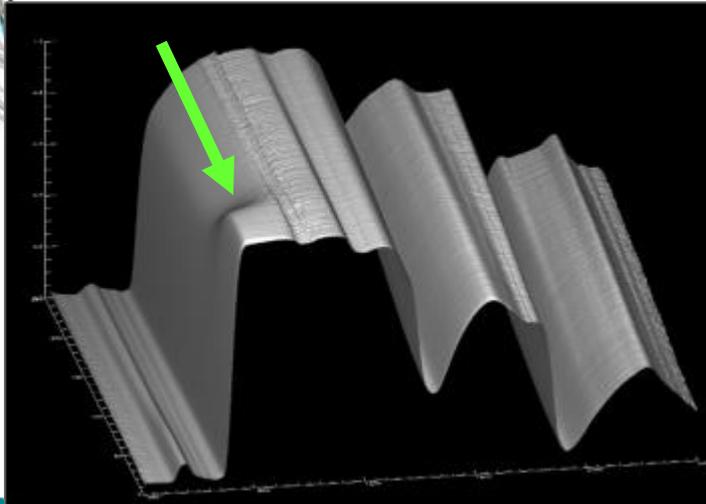


**Dynamics of 2 days!**

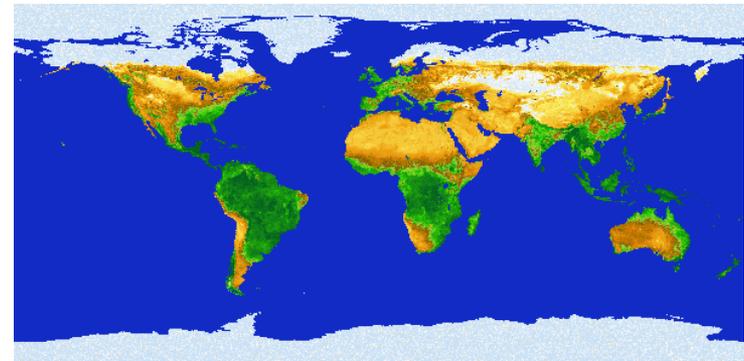
**NDVI**



**Dynamics of 1 year!**



**Change over time of spectral reflectances**

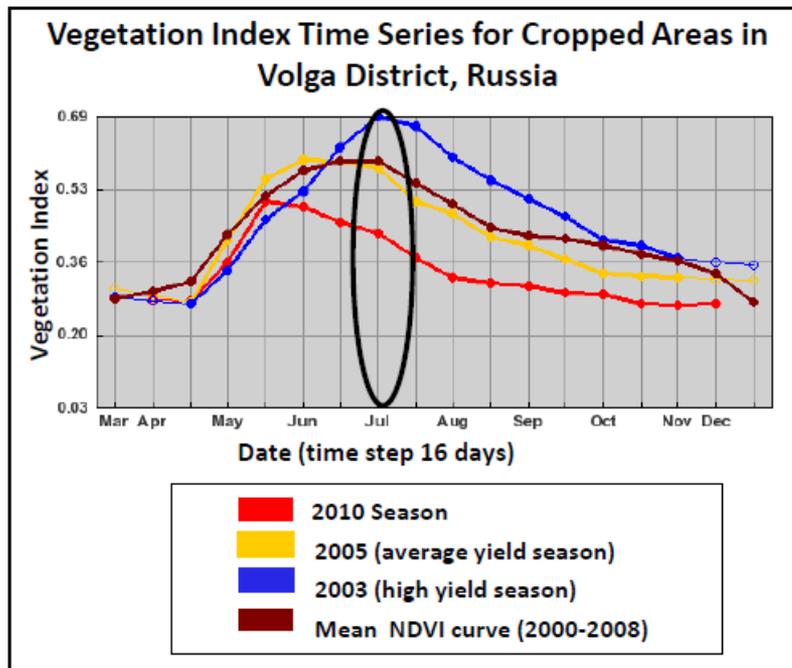
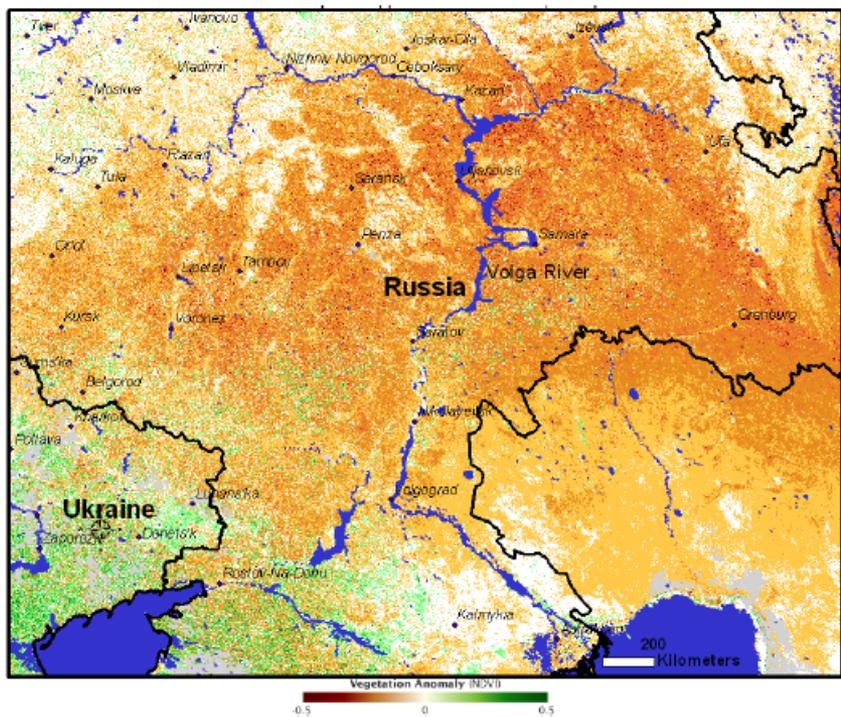


**Our Breathing Planet**

# USDA Monitoring Drought Impact on Crops in Russia, 2010



Vegetation Anomaly Image, Volga District, Russia ; June 26- July11, 2010



- Low rainfall and hot temperatures were largely responsible for a reduction of 37% percent of the country’s grain crops. Global price increased 80% in 6 months

## BUT WHAT WAS GROWN THERE ??

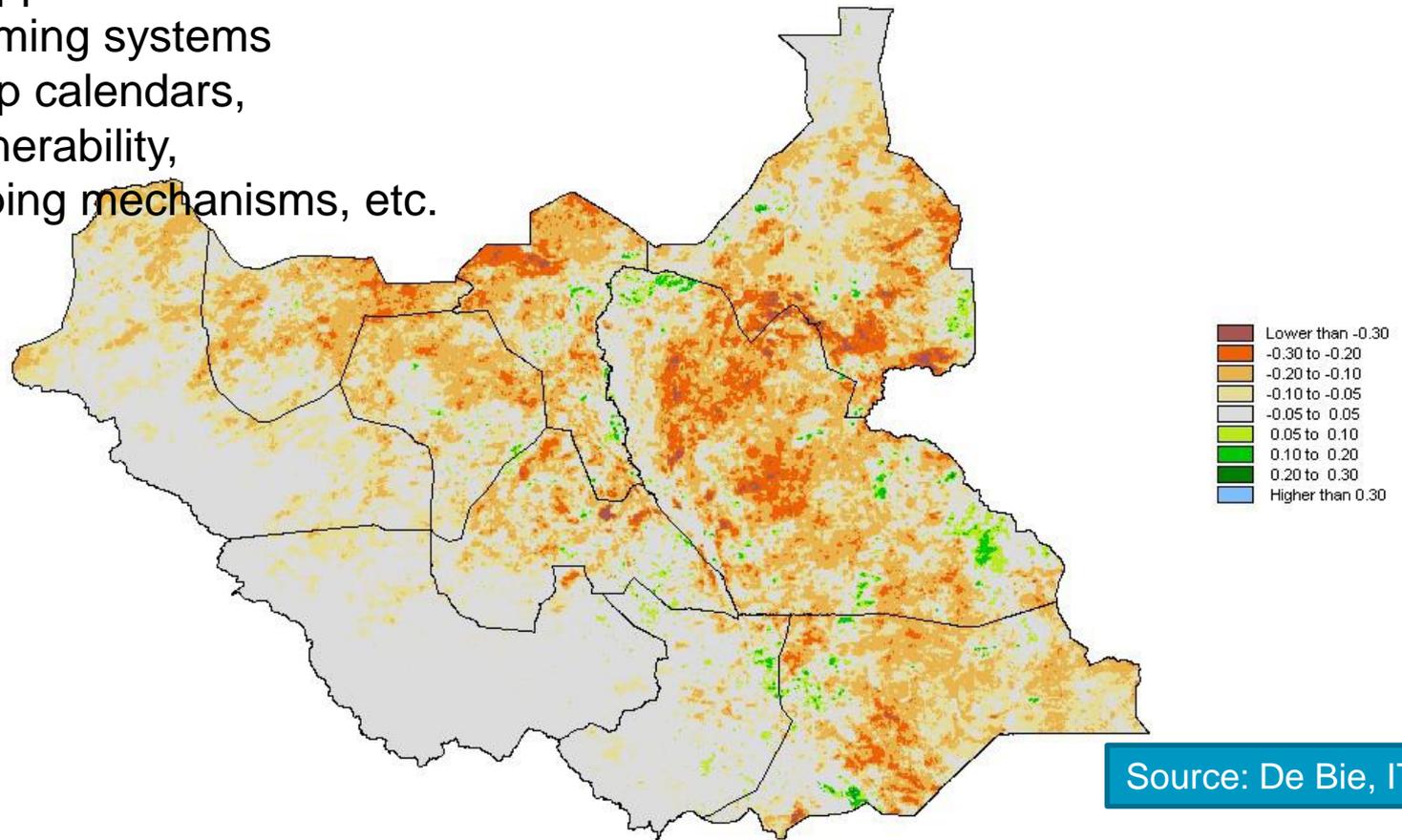


# A product of “Anomaly Mapping” ...

.... how can this be transformed into better information??

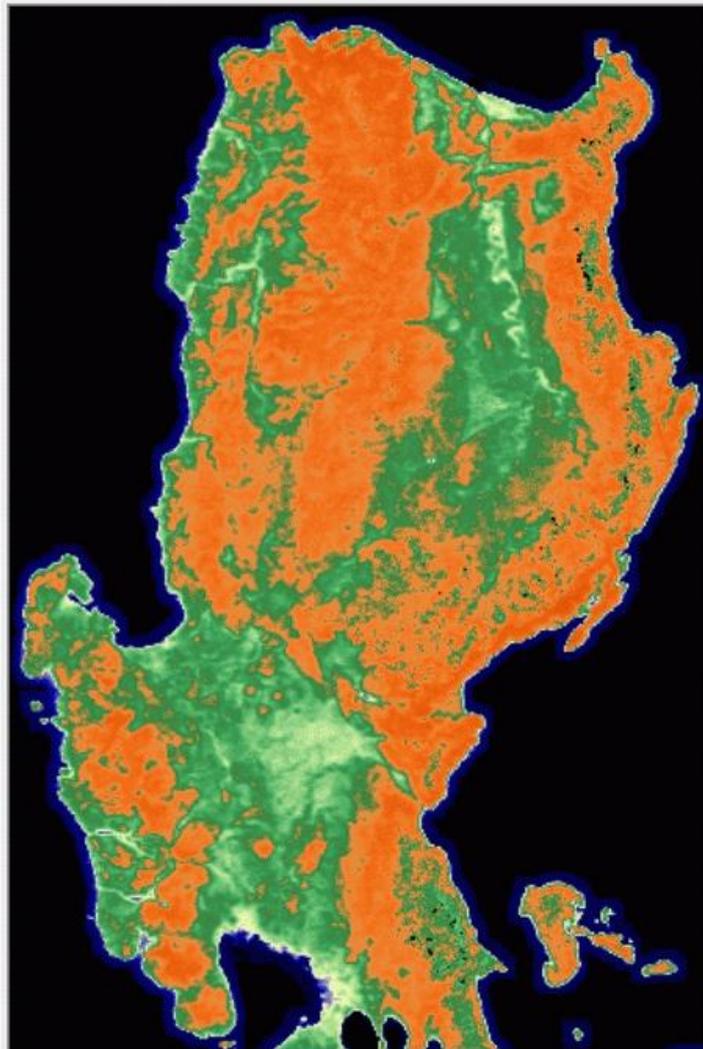
We need info (characterization) on :

- Cropped areas
- Farming systems
- Crop calendars,
- Vulnerability,
- Coping mechanisms, etc.



Source: De Bie, ITC

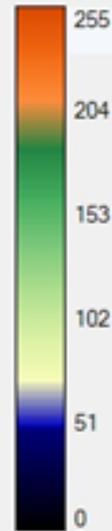
# Preparing NDVI units: e.g. for rice characterization (Luzon, Philippines)



