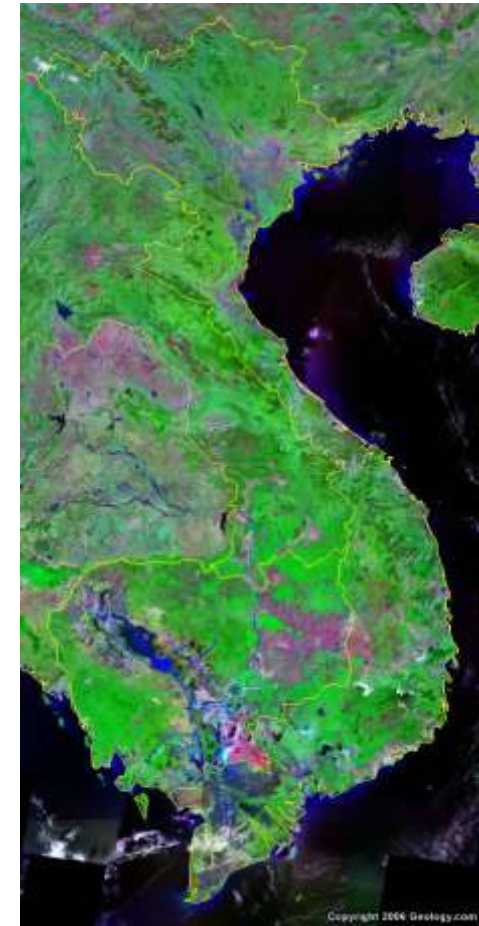




# Food security & satellite based information services



Ruud Grim

Netherlands Space Office (NSO)



## Netherlands Space Office

- ▶ Space agency of the Netherlands government (established 2009)
- ▶ Reporting to:
  - Ministry of Economic Affairs
  - Ministry of Infrastructure and Environment
  - Ministry of Education, Culture and Science
  - Netherlands Organisation for Scientific Research (NWO)
- ▶ Task: **develop the Netherlands space policy and bring that into action**
- ▶ Outcome: **space useful for society**

Netherlands  
**Space**  
Office



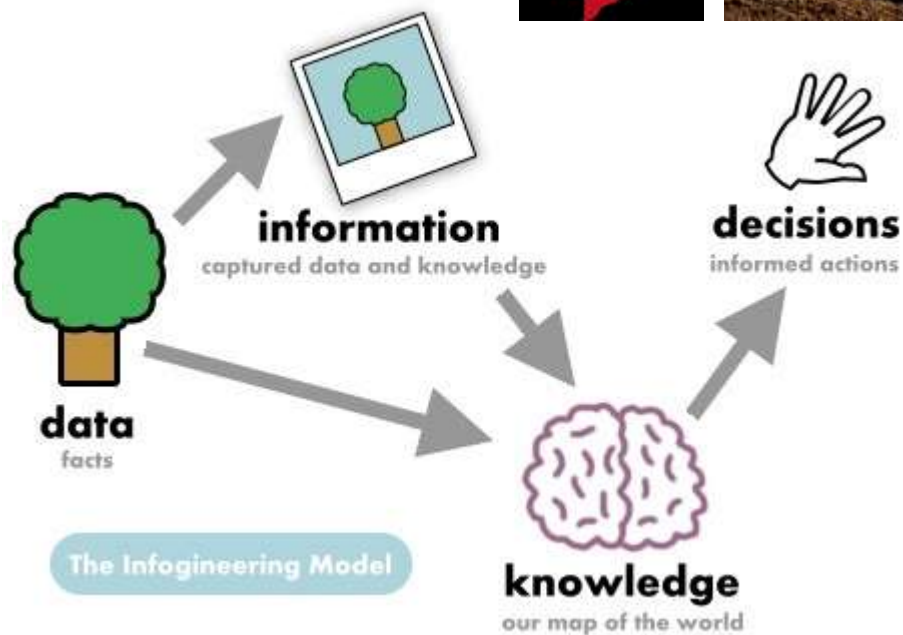
# Climate change



Effects of climate change on food & water security, e.g.

- Drought
- Extensive rainfall

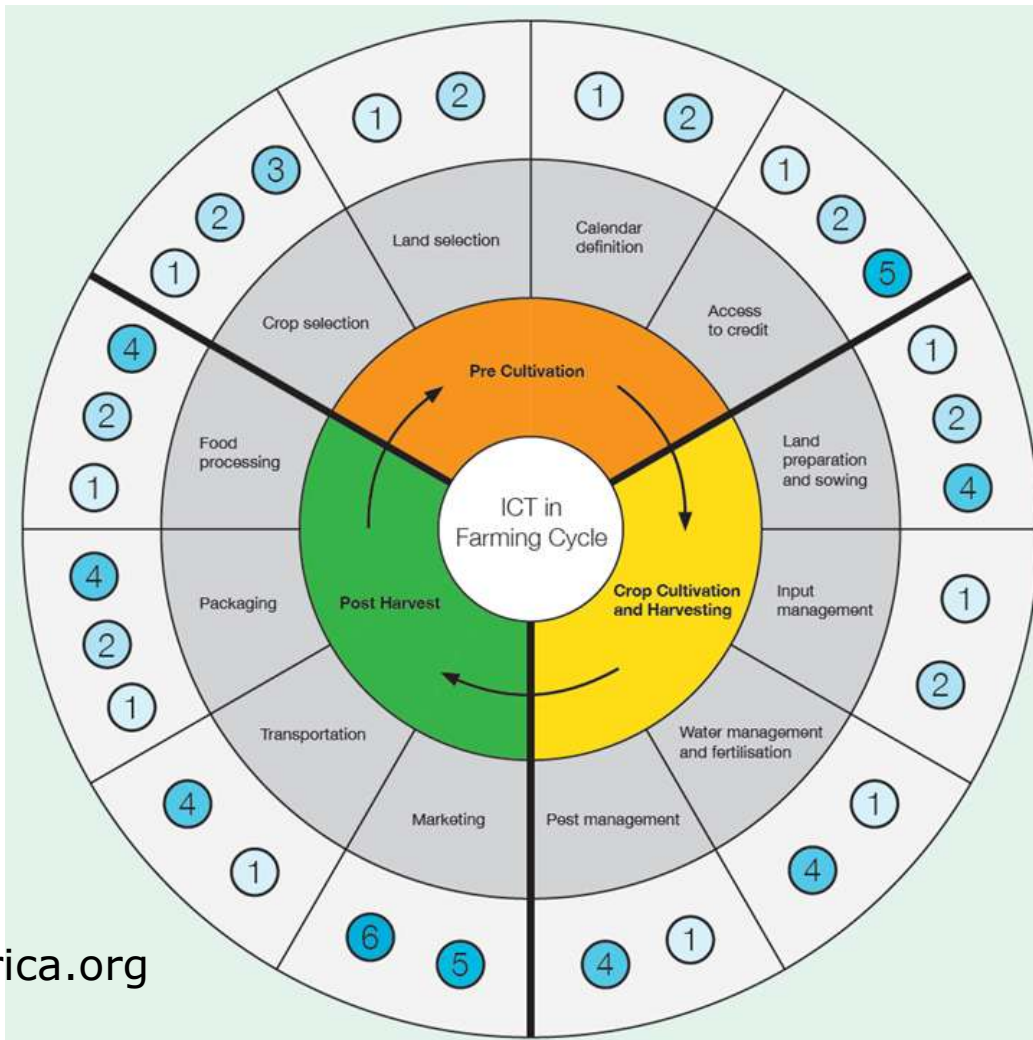
# From data to decision



# Agricultural cycle



- 1 Information systems including DSS/MISS/GIS etc
- 2 ICT-enabled learning and knowledge exchange
- 3 Modelling solutions
- 4 Sensory and proximity devices
- 5 ICT-enabled networking solutions
- 6 Online commerce tools (eCommerce/mCommerce)



[www.eTransformAfrica.org](http://www.eTransformAfrica.org)

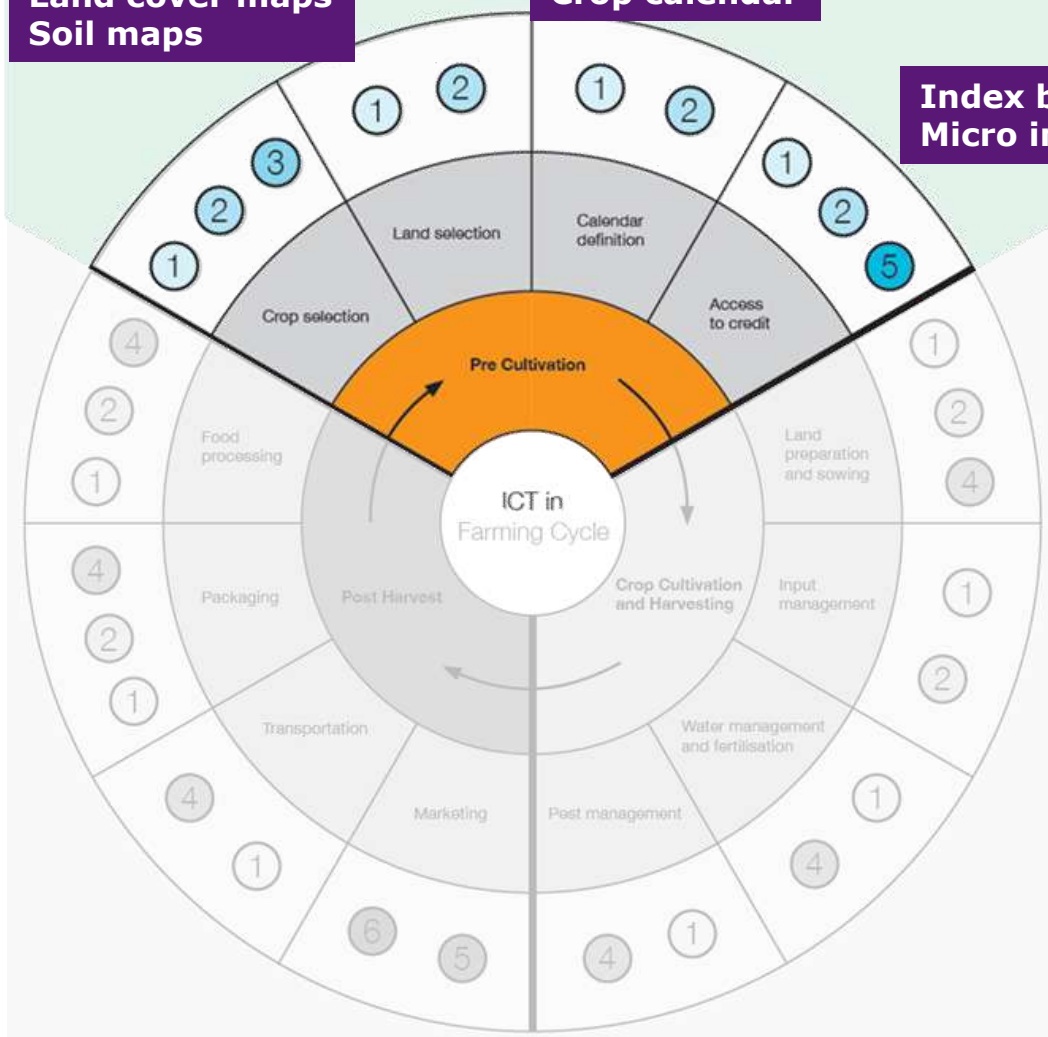
# Pre Cultivation



**Land cover maps  
Soil maps**

**Crop calendar**

**Index based  
Micro insurance**



- 1 Information systems including DSS/MISS/GIS etc
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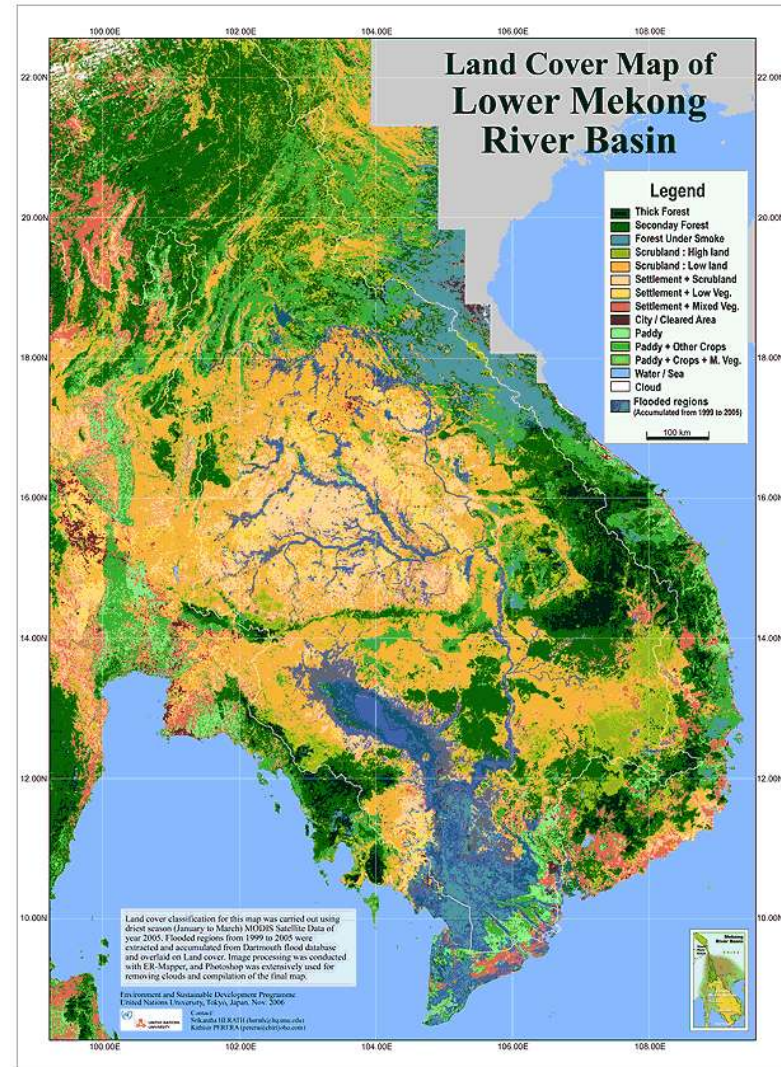
# Land cover map



