



## Sécurité alimentaire & services d'information par satellite

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Agence Spatiale Néerlandaise /  
Netherlands Space Office (NSO)





# Les effets du réchauffement climatique sur la sécurité alimentaire et l'approvisionnement en eau



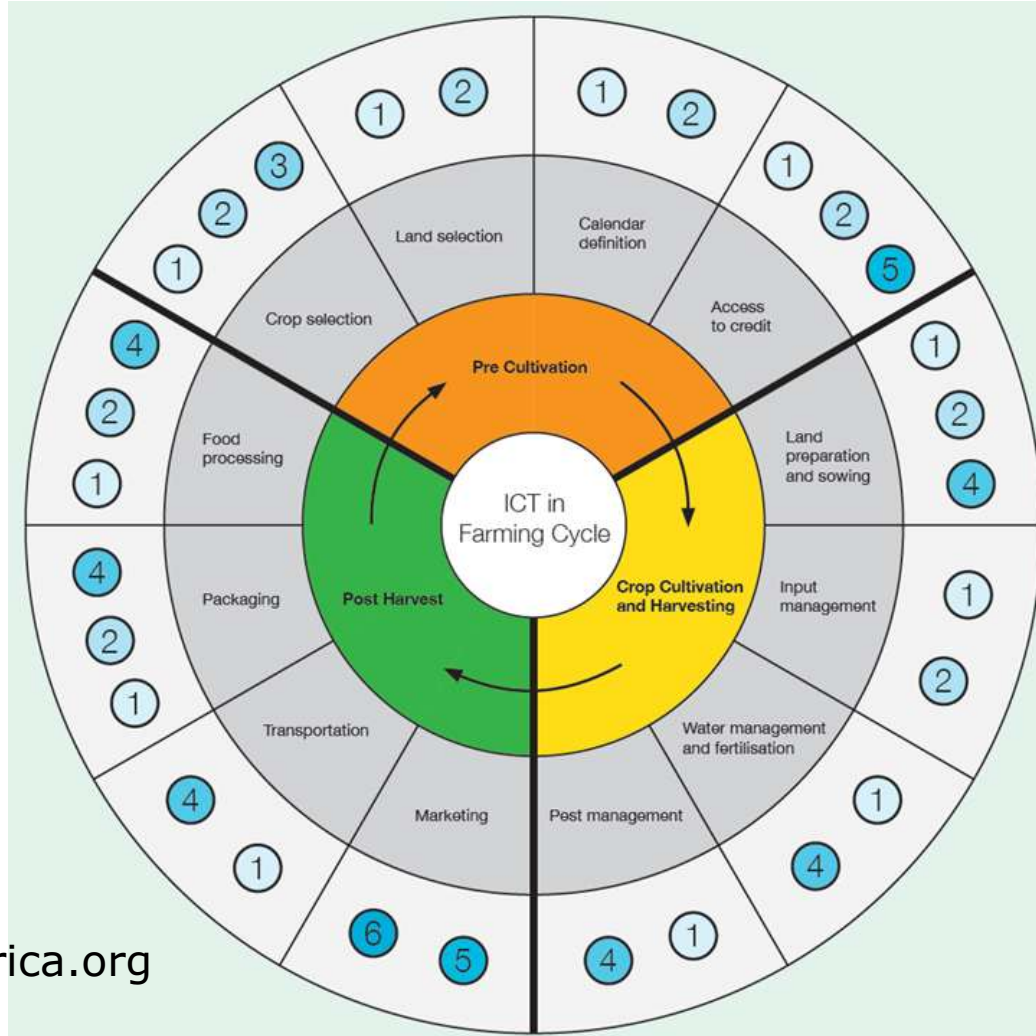
p.ex.

- Averses abondantes
- Sécheresse





- 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)

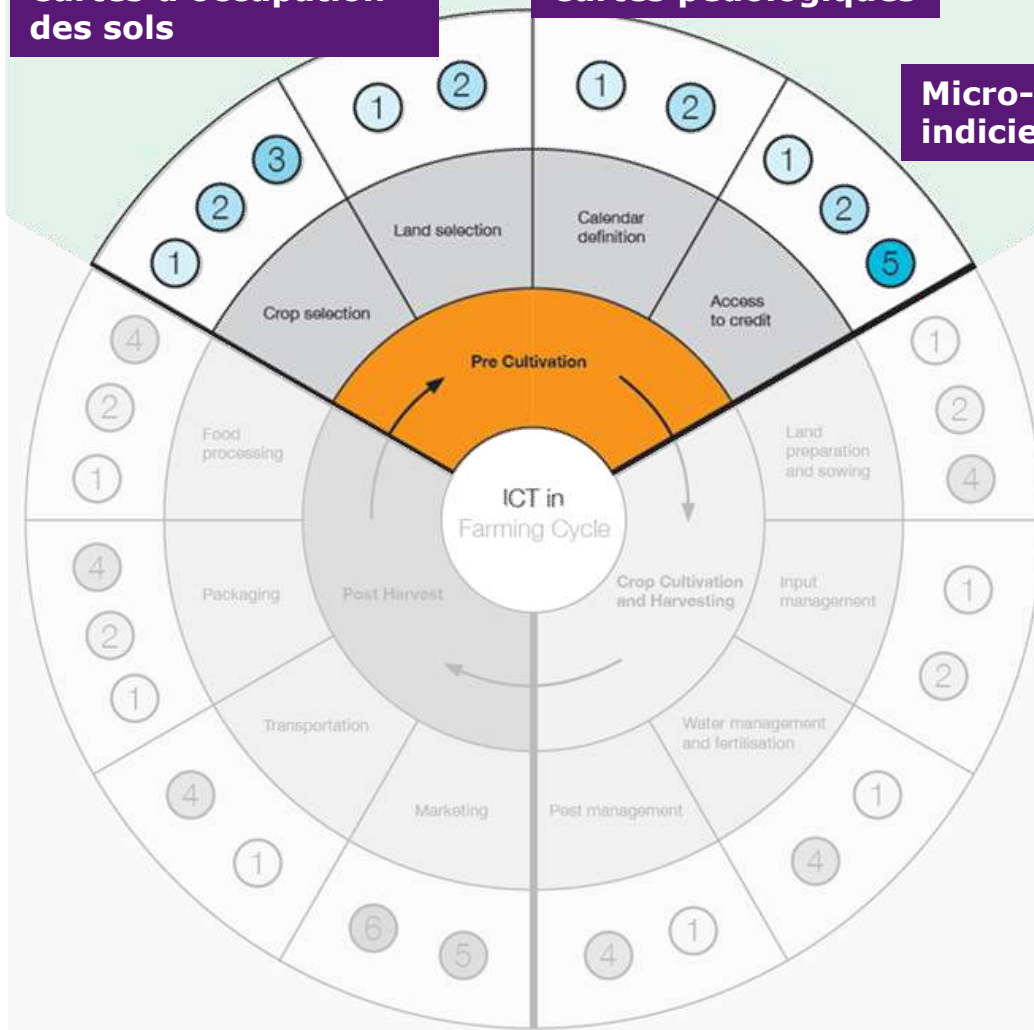


## Cartes d'occupation des sols

## Cartes pédologiques

## Micro-assurance indicielle

- 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)





# Marcela

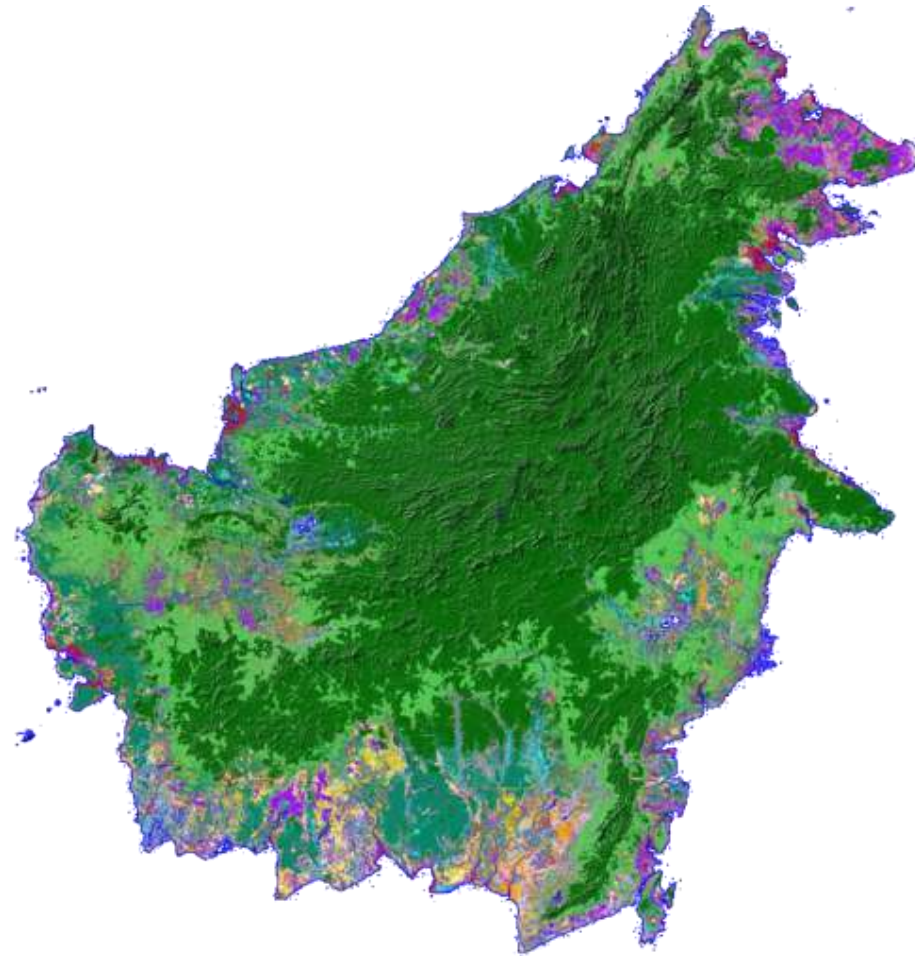
## Cartes d'occupation des sols (radar)



IDEAM



	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

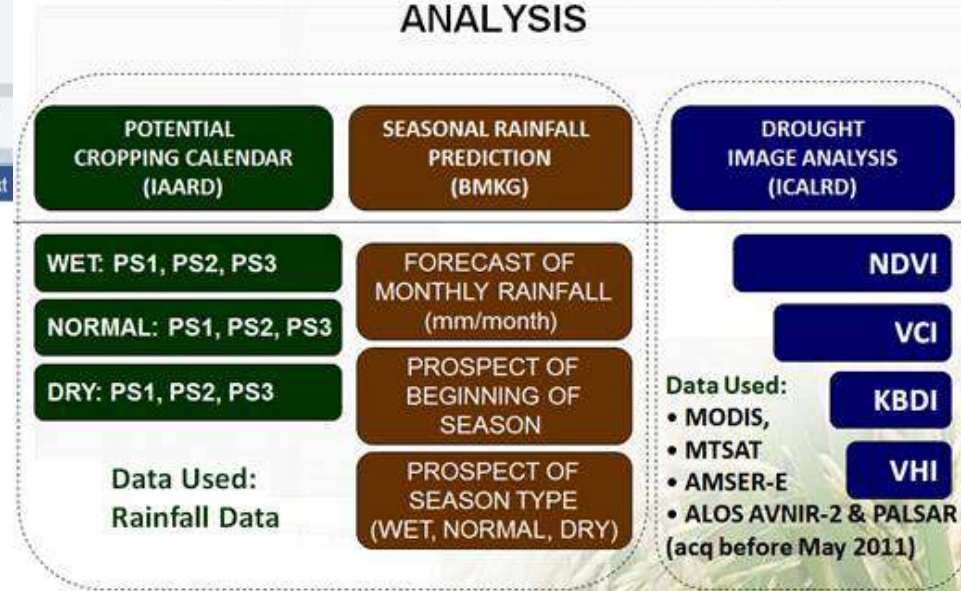




# Crop calendar



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

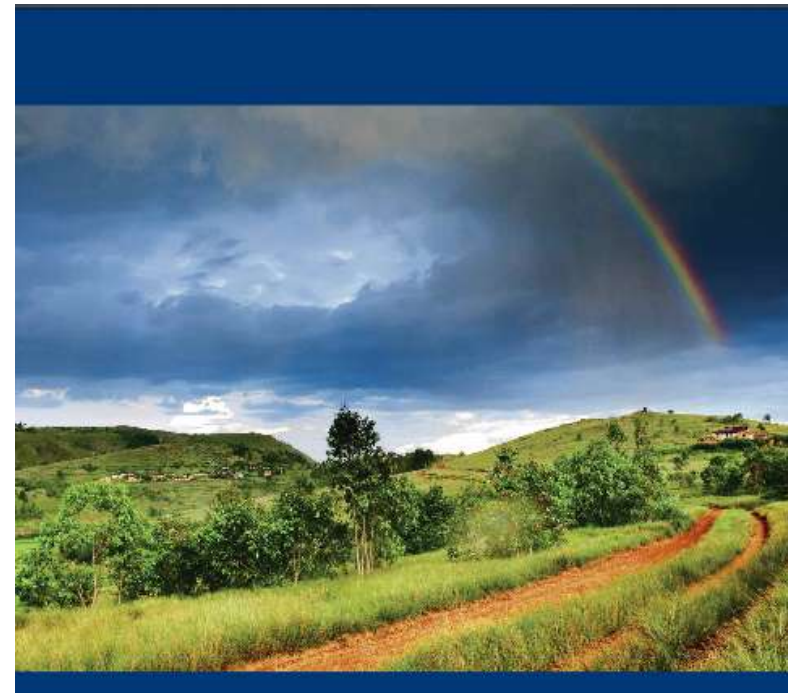






# Micro insurance

- De nombreux projets pilotes
- Exemples :
  - Kilimo Salama
  - Planet Guarantee (projet EARS-FESA)
  - MicroEnsure
  - et autres
- Techniquement réalisables
- Utilisation majeure de mobiles →  
Atteindre les agriculteurs
- Temps de passer à une échelle supérieure



