

# Climate-Smart Agriculture



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STRATEGIC PLANNING TEAM  
**APEC CLIMATE CENTER**



# Climate-Smart Agriculture ?

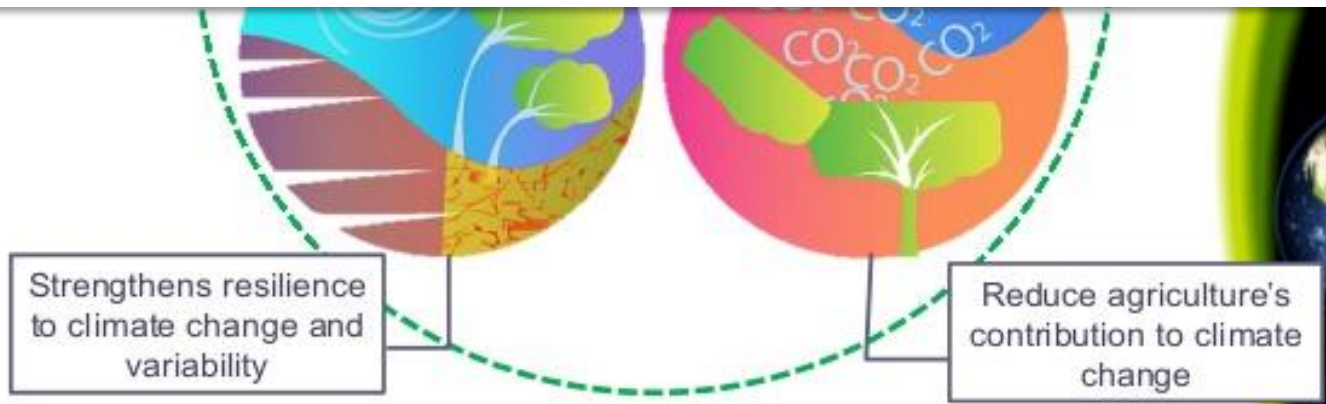
## What is CSA?



Sustainably increases productivity and income



**The SMART USE of CLIMATE INFORMATION in CLIMATE-SENSITIVE DECISION MAKING by AGRICULTURAL STAKEHOLDER**



# Climate-Smart Agriculture

Farmer Smart



*“Climate-smart agriculture story”*

by Farmer Smart



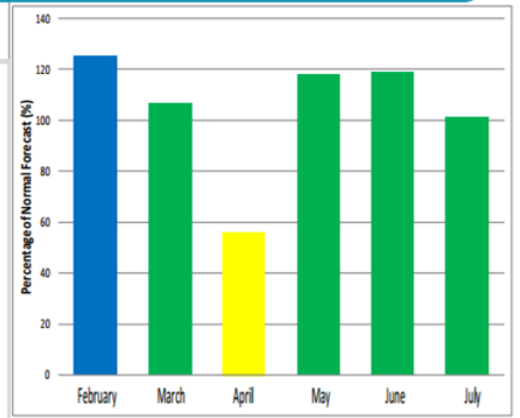
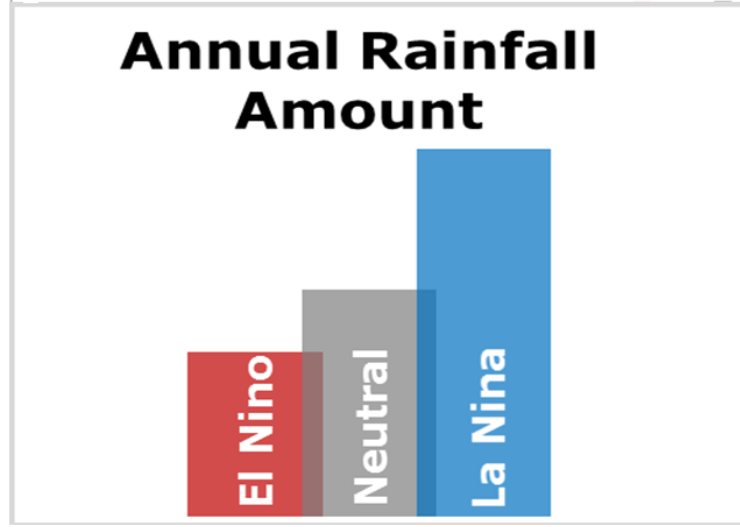
Farmer Smart



- El Niño advisory
- Drier than normal

# CLIMATE FORECAST AND EXTENSION ADVISORY

## ACTUAL RAINFALL COLLECTED (mm) & FORECAST RAINFALL (%)



**Rainfall Forecast for Feb-July 2017**  
 Above normal rainfall condition is expected for the month of February. Near normal and below normal are expected rainfall condition for the month of March and April, respectively. The rest of the months May-Jul are expected to have a near normal rainfall condition.

FORECAST 2017
 WAY BELOW NORMAL
 BELOW NORMAL
 NEAR NORMAL
 ABOVE NORMAL

**EL NIÑO SOUTHERN OSCILLATION (ENSO) & LA NIÑA WATCH**  
 The province of Camarines Sur may experience weakening of La Niña, with a 50% chance of reaching ENSO neutral status.