## Lower Mekong River Basin (1999-2005)

Low resolution  
(250m MODIS,  
optical)

Cloud free



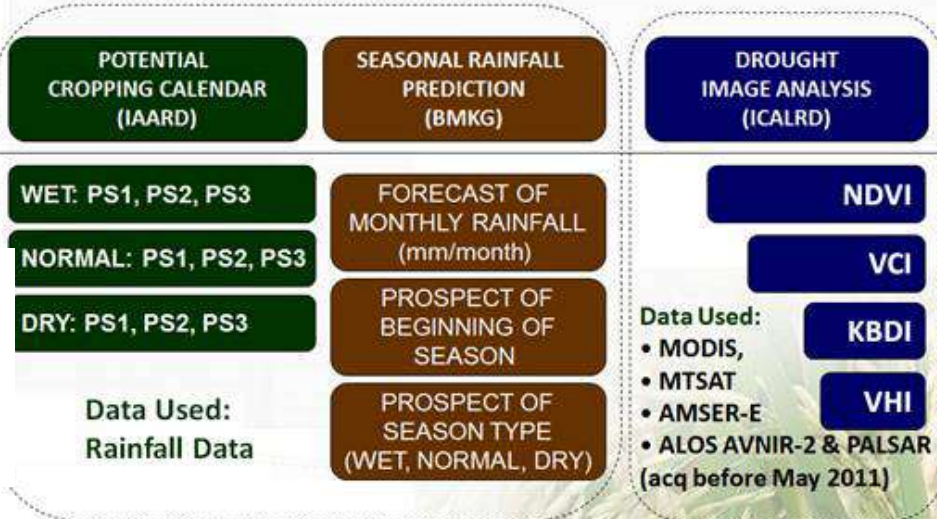
# Crop calendar



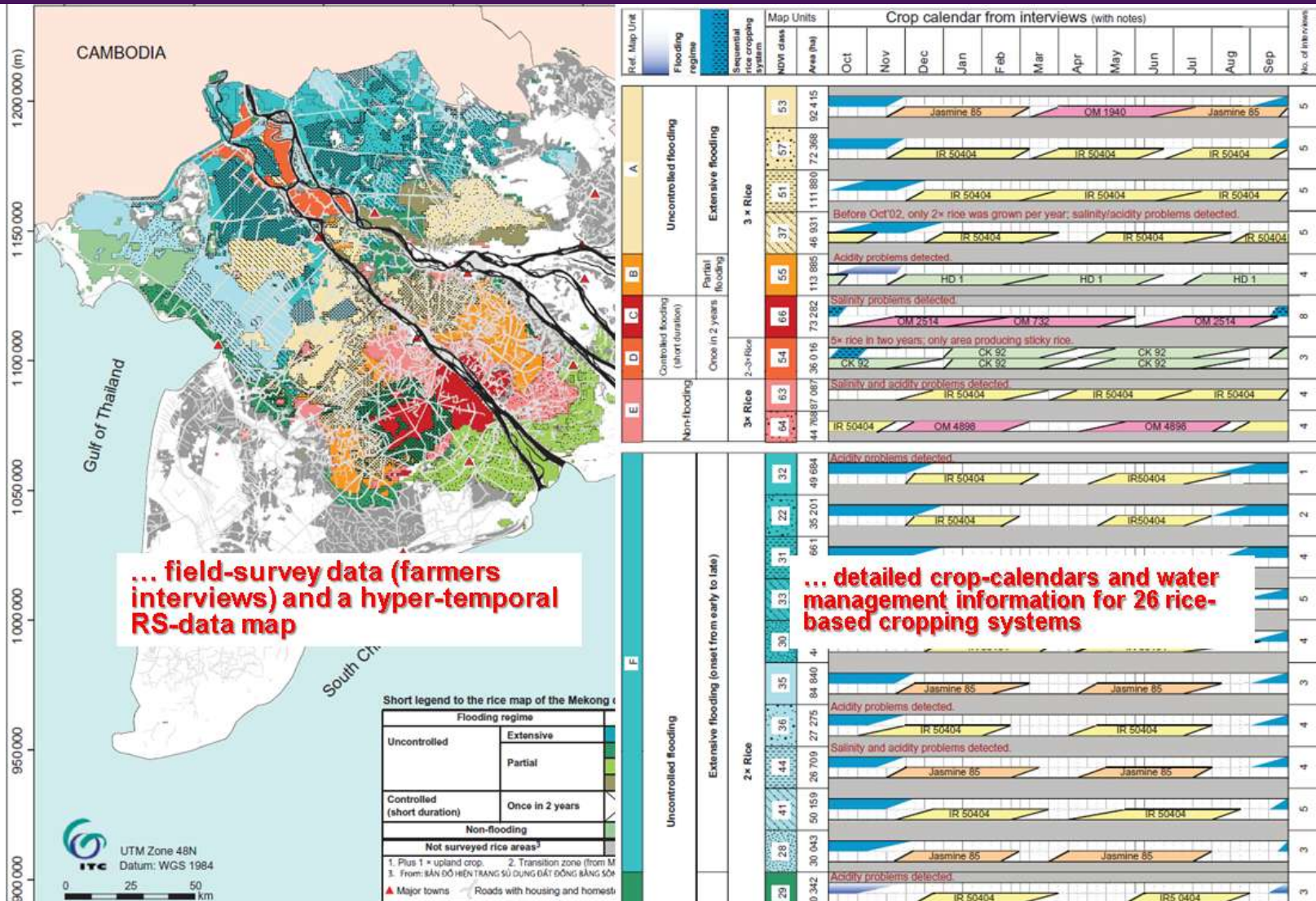
## INTEGRATION OF CROPPING PATTERNS, SEASONAL RAINFALL AND SATELLITE IMAGE ANALYSIS

### Crop Calendar - Colombia - Carmen Cubita

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Customer Indication Needed												
Land Preparation												
Seed Beds												
Transplanting												
Rearing												
Curing												
Drying												
Fermentation												
Optimum Visit Time												
Packing												



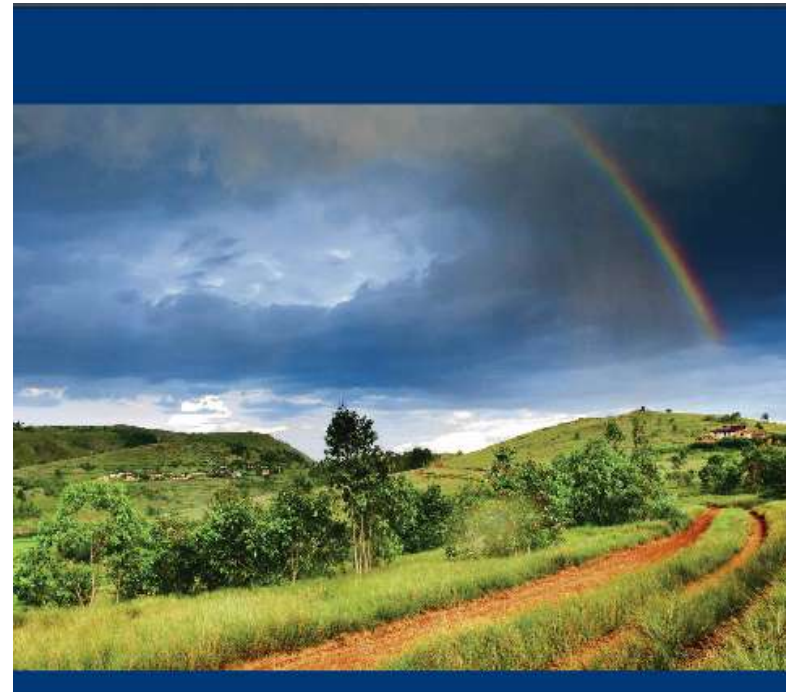




# Micro insurance



- Many pilot projects
- Examples:
  - Kilimo Salama
  - Planet Guarantee (EARS FESA project)
  - Micro Insure
  - and others
- Technically feasible
- Increased mobile use → reach farmers



Weather Index-based Insurance  
in Agricultural Development  
**A Technical Guide**

→ Time for Up-scaling



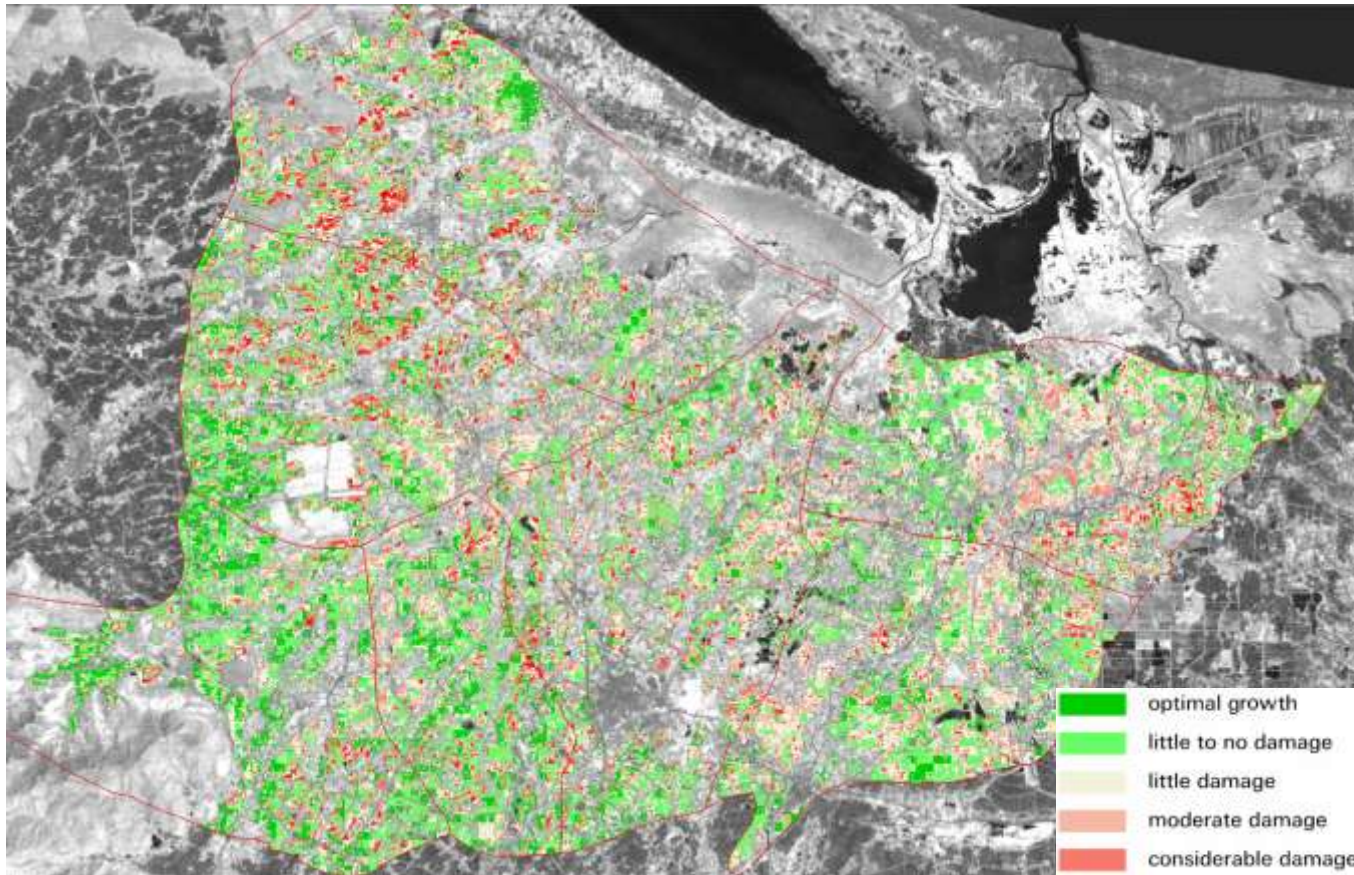
World Food  
Programme



[http://www.ifad.org/ruralfinance/pub/WII\\_tech\\_guide.pdf](http://www.ifad.org/ruralfinance/pub/WII_tech_guide.pdf)