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



World Food  
Programme



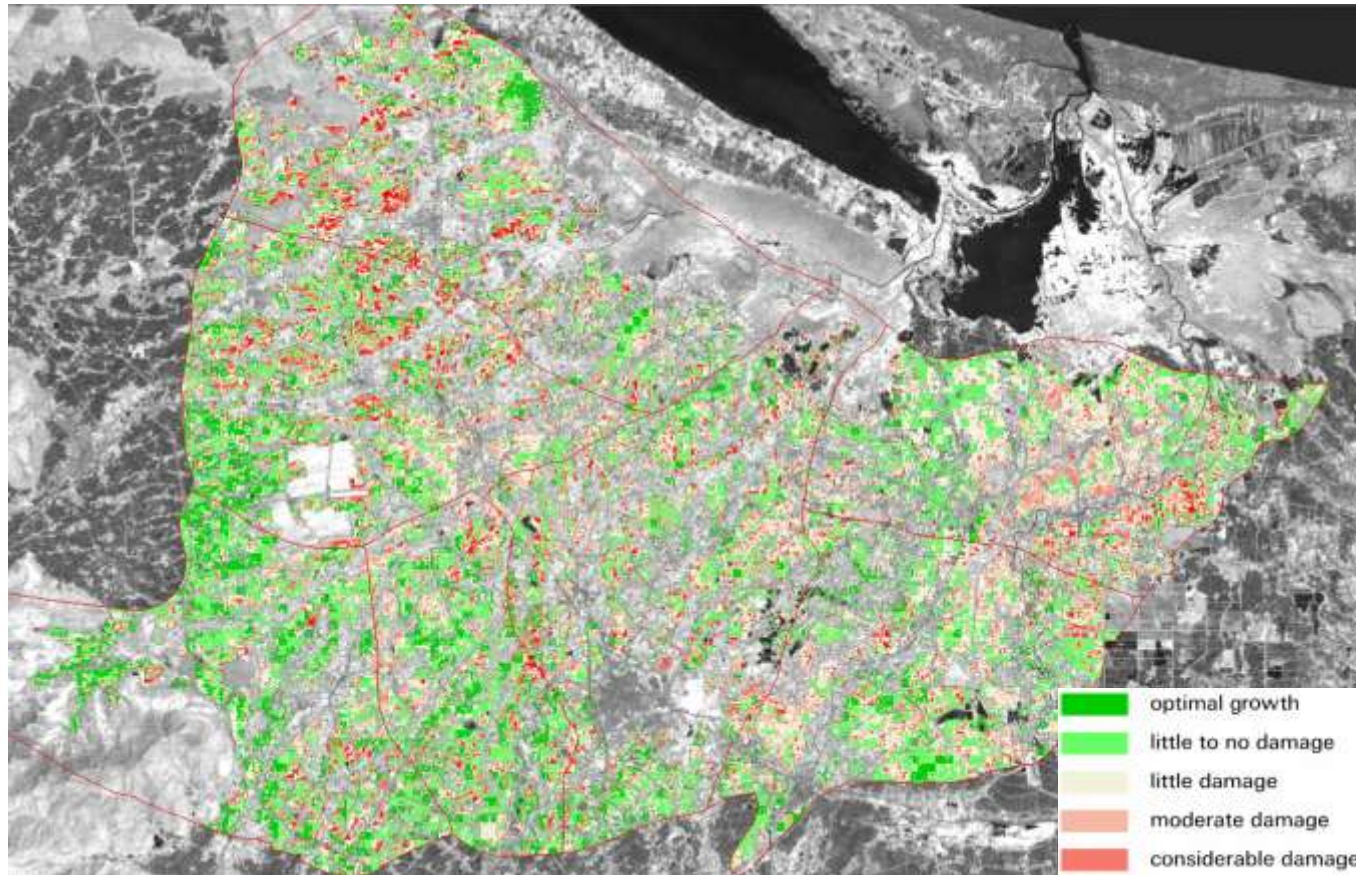
Enabling poor rural people  
to overcome poverty

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



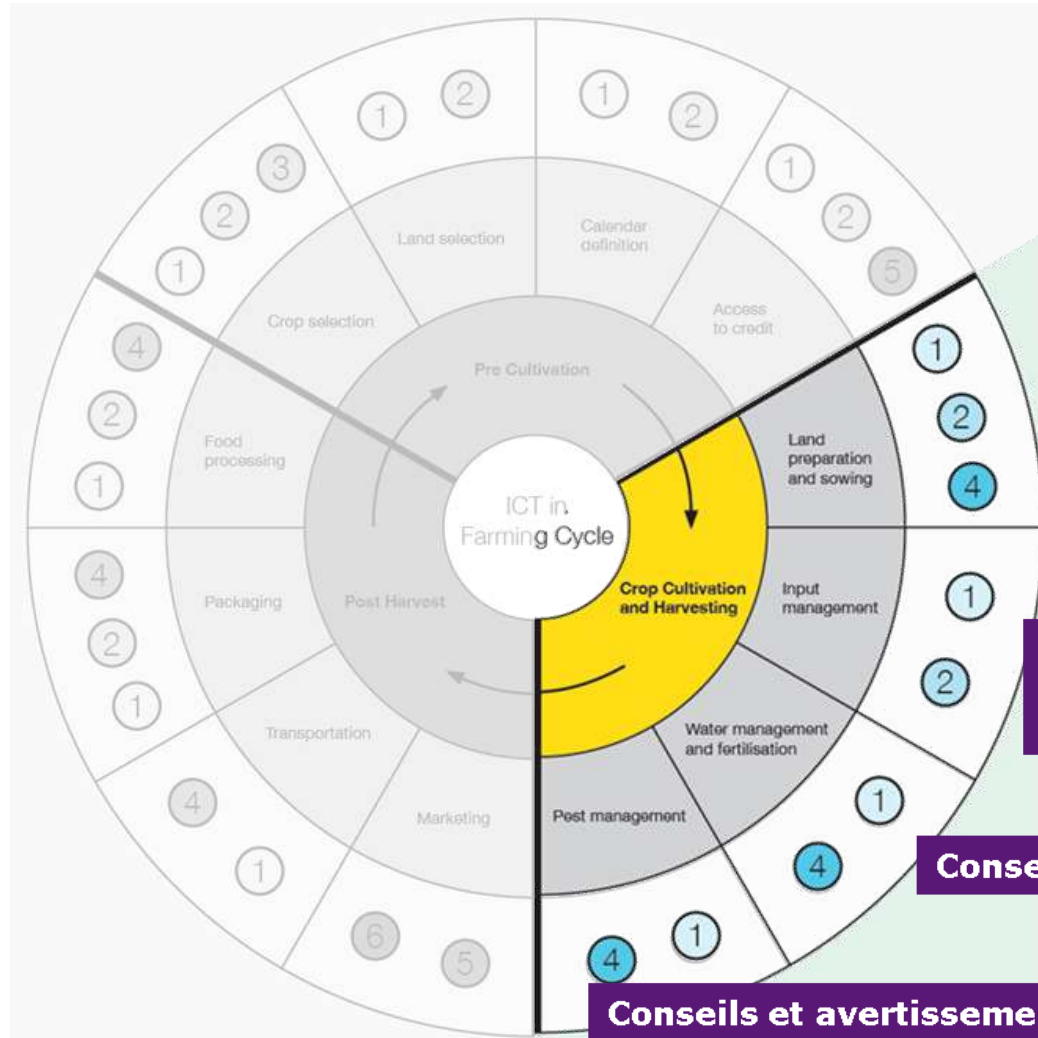
# Micro insurance

## Weather insurance in rice crops





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



**Cartes d'occupation des sols**  
**Cartes pédologiques**

**Surveillance de la croissance des cultures**

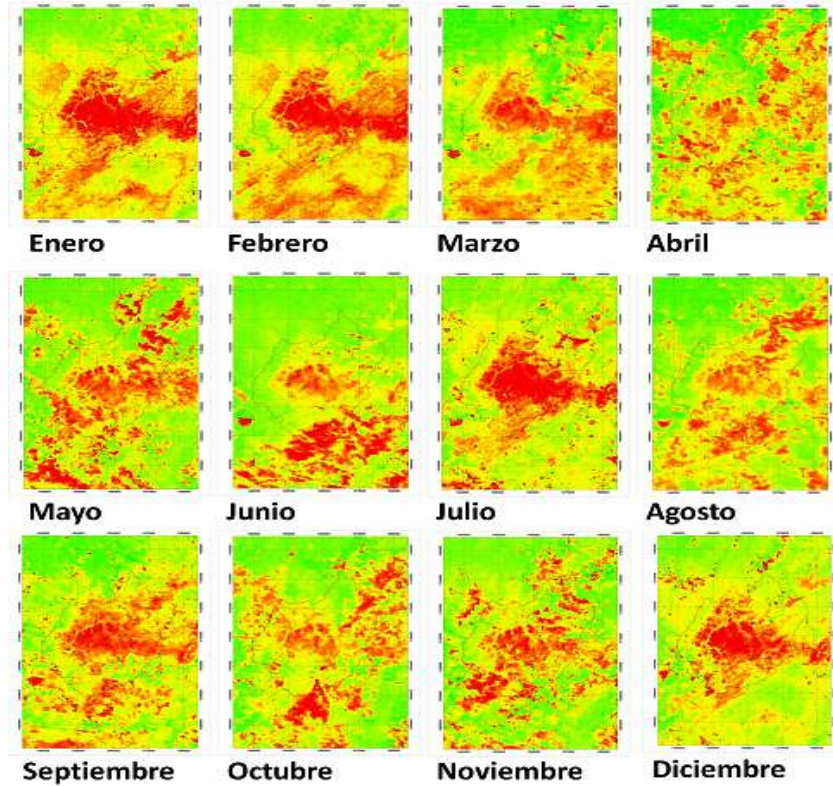
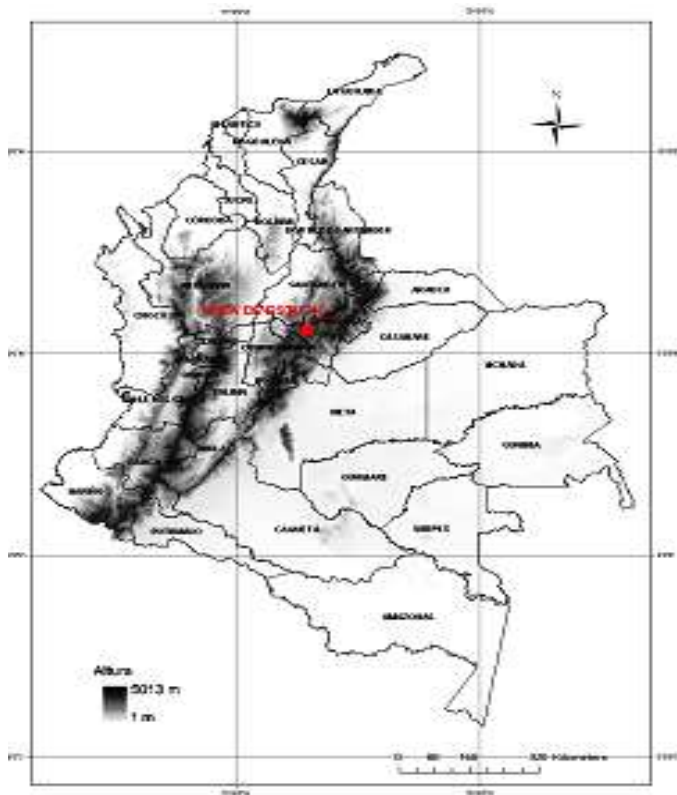
**Conseils d'irrigation**

**Conseils et avertissements**



# Crop growth monitoring

# Villa de Leiva (2008)

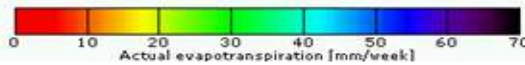
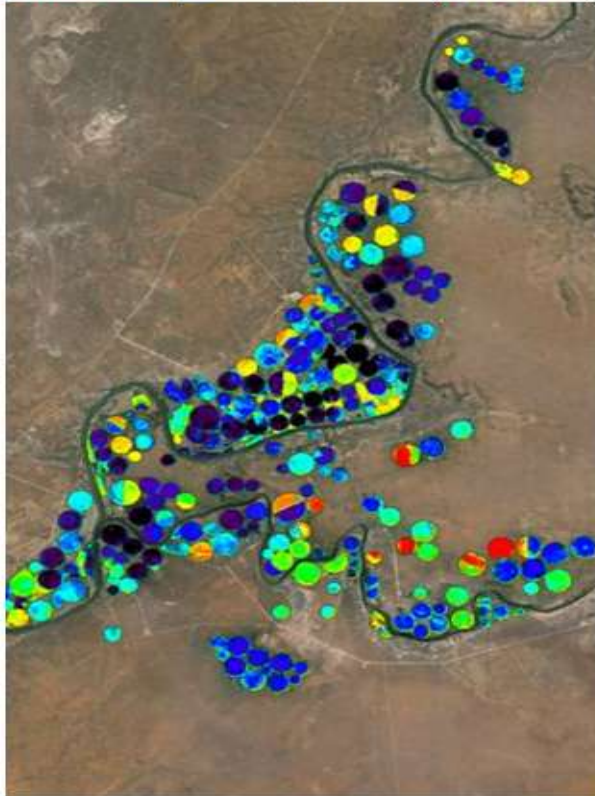