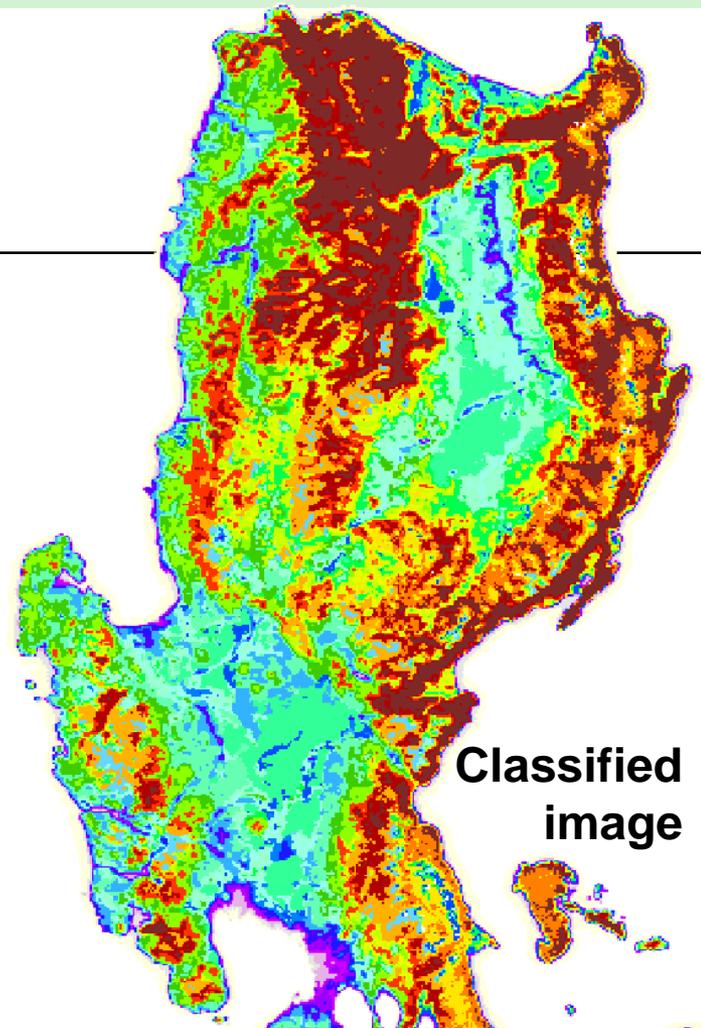
**Greenness of Luzon during a year**



NDVI



**10-day  
periods  
(3 per month)**



**Classified  
image**

**SPOT-VGT NDVI**

S-10 MVC-imagery: 1998-2011

*(de Bie, unpub.)*

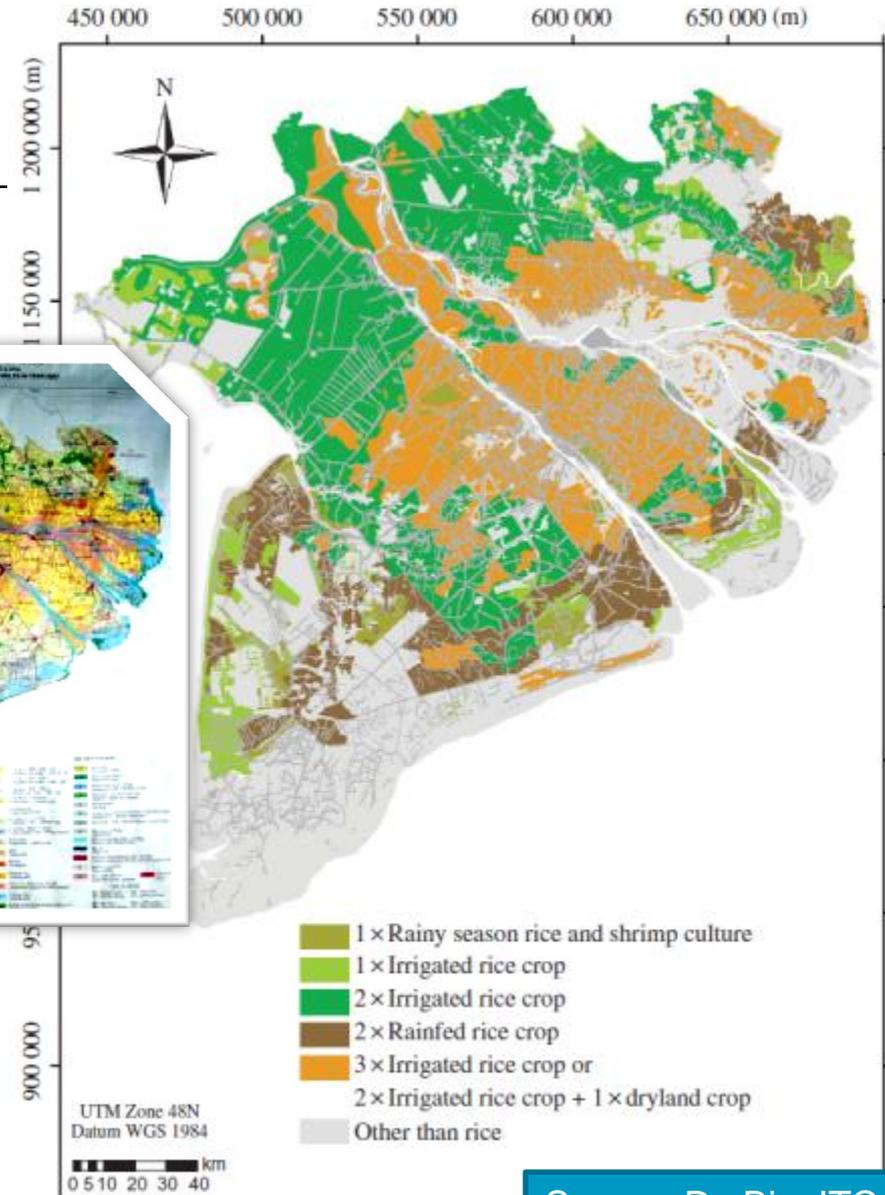
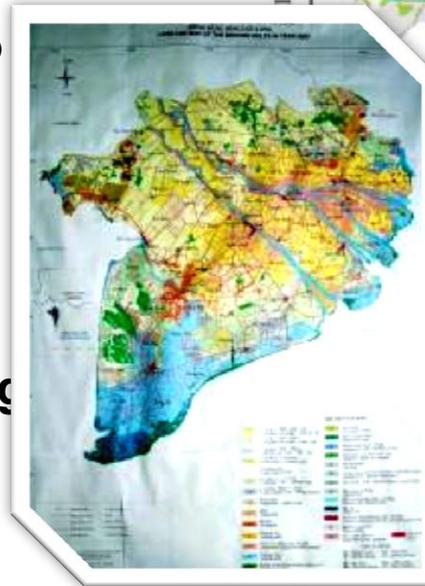
# Then: Mapping crop calendars through field surveys (Mekong)

How to prepare with fieldwork a crop-calendar (cropping systems) map of the rice areas of the Mekong, Vietnam ?

We needed that map to study monitoring methods.

Notes:

- very cloudy area
- ongoing projects using radar images have still not delivered ...



*2002 Existing Rice Map*

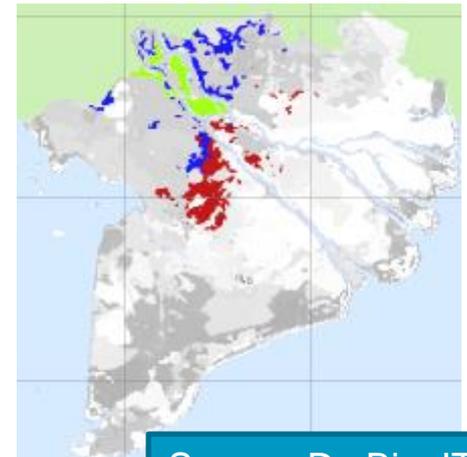
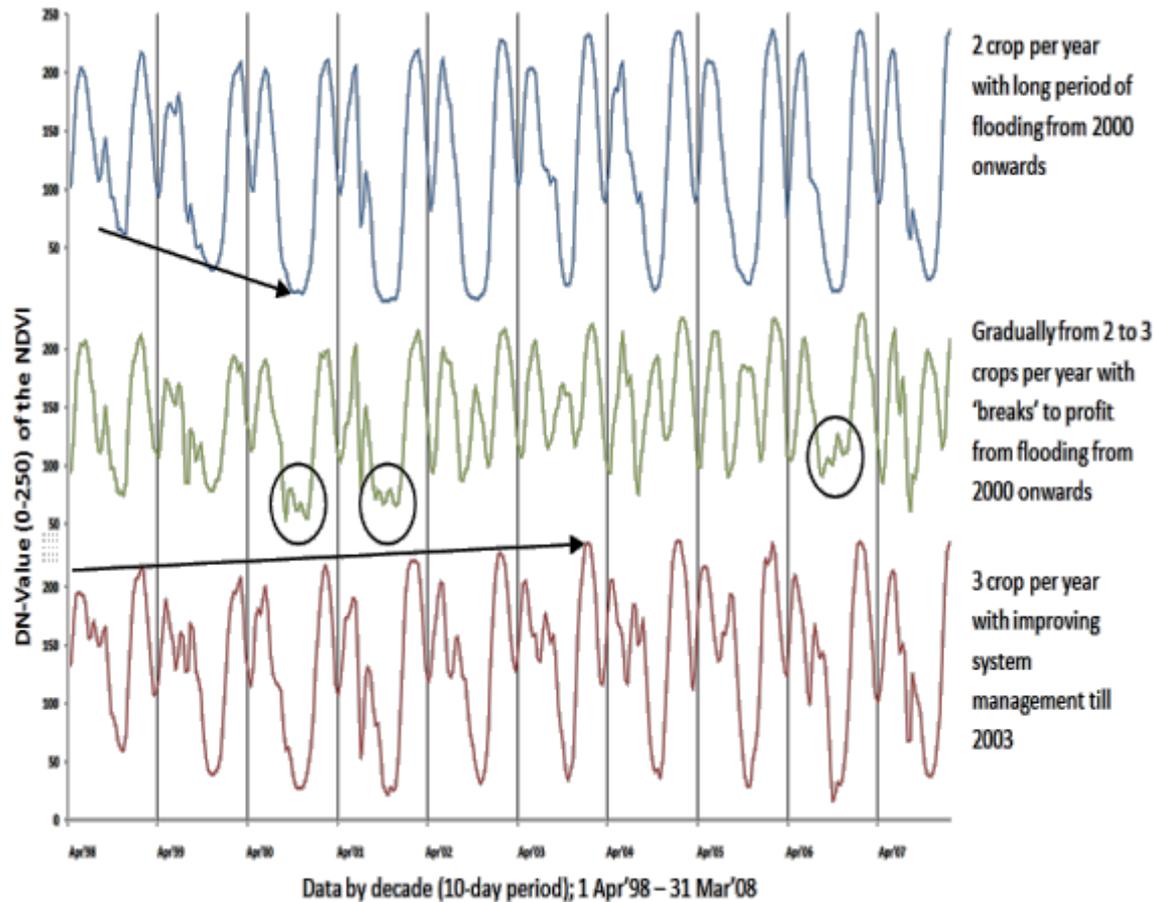
- basically 2 rice classes (2 or 3 crops/year)

- no info *WHEN* the crops are cultivated

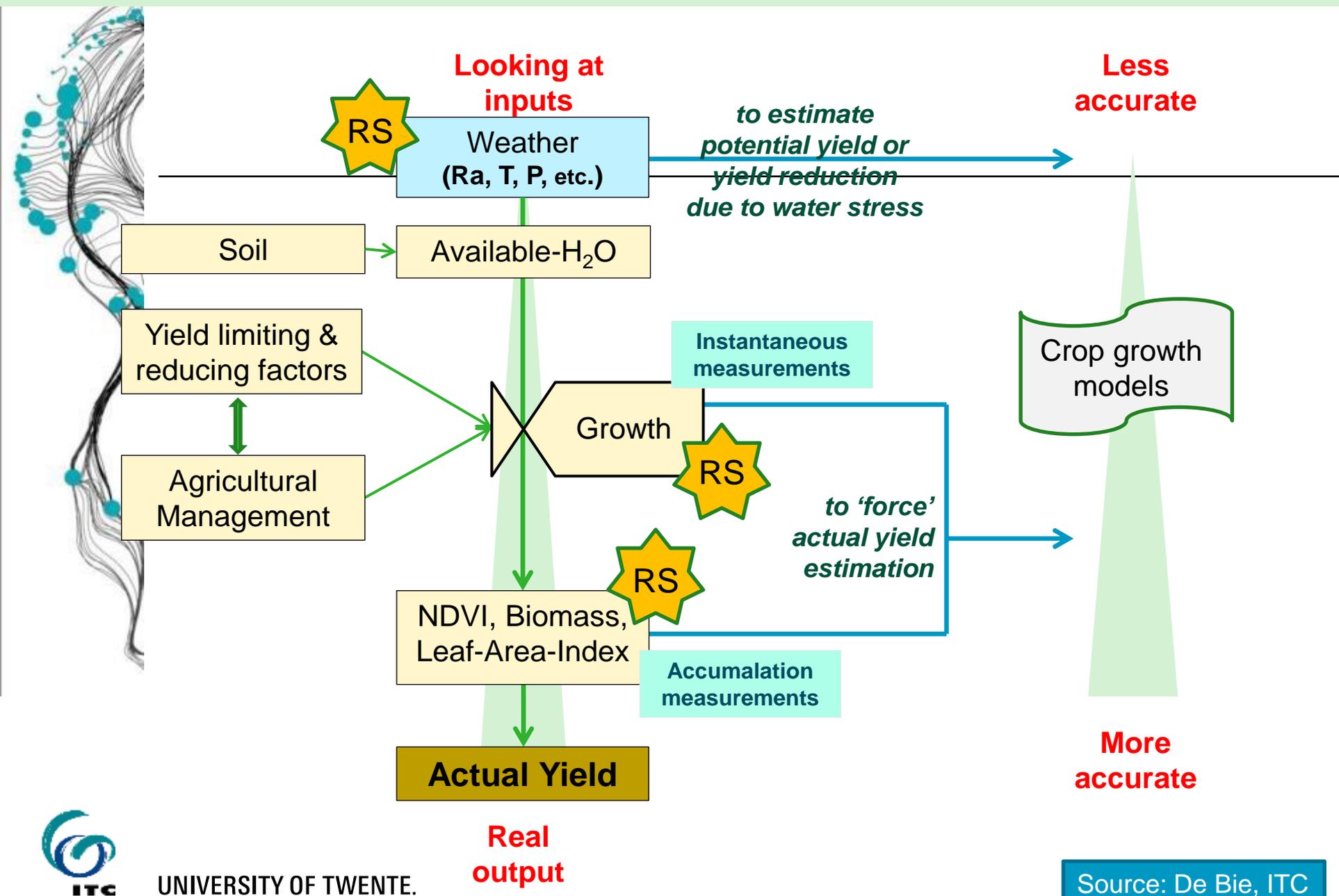
Source: De Bie, ITC

# .... and a choice which period to cover (backwards monitoring!

... generates info on past (10-year) changes

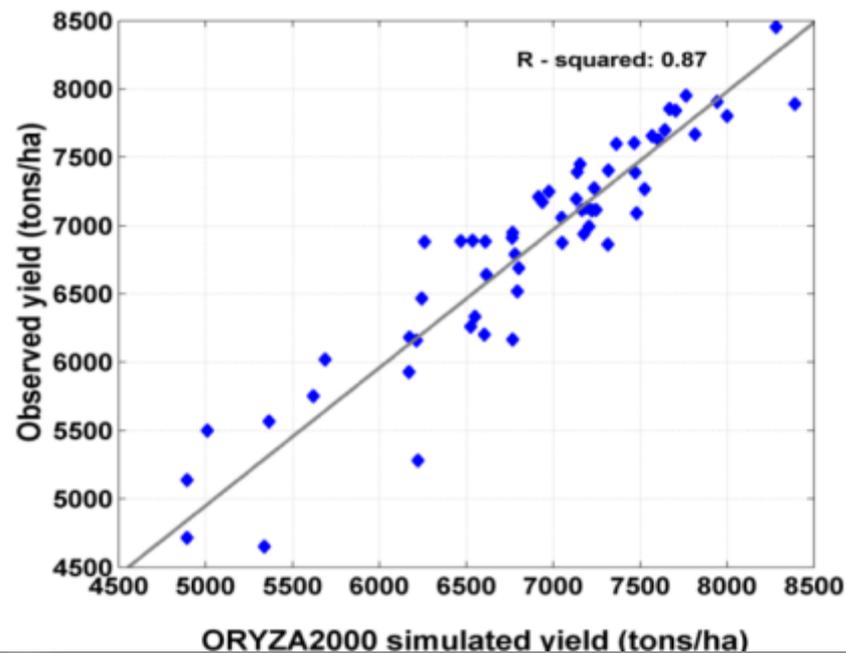
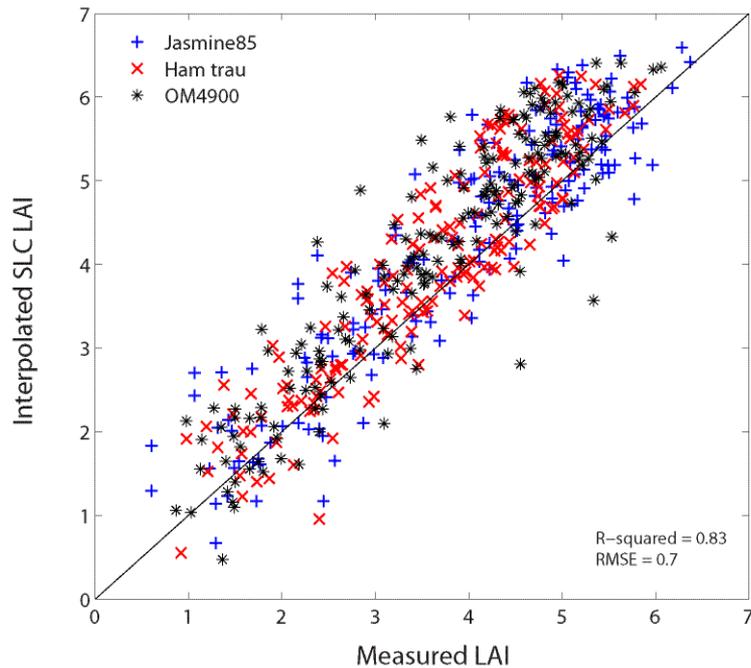
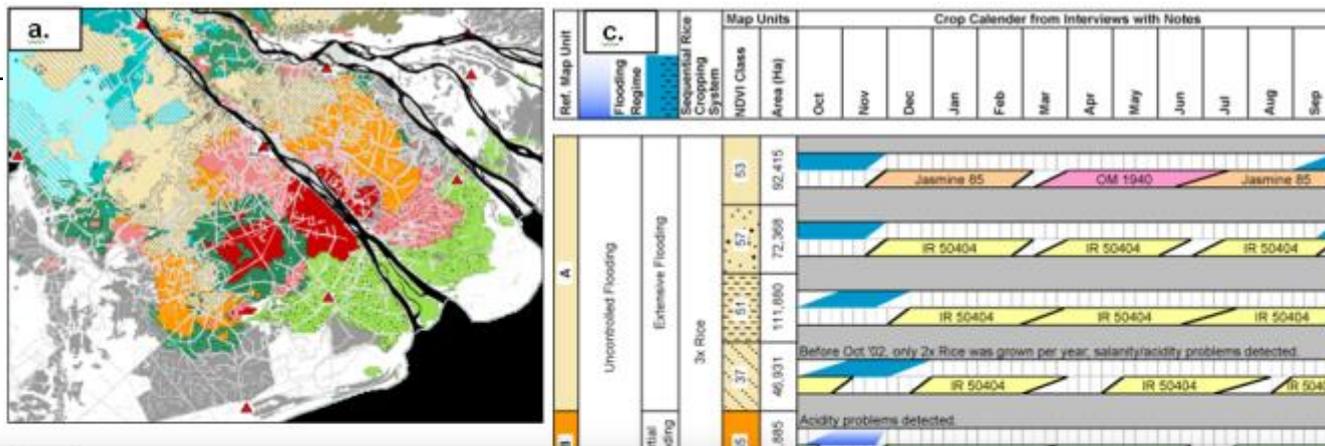