## Weather insurance in rice crops

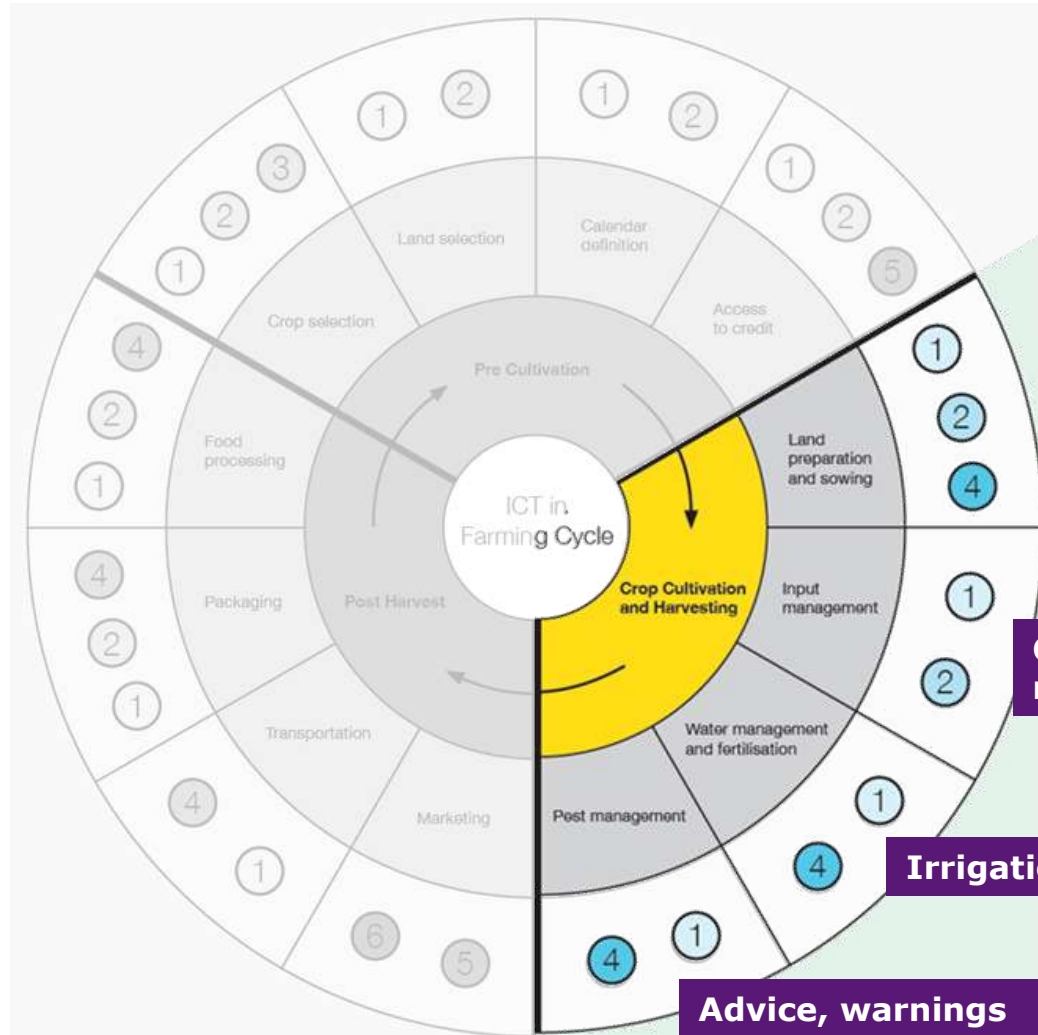


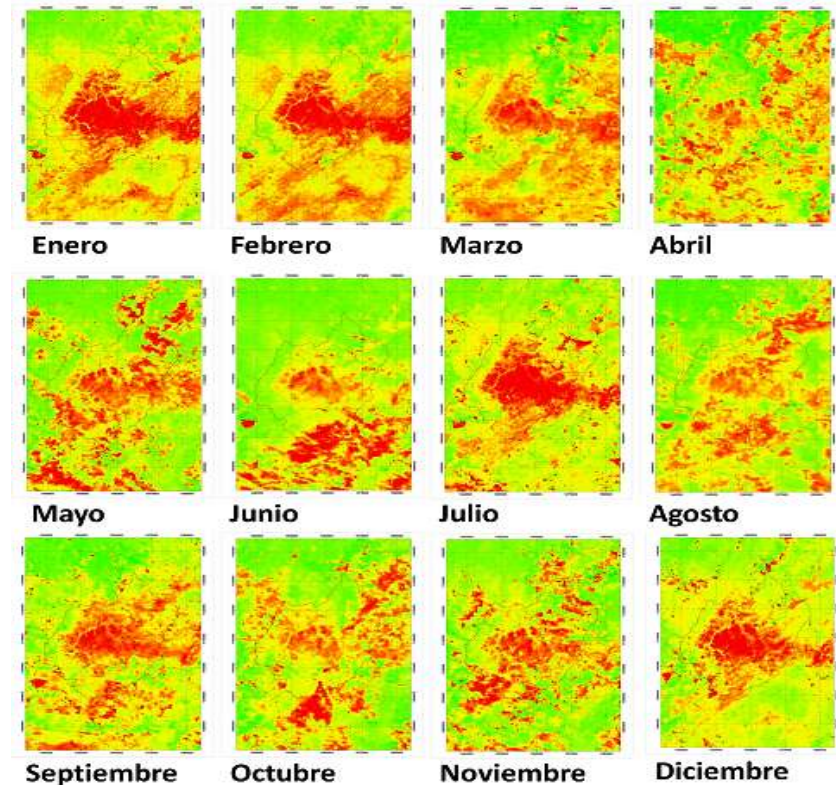
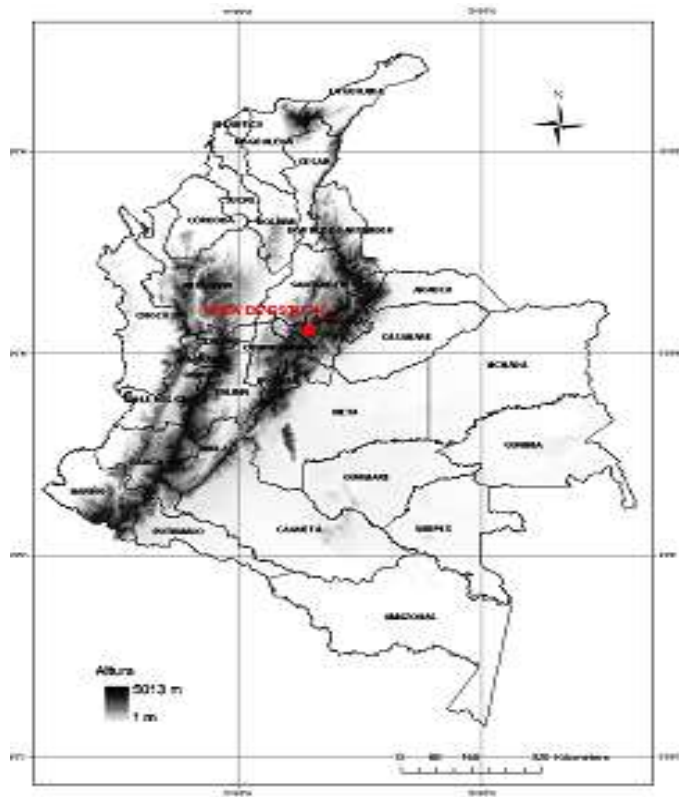
# Crop cultivation &



# harvesting

- 1 Information systems including DSS/MISS/GIS etc
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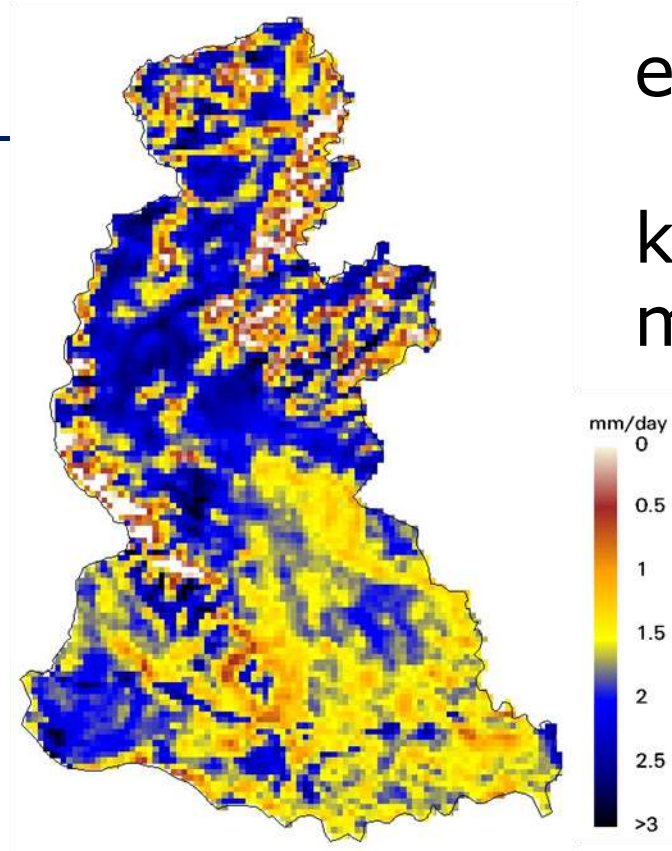
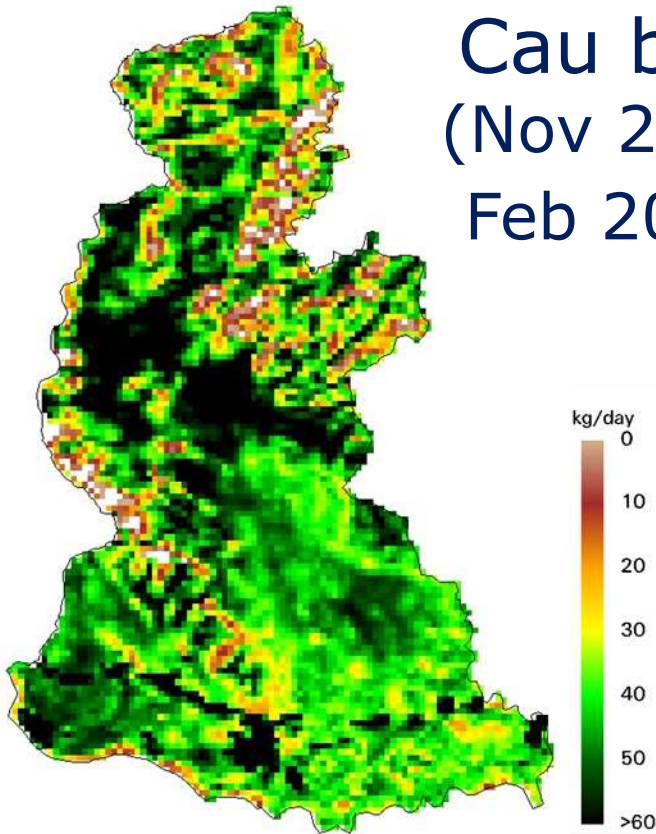