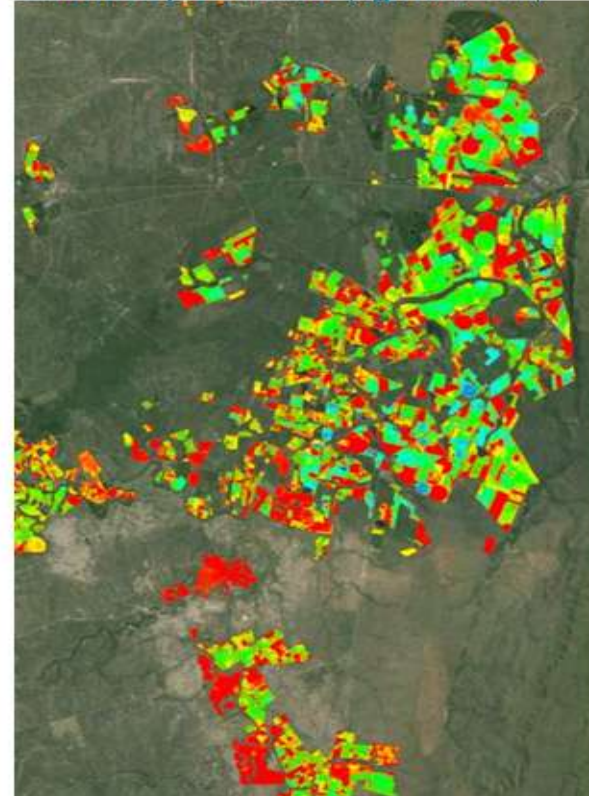
# Crop growth monitoring

# South Africa

GrainLook – Douglas  
Actual Evapotranspiration (mm/week)

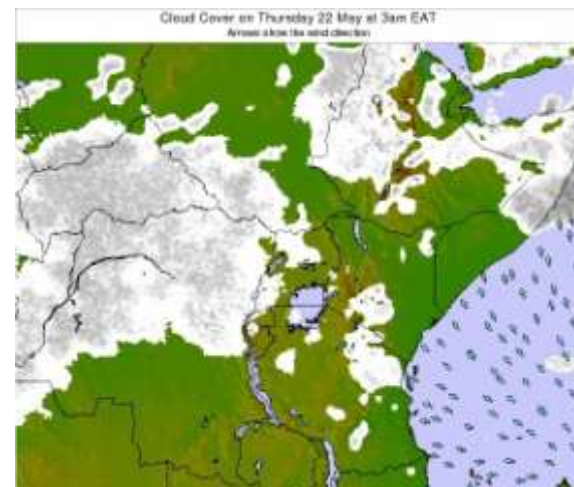
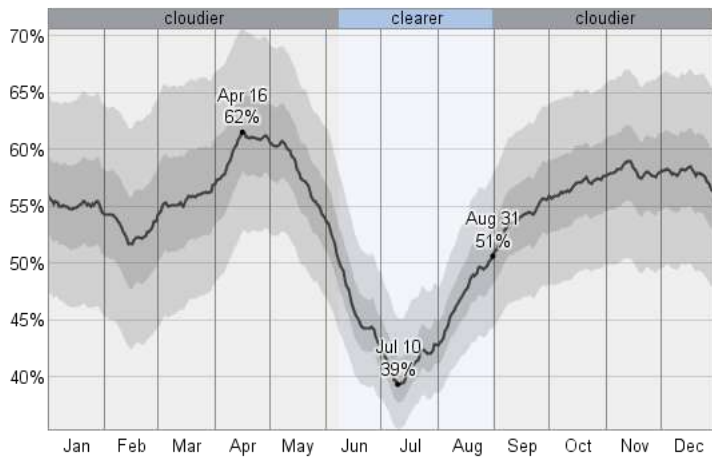
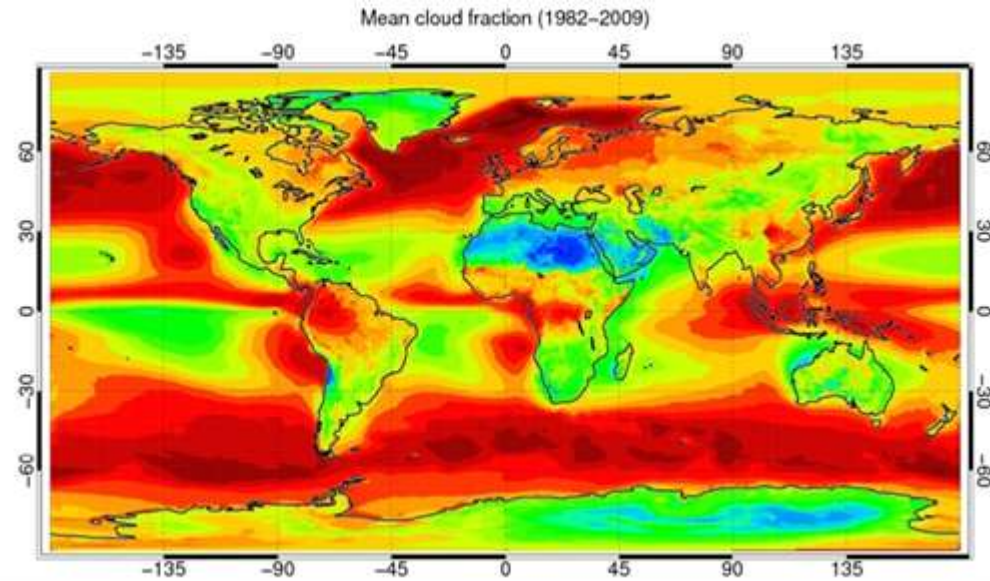
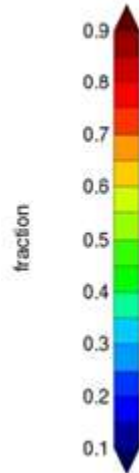


SugarcaneLook – Mpumalanga  
Biomass production (kg/ha/week)



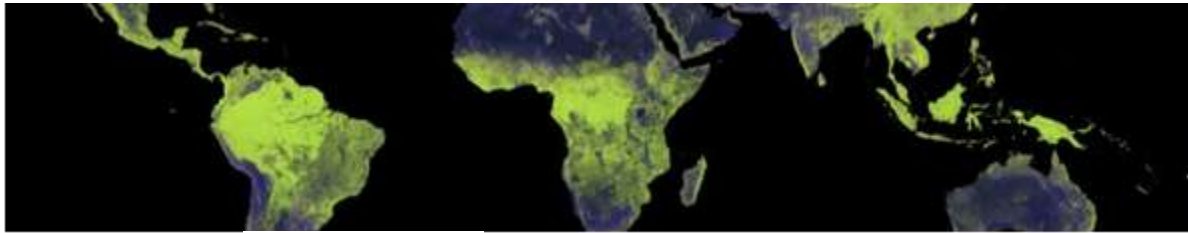


# Cloud cover

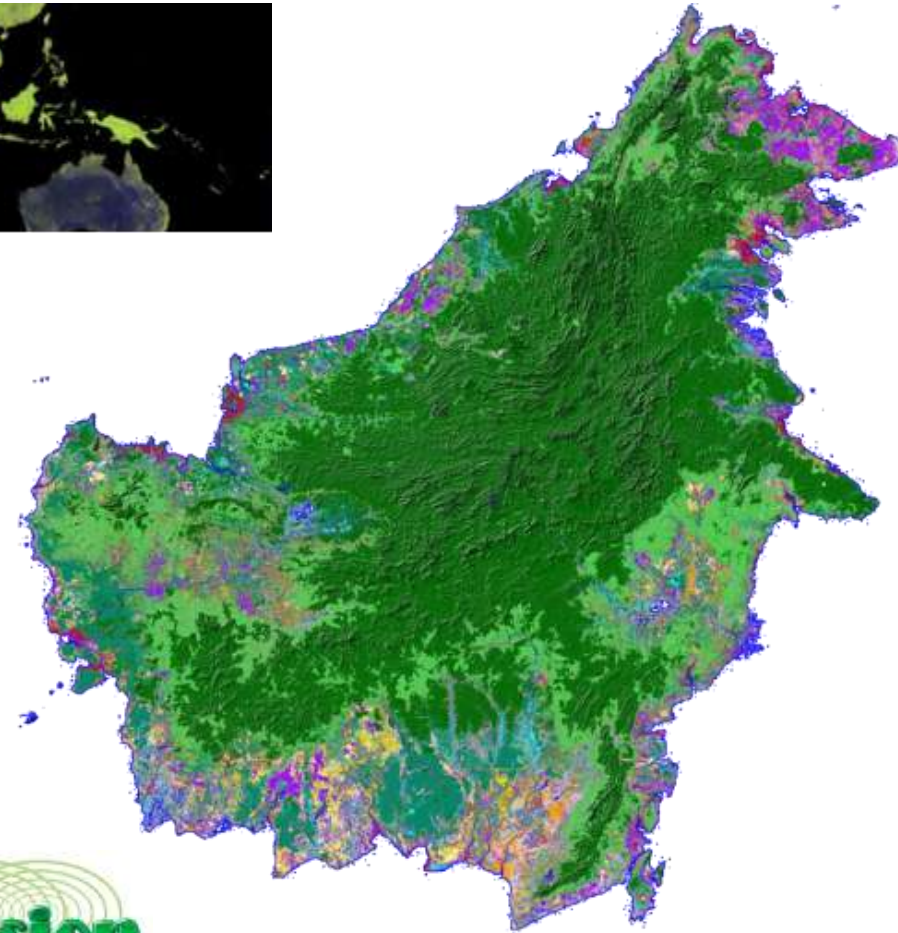




# Radar looks under clouds



	Lowland forest
	Riverine forest
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Kalimantan  
Land cover  
map (radar)



# Crop growth monitoring



Image  
radar  
sans  
nuages



©2012





# Crop growth monitoring

Sugar beet at 25m resolution every  
24 days

22/04/2012



## Radar analysis

Sol nu



©2012



# Crop growth monitoring

Sugar beet at 25m resolution every  
24 days

16/05/2012



## Radar analysis

Sol nu  
Émergence



©2012



# Crop growth monitoring

Sugar beet at 25m resolution every  
24 days

09/06/2012



## Radar analysis

Sol nu  
Émergence  
Accroissement



©2012



# Crop growth monitoring

Sugar beet at 25m resolution every  
24 days

03/07/2012



## Radar analysis

Sol nu  
Émergence  
Accroissement  
Fermeture



©2012



# Crop growth monitoring

Sugar beet at 25m resolution every  
24 days

07/10/2012



## Radar analysis

Sol nu  
Émergence  
Accroissement  
Fermeture  
Récolte



©2012



# Crop growth monitoring

La riziculture avec une résolution de 5m tous les 5 à 11 jours

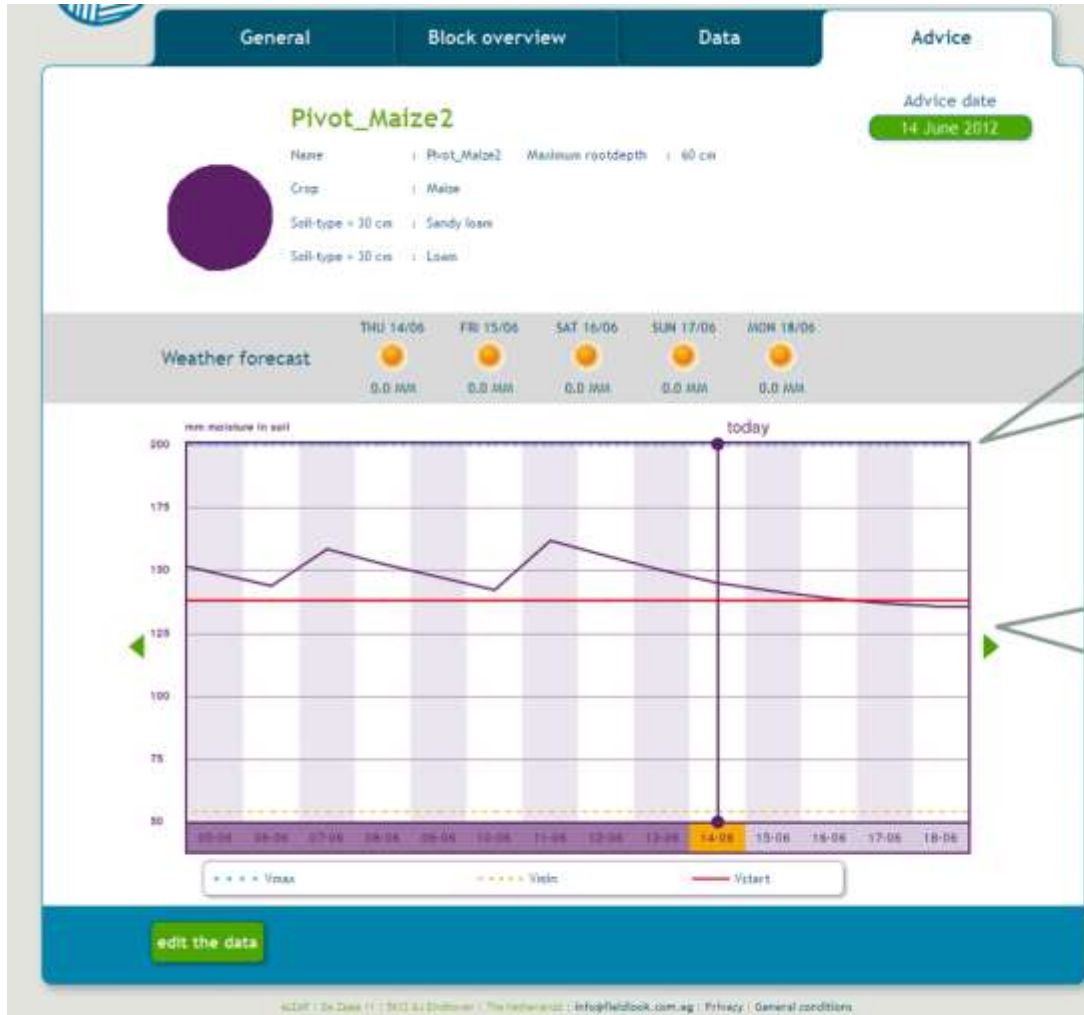


Le niveau de détail de 5m permet la surveillance des exploitations de petite taille





# Irrigation advice



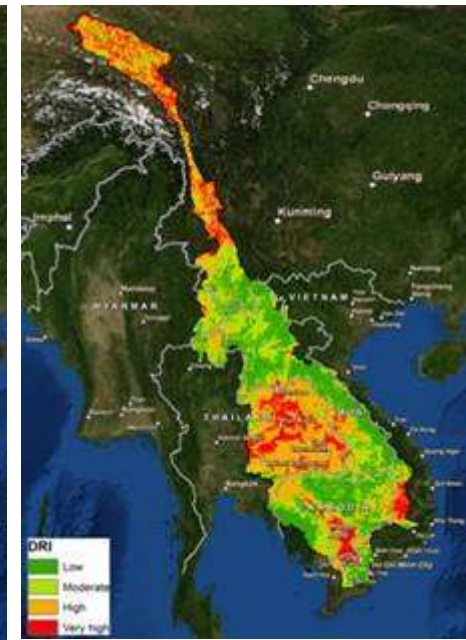
The crop has no water stress when the soil moisture is above the critical level and below the field capacity

