



Remote Sensing-based **I**nformation and **I**nsurance for **C**rops in **E**merging **E**conomy

**Improving Crop Production Monitoring
and Agricultural Insurance Solutions
through Satellite Technology**

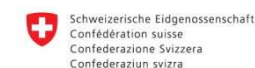




Feeding seven billion people requires a 70% increase of food production until 2050.

Crop insurance helps to decrease the vulnerability of smallholder farmers and better

crop growth information helps Governments and NGOs to mitigate the impact of food shortages.



Swiss Agency for Development and Cooperation SDC



RIICE project set-up: targets, tasks, partners & timeline

Aims

Reduce vulnerability of smallholder farmers by...

1

Helping Governments and NGOs to better plan for food crises through better crop monitoring.

2

Increasing efficiency and effectiveness of crop insurance solutions and turn it into a viable business also in emerging markets.

Partner

sarmap
satellite information for agriculture

Satellite data procurement & processing

IRRI
INTERNATIONAL RICE RESEARCH INSTITUTE

Ground validation & yield modelling

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun Svizra
Swiss Agency for Development and Cooperation SDC

Funding and in-country support in two countries

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ GmbH)

In-country support in three countries; implementation, access to policy-makers,

Allianz

Insurance product development

Timeline

02/2012

05/2015

04/2018

Phase I: Test phase

Technical proof of concept; «dry-test» of satellite-supported insurance products

Phase II: Scale-up phase

Nation-wide upscaling of yield monitoring in collaboration with governments. Implementation of insurance solutions.





Steering Committee

DEZA (Core Donor)
Yves Guinand

GIZ
Matthias Bickel

sarmap
Dr Franc. Holecz

IRRI
Dr Andy Nelson

Allianz Re
Thomas Heintz

Glob. Project Managmt. Office

GIZ
Susan Gille
Project Manager

sarmap
Michael Anthony
Glob. Project Lead

IRRI
Tbd
Process Manager

National Programme Manager

Vietnam
DEZA, Ninh Nguyen

India
GIZ, Manoj Yadav

Regional
IRRI, Pongman. T.

Cambodia
DEZA, Chharom Chin

Philippines
GIZ, Jimmy Loro

Thailand
GIZ, Tbd

Technical Experts

sarmap
M. Barbieri and
4 team members

IRRI
Dr Tri Setiyono,
Arnel Rala a.o.

Allianz Re
S. Haverkamp,
D. Heintz



1

... Help Governments and NGOs to better plan for food crises through better crop monitoring.

Information on rice production and losses

- How much area was planted this season?
- What was the yield in each town or province?
- Was production more or less than last year?
- Was the harvest early or late?
- Was there a storm, flood or drought?
 - Where and how much area was affected?
 - How many tons of rice were lost?

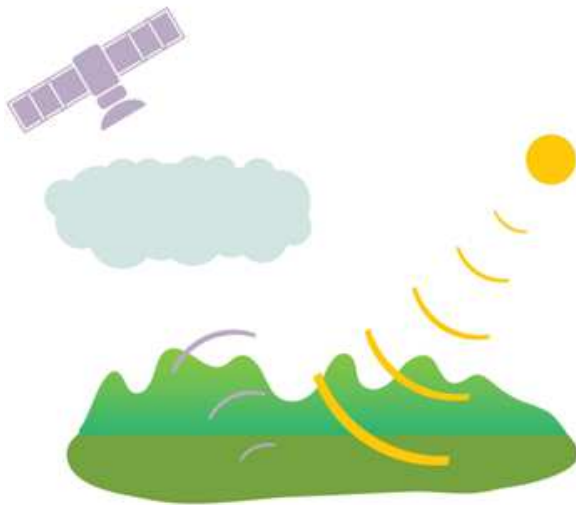
Users of this information

- **National governments** at regional and national level at frequencies matching national reporting requirements, i.e. every quarter.
- **Traders** at national level with sufficient lead time, i.e. 60 or 30 days before harvest
- **Insurance providers** at local level and immediately after the season is completed
- **Disaster response** local level of detail, frequency is as needed.

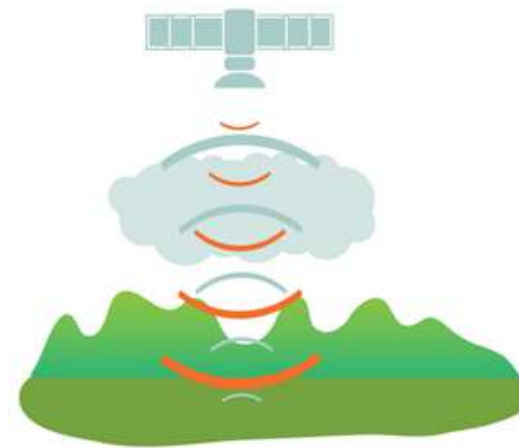
What is the advantage of SAR remote sensing?