NDVI = Relative index for vegetation



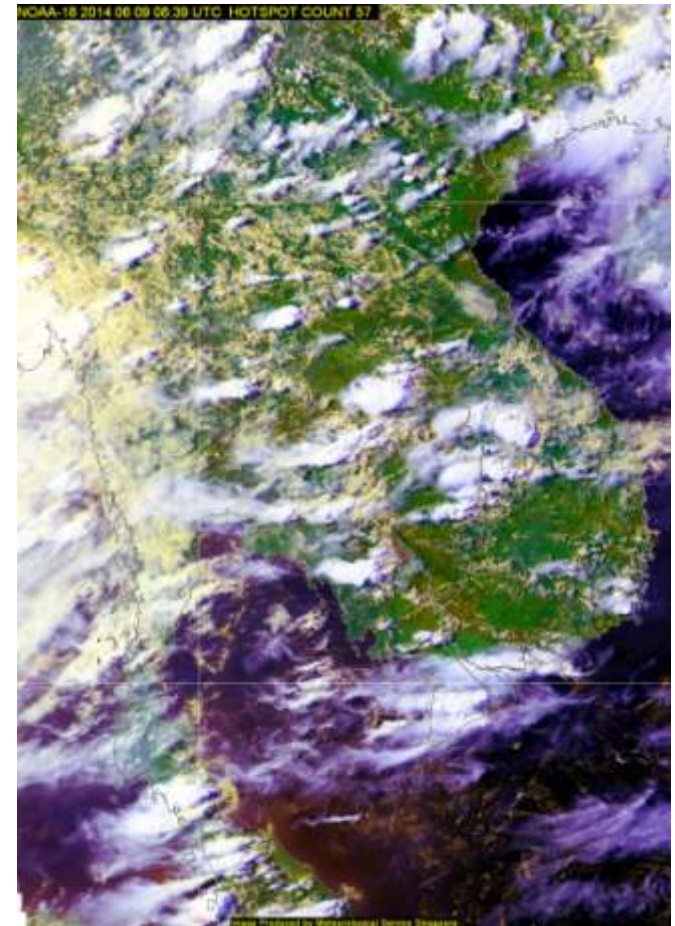
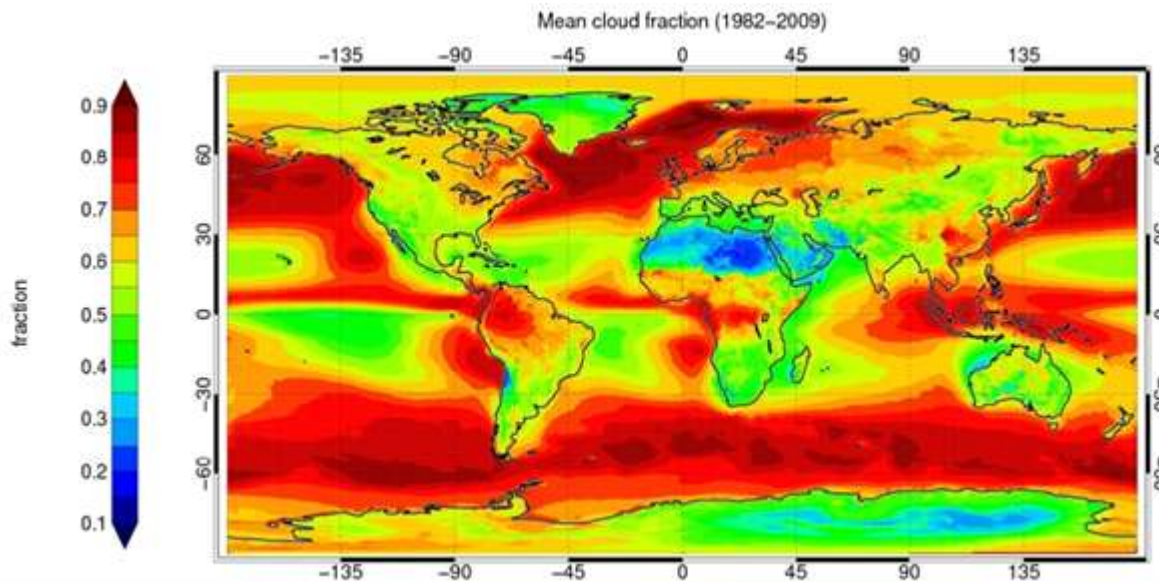
Cau basin  
(Nov 2003 –  
Feb 2004)



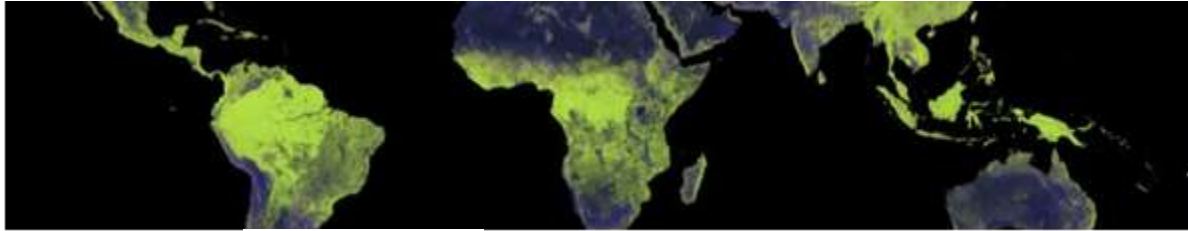
e.g.  
kg / ha  
mm / wk

## Quantitative information from SEBAL model

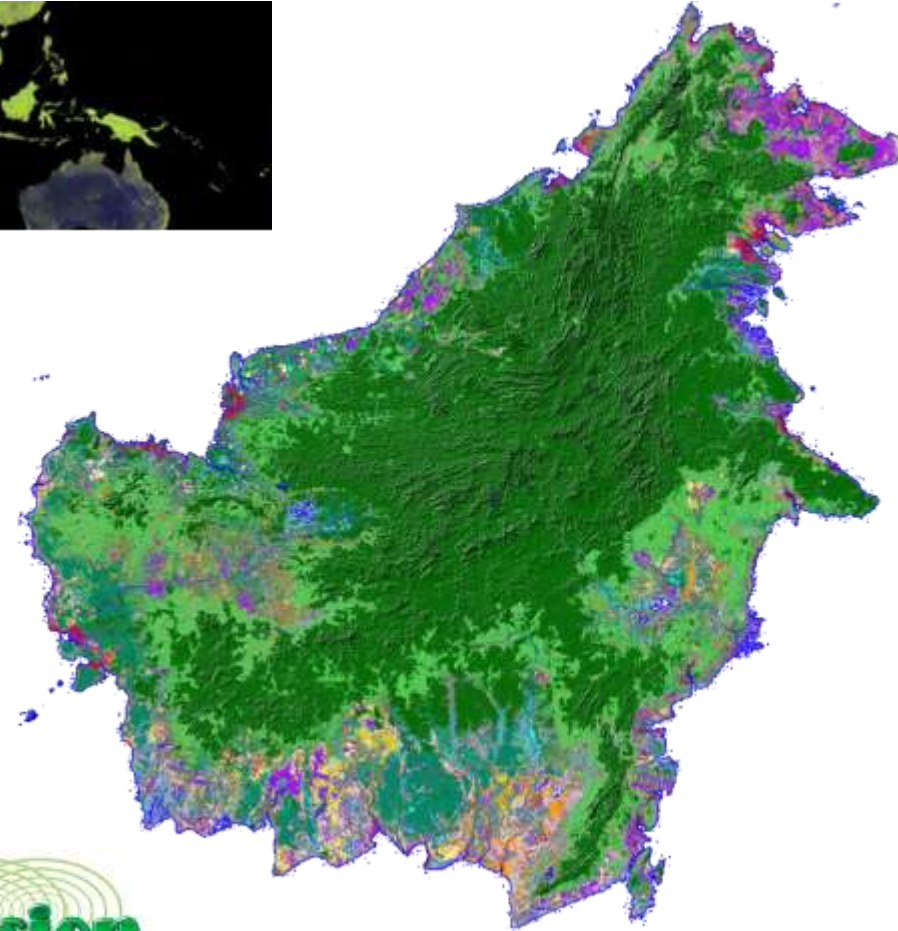
# Cloud cover



# Looking through clouds



- |  |                              |
|--|------------------------------|
|  | Lowland forest               |
|  | Riverine forest              |
|  | Swamp forest                 |
|  | Mangrove forest              |
|  | <i>Nipah</i> mangrove forest |
|  | Peat swamp forest (pole)     |
|  | Peat swamp/riverine shrub    |
|  | Forest mosaics/degraded      |
|  | High shrub                   |
|  | Medium shrub                 |
|  | Ferns / grass                |
|  | Grassland                    |
|  | Cropland (upland)            |
|  | Cropland (irrigated)         |
|  | Plantations (oil palm)       |
|  | Tree cover, burnt            |
|  | Water bodies                 |
|  | Layover /Shadow              |
|  | No strip coverage            |
|  | Mountain forest              |