# Combining RS and Crop Models to estimate actual yields



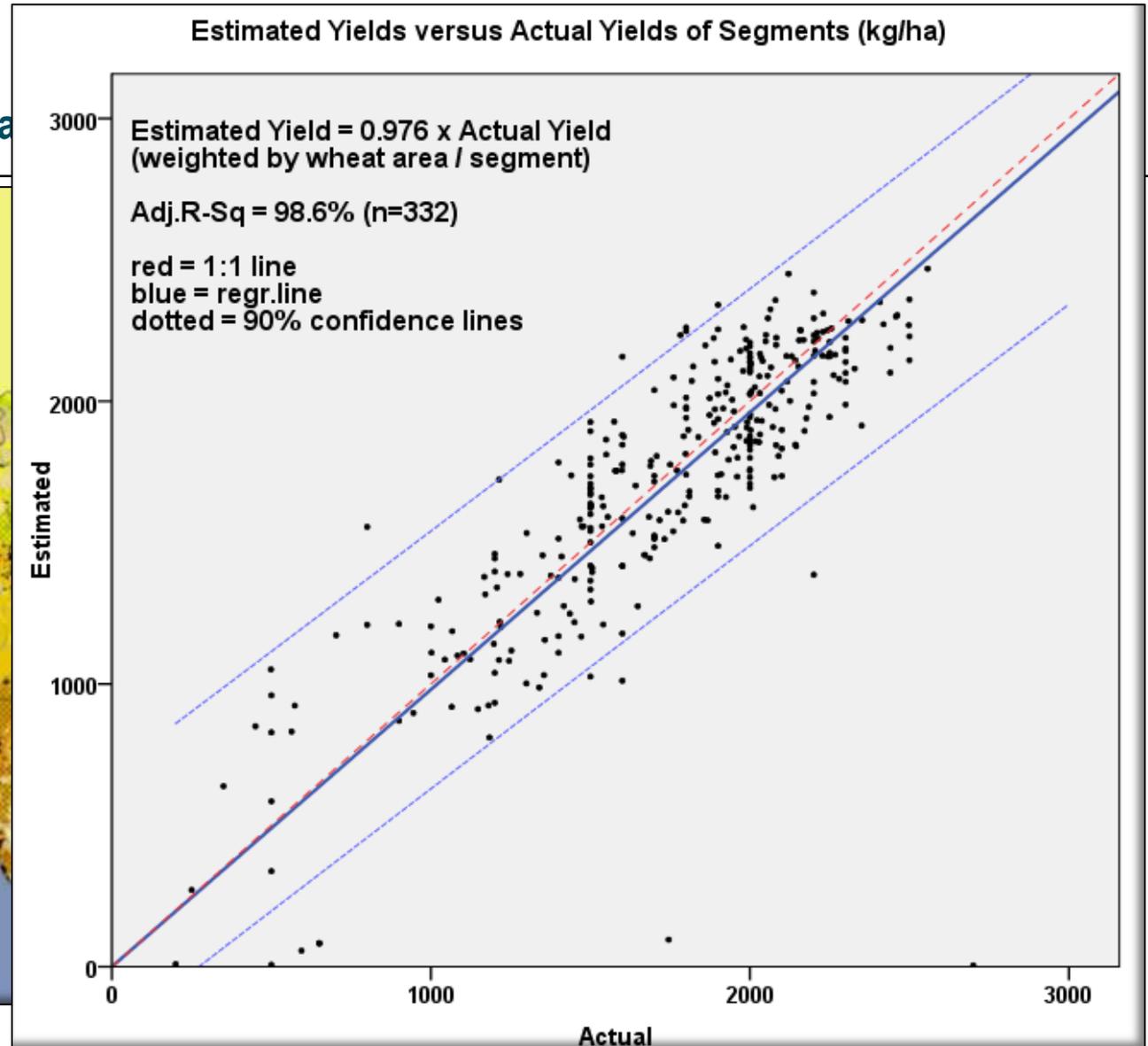
# Example using Accumulation Measurements (*Rice, Mekong Delta, Vietnam*)

Rice yield estimates; 58 sites (*Nguyen Thi Thu Ha et al., in prep.*)



# Example using Instantaneous Measurements (*Wheat, Andalusia, Spain*)

Estimated yields a



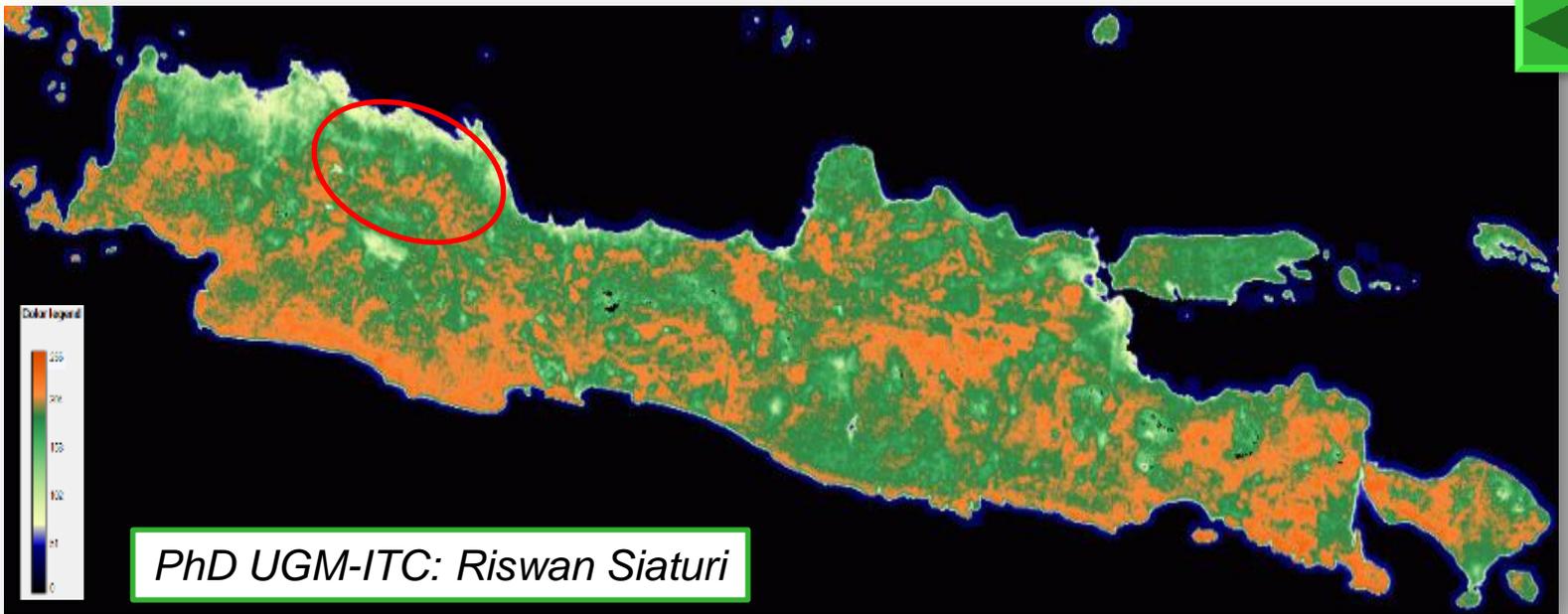
UNIVERSITY OF TV

Validation for 332 700x700m areas

Source: De Bie, ITC

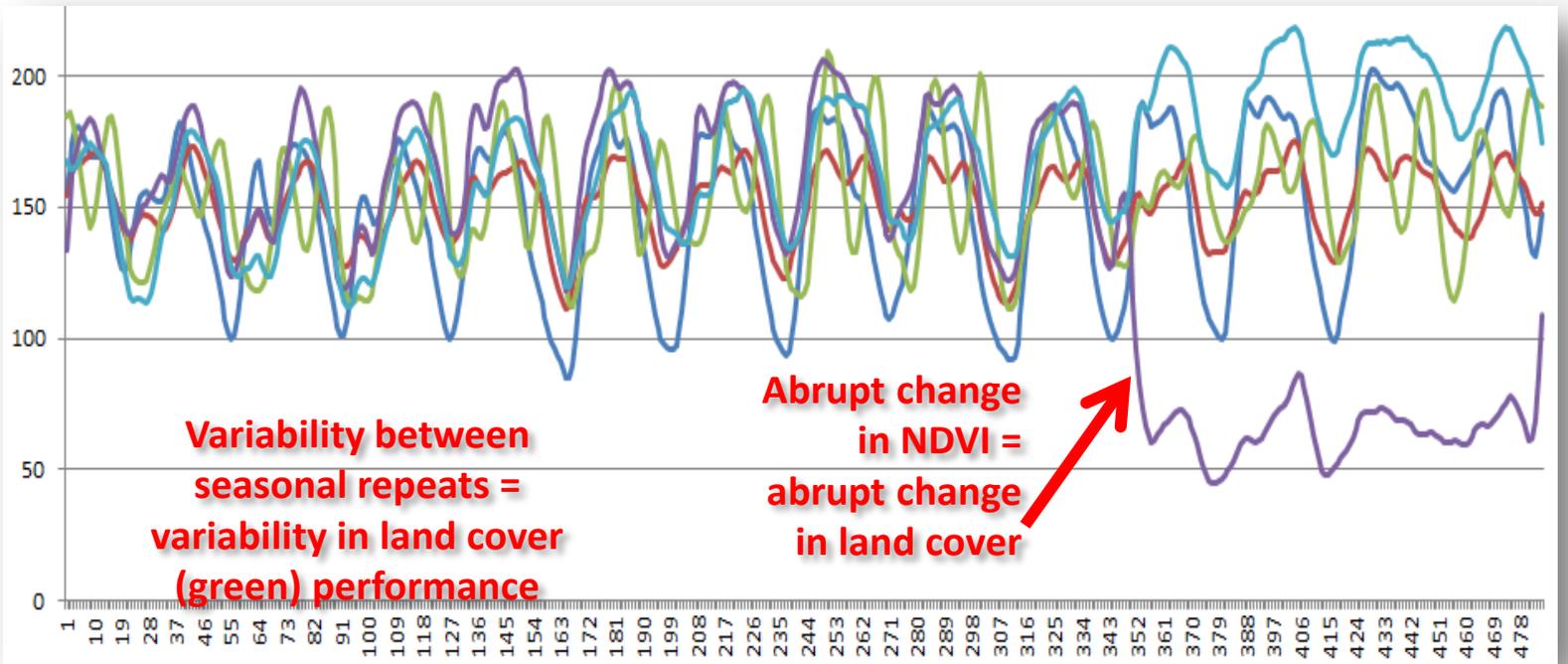
Java: Spot-VGT NDVI DN-data April'98-Sep'13

Movie depicting the median values of the annual repeats  
→



Example of 3 NDVI-profiles that cover the full 15 years!!

Areas with abrupt changes can be identified on the map and the change dated.





*Geodata for Agriculture and Water (G4AW) improves food security in developing countries by using satellite data.*



Rules of the program:  
Proven EO methods; no research  
EO data and products only  
Sound business model



*Netherlands Space Office (NSO) is executing this programme, commissioned by the Dutch Ministry of Foreign Affairs.*

# Dealing with MI-Dogma's → Key decisions made

## 1. What is Insured ?

### a) Yield?

Then, as a consequence, you have insured the farmers business model !!  
This always results in many unhappy farmers !! (basis risk phenomenon)

Results in the need to carry out very expensive validation/complaints campaigns

### basis risk issue

receive a payment when yield was ok, or no payment when yield was poor

Works only when heavily subsidized

### b) A monetary sum?

Then a farmer cannot complain by referring to his obtained yield.

chosen

- i. Insure any sum, with as minimum the amount of credit taken
- ii. A farmer remains responsible for his own business model.
- iii. The insurance can become field, crop and crop-calendar a-specific

The ability to pay issue is partly addressed

scalable

The policy becomes only area and period specific.

validate insured perils on 'test-sites' only

# GIACIS as Public-Private Partnership

200.000 farmers in ethiopia insured

- Offers a geodata-driven risk-mitigation (insurance) product
- Targets smallholder farmers in Ethiopia (80% < 0.5ha)
- Aims to boost purchase of agricultural inputs
- Protects farmers against shocks caused by weather related perils

## The 3 year target

Households reached: 7.2m  
Adopting households: 1.6m  
Indirect beneficiaries: 7.0m

## Expected Impact

Increase in yields: 25%  
Increase in income: 15%

## Business Deal Farmers

Farmers can statistically expect each 10-years indemnity payments that equal paid insurance premiums  
Monetary: Value-Cost ratios are high

- Is a systematic synergetic approach:
  - provides financial inclusion
  - promotes agricultural investment
  - brokers sustainable production methods

## RFS program: Credit Scheme

State bank guaranteed capital: 400m \$  
Must be managed as 'revolving fund'  
Farmers must remain able to pay-back

## Business Deal Kifiya

Charges very small transaction costs, that, multiplied by no.of annual transactions, pays for costs and creates profit expectations



# Mobile apps: Cheetah

A smartphone application allows post-harvest losses during crop transport to be monitored, and reinforcing issues such as unforeseen delays and poor road conditions to be mapped using crowd-sourcing and artificial intelligence.



Uses Copernicus data!

Source: [www.itc.nl](http://www.itc.nl)

"If we are able to reduce post-harvest loss by just one percent in Africa by using the app, we will already have saved US\$480 million annually". Cheetah recently won the App Challenge of the European Space Agency (ESA).