RIICE uses SAR data free of charge from ESA (European Space Agency)
Sentinel 1 mission: 20m resolution, 12 day repeat frequency

Optical remote sensing



Synthetic aperture radar
(SAR)



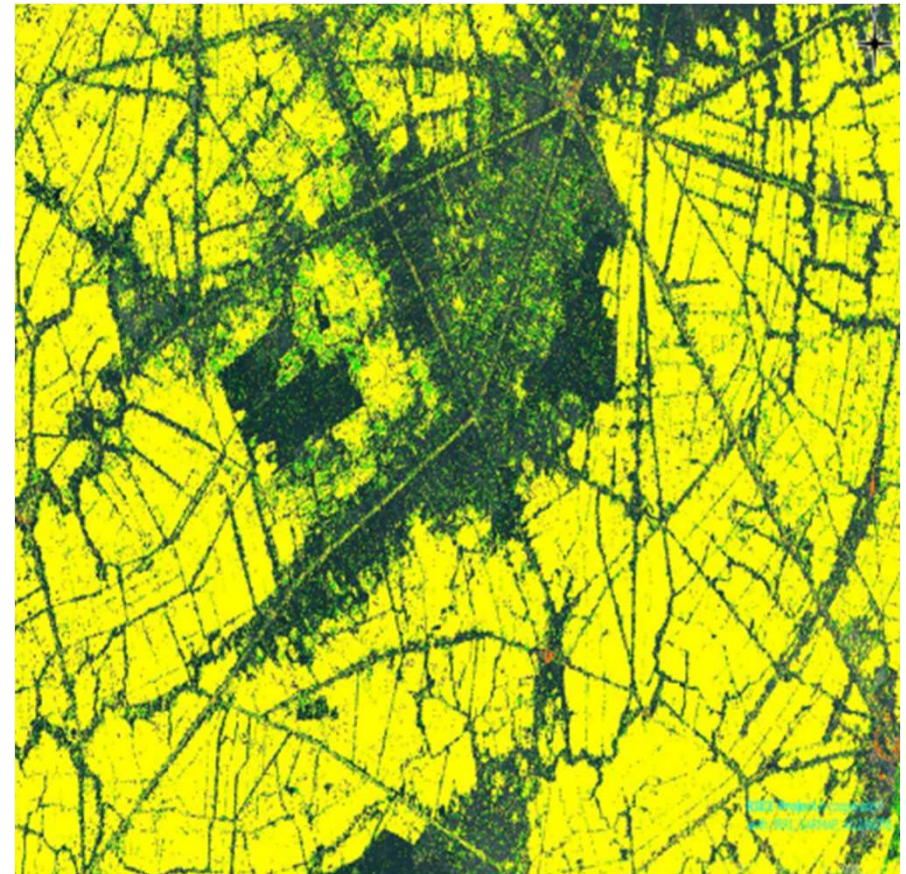
- **Passive sensors** do not emit their own radiation, but receive natural light and thermal radiation from the earth's surface.
- Can not be operated in the night and in the case of cloud coverage (often during cropping season)
- **Active sensors** are weather and sunlight independent: artificial microwave radiation can penetrate clouds, light rain and snow..
- Hardly affected by clouds, dust, fog, wind and bad weather conditions

Rice Field from Optical and Radar RS

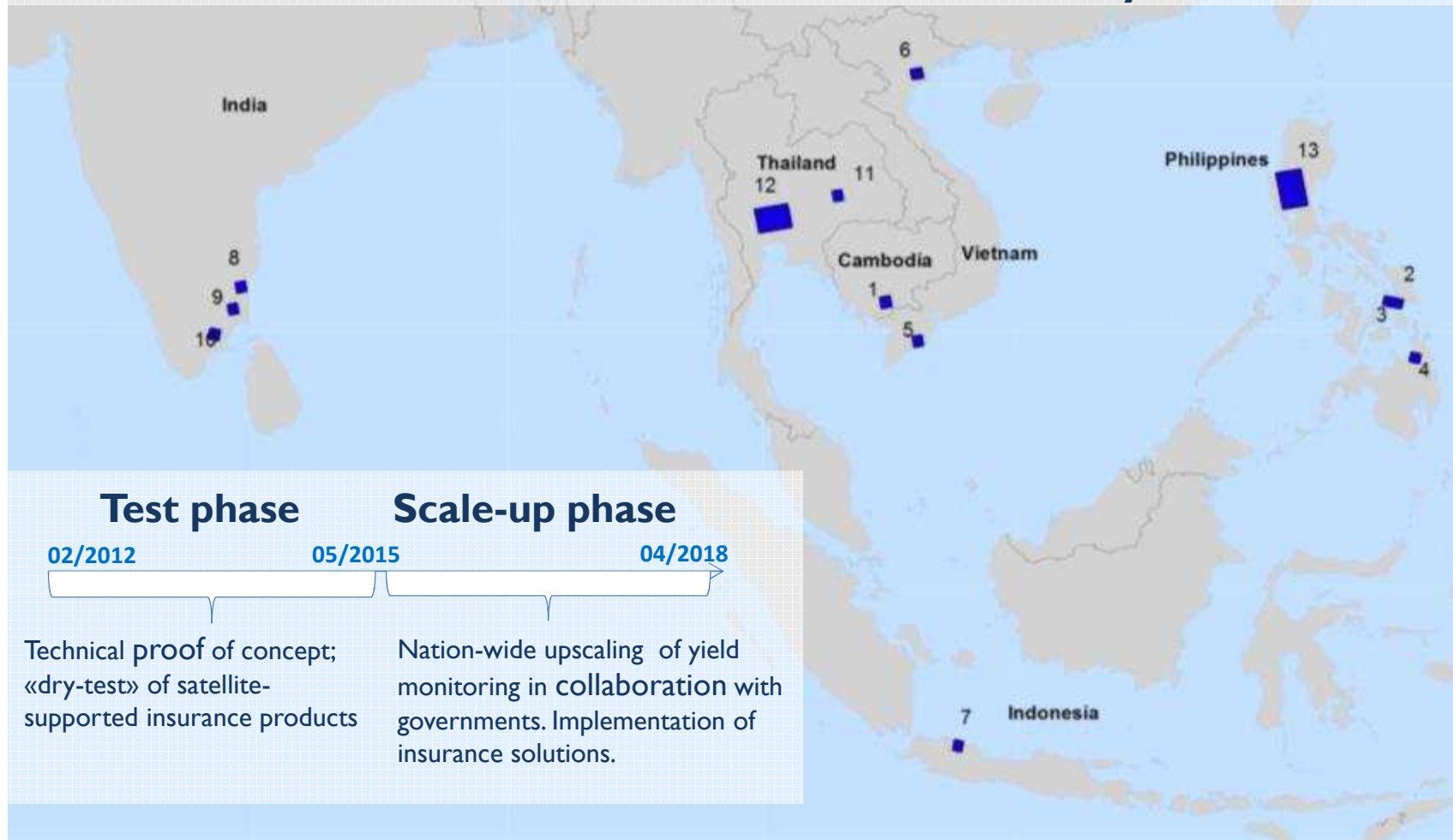
Image from optical satellites
(=> cloud coverage)