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



# Advice and warning

## Hazard & Risk Analysis



Indice de  
vulnérabilité

Distance à une  
rivière

Indice de  
vulnérabilité

Densité de  
population

Indice de  
vulnérabilité

Précipitations

Carte des risques de  
sécheresse





# Advice and warning



## Early warning

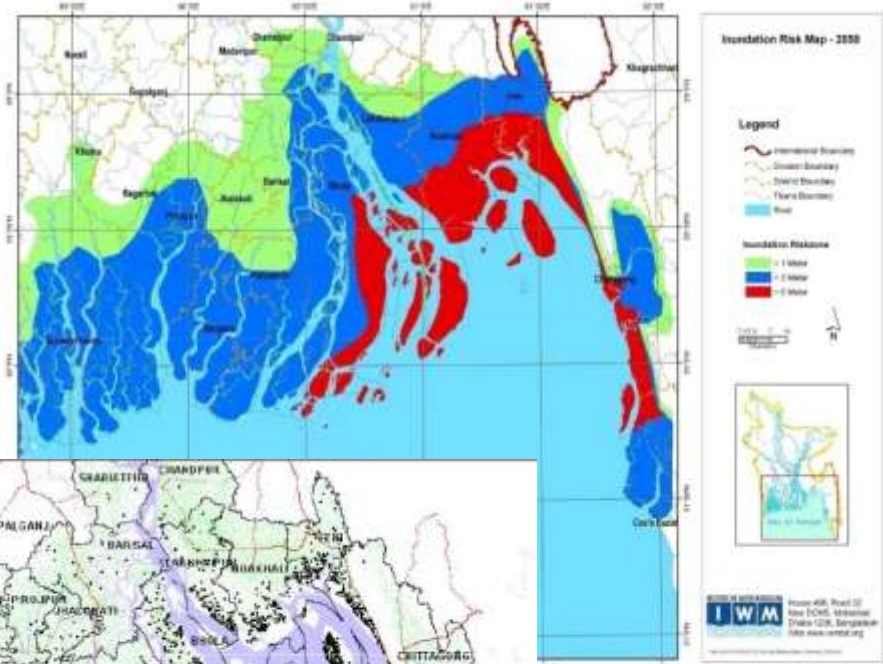
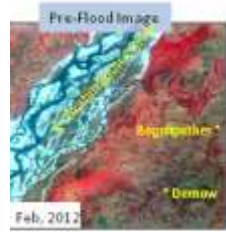
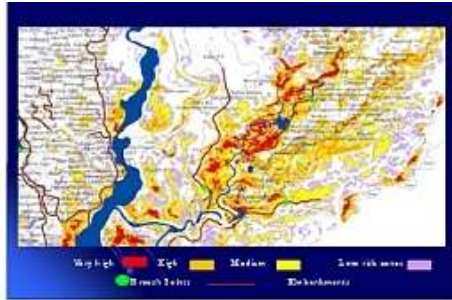
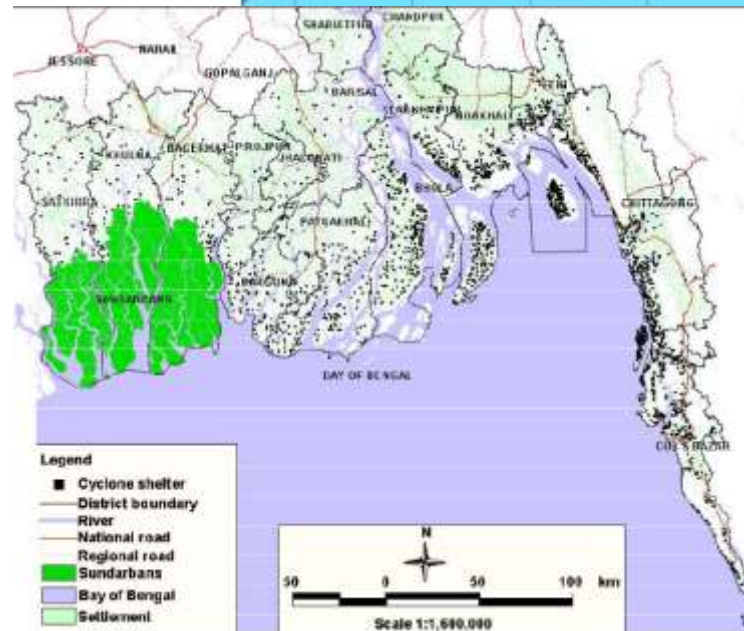
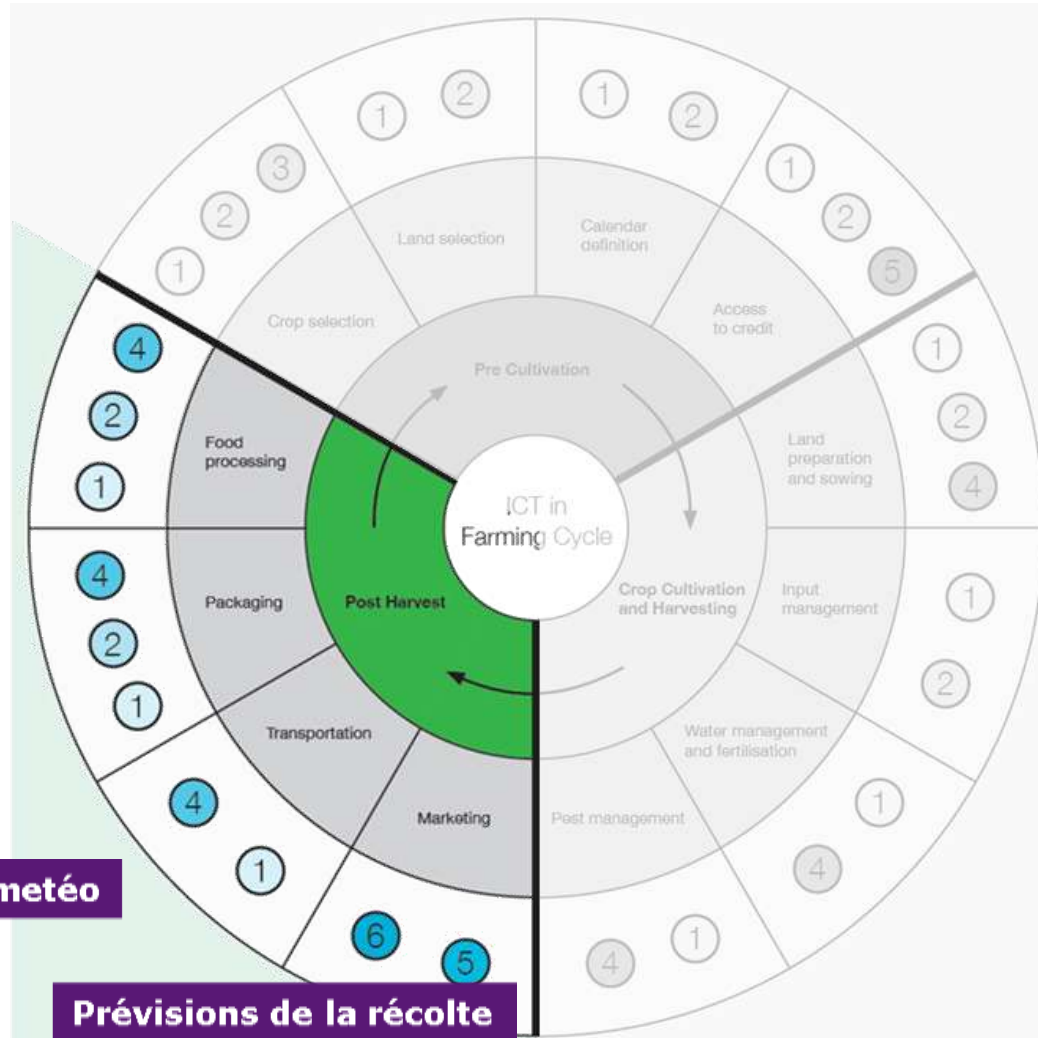


Fig: Flood hazard maps corresponding to various flood discharge and levels





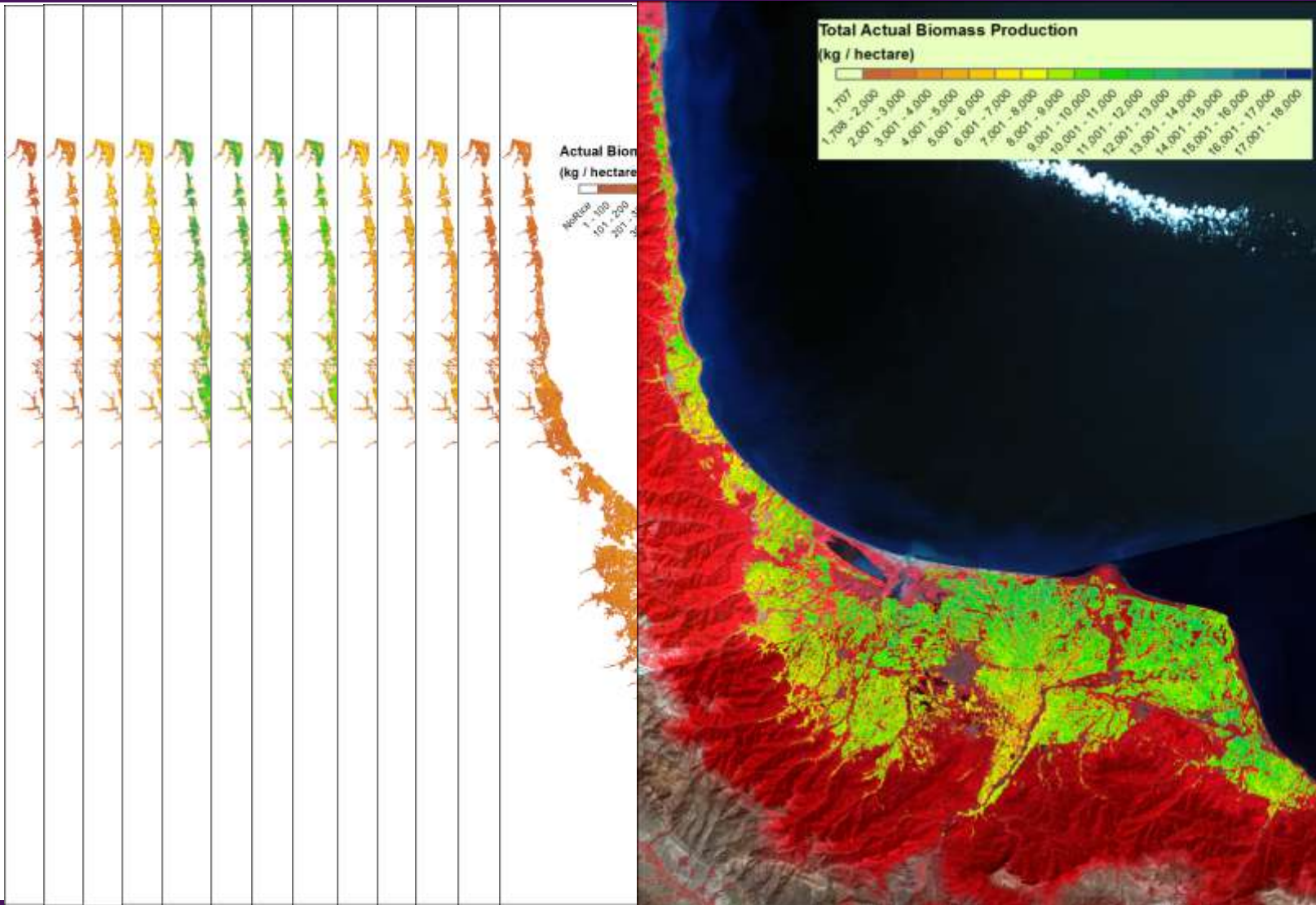
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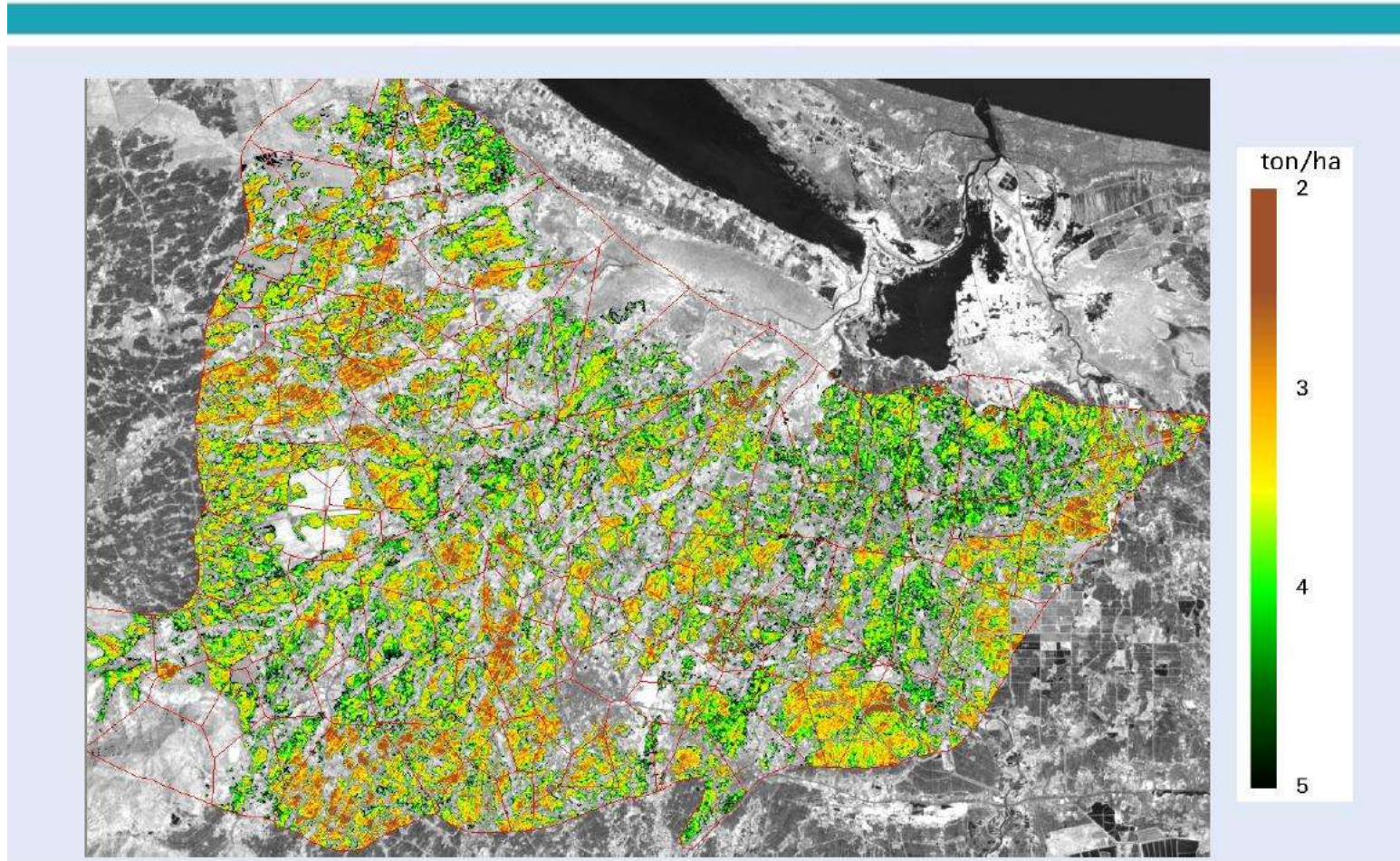
# Yield forecast