# Objectives



SPURRING A  
TRANSFORMATION FOR  
AGRICULTURE THROUGH  
REMOTE SENSING

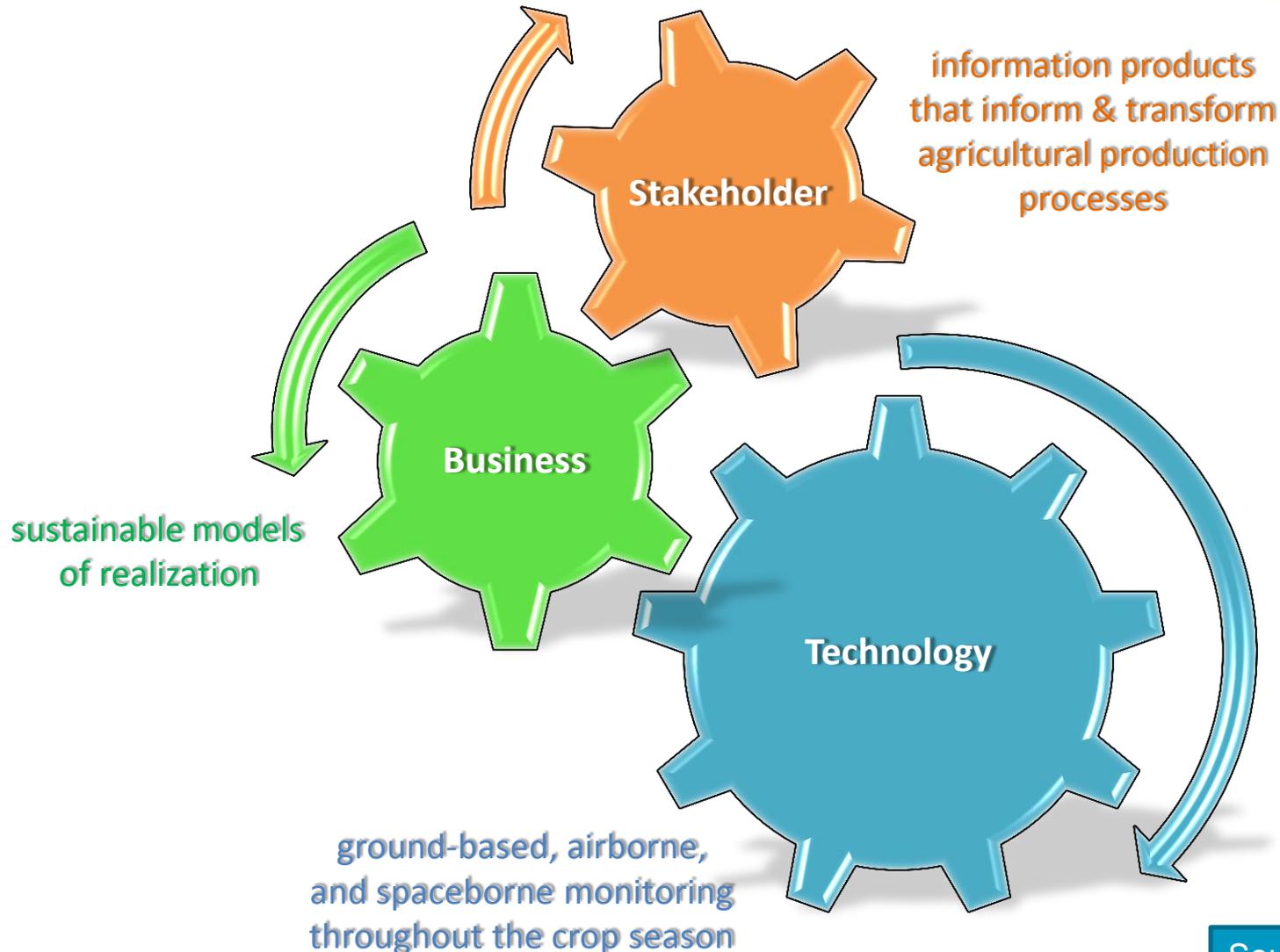
- Support small holder farmer livelihoods and food security in Tanzania and Uganda
- Through provision of timely, transparent information on agricultural prospects to policy makers in order to inform agricultural decisions and policy including:
  - Export bans & trade regulation
  - Amount of crop to purchase for reserves
  - Mobilization of food aid
  - Planning of grain storage
  - Guiding investments, etc

Department of Geographical Sciences, University of Maryland, College Park, MD, USA  
Department of Agricultural Engineering & Land Planning, Sokoine University of Agriculture, Morogoro, Tanzania  
National Food Security Division, Ministry of Agriculture, Food Security and Cooperatives, Dar es Salaam, Tanzania  
Independent Research Consultant, Dar es Salaam, Tanzania  
University of Twente - ITC



Source: De By, ITC

# The philosophy



# Challenge and Opportunity

- Government **mandated to assess food security**, develop policies
- Need **timely, reliable information** at the national scale
- **Long delays** in information collection and aggregation

Remote sensing information can provide:

- Information on **cropland distribution**
- Information on **crop type/system**
- **Crop condition** throughout the growing season



# Pathway

---

**Improve timeliness and reliability** of information on  
agriculture

using

**Remote sensing**  
**Smart phones/tablets**  
**Internet technology**

Working with

**Government & universities**

to

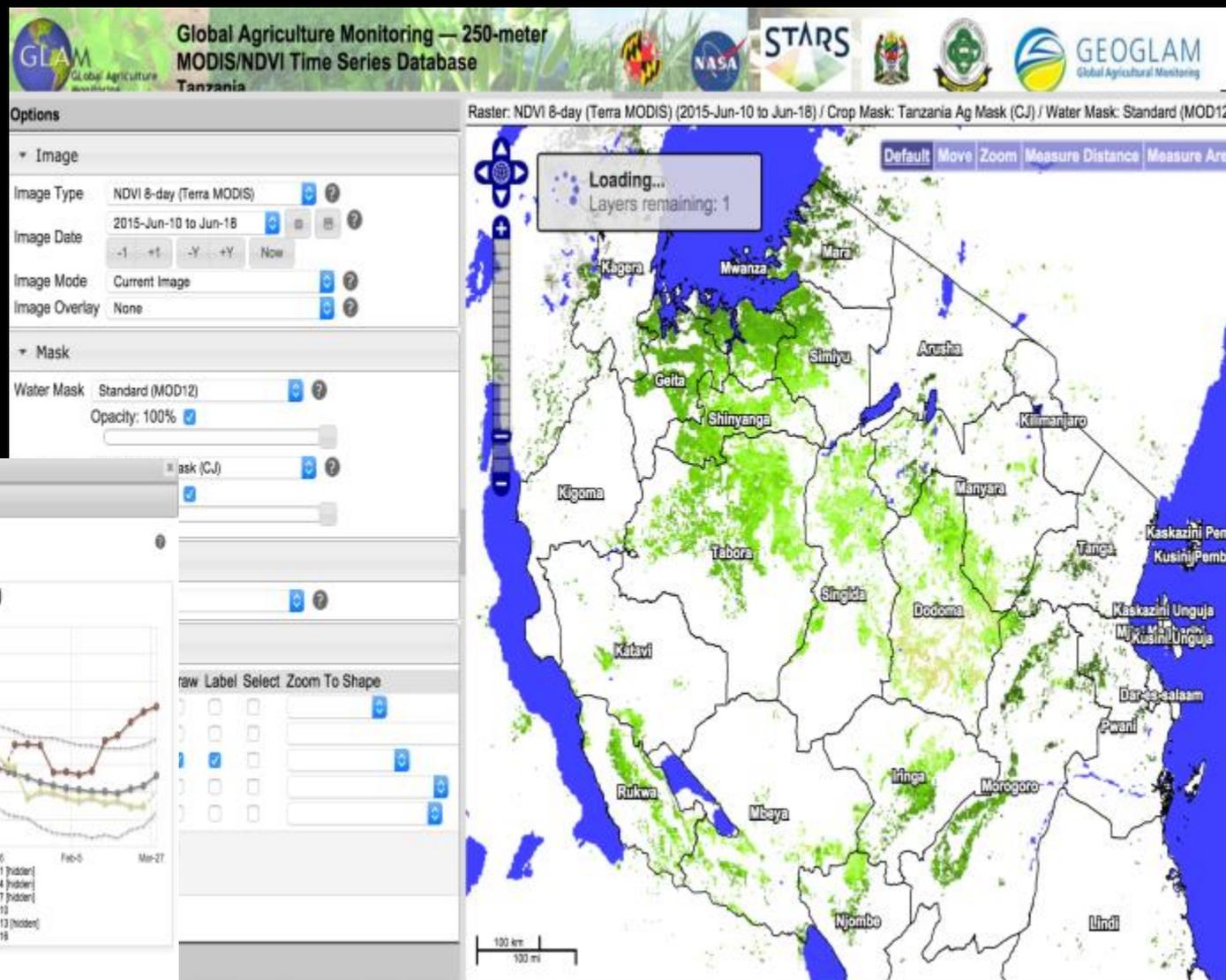
**Inform agricultural decisions** and policy, agricultural  
development initiatives, markets, etc.



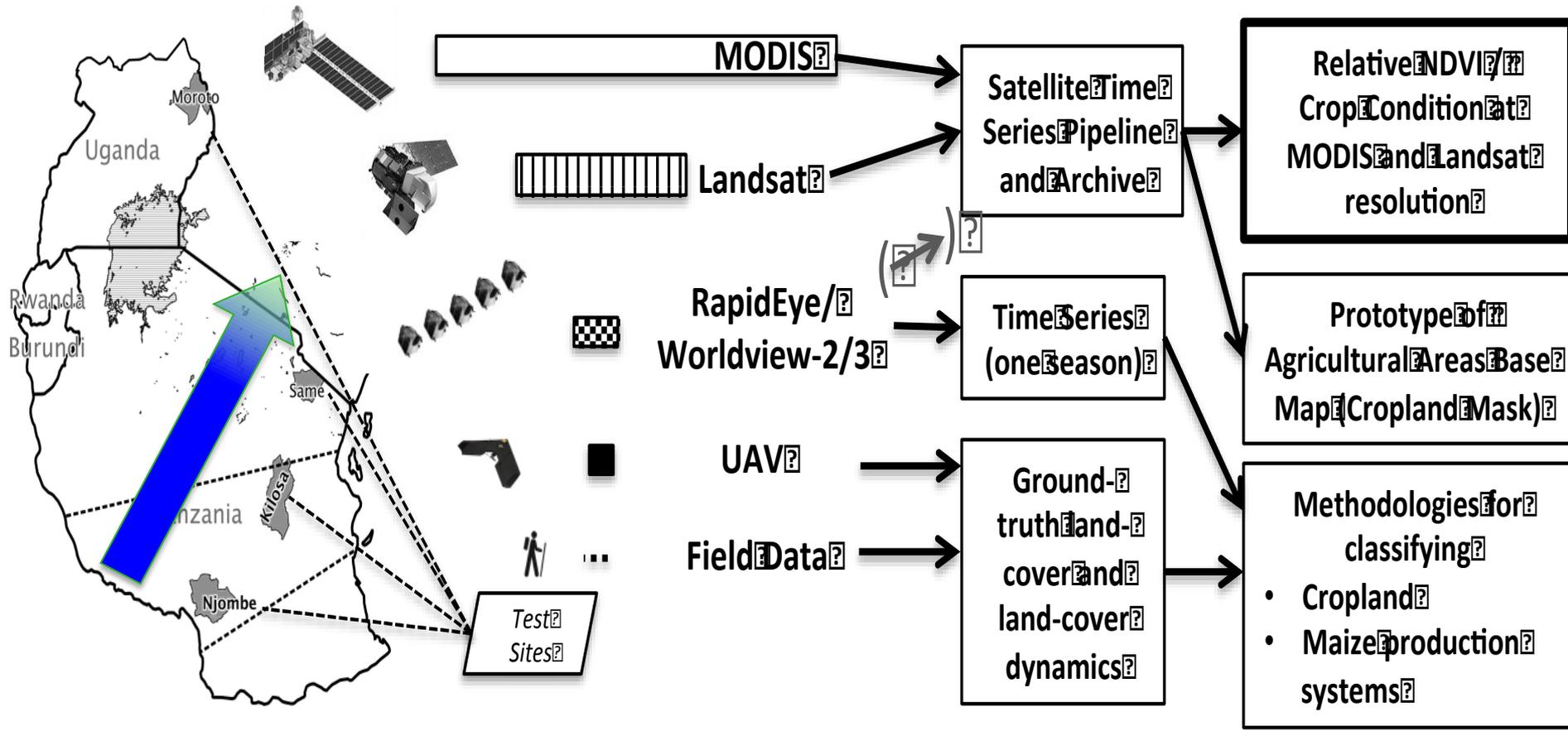
# Crop Condition Monitoring: Adapting the GLAM MODIS System



- Free
- Daily coverage
- Near-Real Time
- Spatially explicit and continuous
- crop condition information