**TROPICAL CYCLONES FORECAST**  
 There's a probability of 4 to 10 tropical cyclones or weather disturbances on the PAR (Philippine Area of Responsibility).

**IMPACT OUTLOOK**  
 The "above normal" forecasted rainfall, particularly on the rainfed areas, may be affected specially at the first quarter of the year with the delay of planting due to...

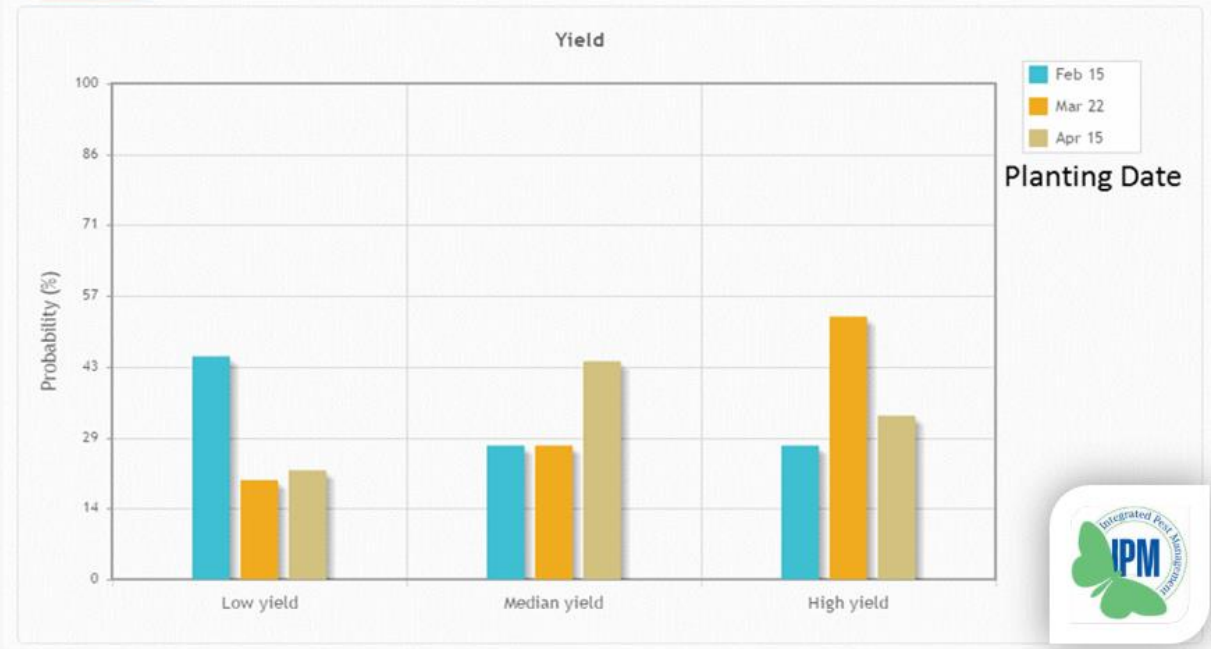


Farmer Smart =



- El Niño advisory
- Drier than normal
- Decision-support tool : Selection of high-yield planting date and variety

Input Variety, Location, Seasonal climate forecast



Wheat



Farmer Smart =

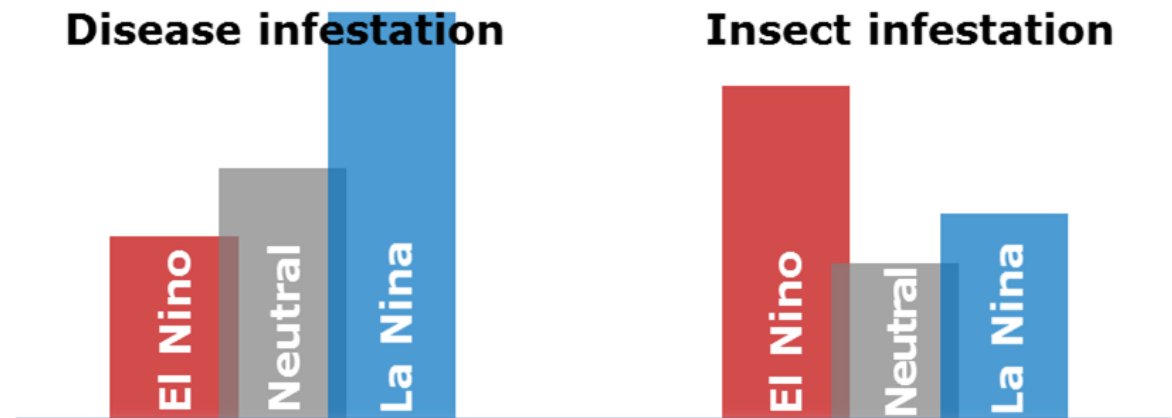


- El Niño advisory
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- Decision-support tool : Selection of high-yield planting date and variety
- Insect infestation increases, thus cultivated *Underhill* for insect control