# Actual Biomass Production



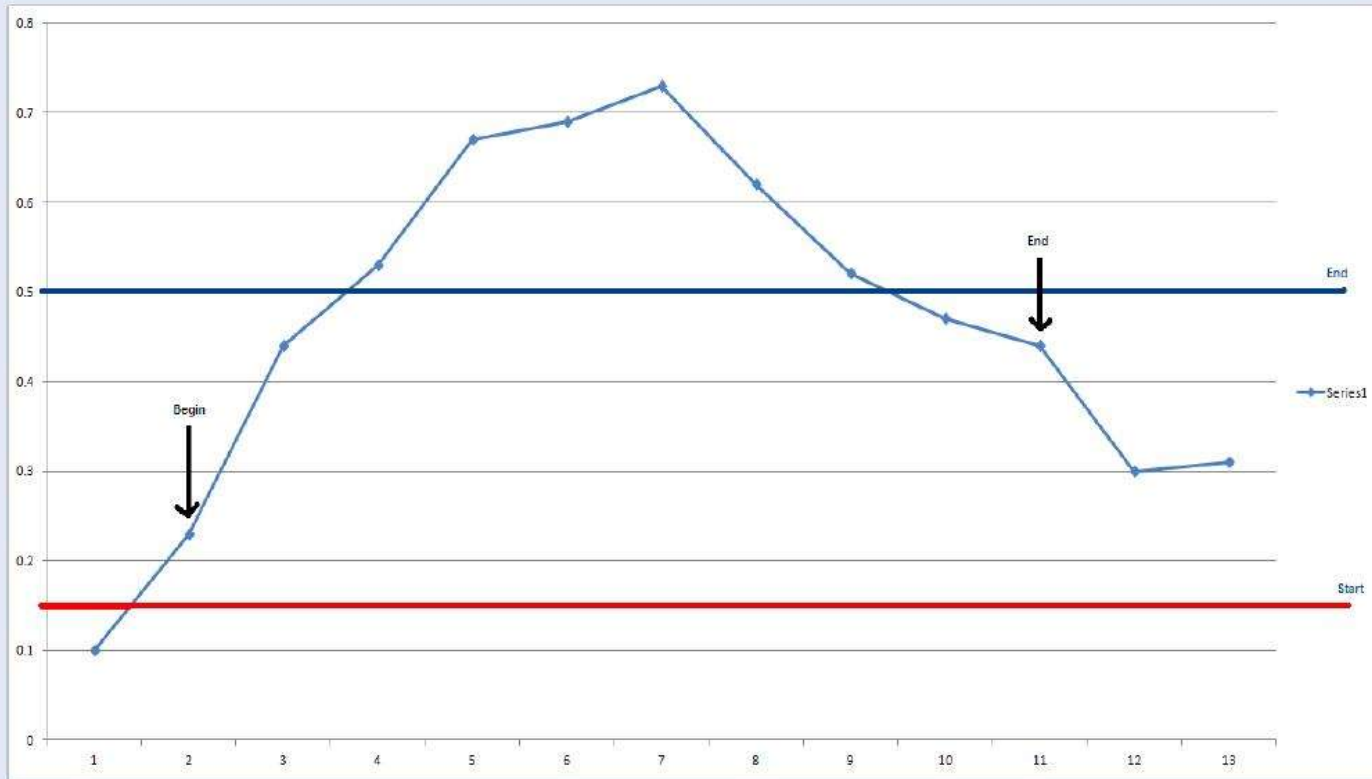


## Rice Yield maps



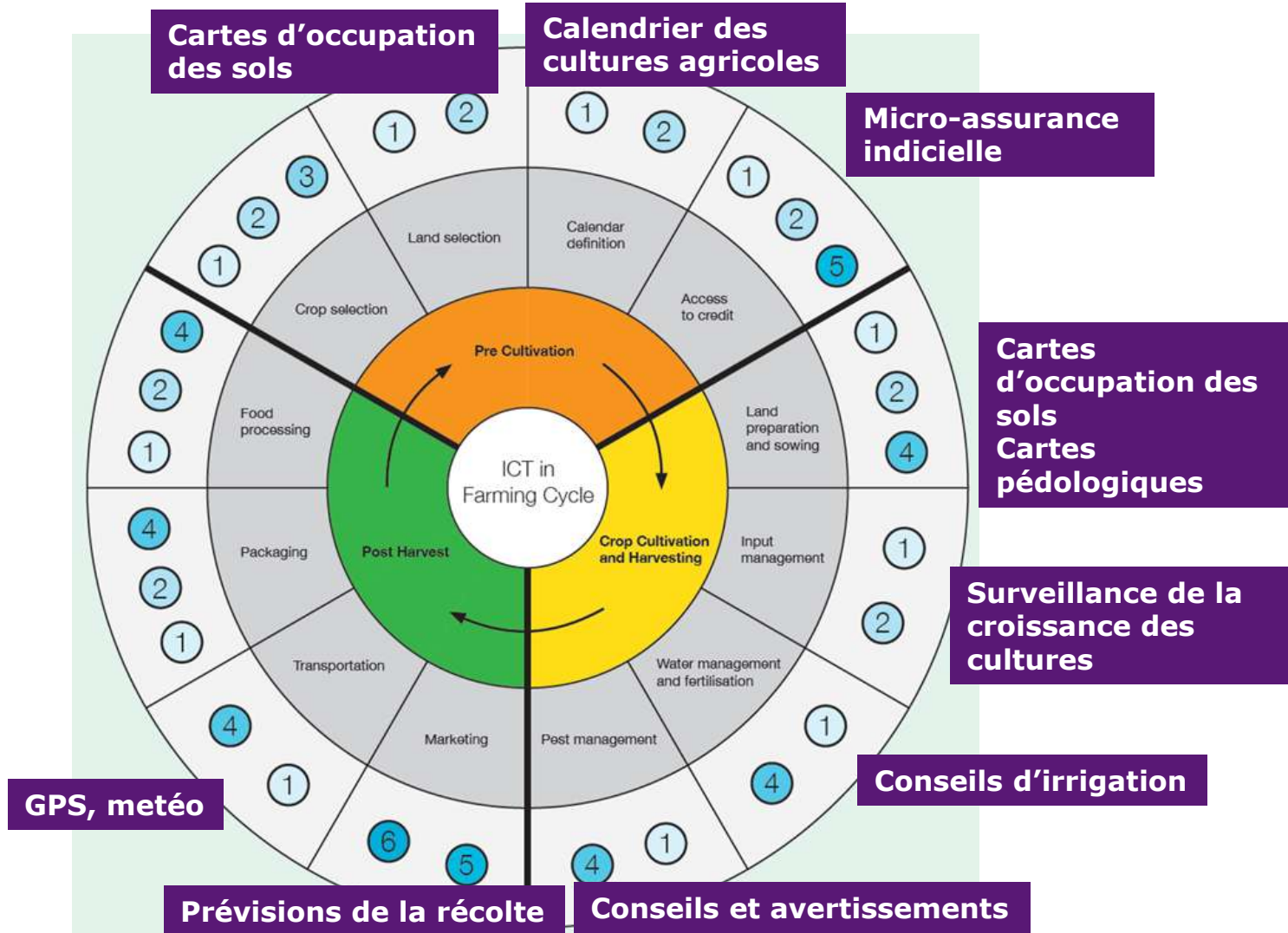


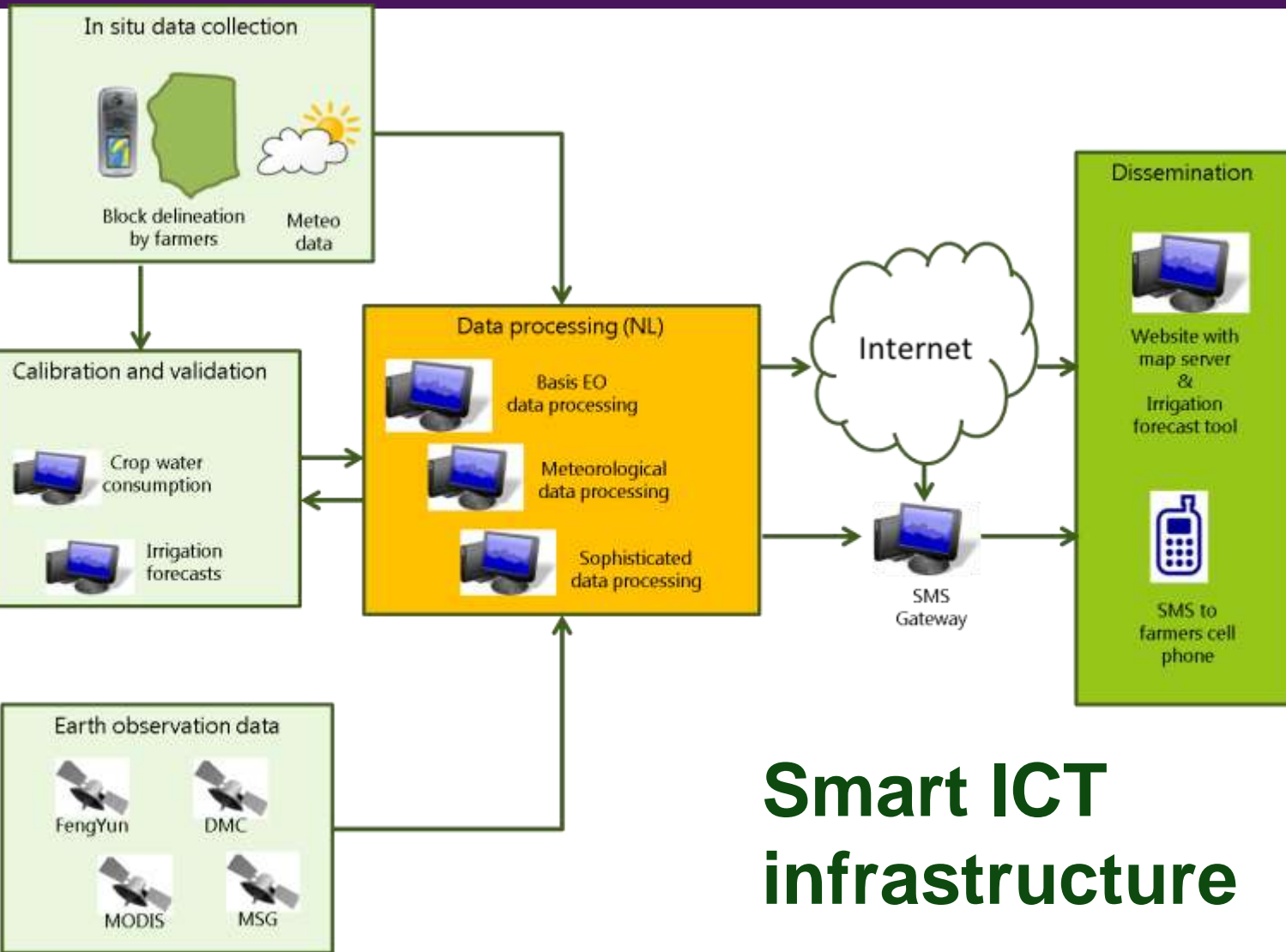
## Rice yield monitoring example using remote sensing