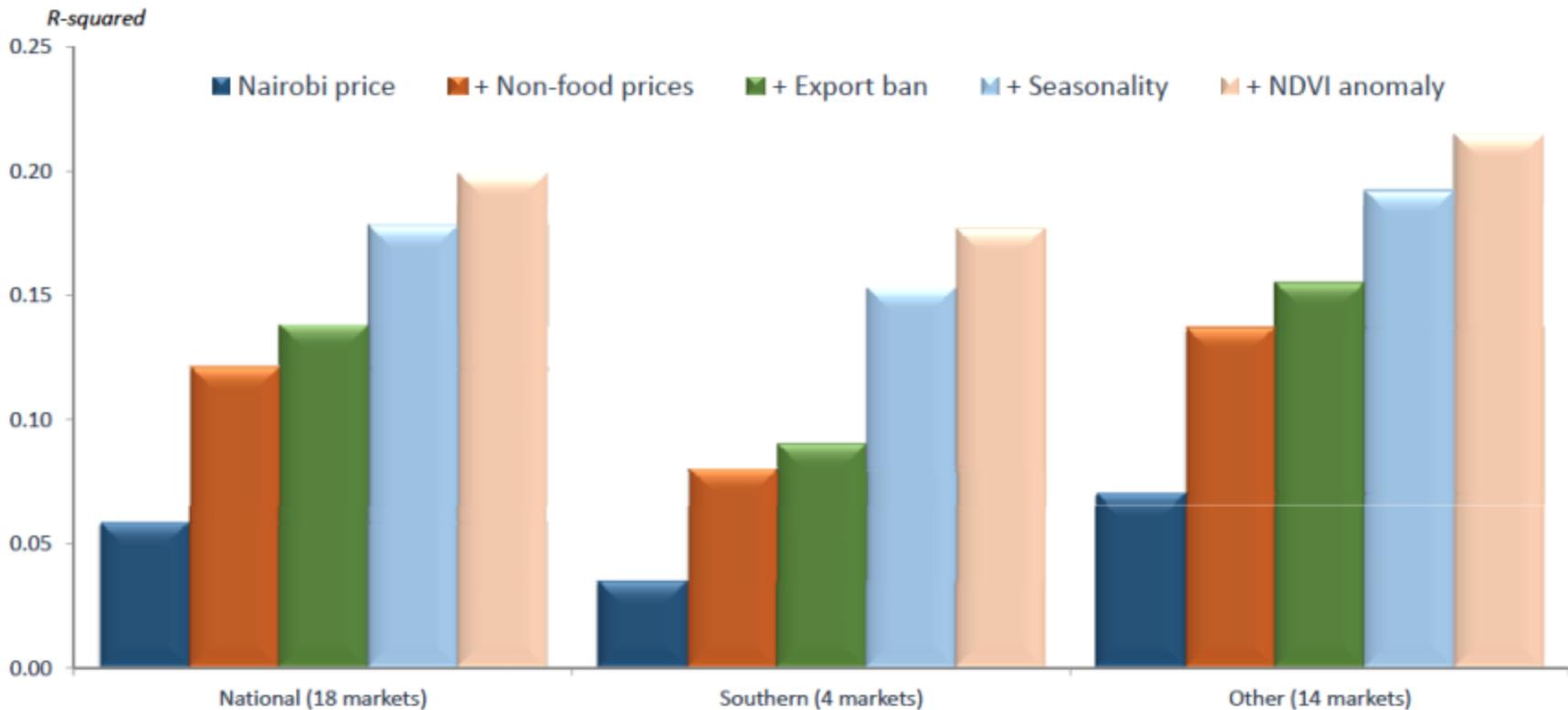


# Remote Sensing Tools

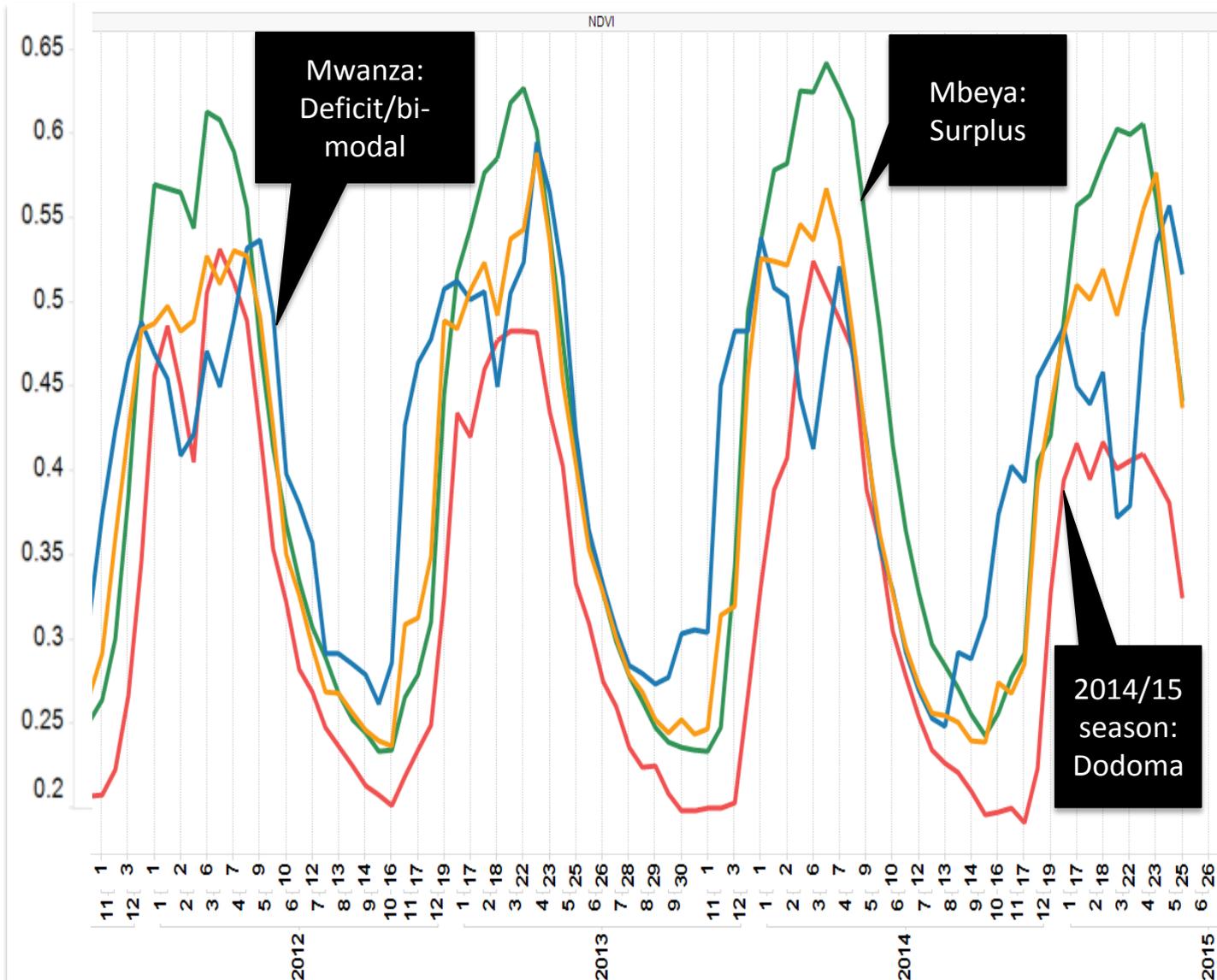


# NDVI & seasonality can explain ~35% of price variations in Tanzania

Source: Baffes, World Bank



# GLAM East-Africa MODIS NDVI Time Series



Source: Becker-Reshef, University of Maryland, STARS project

# Ground Data Collection on Tablets

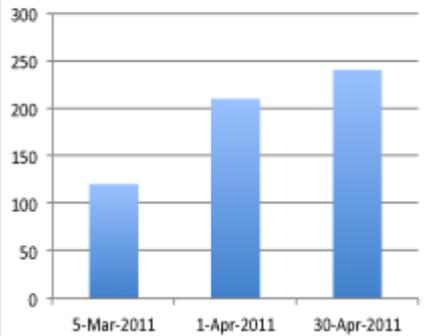


Njombe District,  
Ikisa Village

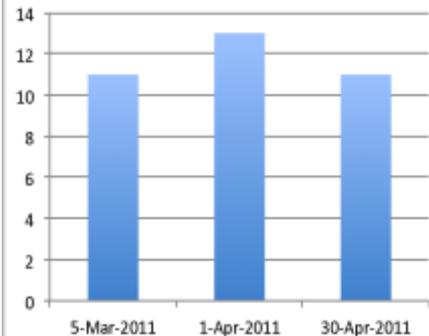
Tanzania



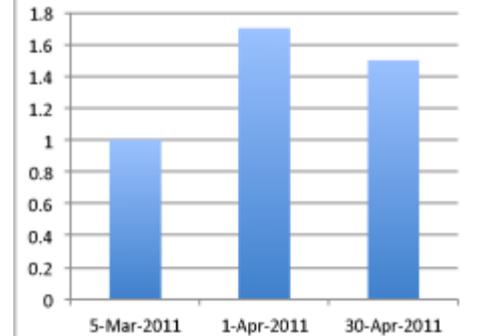
### Crop Height



### Leaf Count



### LAI



# Ministry of Agriculture, Food Security and Cooperatives (MAFC)

*Synthesis and report generation*



## Regional Office-e.g. Morogoro

*Quality check and verification*



## District Office- e.g. Kilosa

*Data aggregation and digitization in Excel spreadsheet and  
WRS-1 to 5 compiled*



## Village/ Ward- e.g. Mbuyuni/Rudewa

*Ward Extension Office (35 officers)  
Village Extension Office (118 officers)  
Data collection via paper forms (ARDS)  
Handwritten notes (WRS 1-5)*



Farmer

# Prototyping a tablet based data collection system

Using the existing paper forms currently used, deployed in Morogoro

## Current Ministry forms (WRS 1-

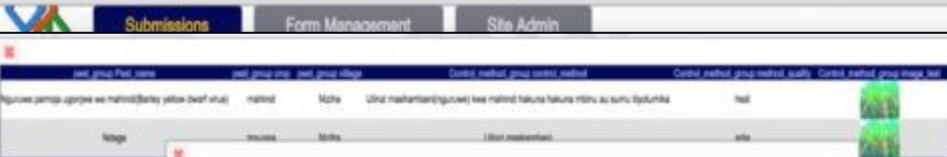
- 1: Crop type, area, production
- 2: Crop condition, drought, food security
- 3: Crop pests and diseases
- 4: Market prices
- 5: Rainfall



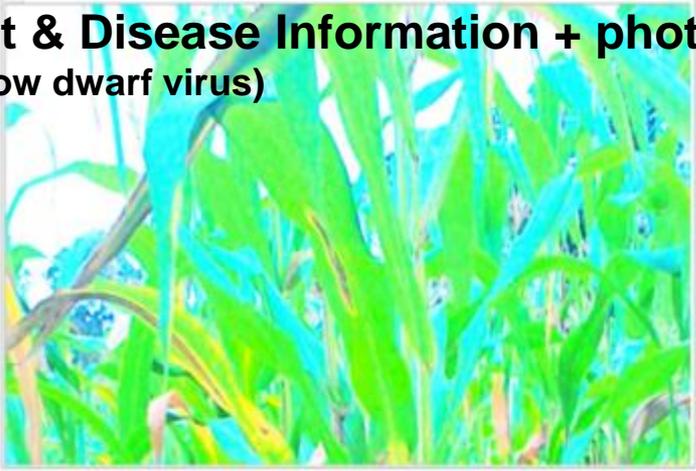
Extension Officer  
Field data collection

Source: Becker-Reshef, University of Maryland, STARS project

# Online ODK Database (ona), example of submitted Crop Condition forms (WRS-2)



**Pest & Disease Information + photos (yellow dwarf virus)**



**Village-level Price Data**

crop	answer2	price_min	price_max	stock
mze	ndani nje	400	470	30
rce	ndani nje	1100	1600	32
cssv	ndani	800	1000	1
rptt	ndani nje	600	800	1
bens	ndani nje	1500	1800	2
sbnn	ndani	600	800	2
sptt	ndani	800	1000	1

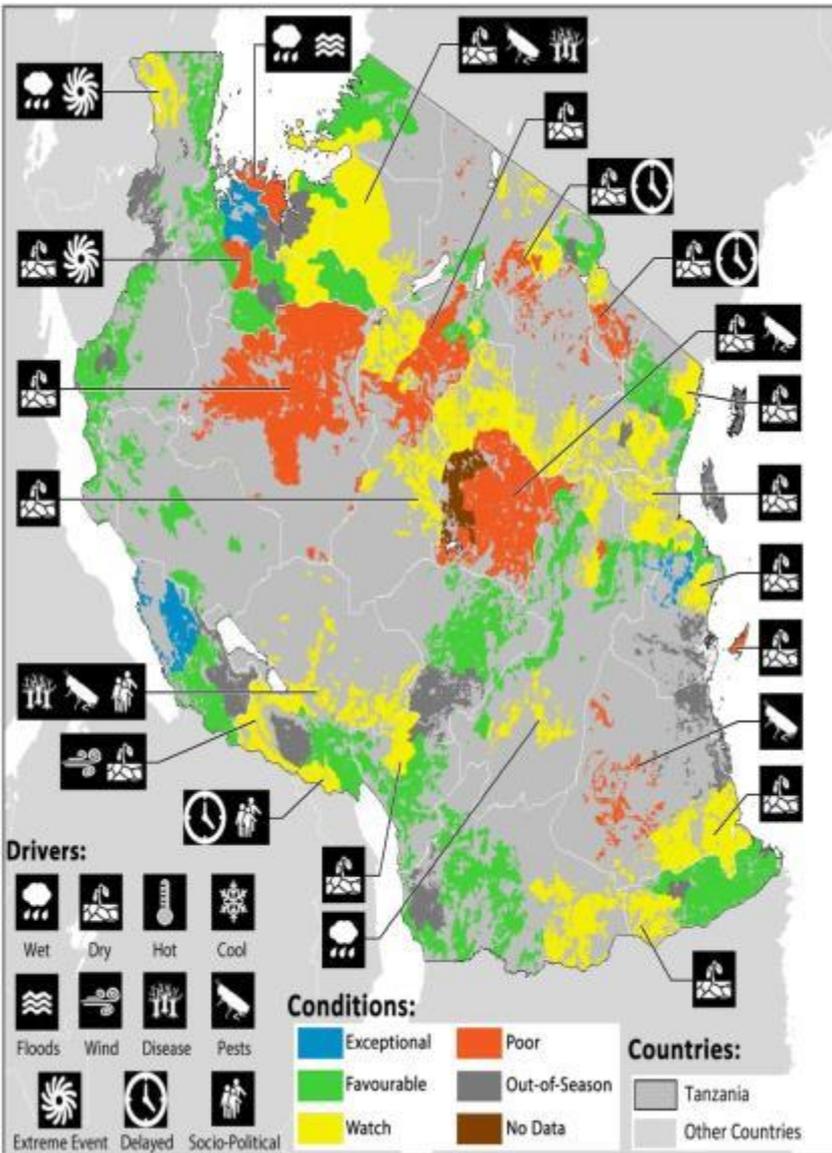
id	created_at	updated_at	name	location	status	view	uid
356586060420633	Sat Aug 01 06:19:47 UTC 2015	Sat Aug 01 06:23:37 UTC 2015	Nzelumina Mbundamila	Kilosa	Redewa	<a href="#">View</a>	uid:a9411a7f-451c-410d-87d3-dddfc4c22774
356586060422530	Tue Jul 07 16:24:19 UTC 2015	Tue Jul 07 16:29:41 UTC 2015	Awadh	Kilosa	Tindiga	<a href="#">View</a>	uid:8f693928-743d-4513-8499-3ff907e5c99c
356586060426671	Mon Aug 03 10:16:02 UTC 2015	Mon Aug 03 10:21:10 UTC 2015	ANNA NGOWO	Morogoro	Mkambalani	<a href="#">View</a>	uid:15c42c0d-30dc-480a-a523-7044f6e04e21
356586060415633	Thu Aug 06 06:35:36 UTC 2015	Thu Aug 06 06:39:46 UTC 2015	Andiliah Kassim Mussa	Gairo	Nongwe	<a href="#">View</a>	uid:ef41d188-d8c0-4632-aa16-3c69a65da22c
356586060420633	Sun Aug 09 05:39:18 UTC 2015	Sun Aug 09 05:40:22 UTC 2015	Nzelumina Mbundamila	Kilosa	Redewa	<a href="#">View</a>	uid:b0d61d0f-1401-46a5-a15f-862994a4c973
356586060420633	Sun Aug 09 05:36:02 UTC 2015	Sun Aug 09 05:37:31 UTC 2015	Nzelumina Mbundamila	Kilosa	Redewa	<a href="#">View</a>	uid:114df217-082f-4f48-a9b7-c29883f45d25
356586060442819	Tue Aug 11 06:28:14 UTC 2015	Tue Aug 11 06:49:45 UTC 2015	Edwin E Ndimugwanko	Morogoro_Urban	Kauzeni	<a href="#">View</a>	uid:41b6d594-0f49-431f-95b6-cbf33ba0bc06
356586060426846	Wed Aug 12 08:44:04 UTC 2015	Wed Aug 12 08:57:56 UTC 2015	Samwel	Ulanga	Mawasiliano	<a href="#">View</a>	uid:dbc77c25-7883-4209-bab4-54f0736b2976
356586060419650	Wed Aug 12 19:44:26 UTC 2015	Wed Aug 12 19:48:22 UTC 2015	RAJABU MDABKU SWALEHE	Mvomero	Mziha	<a href="#">View</a>	uid:4acef337-0bd0-4bdf-b495-d1892e86a2fb
356586060420633	Sun Aug 16 12:43:44 UTC 2015	Sun Aug 16 12:48:34 UTC 2015	Nzelumina mbundamila	Kilosa	Redewa	<a href="#">View</a>	uid:73087e05-55b7-443b-b290-...
356586060426671	Tue Aug 18 08:49:57 UTC 2015						

Source: Becker-Reshef, University of Maryland, STARS project

# Crop Monitor Tanzania

from data to information

Provides real-time information on crop conditions to support decisions such as mobilization of food, grain storage, food reserve purchases, market intelligence that can promote private industry



## Example for prototype in May

Map depicting crop conditions in each region over cropland areas.