## Pest infestation rate based on ENSO phases

Disease infestation

Insect infestation



Wheat

□ Managing tillage



Farmer Smart =



No-till Drill



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- Minimum tillage to protect stored soil moisture





Farmer Smart =

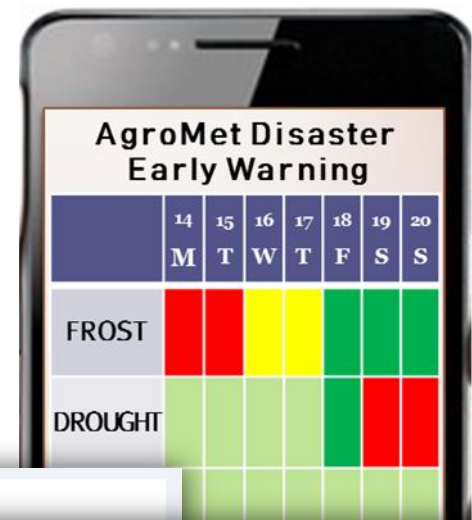


## Informed decisions based on weather/climate information

### ☞ Weather and Climate Forecasts

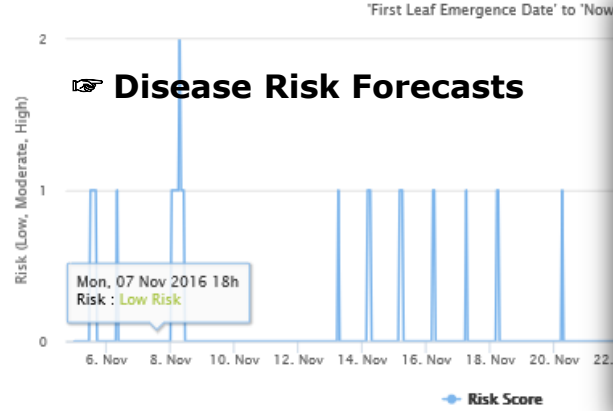
	Rainfall	Temp
Jan to Mar [Observed]		
May to Jul [Forecast]	77%	83%
Aug to Oct [Forecast]	63%	52%

### ☞ Disaster Early Warnings

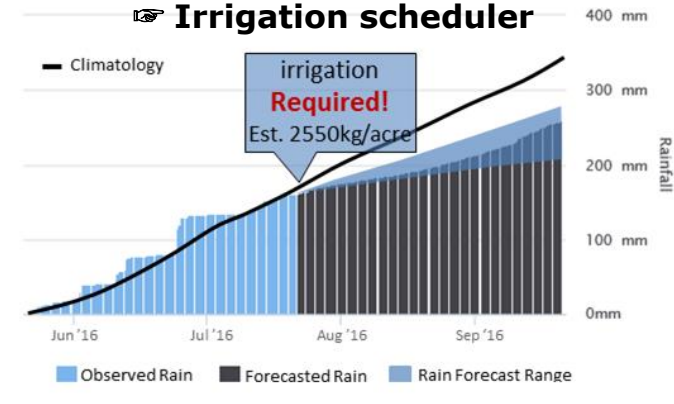


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- Minimum tillage to protect stored soil moisture
- Informed farm management based on weather and climate information

### Powdery Mildew : Risk transition



### ☞ Irrigation scheduler



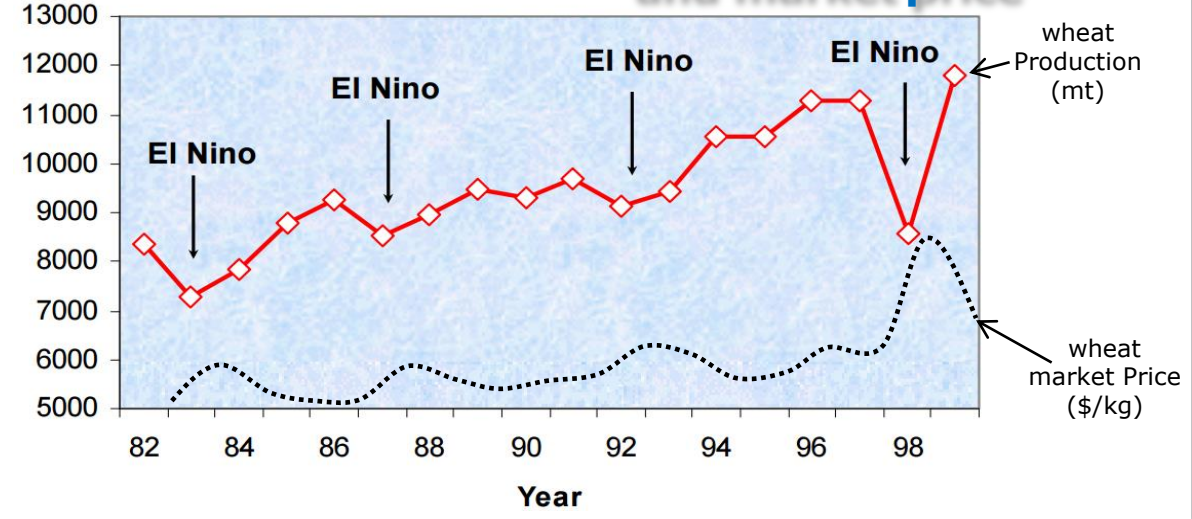


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- Did NOT forward sell hay, decided to harvest the actual wheat