**Kalimantan  
Land cover map  
(15m, radar)**





# Crop growth monitoring



**Cloud  
free  
radar  
image**



©2012

# Crop growth monitoring



Sugar beet at 25m resolution every  
24 days

22/04/2012



## Radar analysis

Bare soil



**SarVision**  
wielasant@sarvision.nl

©2012

# Crop growth monitoring



Sugar beet at 25m resolution every  
24 days

16/05/2012



## Radar analysis

Bare soil  
Emergence



©2012

# Crop growth monitoring



Sugar beet at 25m resolution every  
24 days

09/06/2012



## Radar analysis

Bare soil  
Emergence  
Increment



©2012

# Crop growth monitoring



Sugar beet at 25m resolution every  
24 days

03/07/2012



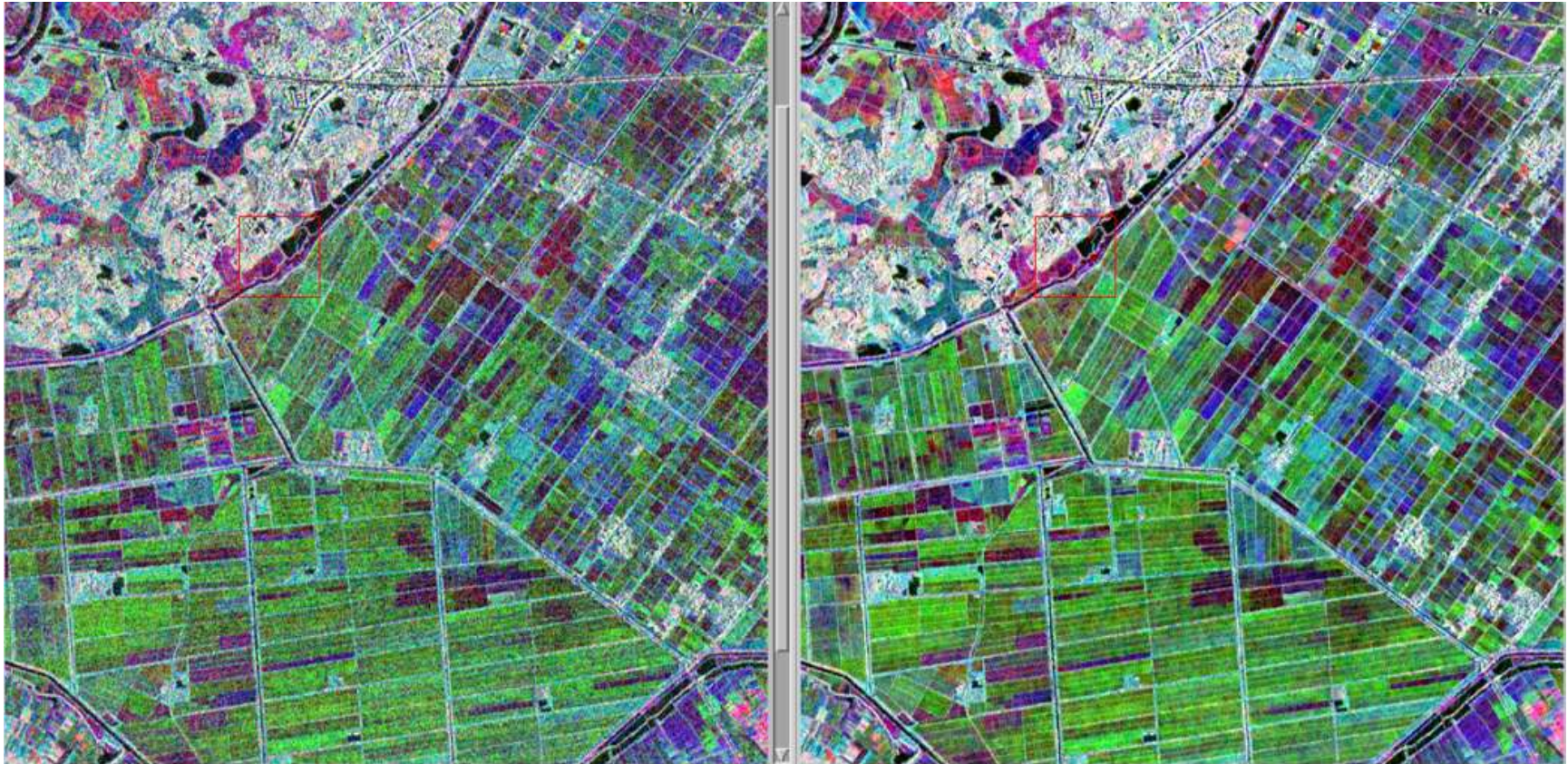
## Radar analysis

Bare soil  
Emergence  
Increment  
Closure



©2012

# Rice monitoring

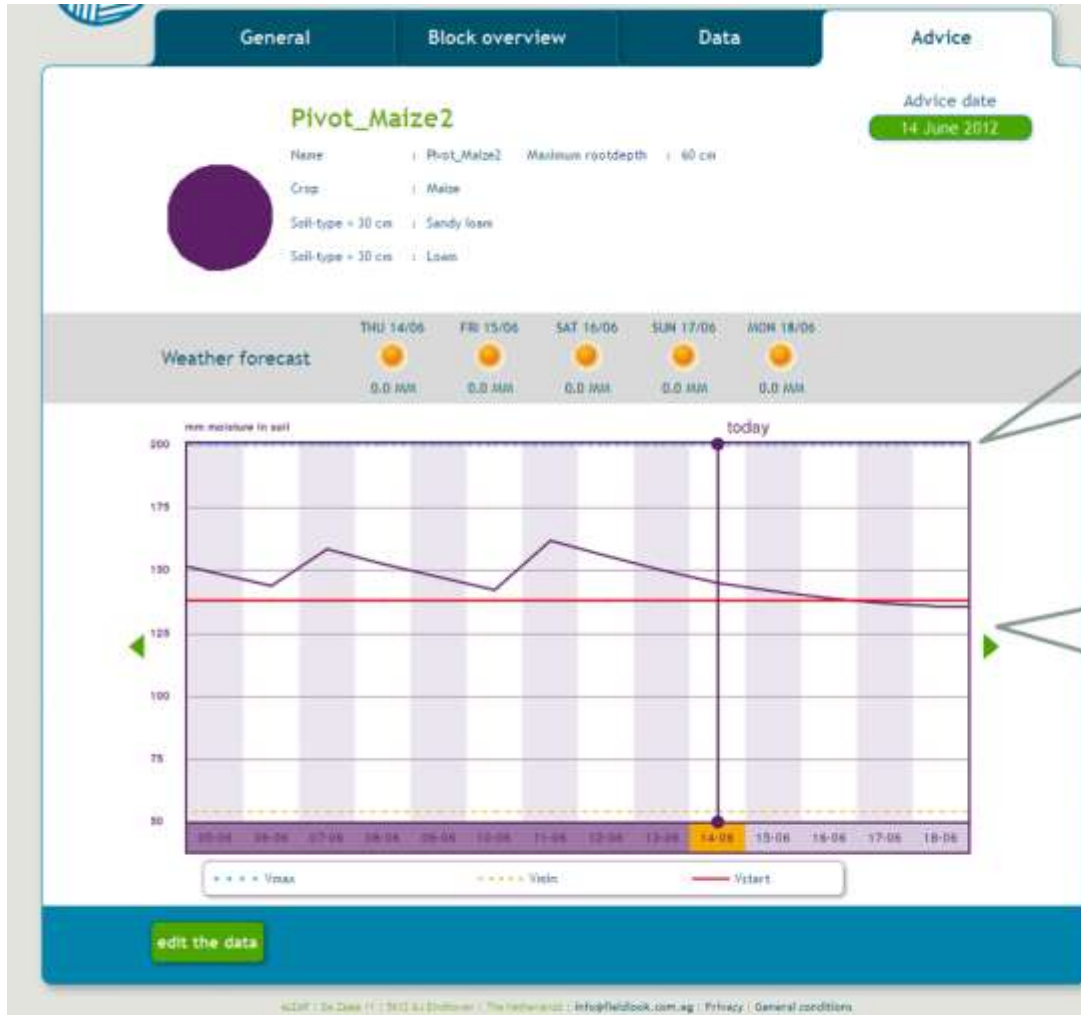


Sharp results: Multi-temporal filtering

**5m detail suitable for monitoring of small farms (every 5-11 days )**



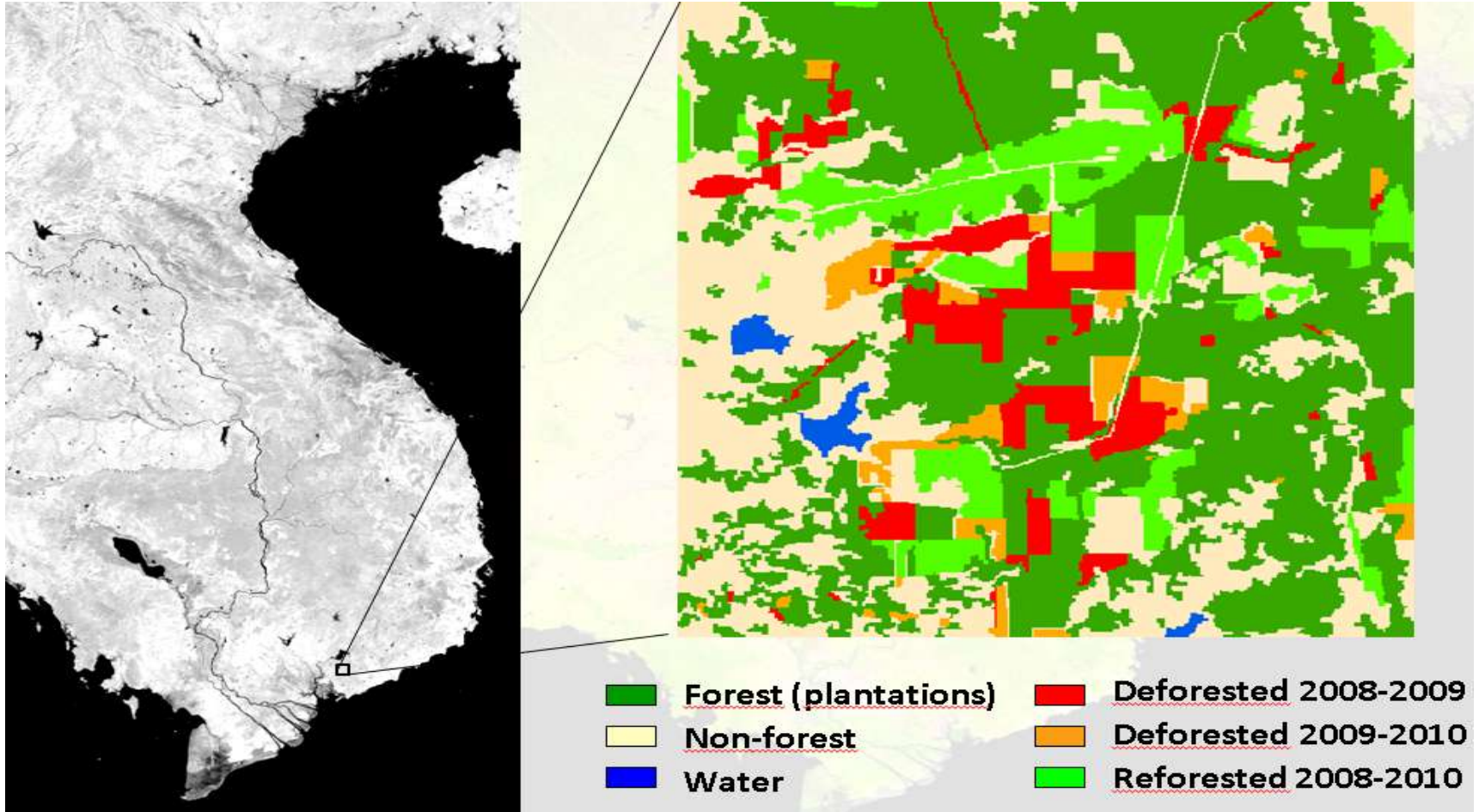
# Irrigation advice



The crop has no water stress when the soil moisture is above the critical level and below the field capacity

When the soil moisture drops below the critical line, irrigation is advised

# Plantation monitoring



Map generated at 2013 December workshop in Hanoi (a.o. MoNRE, MARD)

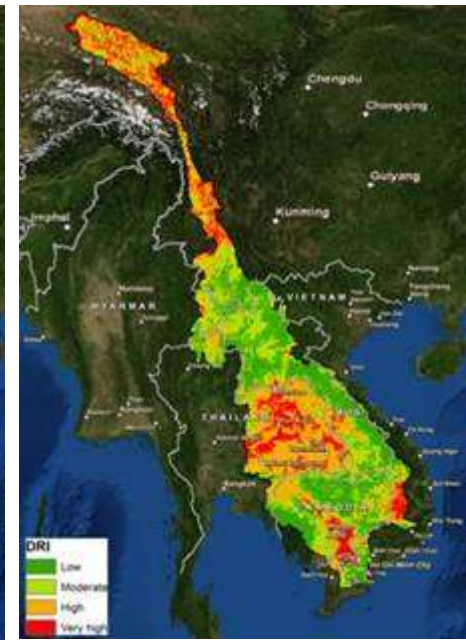




# Advice and warning



## Hazard & Risk Analysis



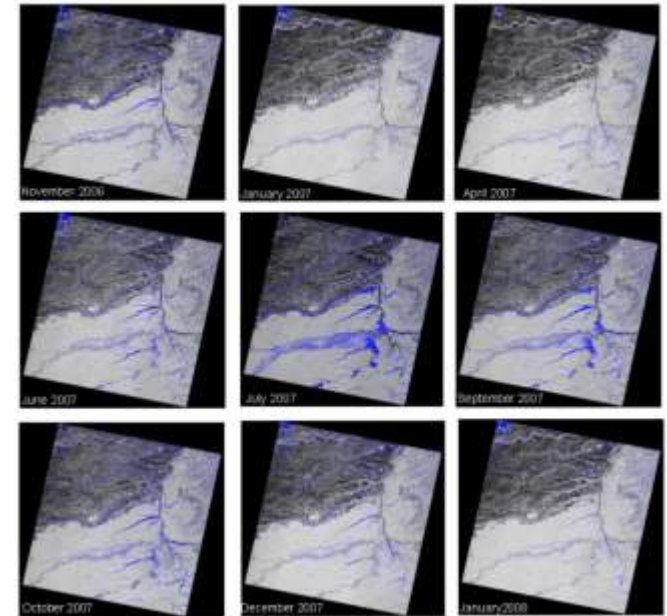
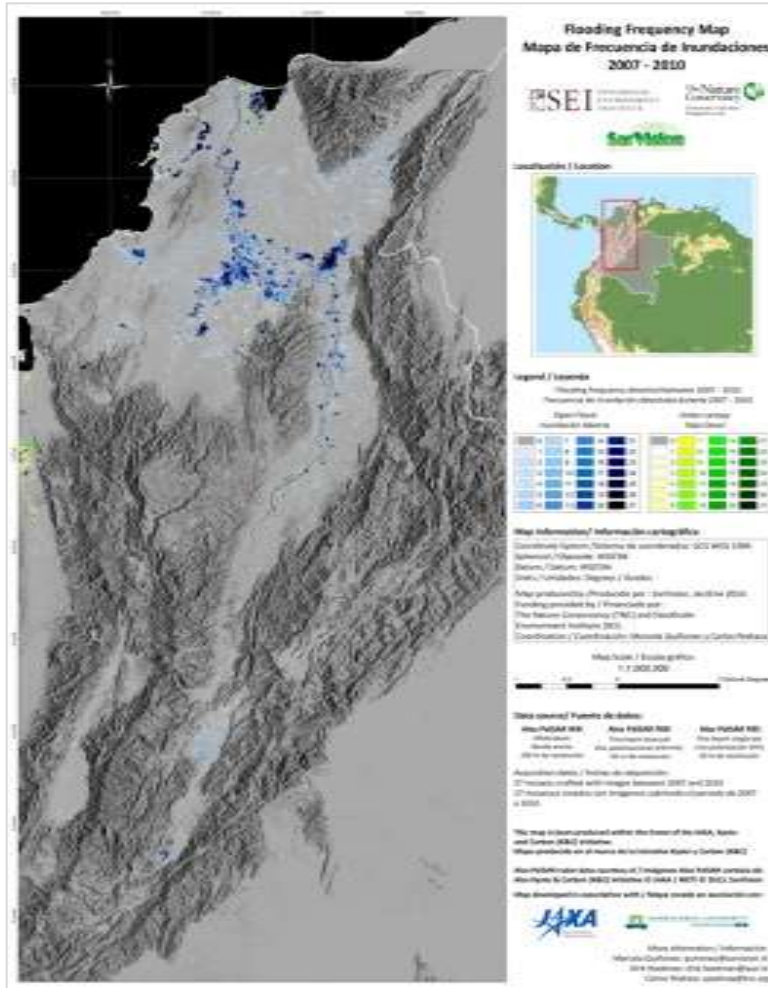
Vulnerability Index  
Distance  
to river

Vulnerability Index  
Population density

Vulnerability Index  
Precipitation

Drought  
Risk Map





Flooding under closed canopy  
High resolution (20-150m)