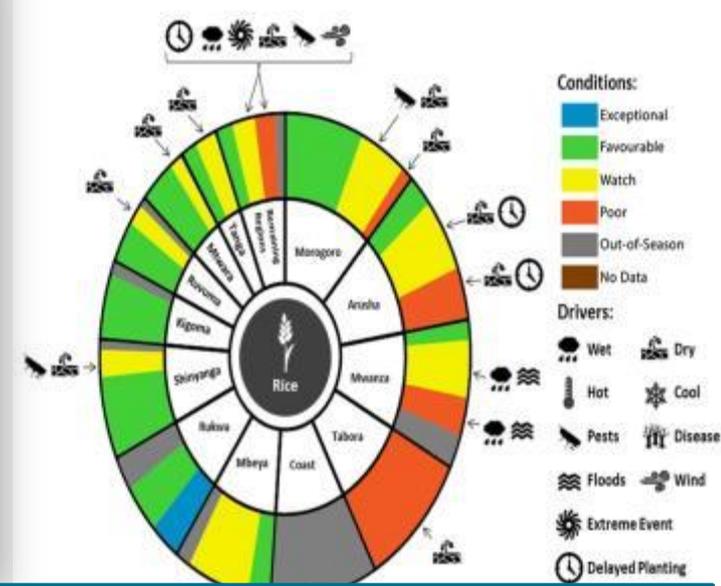
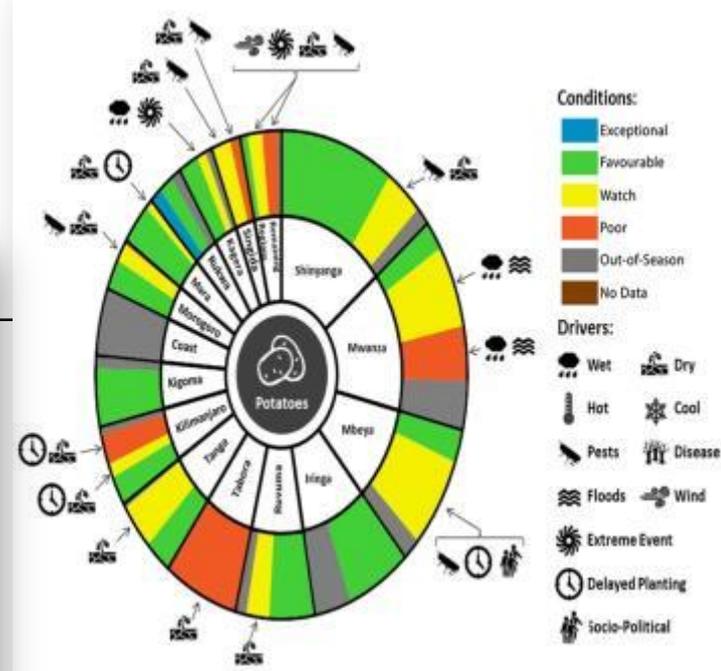
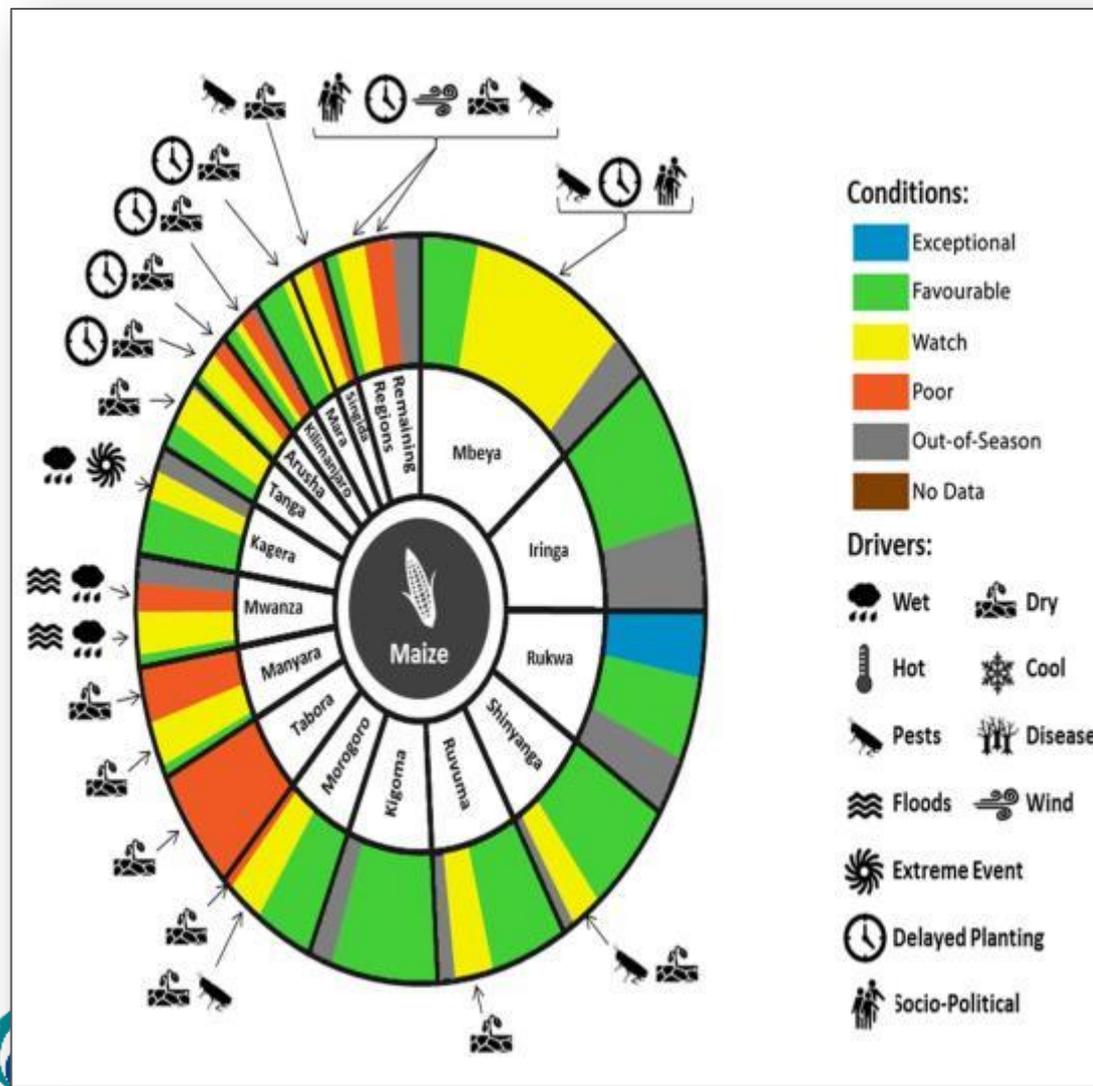
Where conditions are below average, an icon with the driver is provided.

i.e. in Morogoro, dryness and pests were negatively impacting crop conditions



# Crop Condition Pie charts by Crop and Region

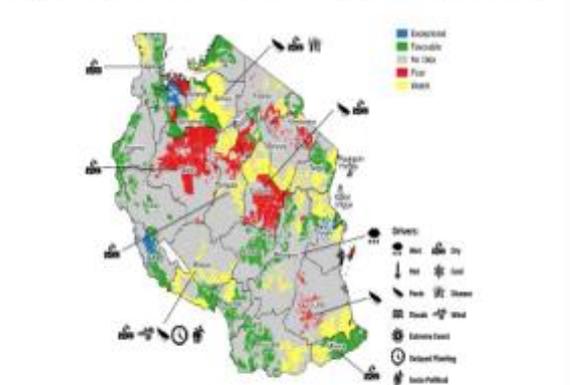
Slice of pie is proportional to production



# Prototype National Food Security Bulletin- Tanzania Bringing RS, tablet, & online GIS tools together

**THE UNITED REPUBLIC OF TANZANIA**  
**MINISTRY OF AGRICULTURE FOOD SECURITY AND COOPERATIVES**  
 Kilimo House 1, Dar es Salaam, P.O. Box 1912, BAKILI KALAMU, Telephone: +255-412-386294, Fax: +255-412-386375, E-mail: [info@nfsb.go.tz](mailto:info@nfsb.go.tz)  
**NATIONAL FOOD SECURITY BULLETIN**  
 Volume 2015, No. 05 www.agriculture.go.tz 30<sup>th</sup> May, 2015

## Major Crop Conditions in Tanzania (as of 30th May 2015)



This crop condition map synthesizes information for all crops as of 30th May 2015. Crop conditions over the main growing areas are based on a combination of national and regional crop analyst inputs along with remote sensing data and rainfall data provided by the Tanzania Meteorological Department. Areas that are in either than favorable conditions are displayed on the map with their drivers

**NATIONAL HIGHLIGHTS**

The maize crop growing areas of the southern highlands conditions are fair to favorable with the exception of Mbeya where conditions are poor. The region experienced a delayed start to the rainy season, which has created early moisture deficits in many areas.

Poor conditions persist in Tabora, Lindi and parts of Geita, Arusha, Kilimanjaro and Dodoma. There is reports of pests and diseases in Simiyu, Dodoma, Lila and Mbeya. The common crop pest is the Larger Gn (Dussum) affecting maize crops in all the districts in Sir Morogoro. The Ceratoma pest and disease in Mara is Maize Leaf Necrosis (MLND), Cassava Mosaic Virus and Brown Streak.

Seasonal rains have begun to intensify in the last two decades, however the effects early season rainfall deficits are still evident. April is the peak month for the long-rain season and given a positive two-week forecast, some relief is expected.

**Contents**

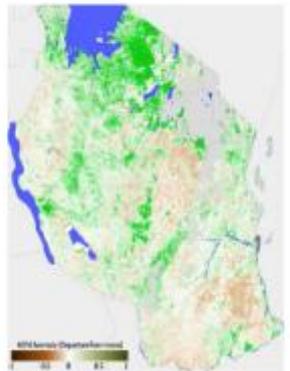
Major crop conditions ..... 2

National highlights ..... 1

..... 0

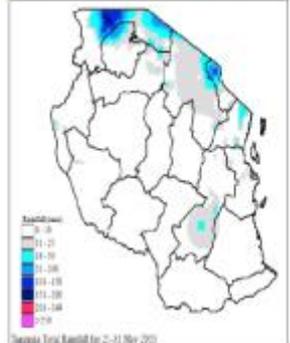
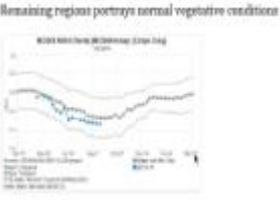
Probability: ..... 4

Intervention programs: ..... 4



**NDVI Summary:**

NDVI anomaly data for the country show above average conditions for the country with Simiyu, Shinyanga, Tabora and some parts of Mbeya and Rukwa performing relatively above average conditions compared to the long-term average for the month of May. Some parts of Iringa, Lindi and Dodoma current vegetation conditions fall slightly below average.



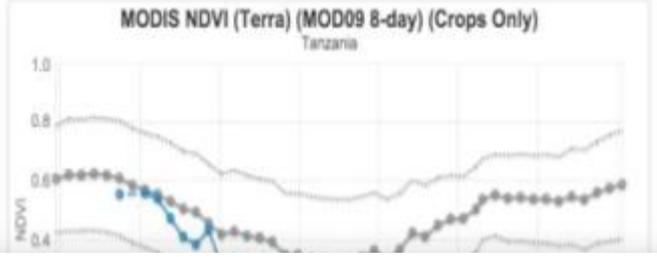
**Agro-meteorological outlook:**

The Tanzania Meteorological Agency (TMA) reports that with the observed synoptic conditions during May 21-31, 2015, Maisha continued to feature over some of the bimodal areas especially north-eastern highlands and Lake Victoria Basin. However, parts of those areas and much of the northern coast experienced dry conditions. The seasonal areas on the other hand experienced mostly 4 including over the normal 1 and Lake rainfall, 4 year unit (mostly 3 Neregon

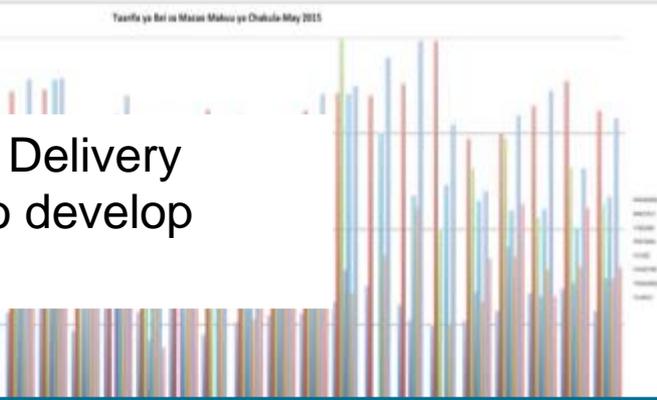
## Highlights by Major Food Crop

**Maize:**

A delayed start of the 2015 Maisha for maize has led to significant rainfall deficits in parts of Njombe and Iringa. A major proportion of the maize growing areas of Dodoma are experiencing poor conditions. The three crop growing areas Singida, Kilimanjaro, and Tabora are currently in a watch status due to abnormally hot temperatures and reduced rainfall. The maize growing area of SNNPR has been significantly impacted by these same drivers, but also experienced a more significant delay in the onset of seasonal rains, thus owing to the areas poor cropping conditions. Earth Science has been reported in Mozambique from the south.



## Food Prices by region:



Strong interest from Ministry, Prime Minister Delivery Bureau, and Deputy Permanent Secretary to develop operationally

# Real-time *DATA* leading TO *Informed DECISIONS*



Figure 3: Crop Conditions in Kupa Sub-County August 13, 2015.  
A food security monitoring officer talking to a farmer whose maize prices totally dried.



Figure 4: Crop Conditions in Nalungel Sub-County August 14, 2014  
The above garden should have been at harvest stage at the time the above photograph was taken.  
On 17<sup>th</sup> August 2015, the Hon. Minister for Relief, Disaster Preparedness and Management visited the area and wrote and physically delivered a letter to the Hon. Minister of Finance pointing out the worsening situation. On 24<sup>th</sup> August 2015, the Rt. Hon. Prime Minister called a meeting with the Ministers for Finance, Agriculture, and Disaster on the subject. The meeting was chaired by the Minister for Relief, Disaster Preparedness and Management and attended by the PS (Secretary to Treasury) who promised to avail funds within one week. Funds have not been released.

THURSDAY, OCTOBER 15, 2015 | Last Updated 3 Hours Ago | CONTENT RIGHTS AND PERMISSION | RSS | ADVERTISE | SUBSCRIBE

## New Vision

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### Environment

#### Govt to distribute relief food to Karamoja

Published Date: Sep 26, 2015

Prime Minister Dr. Ruhakana Rugunda chaired a meeting that discussed the food situation in Karamoja region. (File photo)

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Food security report presented to Inter-Ministerial Committee September 25, 2015



First trucks of relief food dispatched September 26, 2015



# GEOCAP

Geothermal Capacity Building Program Indonesia - Netherlands

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Home

## Apakah GEOCAP?

The Geothermal Capacity Building Programme - Indonesia-Netherlands (GEOCAP) adalah sebuah kolaborasi internasional antara lembaga-lembaga Indonesia dan Belanda dengan tujuan untuk mengembangkan keterkaitan erat antara program panas bumi untuk pendidikan, pelatihan dan penelitian dan juga untuk mengembangkan suatu database lapisan bawah permukaan bumi.

[Continue Reading »](#)

## What is GEOCAP?

### Login Form

Remember Me

[Forgot your password?](#)

[Forgot your username?](#)

Source: den Hartog

# GEOCAP : GEOTHERMAL CAPACITY BUILDING PROGRAM

## Objective of GEOCAP:

increase the capacity of Indonesian Ministries, Local Government, Agencies, Public and Private Companies, and Knowledge Institutions in developing, exploring and utilization of geothermal energy resources and to assess and monitor its impact on the economy and the environment

**ENDORSED BY BAPPENAS**



UNIVERSITY OF TWENTE.