### Relation between climate and wheat production and market price



Market

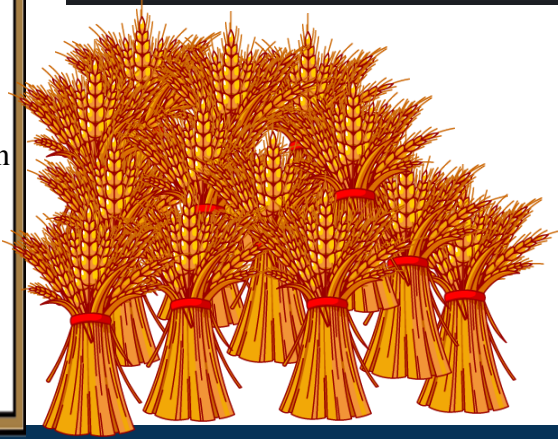
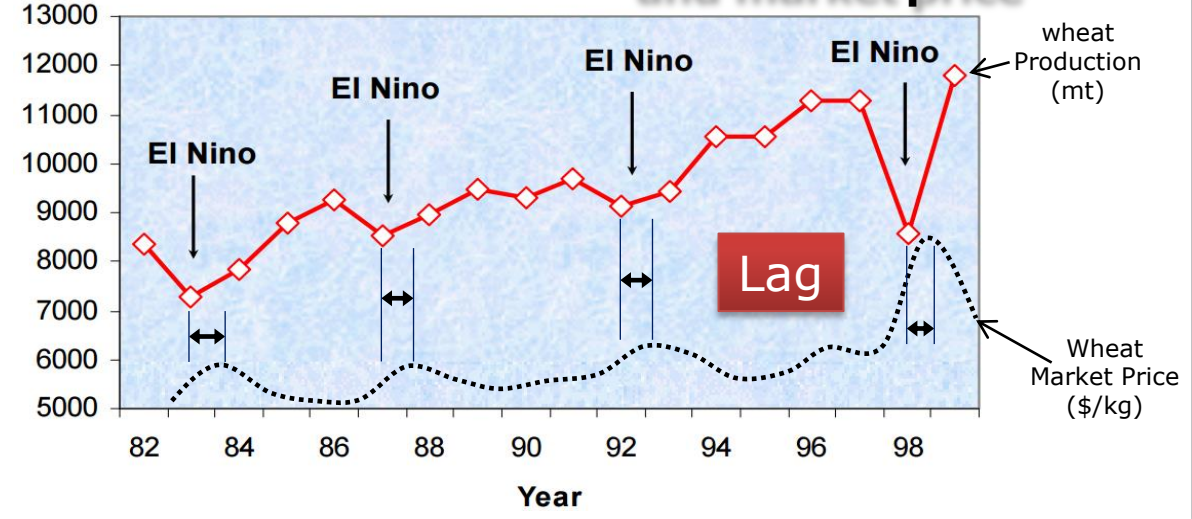


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- Insect infestation increases, thus cultivated *Underhill* for insect control
- Minimum tillage to protect stored soil moisture
- Informed farm management based on weather and climate information
- Did NOT forward sell hay, decided to harvest the actual wheat
- Sold a little for cash, but stored quite amount for higher priced market