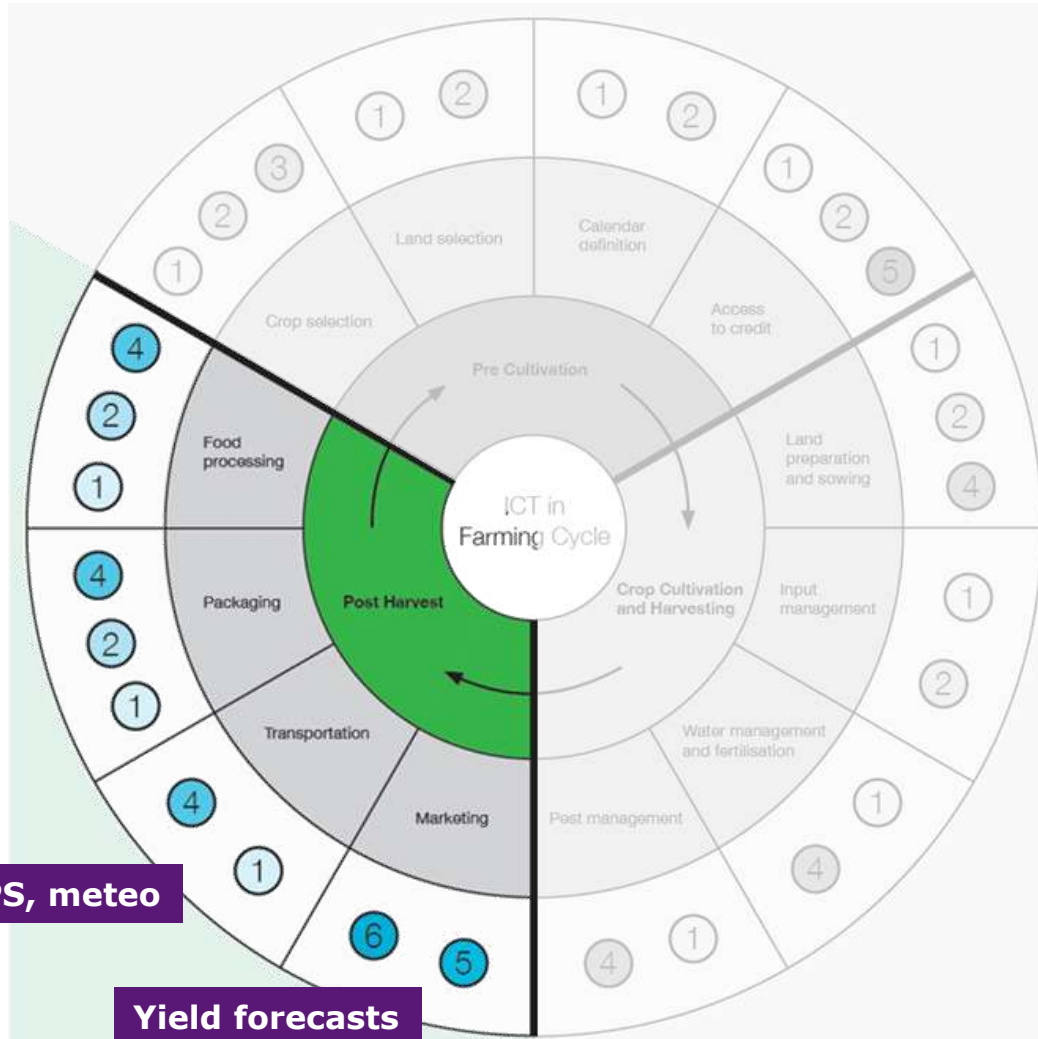
wielaard@sarvision.nl

Example: subset of 2007-2011 flood Colombia using ALOS PALSAR  
©Cooperation SEI, TNC, USAID



# Post Harvest

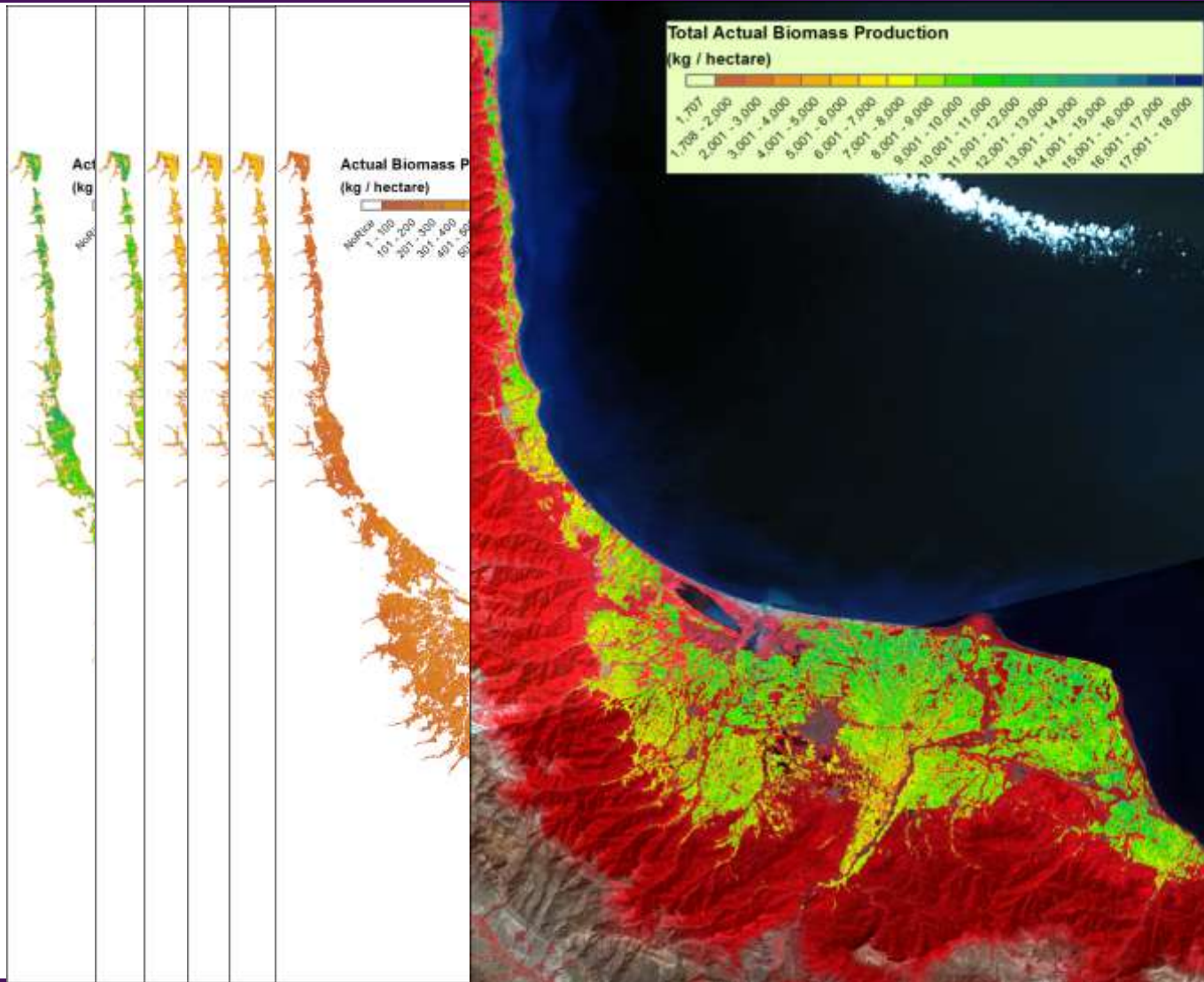
- 1 Information systems including DSS/MISS/GIS etc
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# Yield forecast