Source: den Hartog



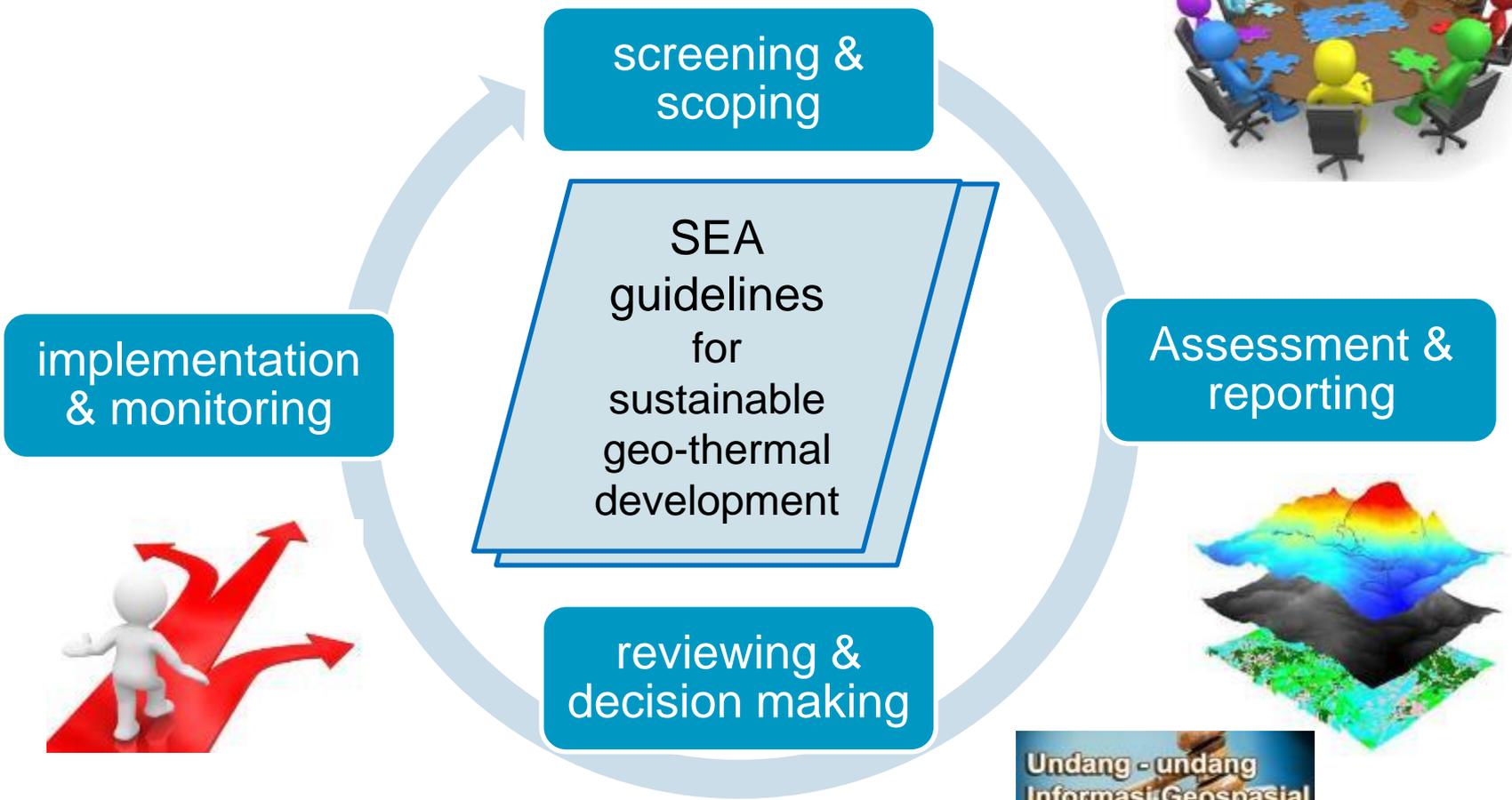
# GEOCAP : GEOTHERMAL CAPACITY BUILDING PROGRAM

## Background:

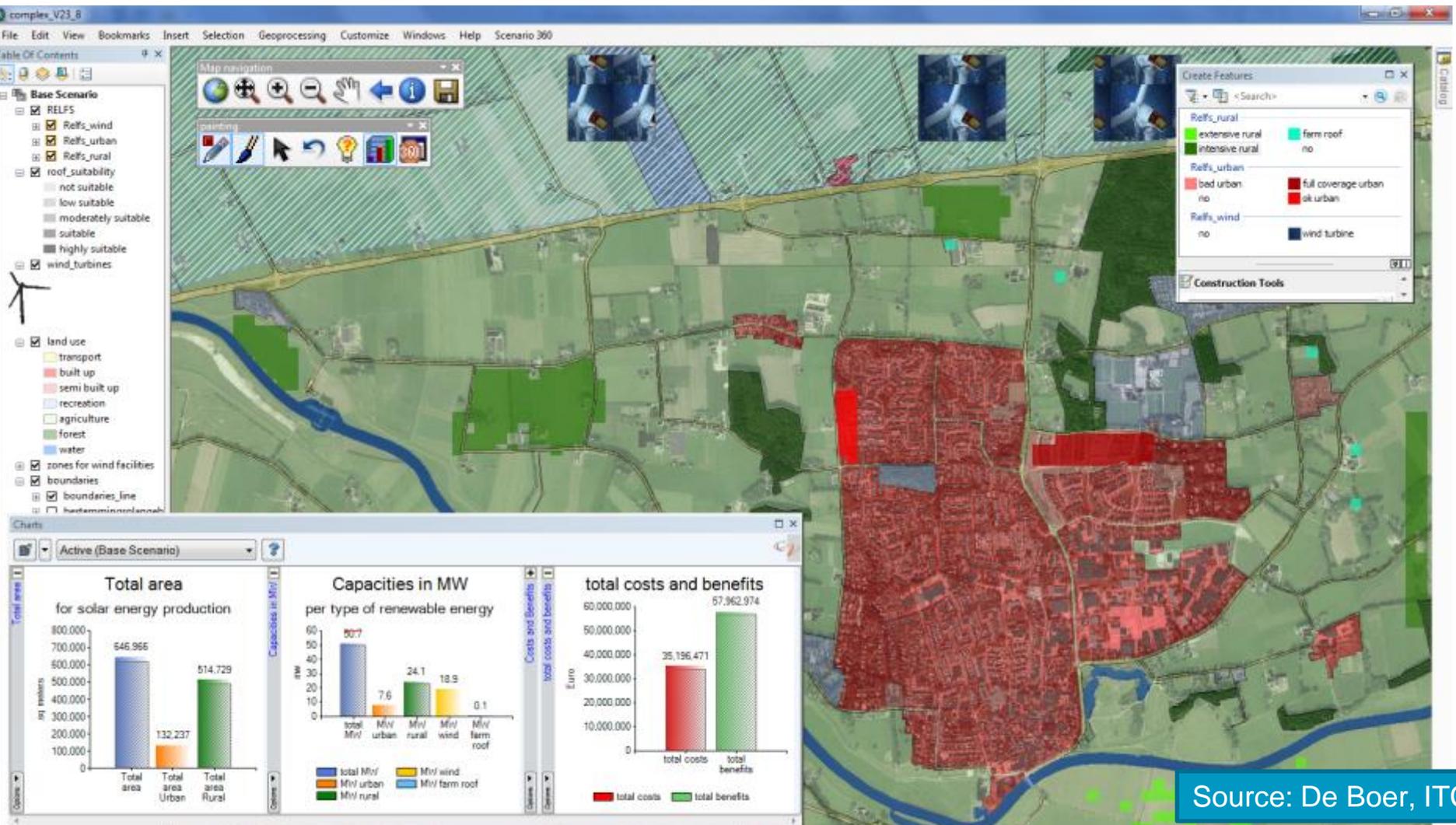
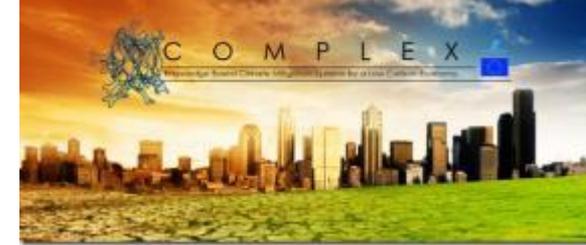
- Ambitious plans to upscale activities in Geothermal Energy
- Substantial increase in Geothermal Energy (3900 MW by 2015)
- Assessment of the need for trained personnel
  - Scientific staff in Universities
  - National and local Government staff
  - Management and technical staff in Companies
- 50 to 70 Engineers/Earth Scientists per 1000 MW
- 1.7 FTE per additional MW of GE installed



# governance, awareness, policy



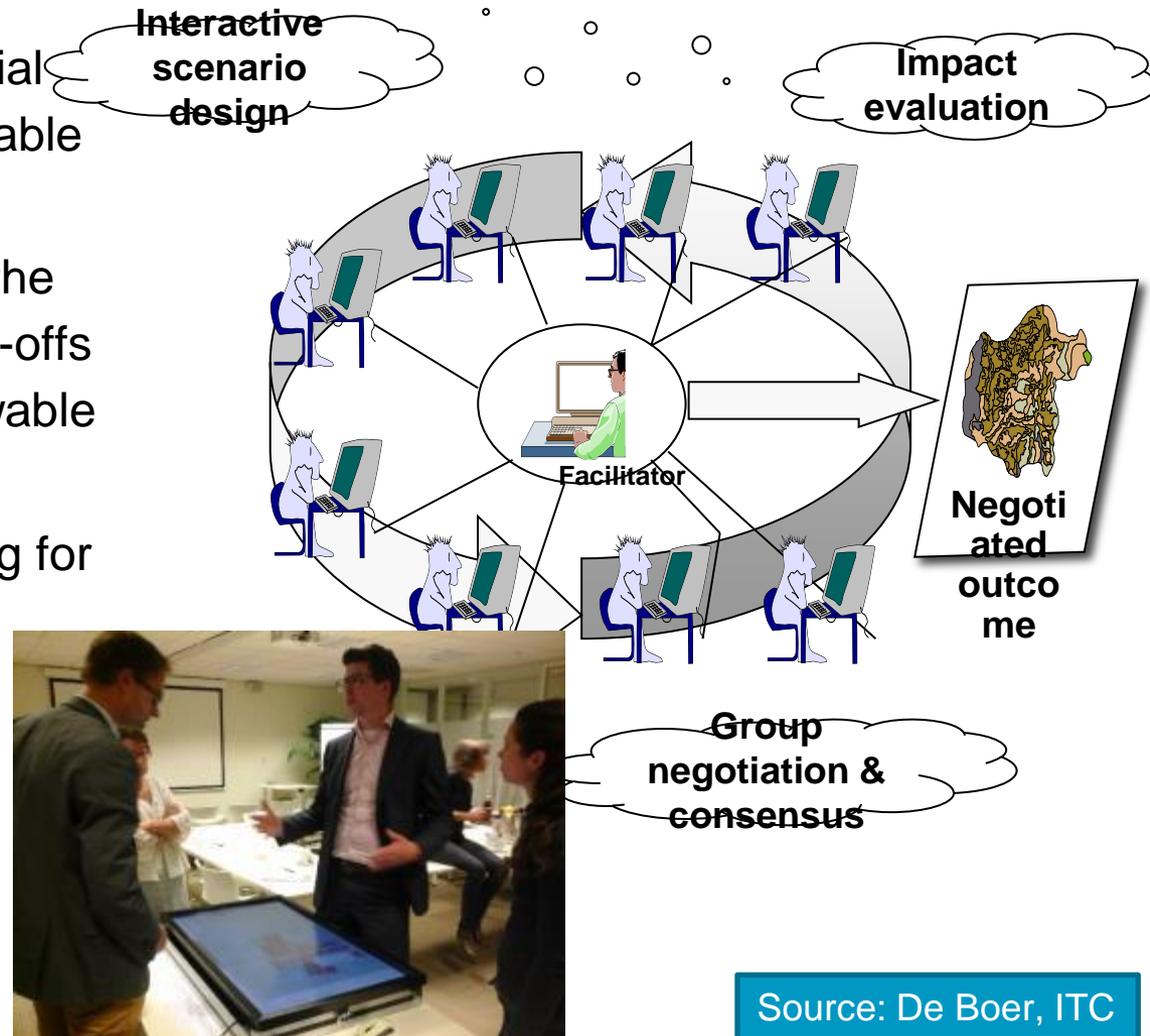
# MODEL INTERFACE



Source: De Boer, ITC

# POTENTIAL USES OF GROUP DECISION ROOM

- Decision Support for Spatial Planning related to renewable energy development
- Awareness raising about the various impacts and trade-offs when implementing renewable energy
- Collective Decision making for CO2 Neutral Plans at the Municipal level





- aimed at improving water safety and security in the Mara River Basin to support structural poverty reduction, sustainable economic growth and conservation of the basin's ecosystems.
- Public-private partnership: Improve private sector practices.
- Kenya



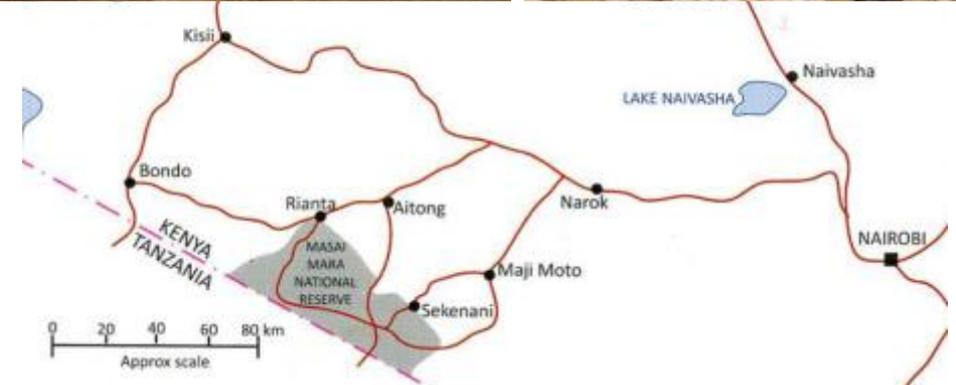
# Mau Mara Serengeti Sustainable Water (MaMaSe) Initiative



Wildlife/livestock competition, conflicts, and risks under water variability..



.. rapid transition from communal to private land..



.. Pressures from agriculture, population, tourism, fencing, etc...

Source: Boerboom, ITC

Biomass supply (growth)

Biomass consumption & demand by Wildlife & Livestock (species)



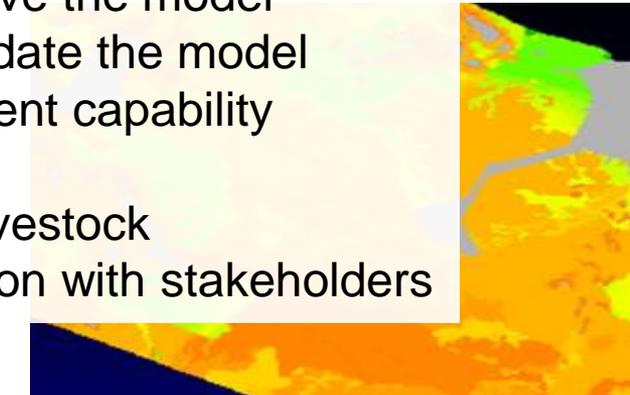
water



Mara Rangeland Information System (MARIS) is:

- A rangeland carrying capacity model that:
  - Models supply of biomass
  - Models consumption of biomass by livestock and wildlife
  - Assesses carrying capacity
  - Uses satellite rainfall observation to drive the model
  - Uses satellite NDVI observation to validate the model
  - Provides long term scenario development capability
  - Near real time two week forecasts
- Linked to near real time market prices for livestock
- Web-based and phone-based communication with stakeholders

availability for livestock/wildlife species (modelled)



This results in the status of the rangelands, indicating overgrazing (red) and undergrazing (green) based on sustainable utilization of the natural resources.