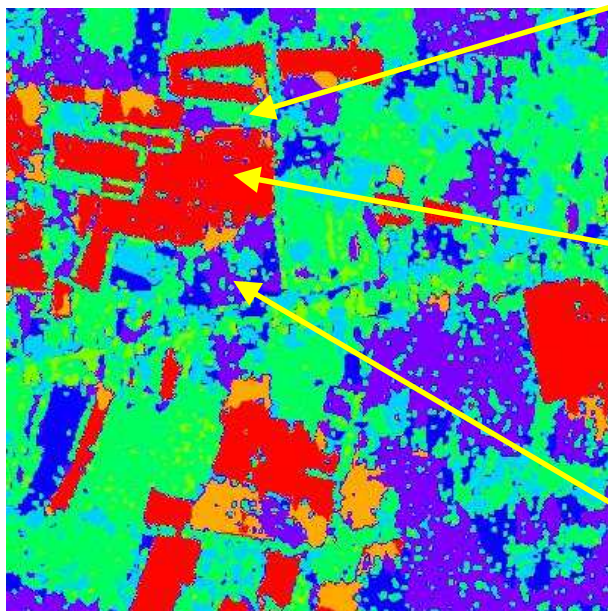
Image from radar satellites
(=> clear image)






RIICE has been demonstrating the technology in 13 sites of 6 Asian countries for the last three years



Close-up look: Validating remote sensing data on the ground

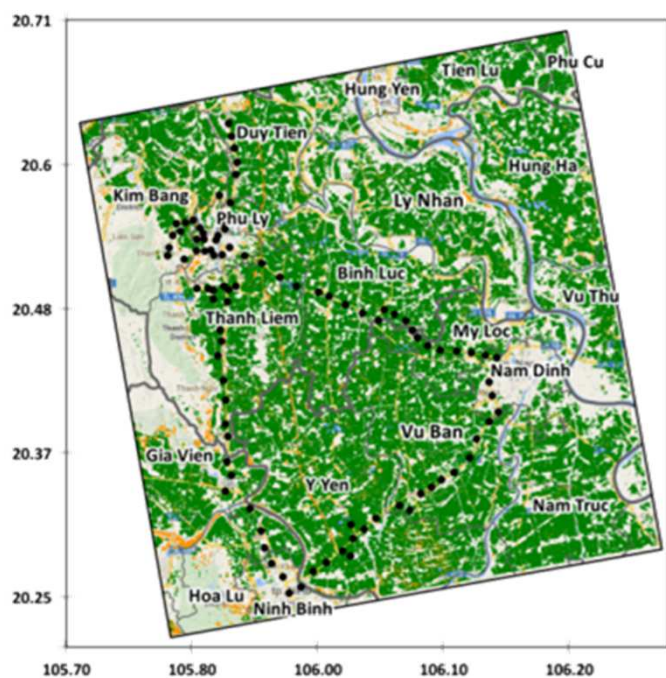


-  = Full developed rice
-  = Flooded rice (losses)
-  = Soil covered partially with water before rice flooding