### Relation between climate and wheat production and market price



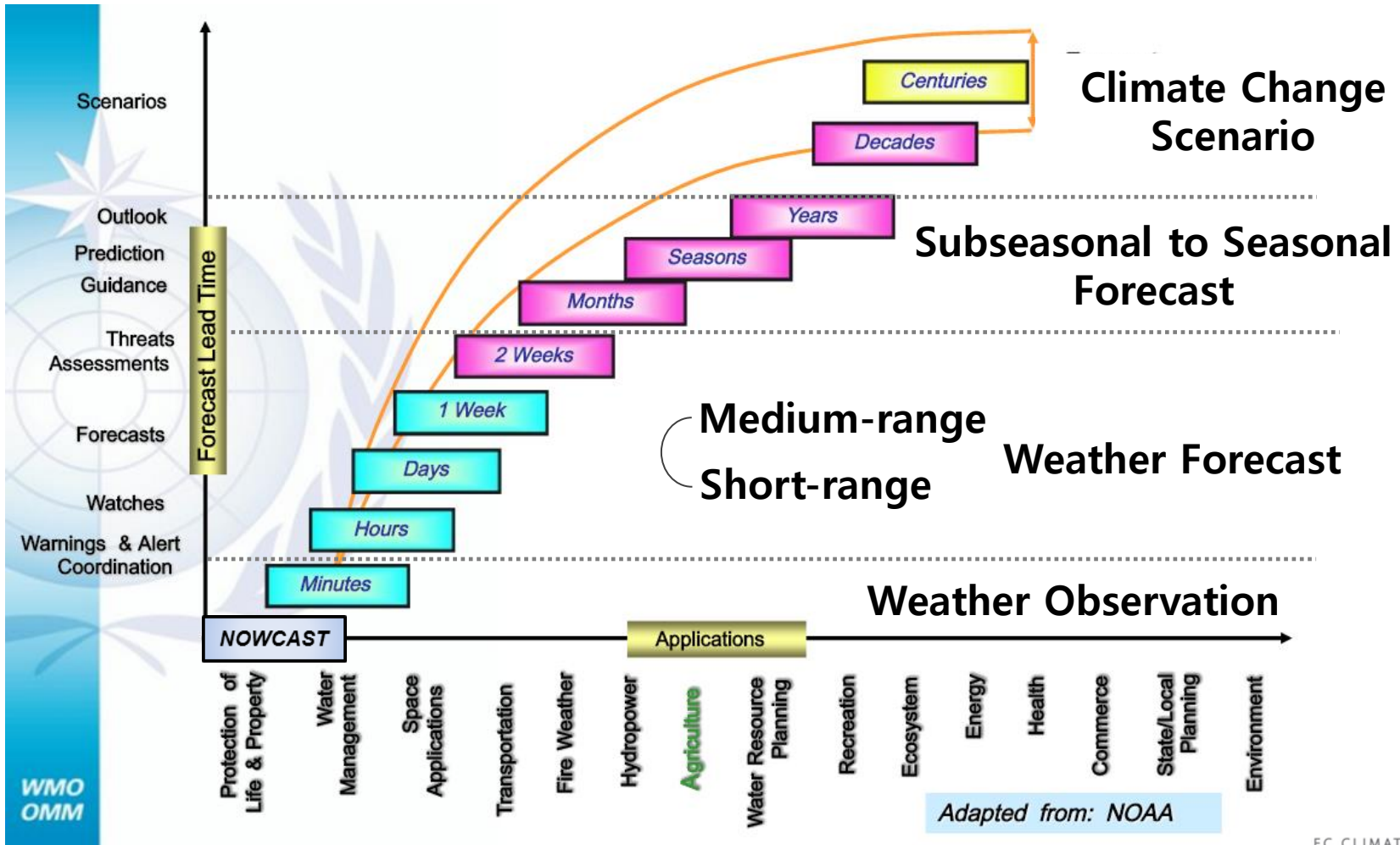
# What needed to be climate-smart?

- 1. Tailored weather/climate information** (Observed, Forecasted)
  - Available, Accessible, Usable and Fairly Accurate
- 2. Agriculturally-relevant, translated information**
  - Crop Yield, Pest/Disease Risk, Market Price Predictions
  - Heat/Water Stress Index, AgroMet Index, Spray Index
  - Agro-Advisories, Early Warnings
- 3. Capacity building opportunity**
  - Climate Field School, Extension Meetings
  - National/Local Climate Outlook Forum
- 4. Success story**
  - 'Farmer Smart' (Champion Farmers)
  - Knowledge/Technology Sharing Platform
- 5. Institutional/governmental support**
  - Safety Net, Incentive, Policy, Market Access, Extension
  - Inter-Departmental Collaboration



# Tailored weather/climate information

Weather/climate information **AVAILABLE**



(Source: <http://slideplayer.com/slide/1447561/>)

# Tailored weather/climate information

## ● Weather/climate information **AVAILABLE**

### Seamless weather/climate information

#### **Short term (1-3 days) forecast**

- Decide whether to sow or not to sow
- Decide irrigation based on rainfall forecast
- Decide to harvest or not to harvest
- Management of labor and equipment
- Livestock protection from cold and heat
- Fertilizer and pesticide applications

#### **Seasonal forecast (3-6 months)**

- Cropping strategy for the season
- National planning on response activities and budget for relief and rehabilitation
- Estimating the likely crop production to plan importing food crops

#### **Observation**

- Historical, long-term data
- Monitoring and analysis
- Immediate action based on monitoring
- Mostly from weather stations

#### **Medium range (5-7 days) forecast**

- Irrigate water during the dry period
- Planning of planting date

#### **Climate change scenarios (>10 years)**

- Land use planning
- Planning on cropping system and crop varieties
- Investing on building infrastructure

# Tailored weather/climate information

## Weather/climate information **ACCESSIBLE**

- Historical and forecasted meteorological data
- Radio, TV, Newspaper, etc
- Web, mobile-based ICT services (email, text message, push-alarm)
- Face to face communication (meetings using comm. tools such as agro-advisory bulletin, weather/climate board)