- 1 Information systems including DSS/MISS/GIS etc
- 2 ICT-enabled learning and knowledge exchange
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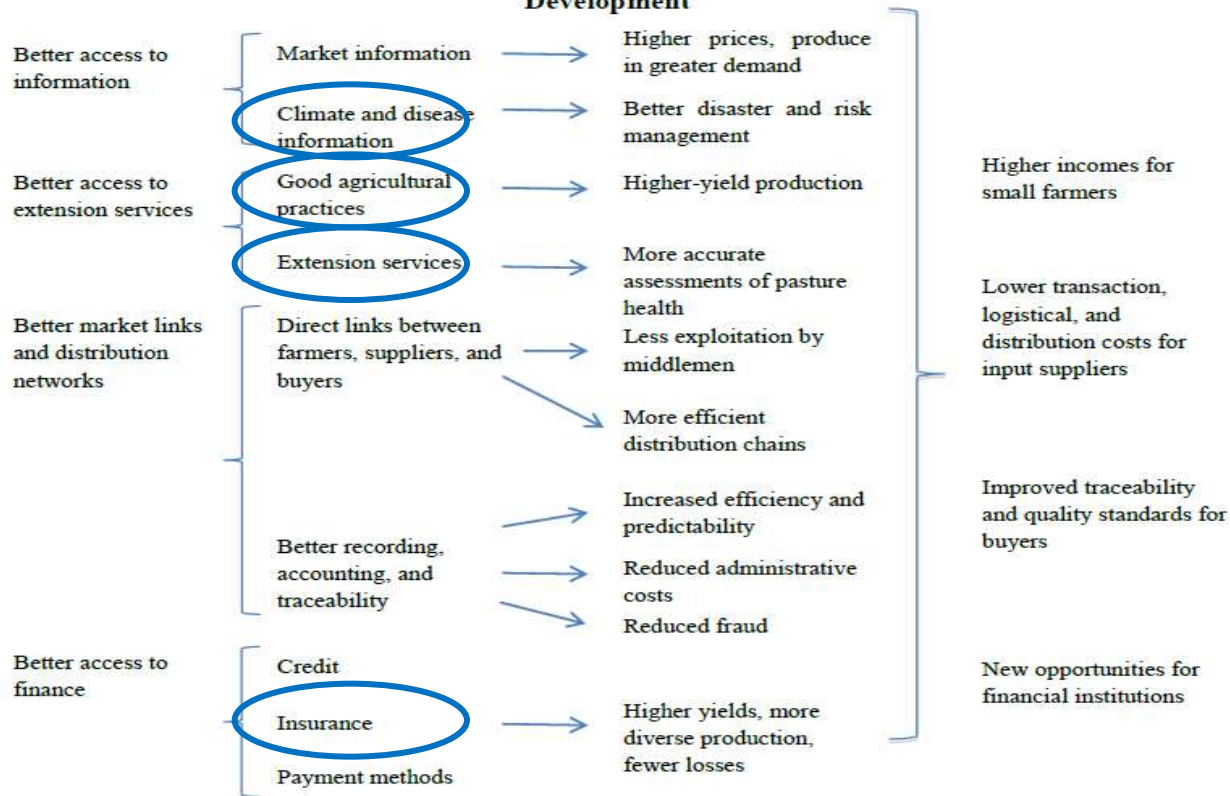


# Smart ICT infrastructure



# 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



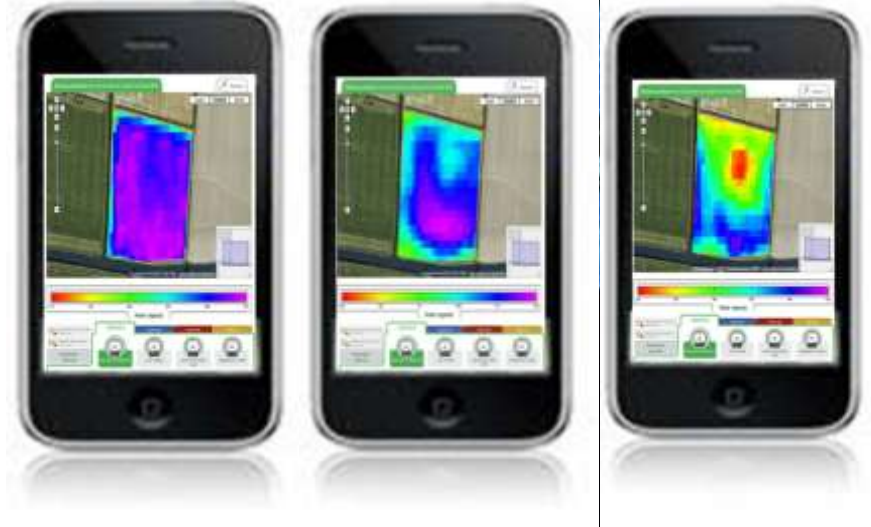
Insurance/finance





# Possible service provision

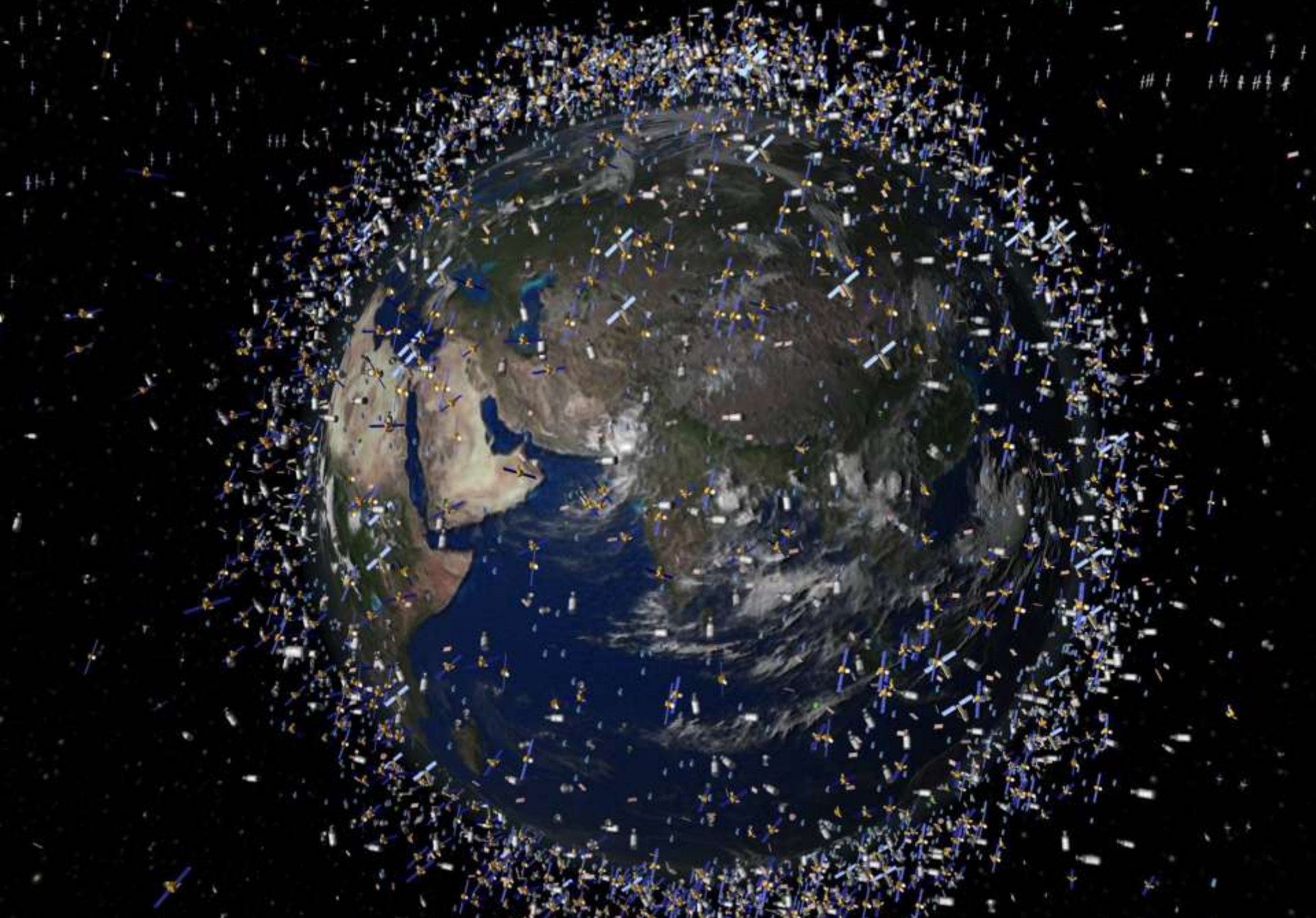
- Calendriers des cultures
- Informations météorologiques
- Cartographie
- Surveillance (p.ex. la croissance végétale)
- Irrigation / conseil d'approvisionnement d'éléments nutritifs
- Sur base individuelle
- Intégré aux services de chaîne de valeur
- Complémentaire à la micro-assurance





# Pourquoi utiliser des données satellitaires?

- Objectif, consistant, transfrontalier
- Peu ou pas d'infrastructures de surveillance (locales)
- >25 ans de séries chronologiques (satellite géostationnaire, Landsat)
- Beaucoup de nouveaux satellites ont été (et seront) lancés, peu ou pas de frais



Landsat 8 (US, 2013)  
No cost

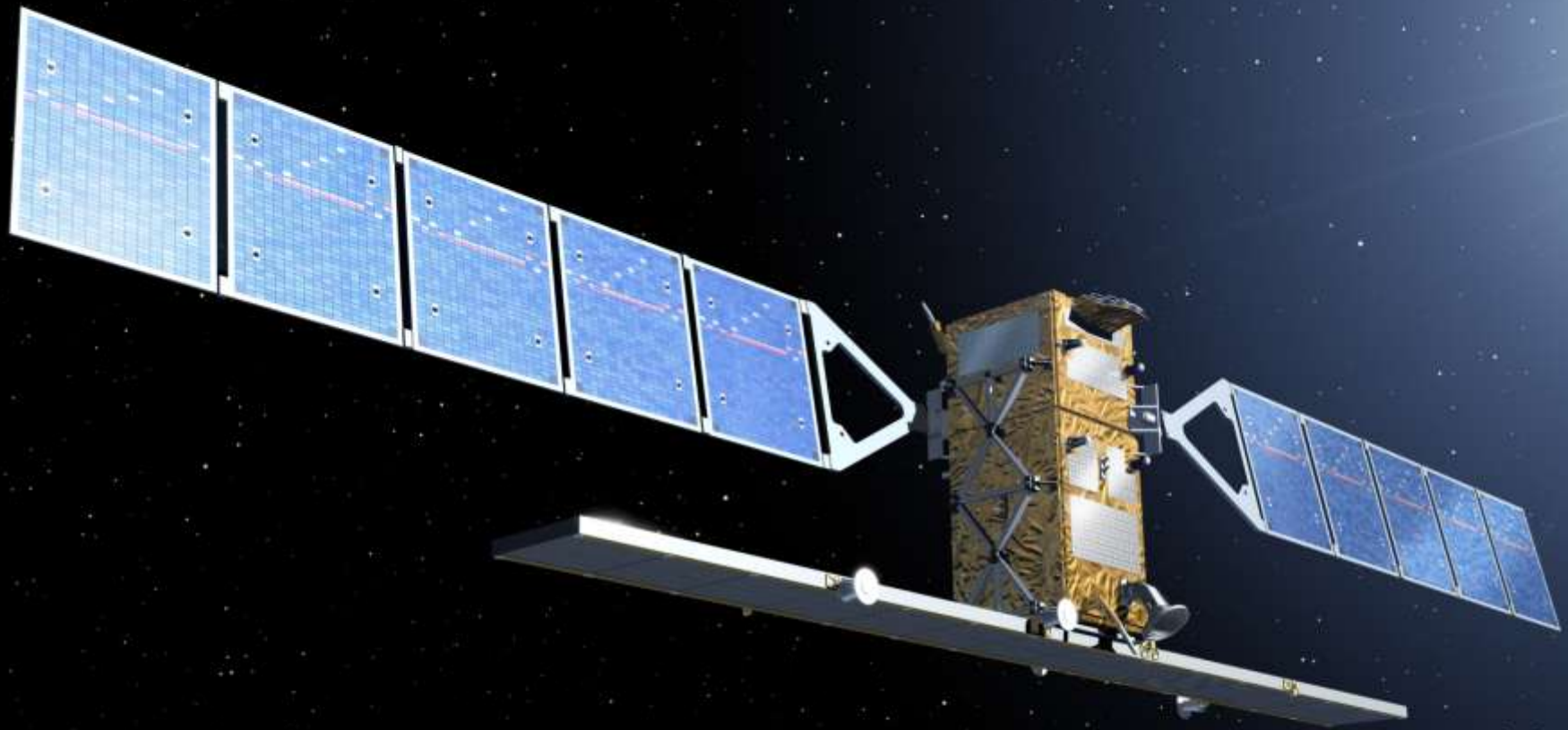




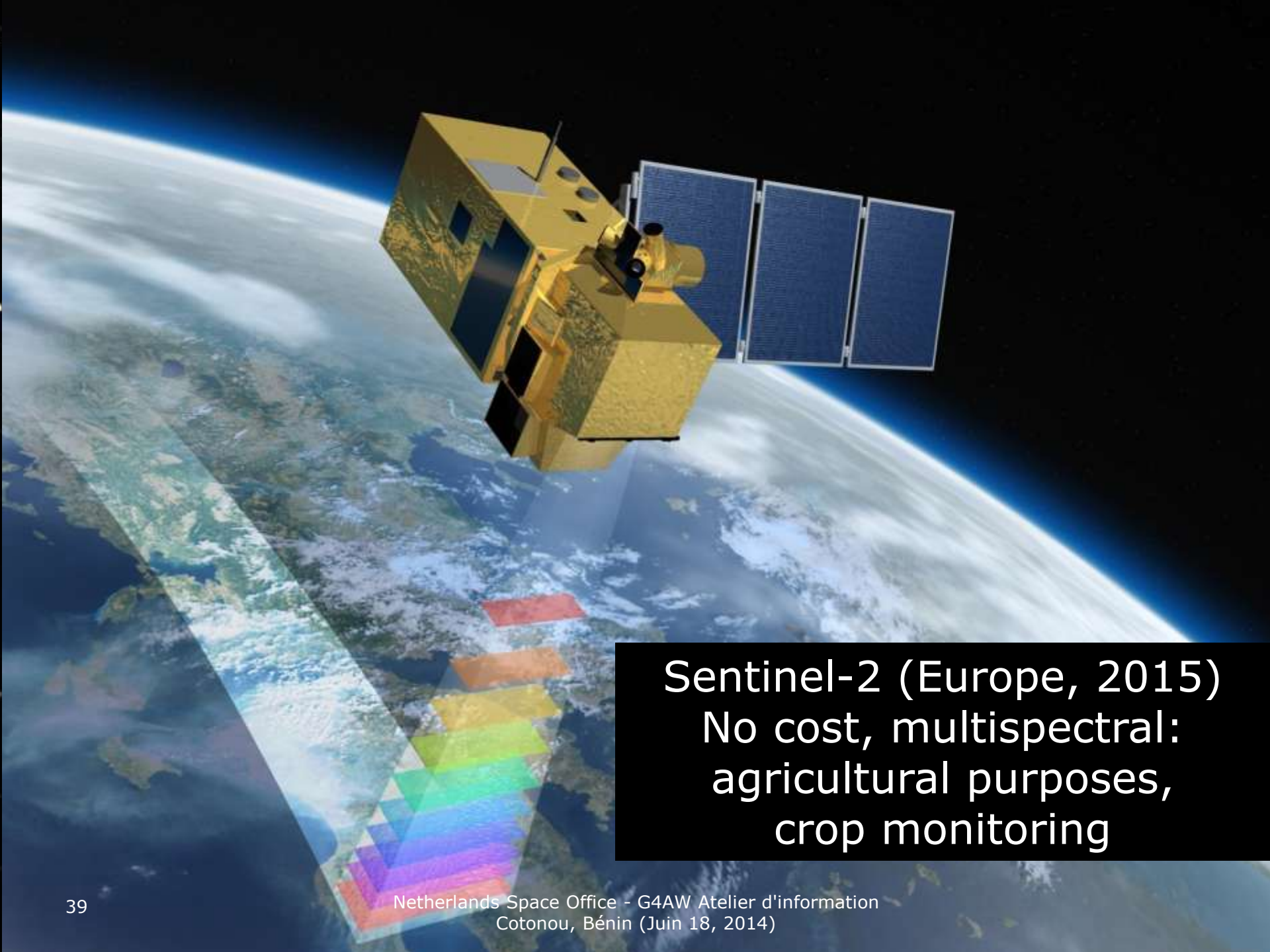
Planet Labs (2014)