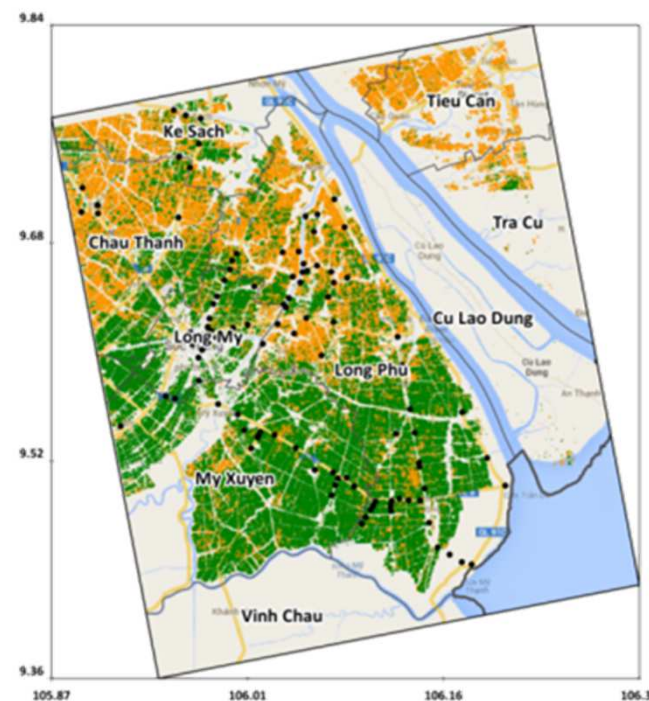
Soc Trang Province, 7 September 2012

What information can be delivered : Where? Rice area estimates



Nam Dinh in the Red River Delta

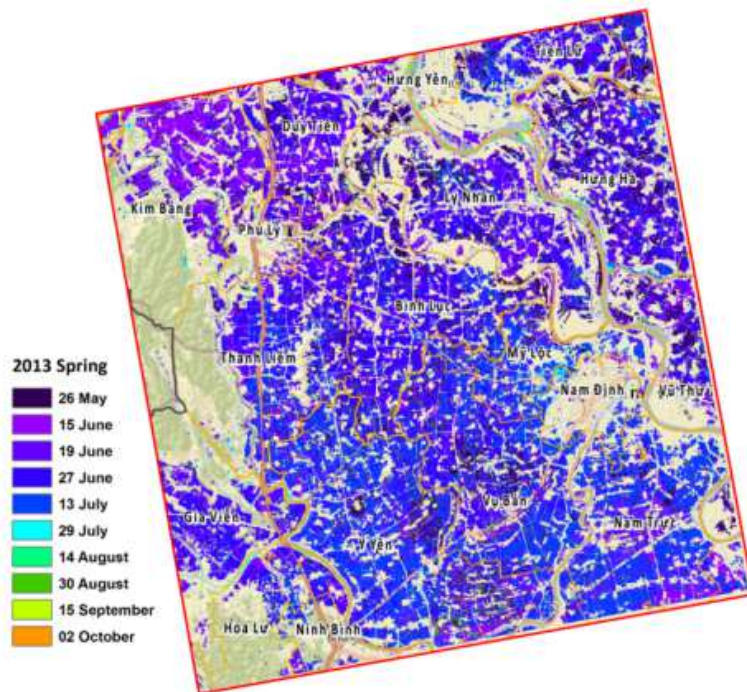
• Validation point
 ■ Rice
 ■ Early/late rice



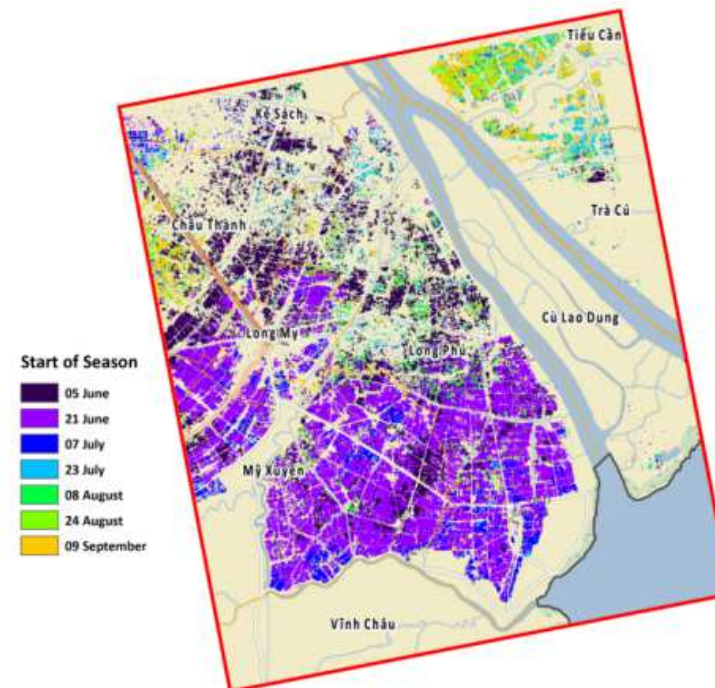
Soc Trang in the Mekong River Delta

Rice map classification accuracy (%) is based on comparison against 100 ground truth points per footprint. Consistently above 85% in all 13 RIICE sites.