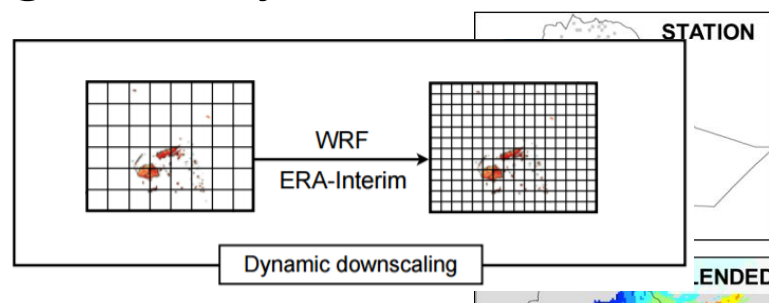


# Tailored weather/climate information

## Weather/climate information **USABLE**

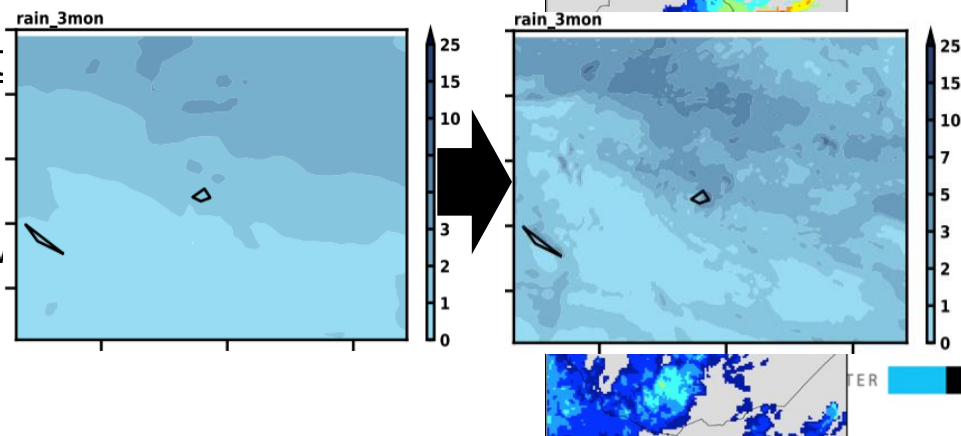
- Tailored information for agricultural use
  - 3-month average rainfall vs **Season Onset, Duration, Extremes, Wet/Dry Spells**
- Temporal, spatial downscaling to daily, local scales

- Dynamical downscaling with WRF, Reanalysis, and satellite data (observation, ~1 km grid, >30 years)



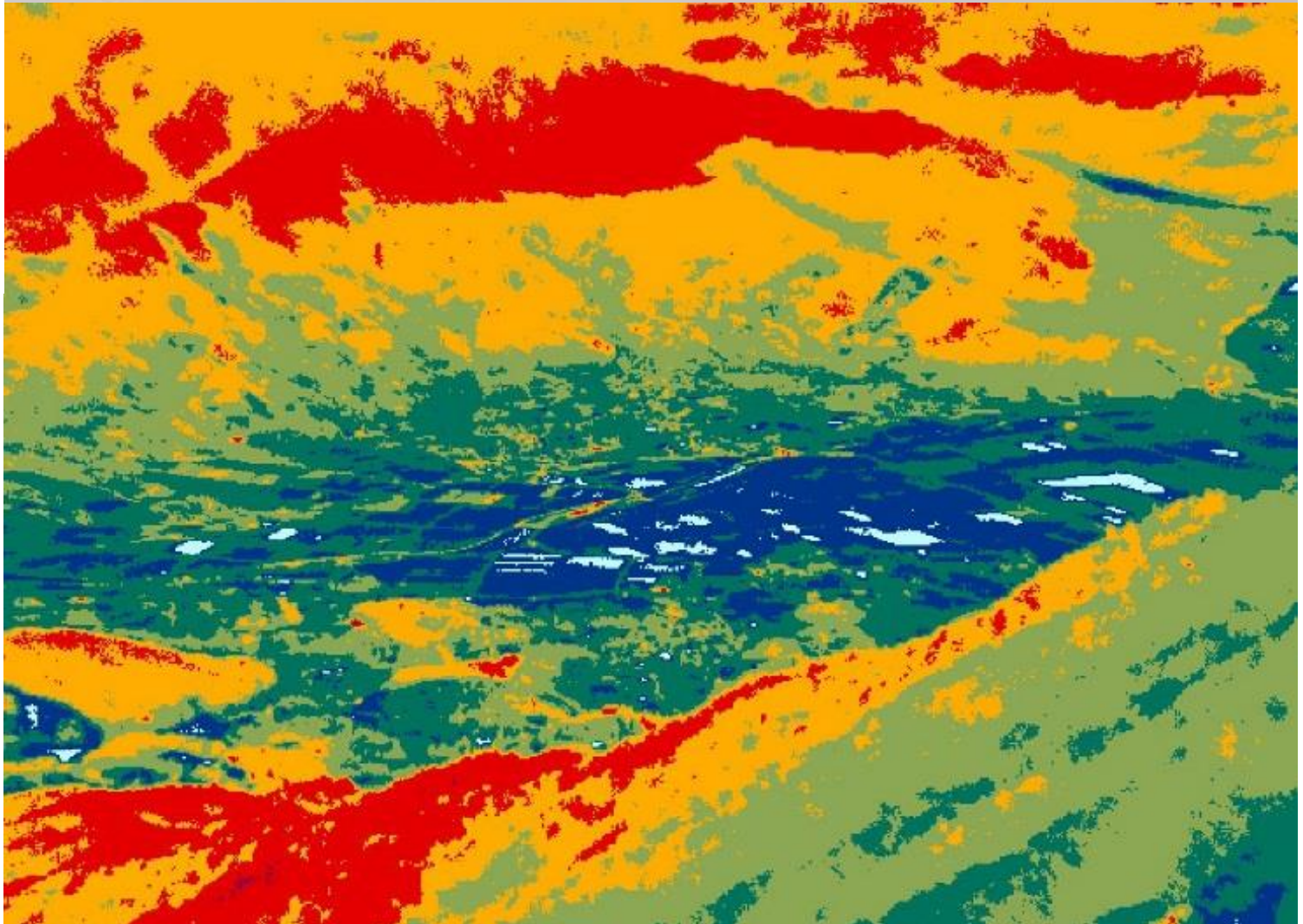
- ENACTS(Enhancing National Climate (observation, satellite + station, ~5