Economic and social implications and options for different stakeholders:  
INFLUENCE DECISIONS IN VALUE CHAINS: LIVESTOCK, WILDLIFE and TOURISM



# MARIS WEB-CLIENT SHOWS COLLECTED MARKET DATA

Mara Rangeland Information System (MARIS)

MaMaSe

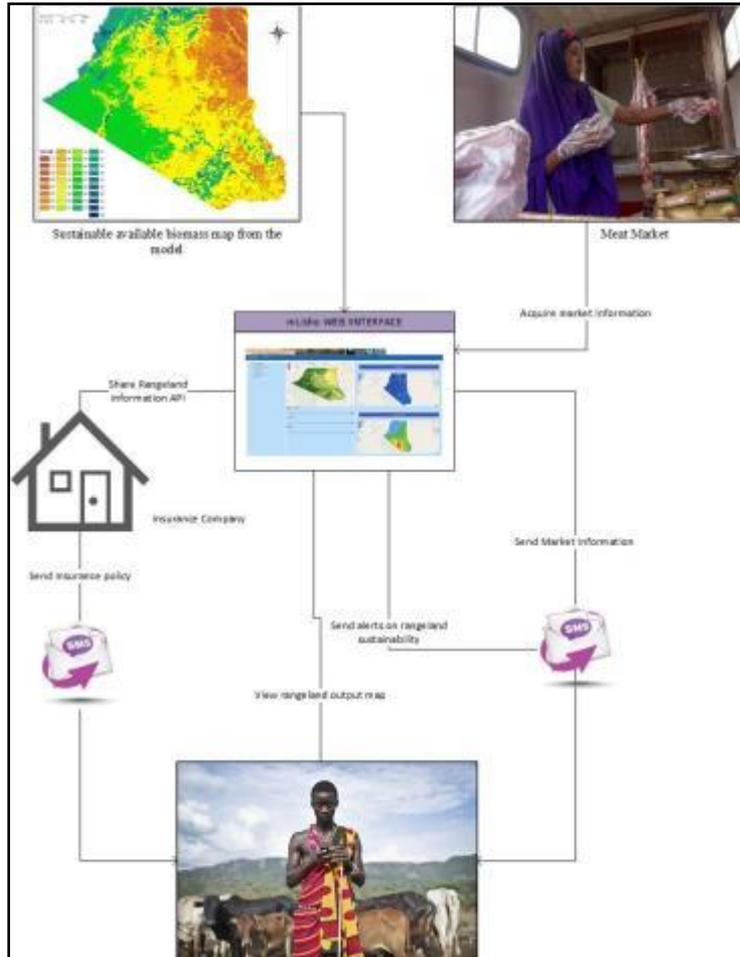
Livestock Market Information

CATTLE		SHEEP	GOATS			
Date	Sex	Age	Quality	Breed	Price	Number Trades
2016-04-25 17:43:50.472	Cow	Medium2-6	Cattle medium (condition score 3)	Borana	25000	120
2016-04-25 17:43:50.472	Cow	Medium2-6	Cattle skinny (condition score 2)	Borana	25000	120

Copyright © 2016 MaMaSe Sustainable Water Initiative



# MLISHO = MOBILE FOOD/PASTURE ADVISE



- Warn pastoralists of impending forage and water shortages for their livestock.
- Advise them to move to areas with better pastures and water.
- Advise them to sell some of the cattle by giving them daily market information.
- Liaise with the insurance companies to help them insure their livestock.

# MARIS TO BE INSTITUTIONALIZED THROUGH

---

Strategy to establish with multiple agencies:

- Conservation agencies
- Risk management agencies such as insurance companies, as improvement of Index-Based Livestock Insurance (IBLI)
- Local government

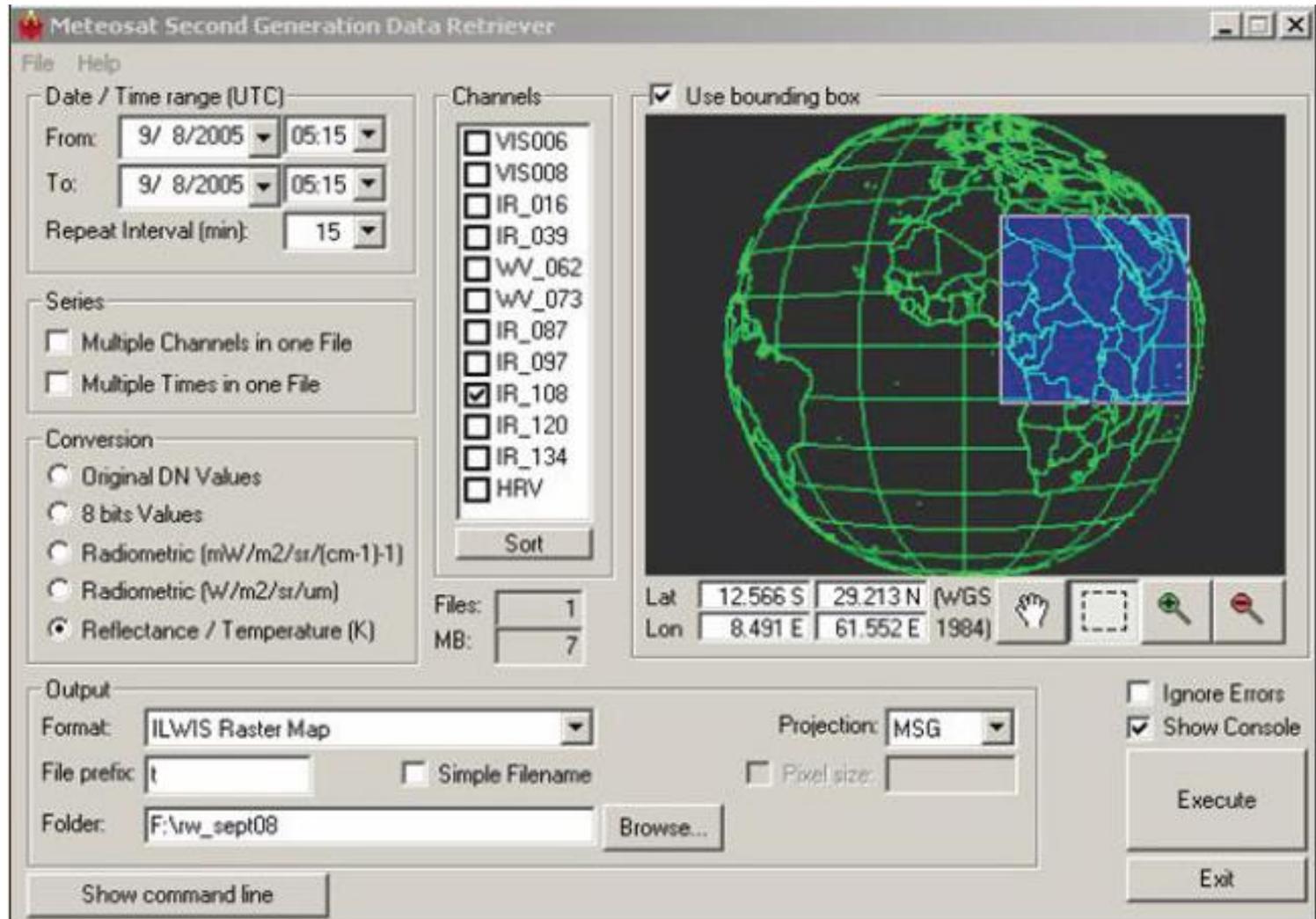
Strategy to cover the last mile: Development of multiple end-user products for different stakeholders from multiple live data sources, incl. Earth observation.

# GEONETCast: low cost hardware

- Satellite antenna dish
- Receiver card or box
- Personal computer

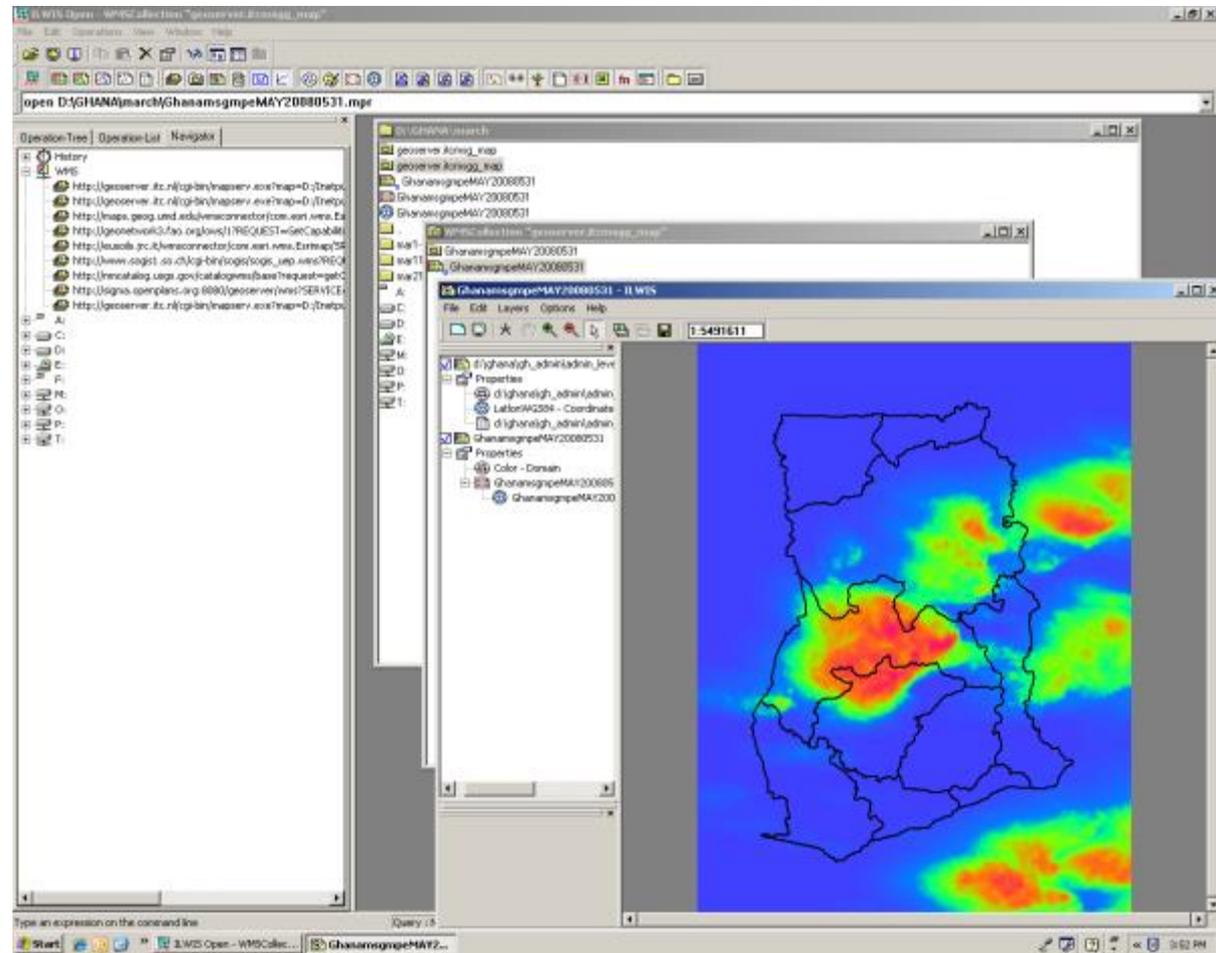


# GEONETCast: Import toolbox for ILWIS



# GEONETCast: Visual analysis in ILWIS

Integrated view of Geonetcast, Web Map Services & local data



# Other projects

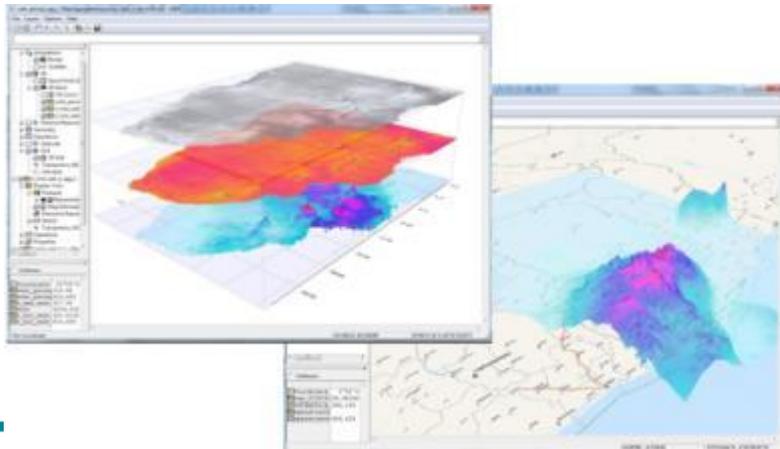
GIS on a tablet



Integration of satellite images and crowdsourced geoinfo from mobile phones



Modelling data in 3D



Hill-shading with OpenGL based on raster and height data



# ACKNOWLEDGING MY COLLEAGUES!

---

- ITC vision 2020, Tom Veldkamp (Dean ITC) – [a.veldkamp@utwente.nl](mailto:a.veldkamp@utwente.nl)
- Capacity development 2.0, Freek van der Meer – [f.d.vandermeer@utwente.nl](mailto:f.d.vandermeer@utwente.nl)
- G4AW program, Ruud Grim, Netherlands Space Office, [r.grim@spaceoffice.nl](mailto:r.grim@spaceoffice.nl)
- Crop yield and GIACIS program, Kees de Bie, [c.a.j.m.debie@utwente.nl](mailto:c.a.j.m.debie@utwente.nl)
- STARS program, Rolf De By, [r.a.deby@utwente.nl](mailto:r.a.deby@utwente.nl)
- Tanzania STARS project, Inbal Becker-Reshef, University of Maryland
- Geocap program, Tia den Hartog, [tia.denhartog@utwente.nl](mailto:tia.denhartog@utwente.nl)
- Group decision support, Cheryl de Boer, [c.deboer@utwente.nl](mailto:c.deboer@utwente.nl)
- MAMASE program, Luc Boerboom, [l.g.j.boerboom@utwente.nl](mailto:l.g.j.boerboom@utwente.nl)
- ILWIS GIS, Rob Lemmens, [r.l.g.lemmens@utwente.nl](mailto:r.l.g.lemmens@utwente.nl)



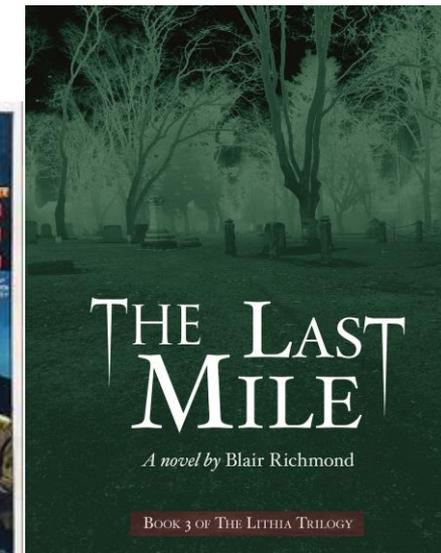
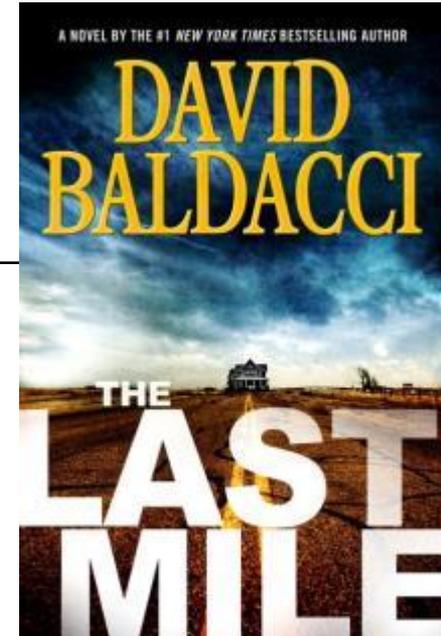
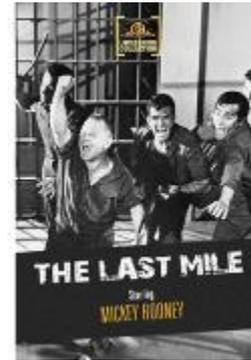
# THE LAST MILE

## IN EARTH OBSERVATION

---

- Bring EO data products to the people
- EO firmly embedded in policy making and governance
- EO and market development: entrepreneurial
- EO new products; data continuity
- EO used in a longterm sustainable way

We are not there but we make progress!



The last mile is the common colloquialism referring to the portion of the telecommunications network chain that physically reaches the end-user's premises - Wikipedia

# Thank you!

---



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[www.itc.nl](http://www.itc.nl)



UNIVERSITY OF TWENTE.