What information can be delivered : When? Start of the season



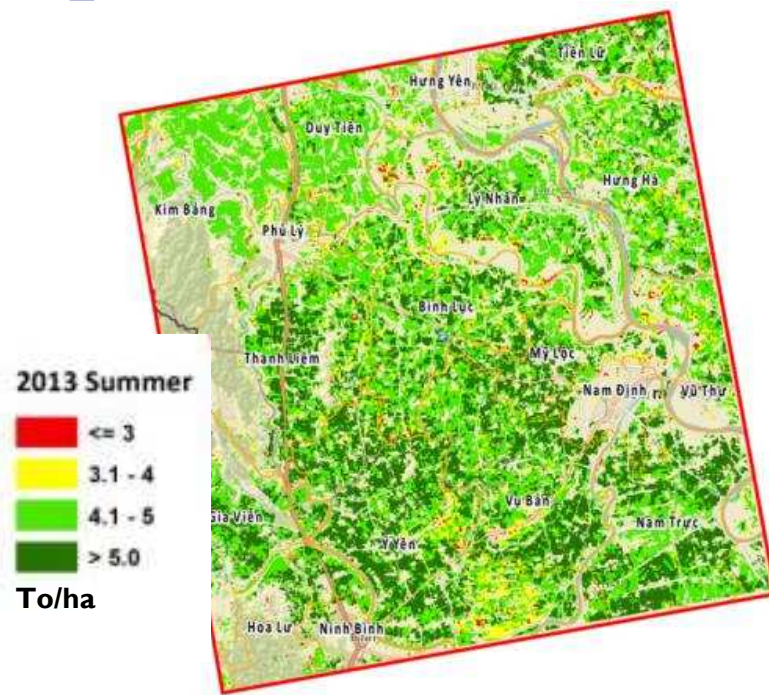
Nam Dinh in the Red River Delta



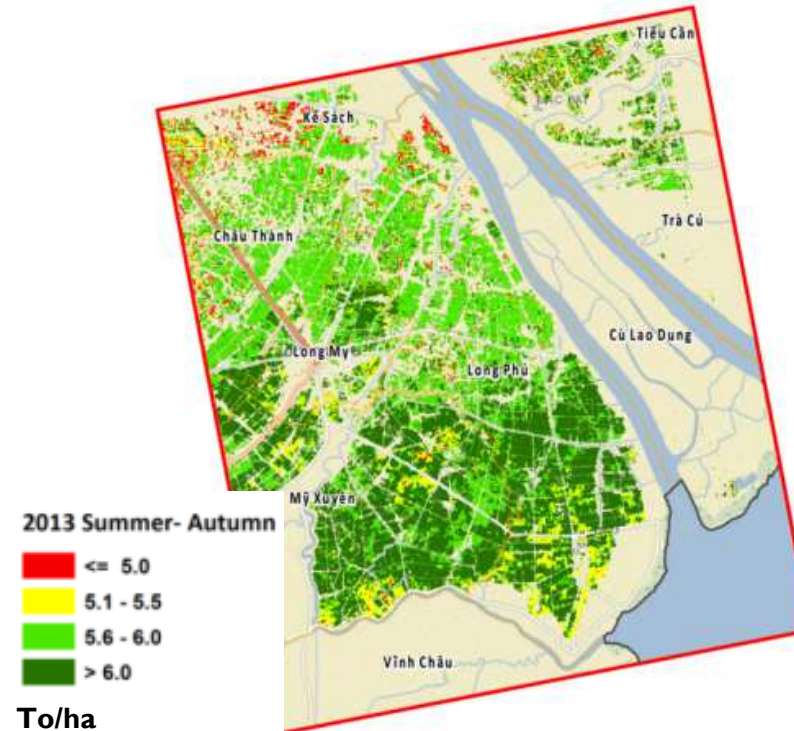
Soc Trang in the Mekong River Delta

Start of Season (SoS) is an important variable for yield estimation. It also reveals any heterogeneity in planting, which has crop health and management implications. It also shows if a season is early or delayed which has implications for imports/exports and also for distribution of crop insurance (e.g. sales cut off)