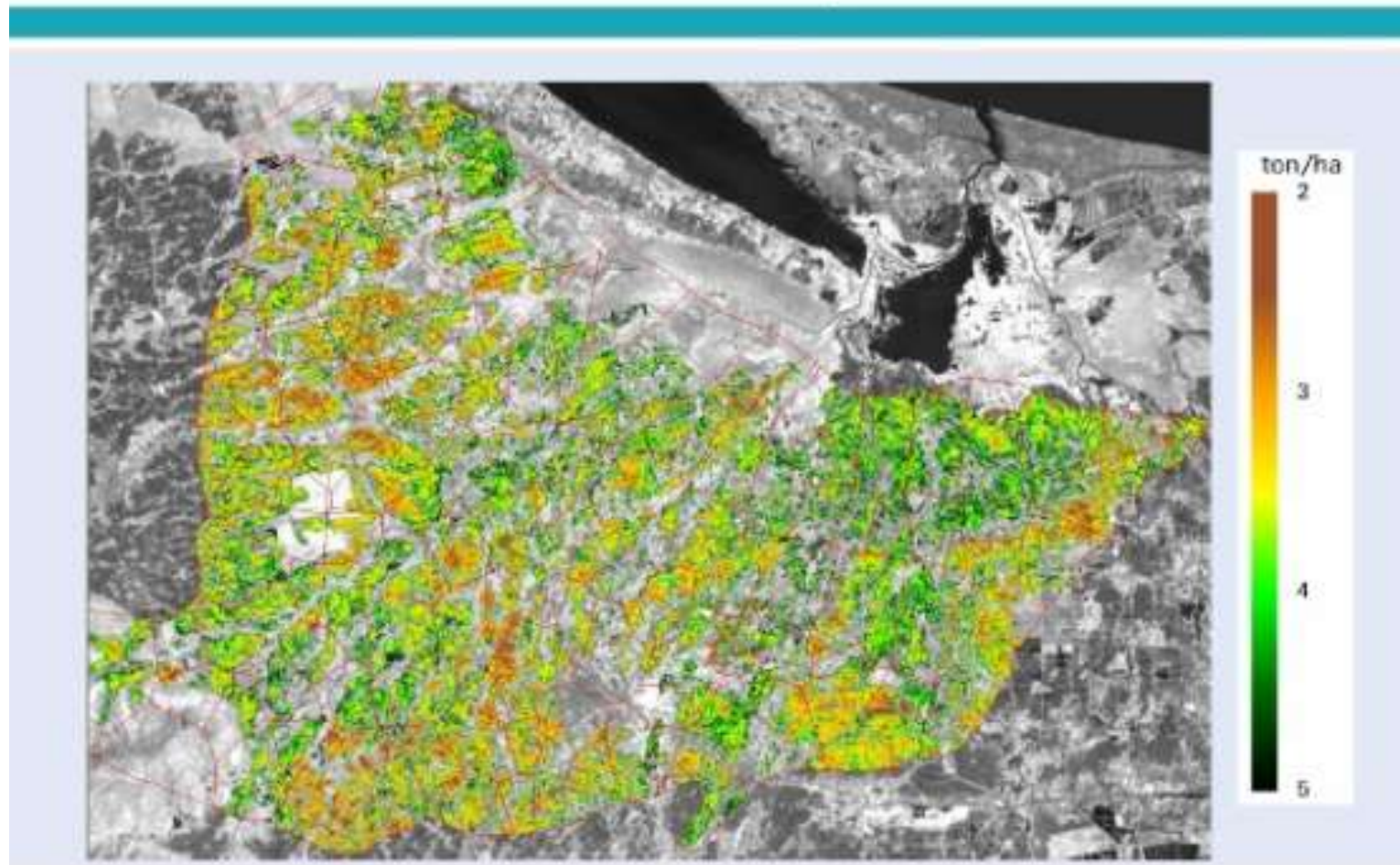


# Actual Biomass Production





## Rice Yield maps

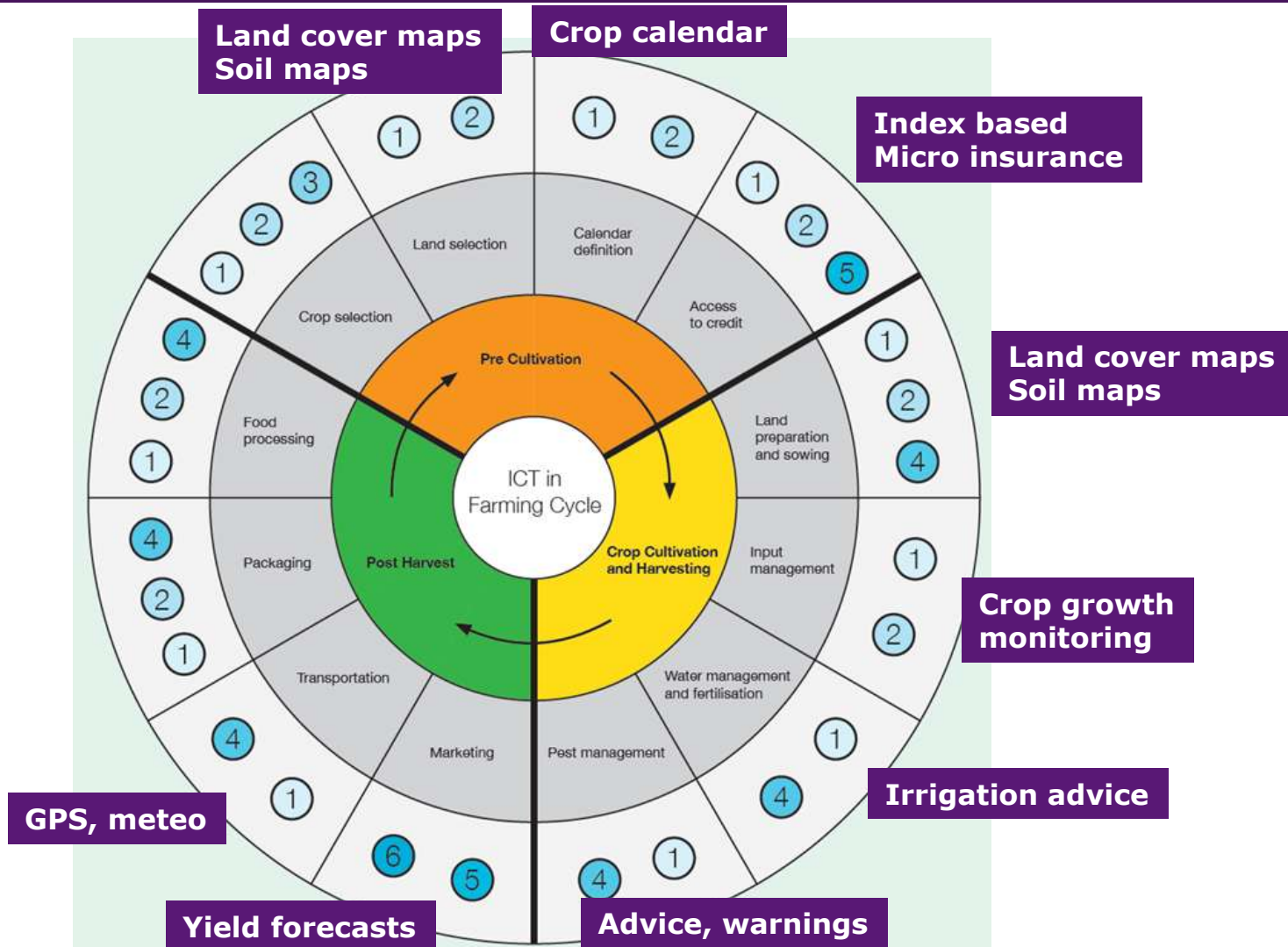




# Agricultural Cycle



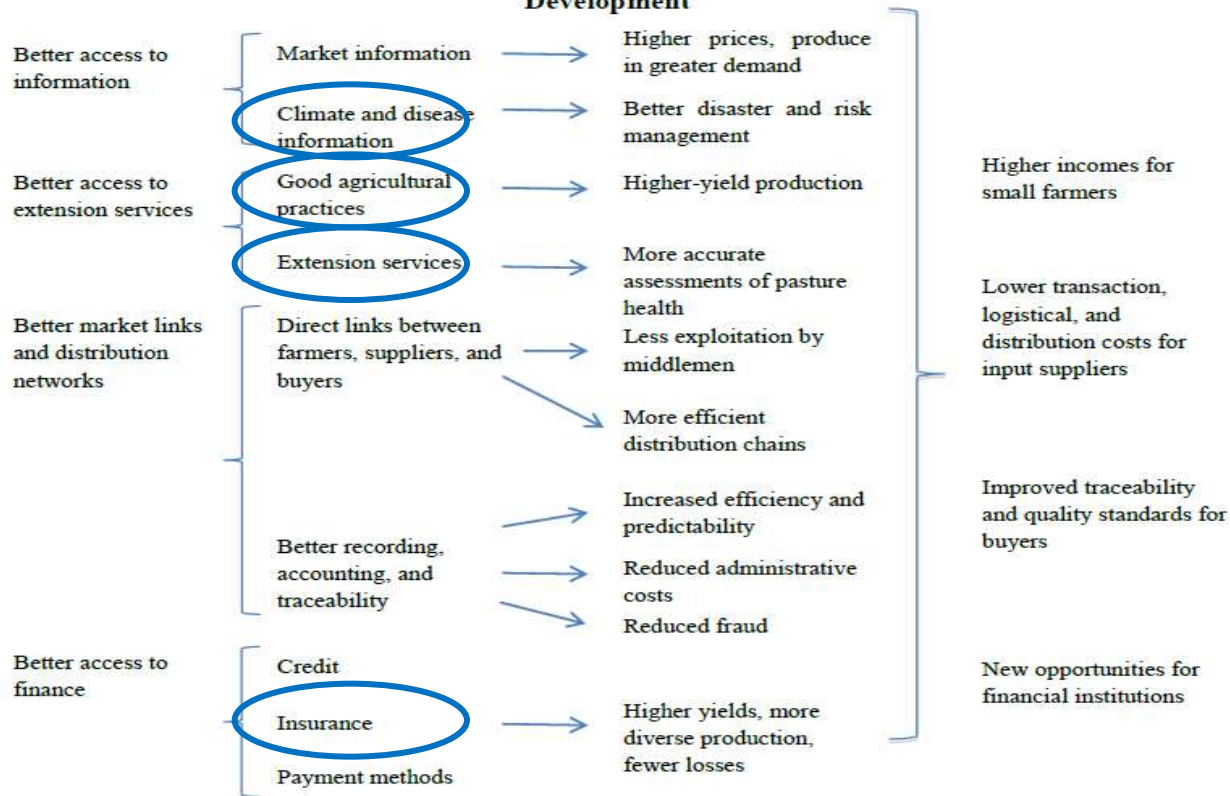
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# Mobile/ICT applications

Figure 1. Results Generated by Mobile Applications for Agricultural and Rural Development



## Mobile Applications for Agriculture and Rural Development

Christine Zhenwei Qiang, Siou Chew Kuek\*, Andrew Dymond and Steve Esselaar

ICT Sector Unit  
World Bank

December 2011

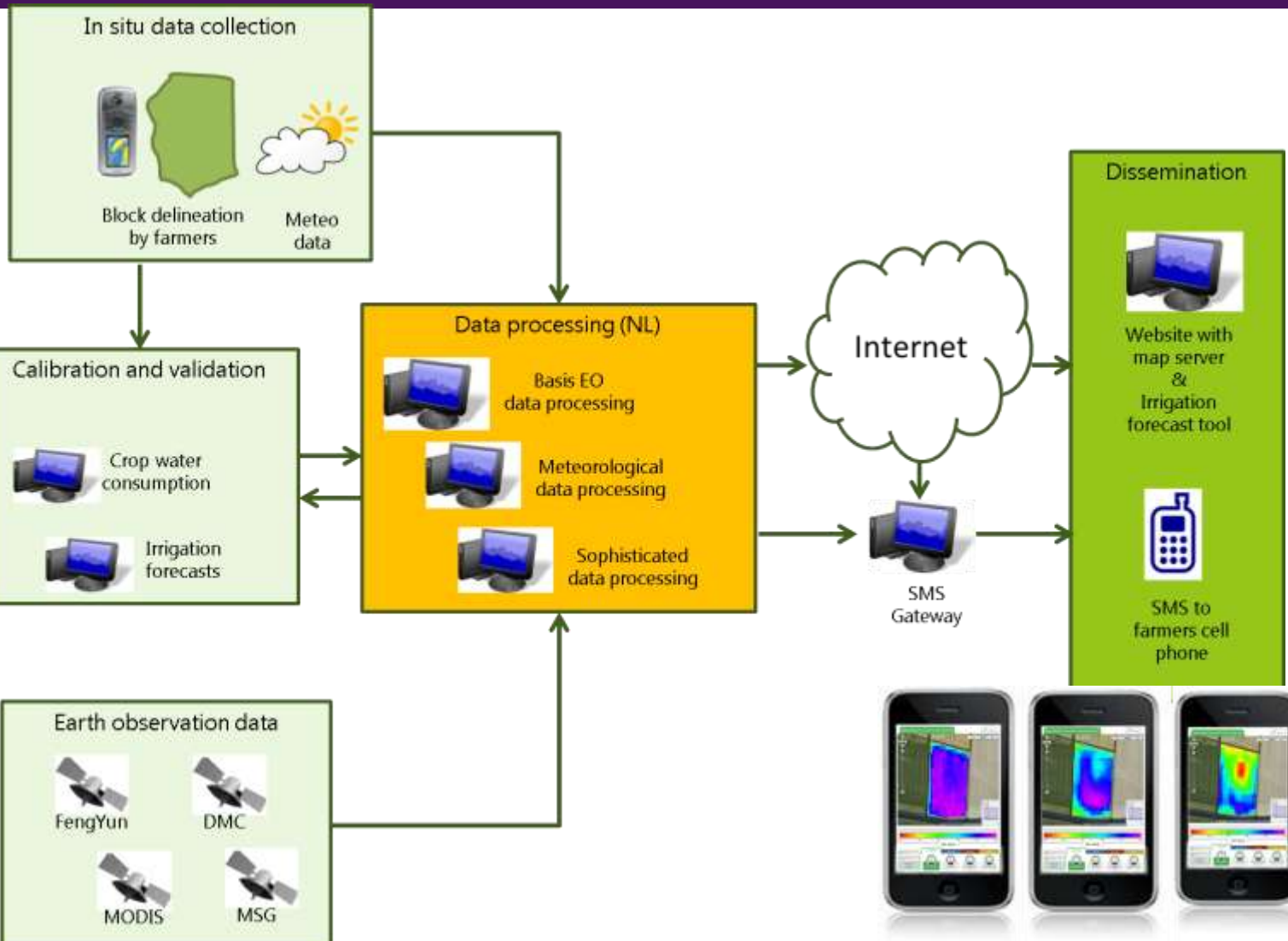
Advisory



Insurance/finance



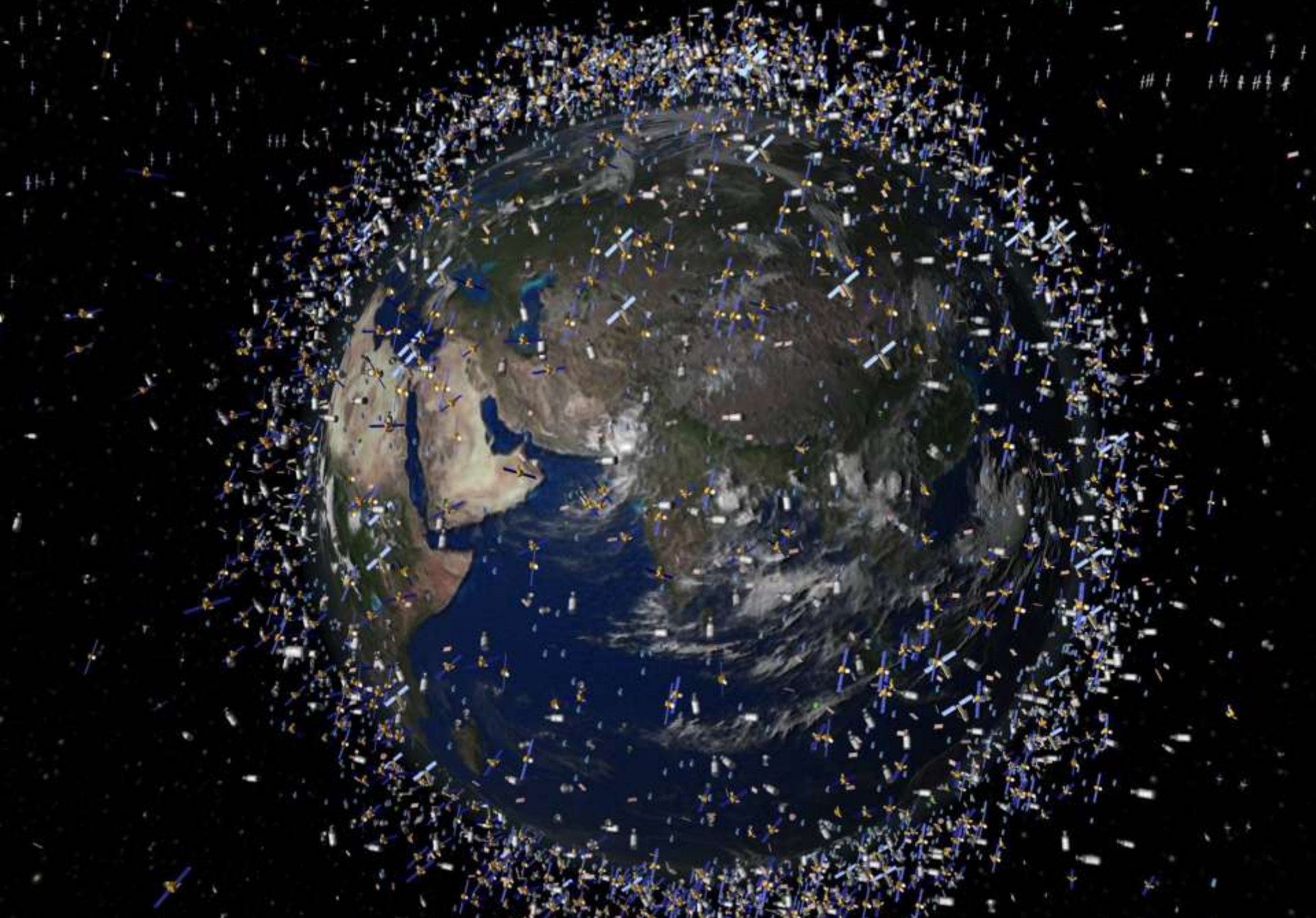






## Why also satellite data?

- Objective, consistent, cross border
- No or few (local) monitoring infrastructure
- 25+ years time series (geostationary satellite, Landsat)
- Many new satellites (to be) launched, no or low cost