- Statistical, dynamical, or hybrid downscaling for weather/climate forecast



# Tailored weather/climate information

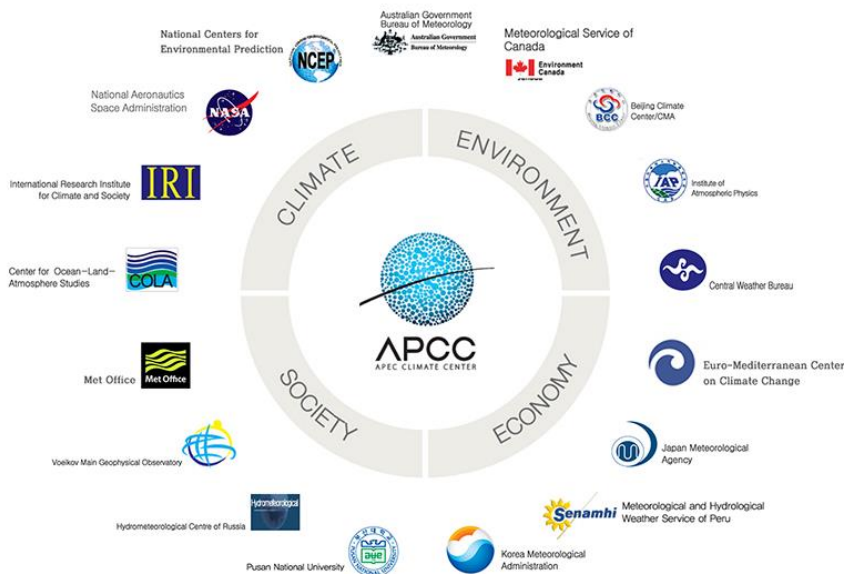
○ Weather/climate information **USABLE**



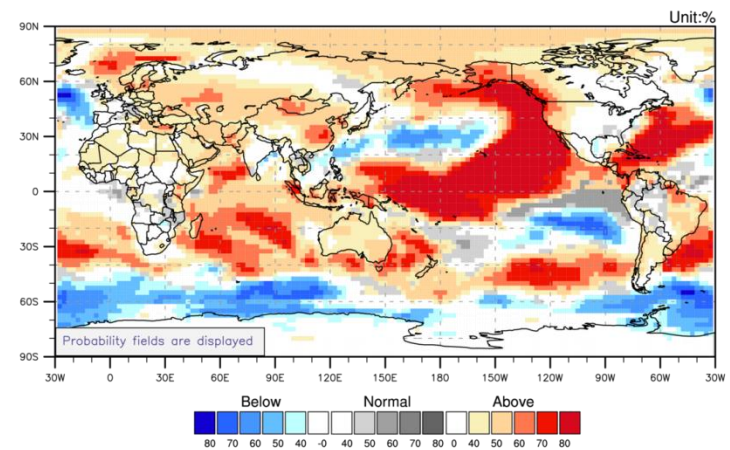
# Tailored weather/climate information

## Weather/climate information **ACCURATE**

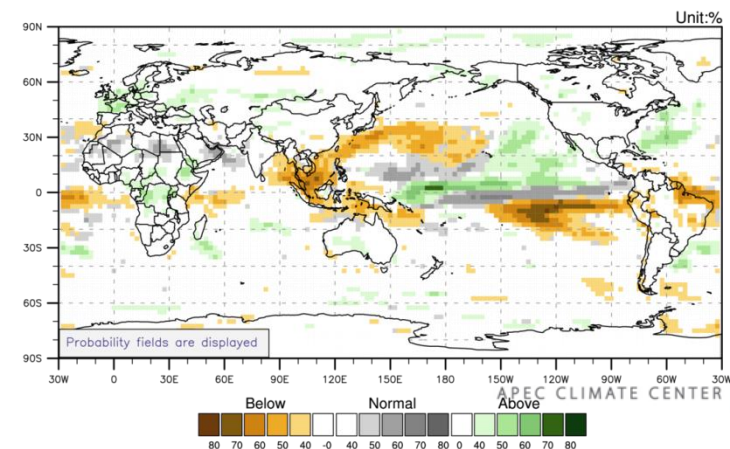
- APCC Multi-Model Ensemble (MME) Seasonal Forecast