What information can be delivered : How much? Yield estimates



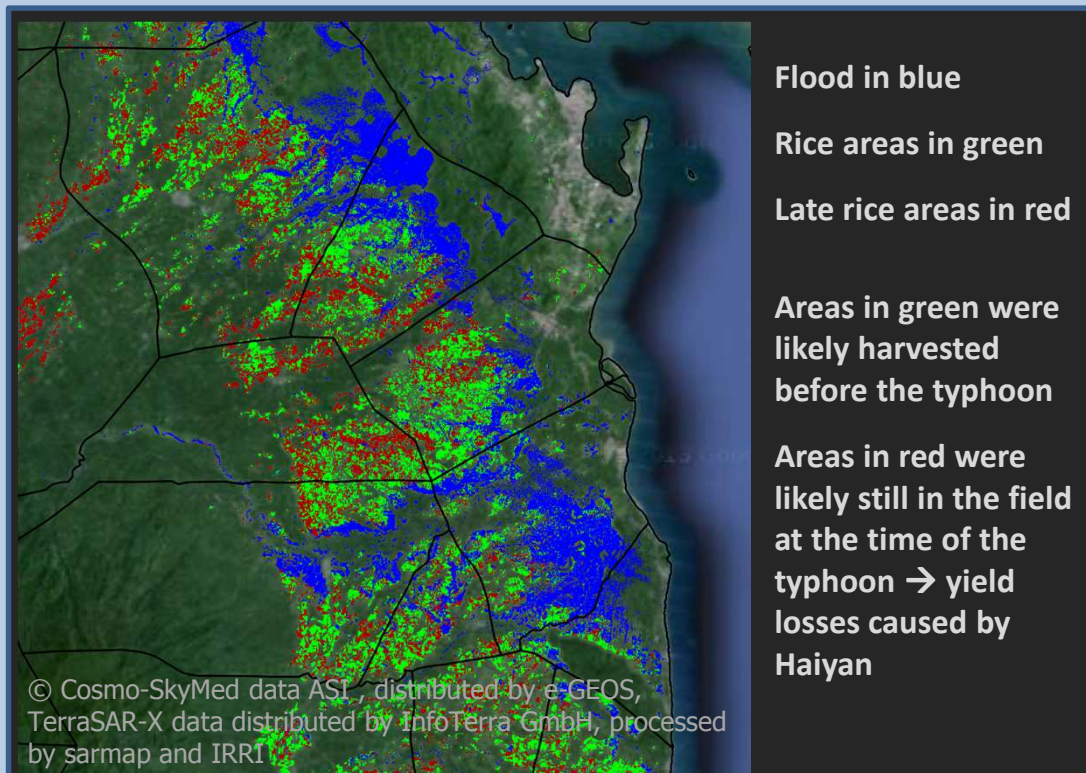
Nam Dinh in the Red River Delta



Soc Trang in the Mekong River Delta

Yield forecasts during the season and final estimates are the most important variable for food security monitoring and THE input variable for crop insurance solutions., i.e. the trigger variable which determines a payout. Compared against crop cut experiments (CCE), the yield accuracy at district level was 91% in Soc Trang and 97% in Nam Dinh.

RIICE Case: Typhoon Haiyan (Philippines, 8th Nov 2013)



Flooded rice fields after Haiyan, Iloilo province

Post-disaster information on rice crop losses after typhoon Haiyan were submitted by RIICE within few days to the Department of Agriculture of the Philippines: The satellite-generated map shows that flooding (in blue colour) has affected about 1,800 hectares of standing rice crop (in green colour) across 15 municipalities.



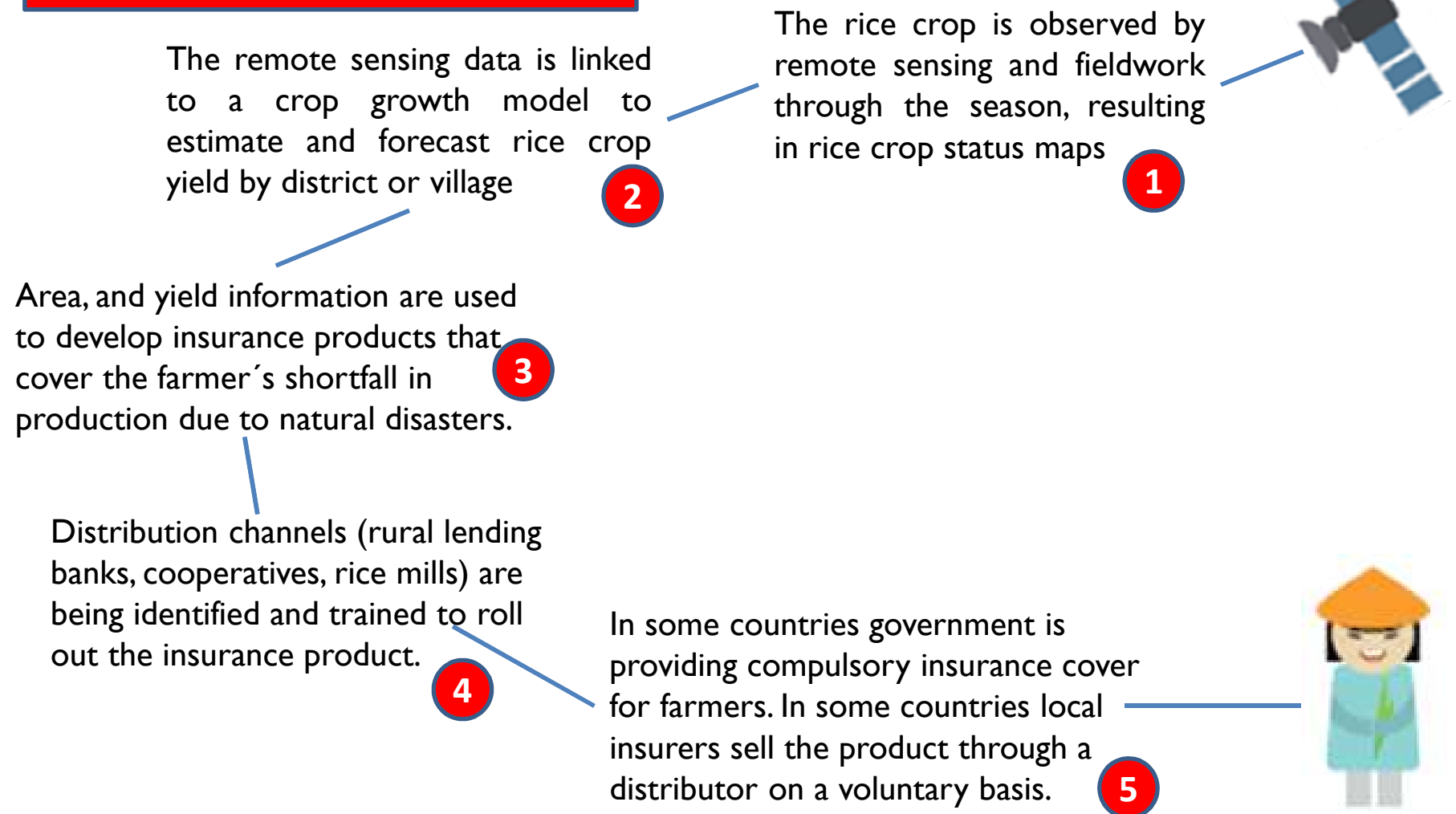
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... Increase efficiency and effectiveness of crop insurance solutions and turn it into a viable business also in emerging markets.