Landsat 8 (US, 2013)  
No cost





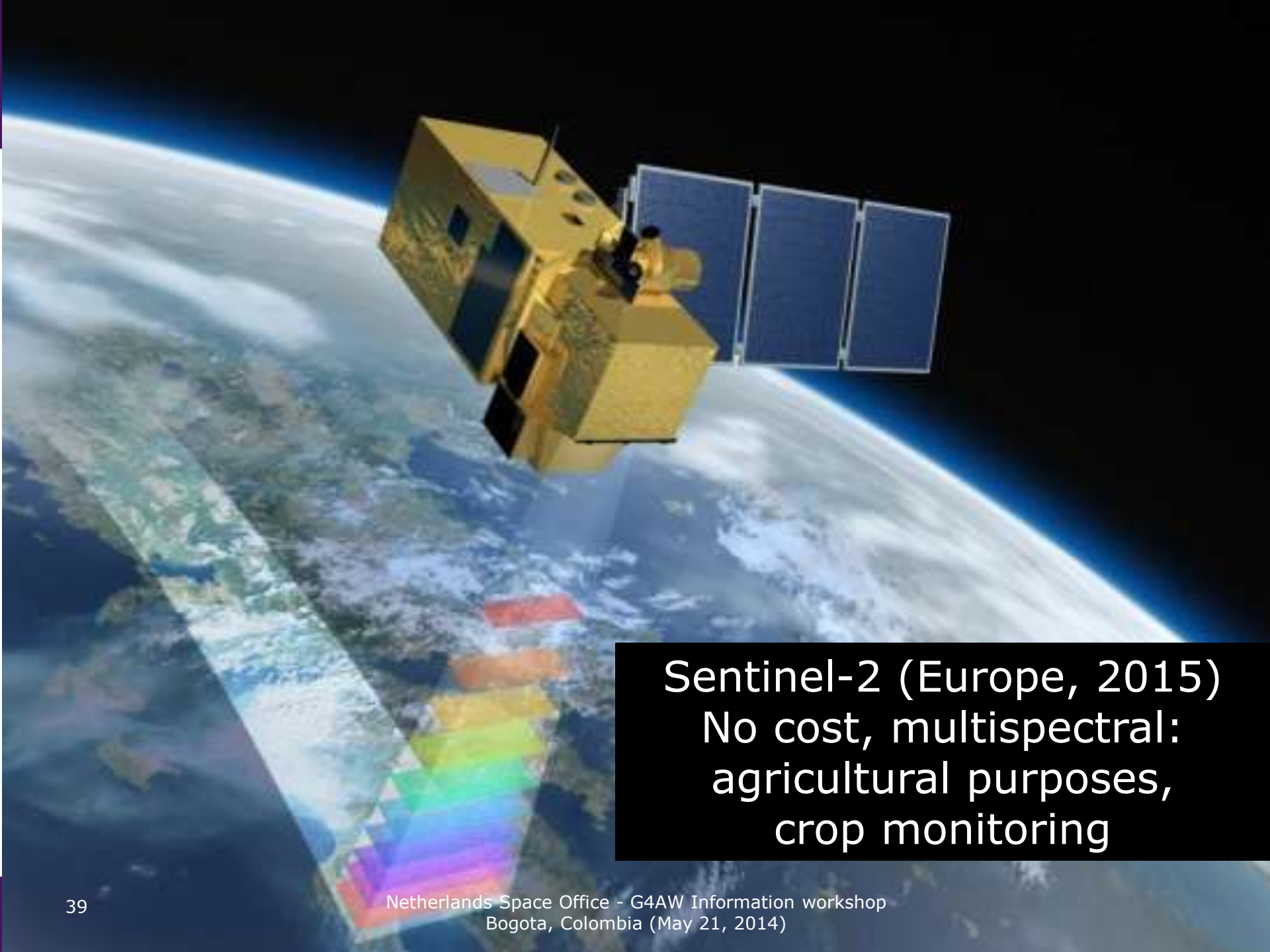
**Sentinel-1 (Europe, 2014)**  
**No cost**  
**Looking through clouds, day & night**



Planet Labs (2014)

Skybox (2014)

Constellation  
High revisit time  
Commercial  
Low cost

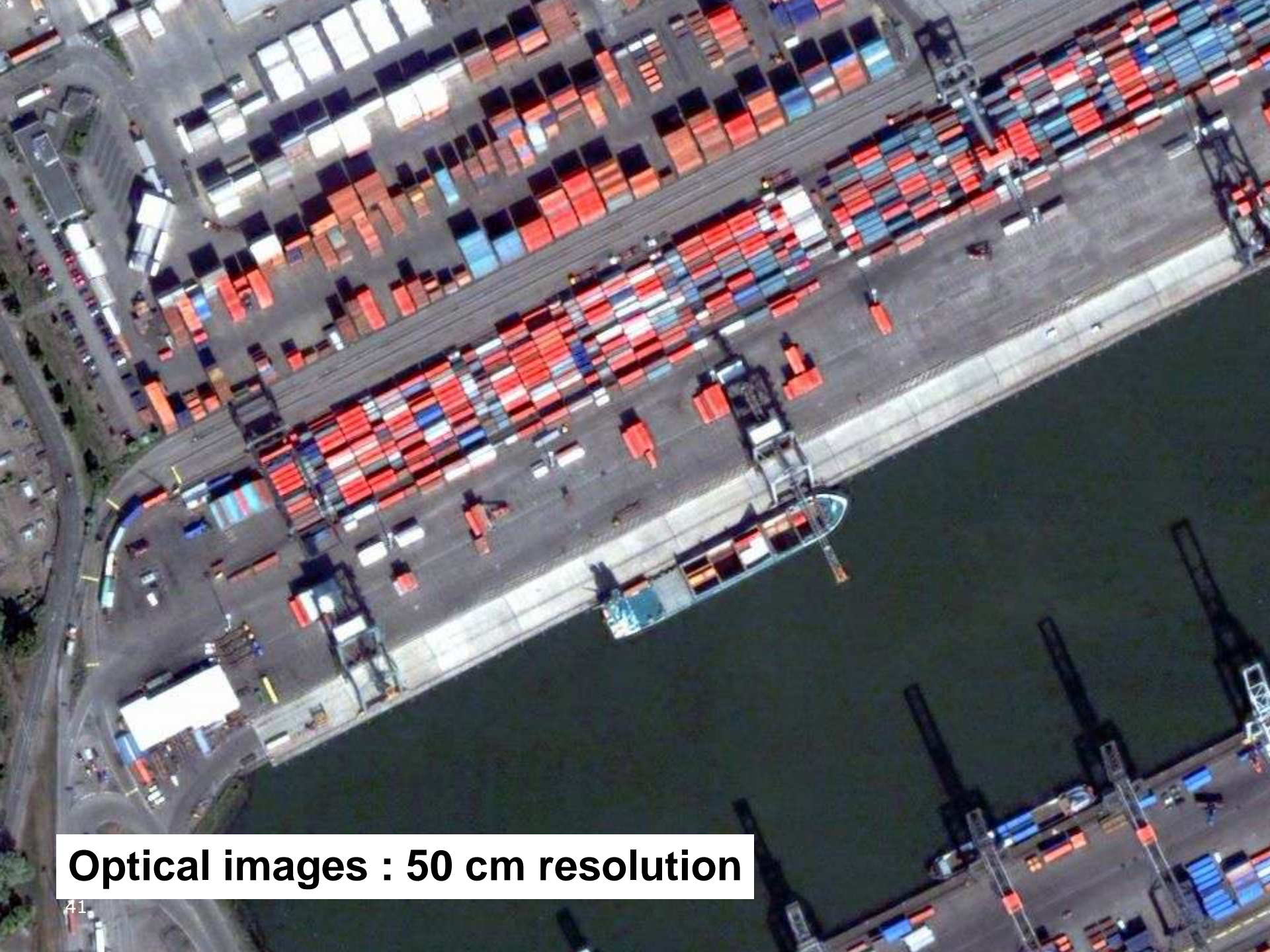


Sentinel-2 (Europe, 2015)  
No cost, multispectral:  
agricultural purposes,  
crop monitoring

# High resolution satellites

Worldview-2

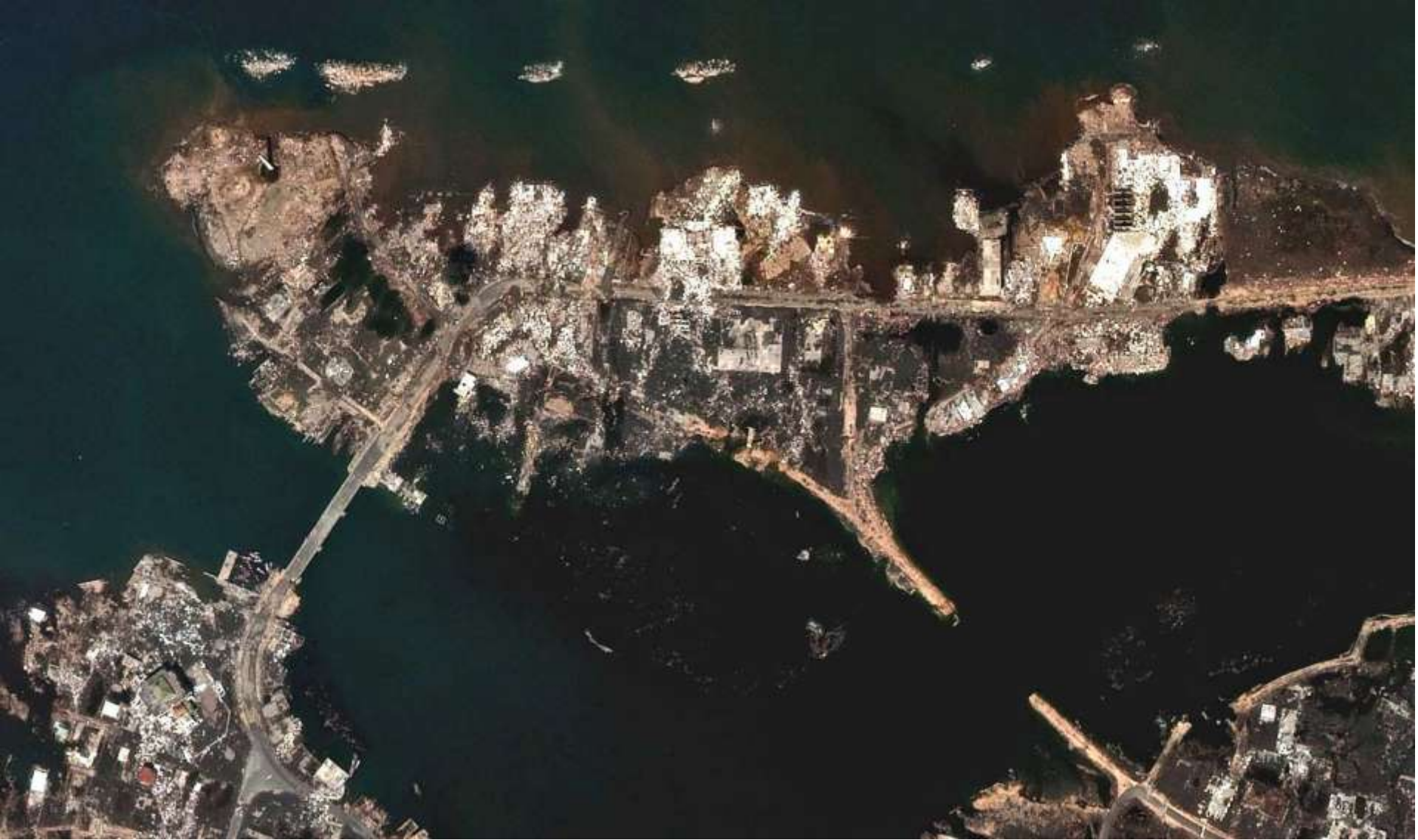




**Optical images : 50 cm resolution**



**Aceh, before the tsunami (2004)**



**Aceh, after the tsunami (2004)**



Cảm ơn bạn đã quan  
tâm của bạn

Thank you for your  
attention

Netherlands  
**Space**  
Office