Skybox (2014)

Constellation  
High revisit time  
Commercial  
Low cost



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



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

High resolution  
VNIR satellites

Worldview-2



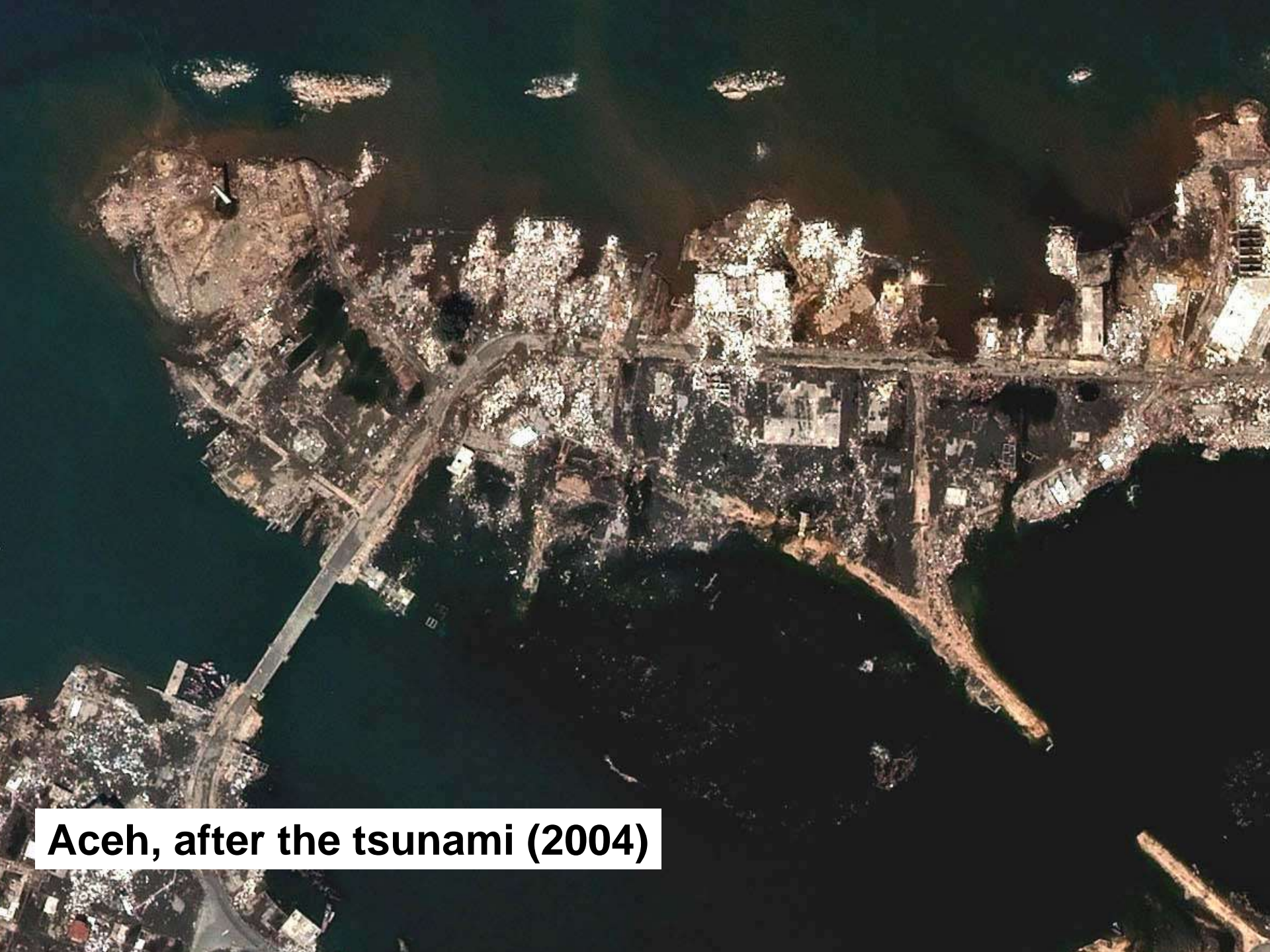


## Optical images : 50 cm resolution





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



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



**Sarawak Oil Palm plantations (Google)**



Thank you



# Required for a G4AW application

- User demand / information needs
- Possible service provision
- Partnership
- Business model
- Cooperation Agreement





# Reaching small holders

- Small holders represented through intermediate, e.g.:
  - Ministry of Agriculture (extension officers)
  - Industry (brewery, nutrient supplier, etc)
  - local NGO
  - farmer cooperation
  - other





## Possible service provision – insurance (2)

Partnership might include e.g.:

- Intermediate(s) (MinAg, NGO, value chain organization, other)
- (Spatial) information service provider(s)
- Local insurance companies
- Re-insurance company
- Others, e.g. mobile telecom provider, bank





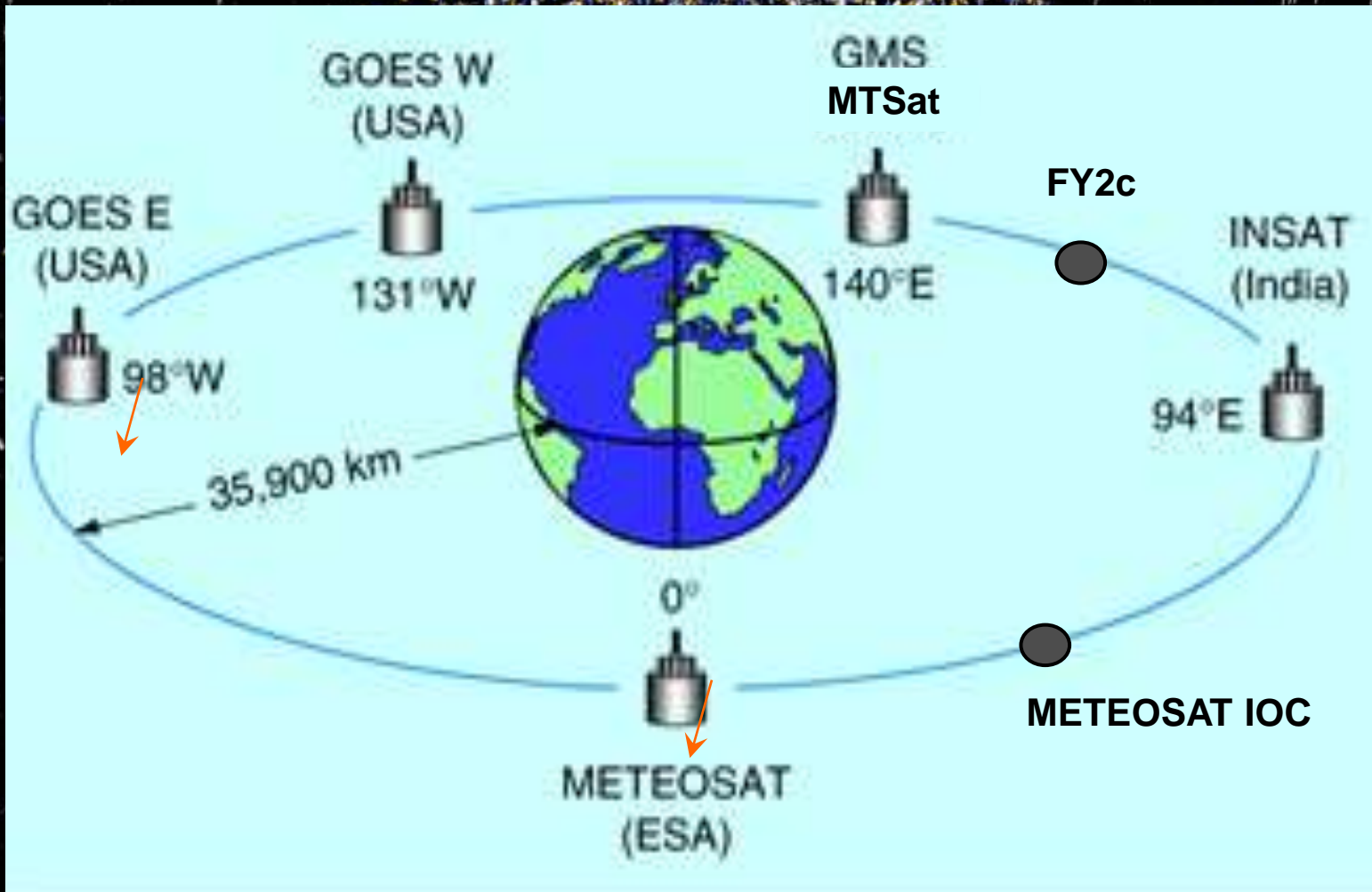


## Possible service provision – advice (2)

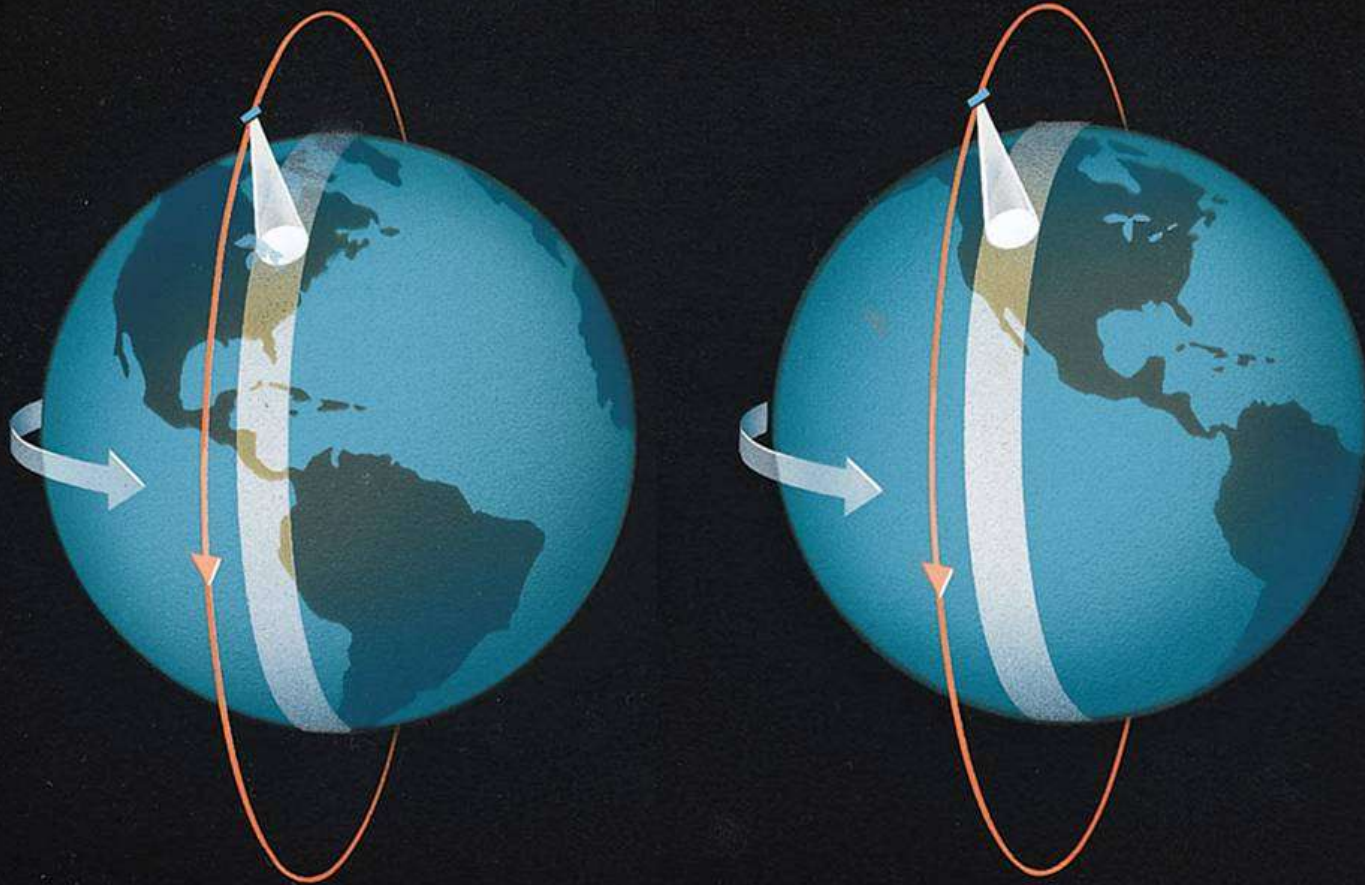
Partnership may include, e.g.:

- Intermediate(s) (MinAg, NGO, value chain organization, other)
- (Spatial) information service provider(s)
- Knowledge institutes
- Meteorological Offices
- Others, e.g. mobile telecom provider, bank



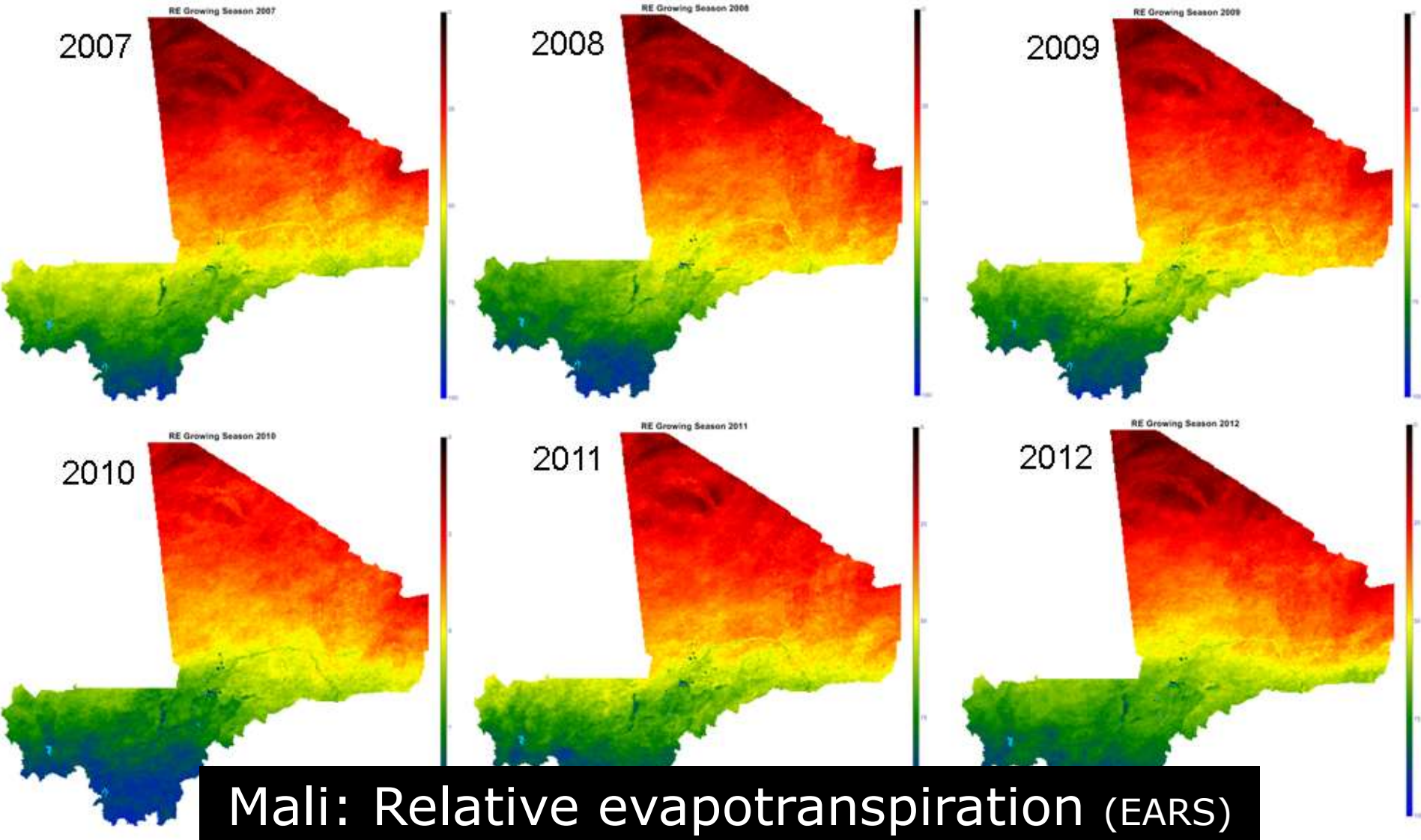


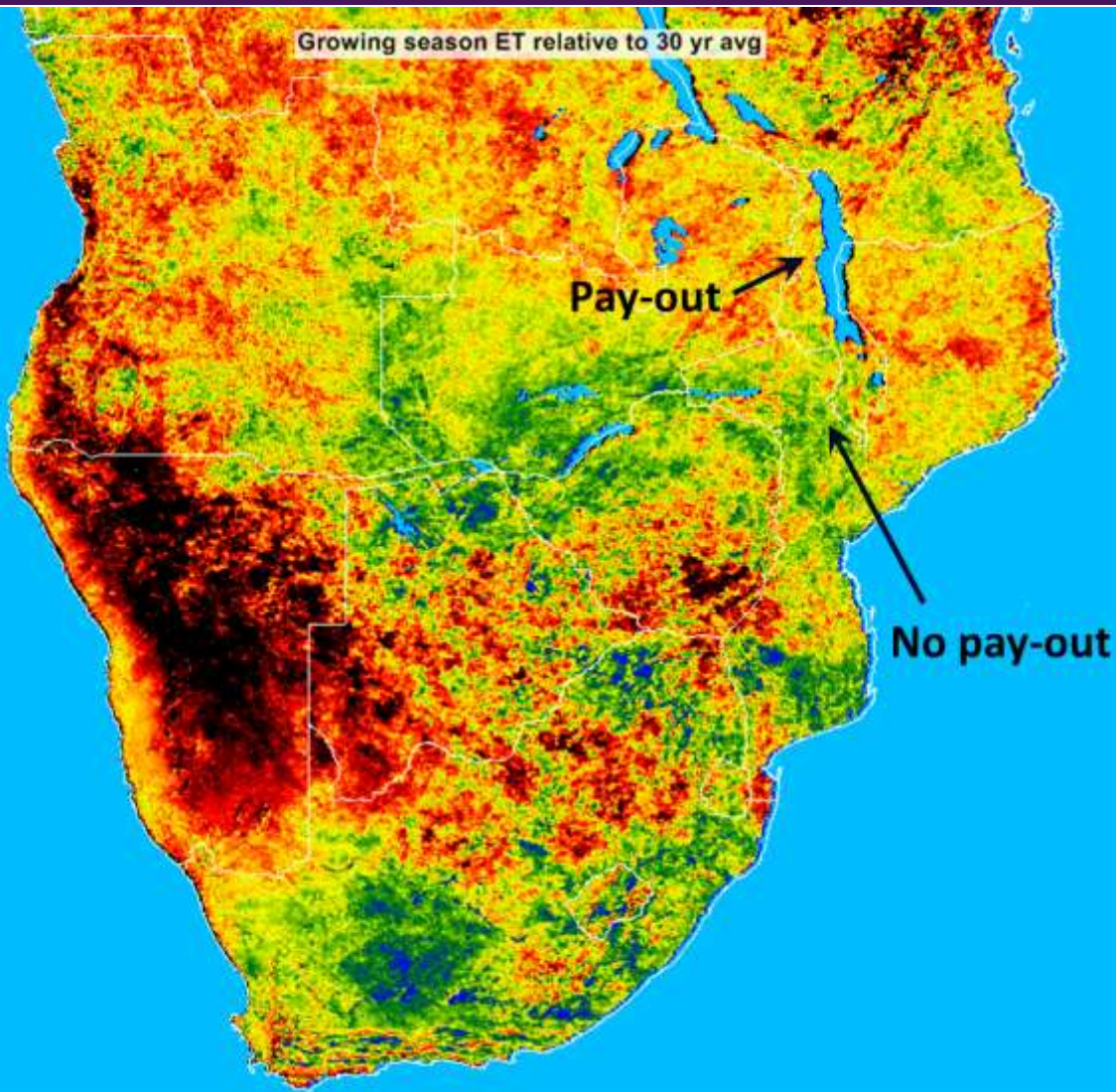
## Geostationary satellites (upto every 15min, 3x3 km)



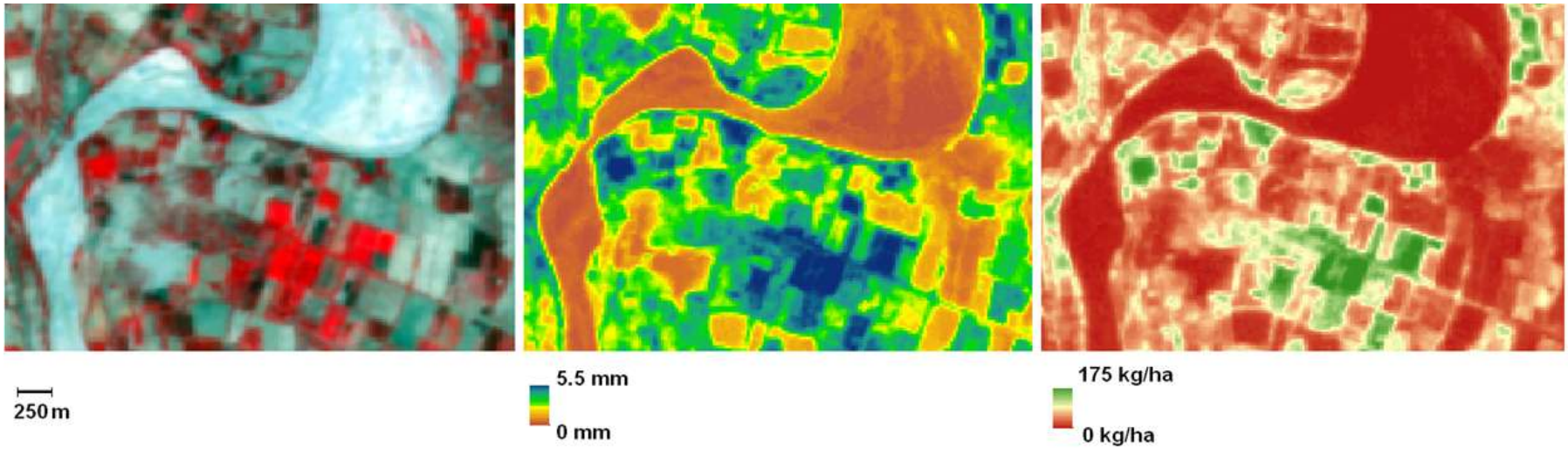
© 2007 Thomson Higher Education

**Polar orbiting satellites**  
**(cycle  $\sim 90$ min, revisit few to  $\sim 30$  days)**





Malawi:  
Maize index  
insurance  
(EARS)

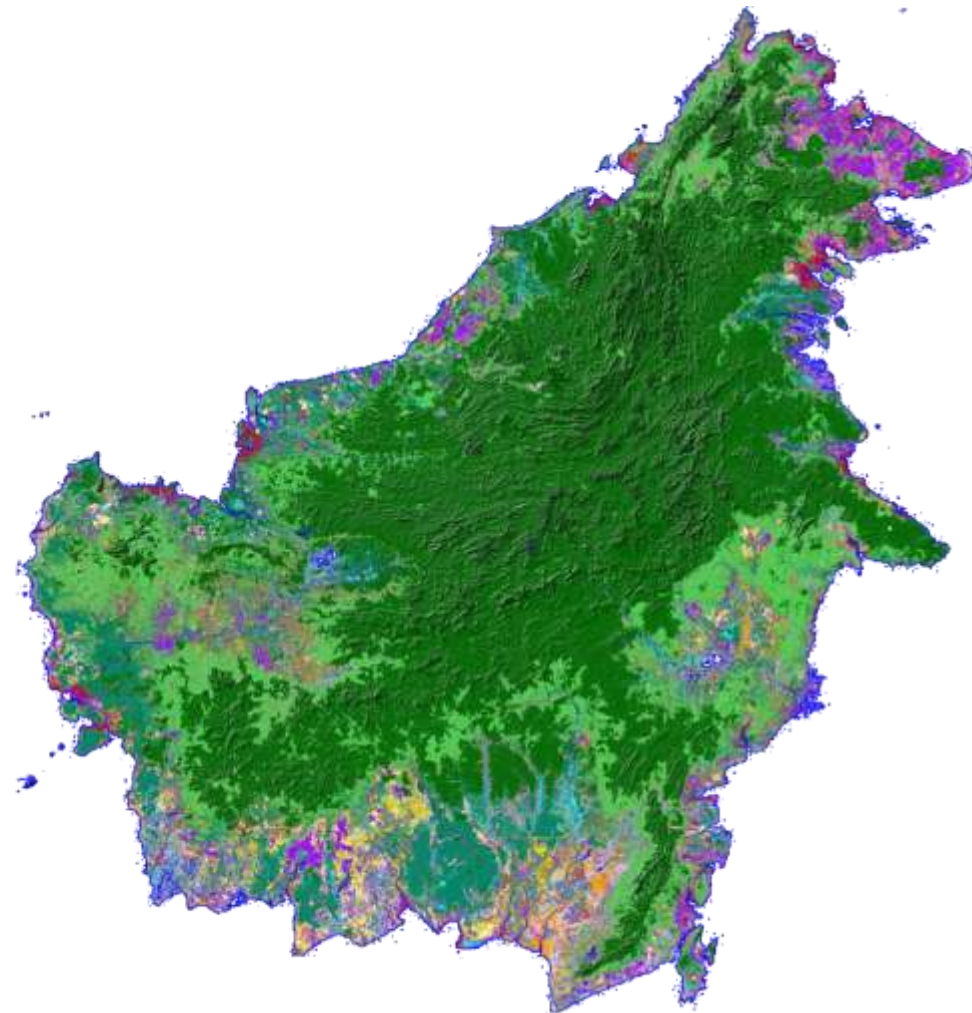


Example: Raw satellite data (L), derived daily evapotranspiration (M) and biomass production (R).

## Gash: Example (eLeaf)



# Kalimantan Land cover map (radar) (SarVision)





**Thank you for your attention**



More info: [www.spaceoffice.nl/g4aw](http://www.spaceoffice.nl/g4aw)





## Reach: Breadth vs Depth (by source of initiative)