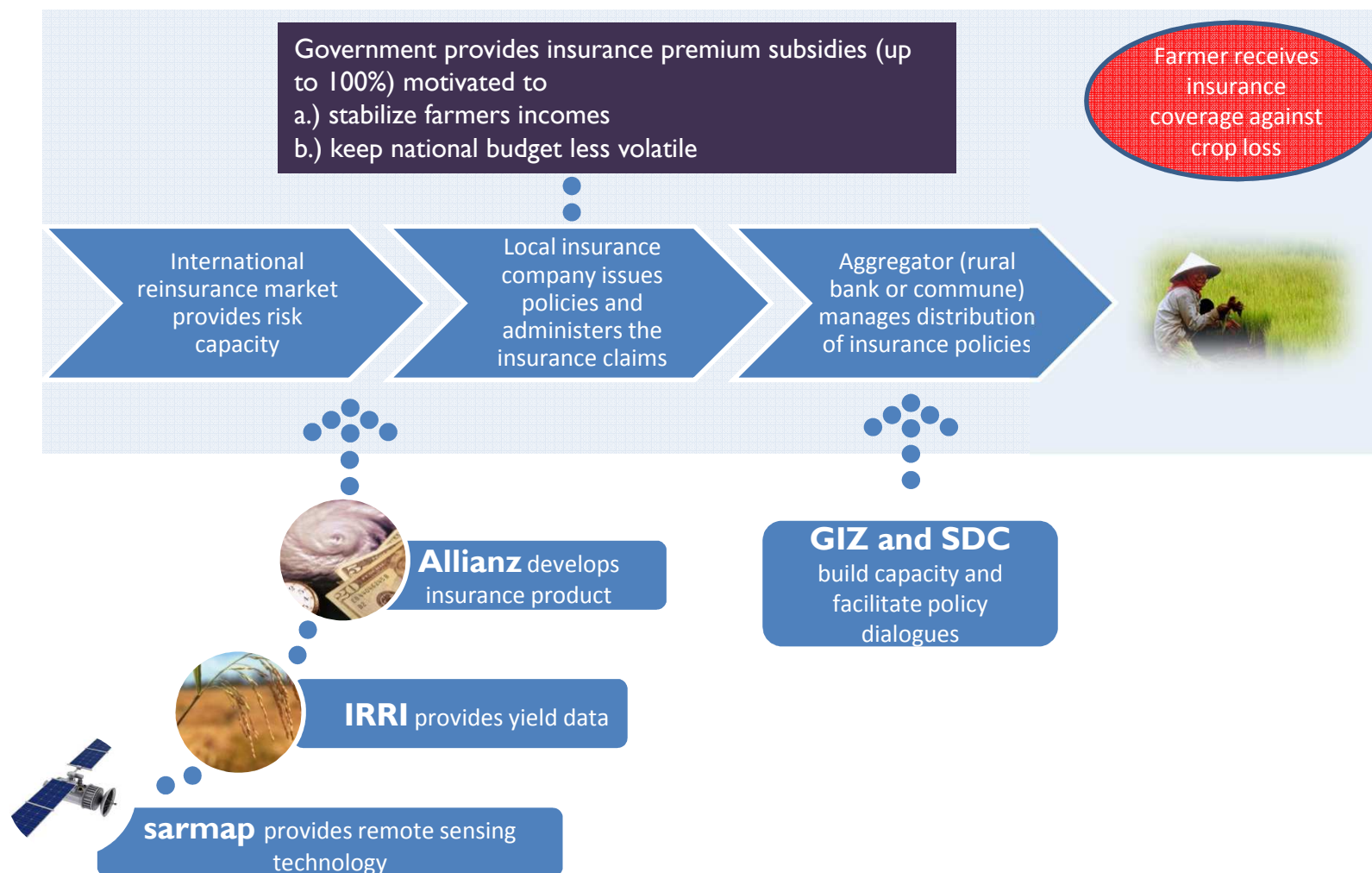


From technology to delivery

.... In the case of crop insurance



RIICE Business Model: Multi-stakeholder partnership to deliver crop insurance



How can the **RIICE** technology be used in crop insurance: **Area-yield index insurance (AYII)**

Con- cept

- RIICE delivers satellite-based yield estimates.
- This figure can be used in operating an AYII product. Other than the known weather index-insurance which uses rainfall estimates as a proxy for yield results, AYII directly operates with yield estimates.
- Farmers in a particular district are indemnified, if this season's average district yield is below a certain percentage of the average historical yield of the district

Cove- rage

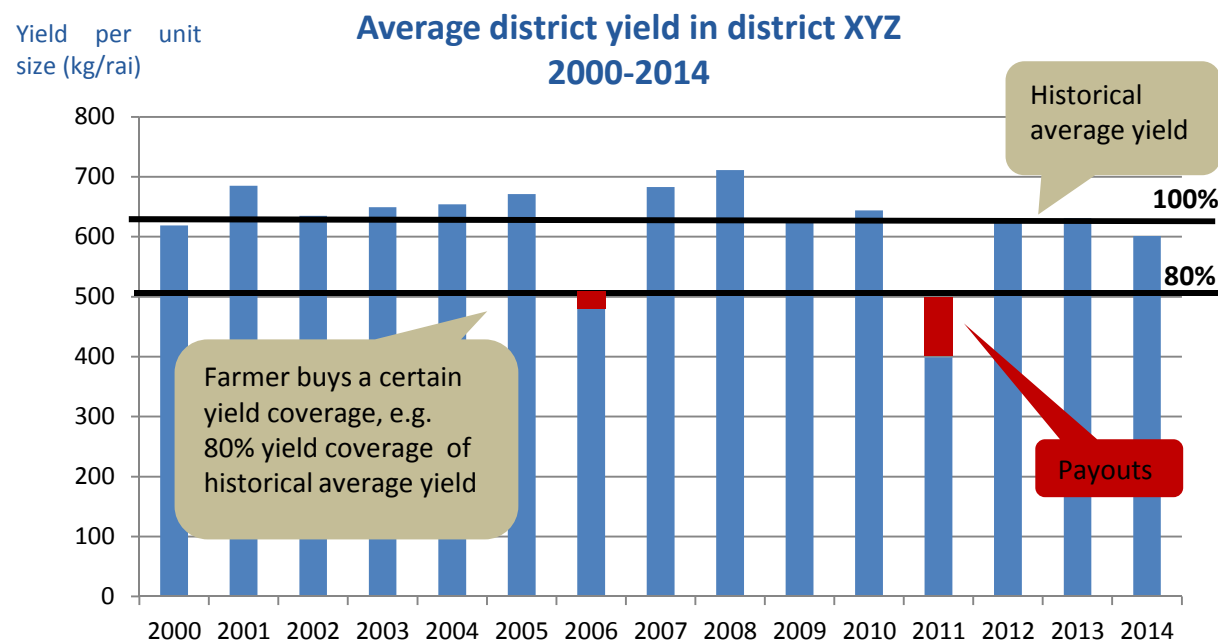
- Perils: All perils covered that affect average district yield
- Farmer can buy optional coverage levels (typically between 50% -90%) of the historic average yield

Claims assess ment

- No timely and costly field inspections necessary
- Use of satellite-based estimation of crop yields for claims assessment

How can the RIICE technology be used in crop insurance: Area-yield index insurance (AYII)

Satellite-based yield loss estimates can be used as a trigger for insurance payouts



=> There would have been a payout in 2006 and 2011.

The area-yield index insurance product in this example indemnifies the farmer if the average district yield is below the threshold of 500 kg/rai (80% of the historical yield).

This product does not operate on an individual field level, but takes the district yield as a proxy.

SAR data is used to provide accurate and timely estimates of district yield.

Growing Asian crop insurance market

Both area-yield based and weather index-based crop insurance schemes; subsidies from state and national governments.

Mostly compulsory and loan-linked

Open to public and private Indian insurance companies and partly reinsured

India (25 m farmers)

Largest crop insurance scheme in Asia; mostly internationally reinsured

China (200m farmers)

Voluntary rice insurance scheme, distributed through two insurers; partially reinsured

Vietnam (Pilot)

Thailand (pilot)

Voluntary top-up scheme to governmental disaster relief scheme.

Distributed through the Cooperative Bank BAAC
Partly reinsured

RIICE offers governments and insurance providers in the RIICE countries to operate their existing or newly planned crop insurance schemes / disaster relief schemes on the basis of SAR-delivered information on

- Rice area : **Where?**
- Start and status of the season: **When?**
- Yield forecast , yield estimates and yield loss estimates: **How much?**

Through RIICE, crop insurance programmes can be made more efficient, accurate and transparent to ensure timely payouts to farmers in the case of extreme weather events.

Scaling up...



Sentinel-1a

- Launched 3rd/April/2014 by ESA
- 12 day repeat frequency
- 20m resolution
- Free and open access to imagery
- SAR sensor – perfect for rice
- A second satellite - Sentinel-1b - will further increase monitoring capabilities, one image every 6 days