Temperature at 2m for March-May 2015



Precipitation for March-May 2015



**APCC has developed a climate prediction system based on a Multi-Model Ensemble (MME) technique, which collects seasonal forecast data from 17 institutes in 11 economies**



# What needed to be climate-smart?

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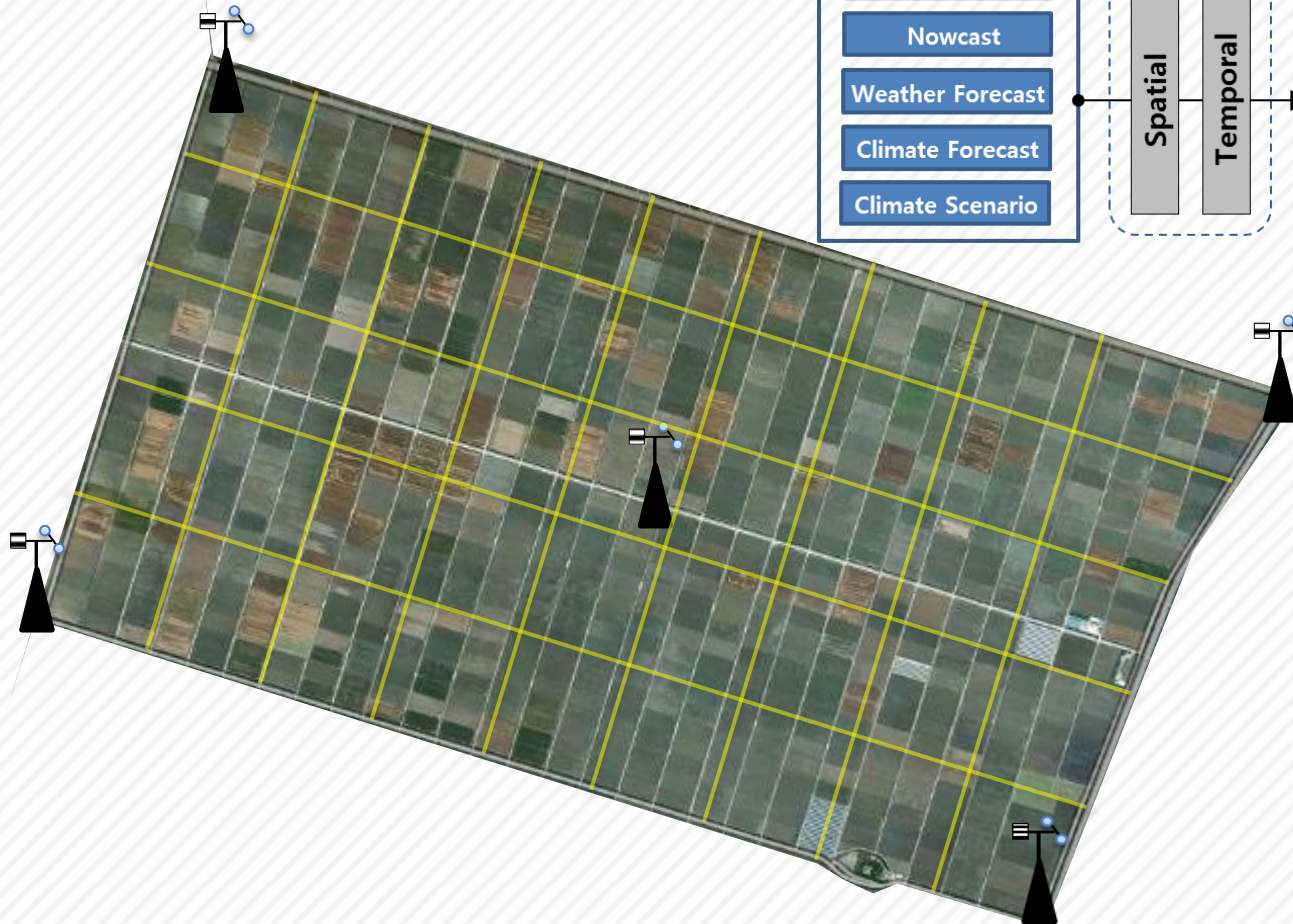


# Agriculturally-relevant information

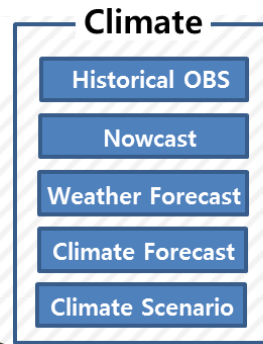
## Climate Services for Agriculture

- AgroMet Station Network

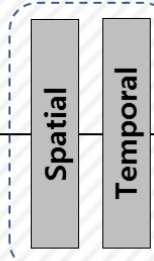
- Agro-Climate Modeling



### Climate Information



### Downscaling



### Agricultural Information

#### Agro-Climate Modeling

Crop  
Pest  
Water  
Soil  
Models

#### Decision Making

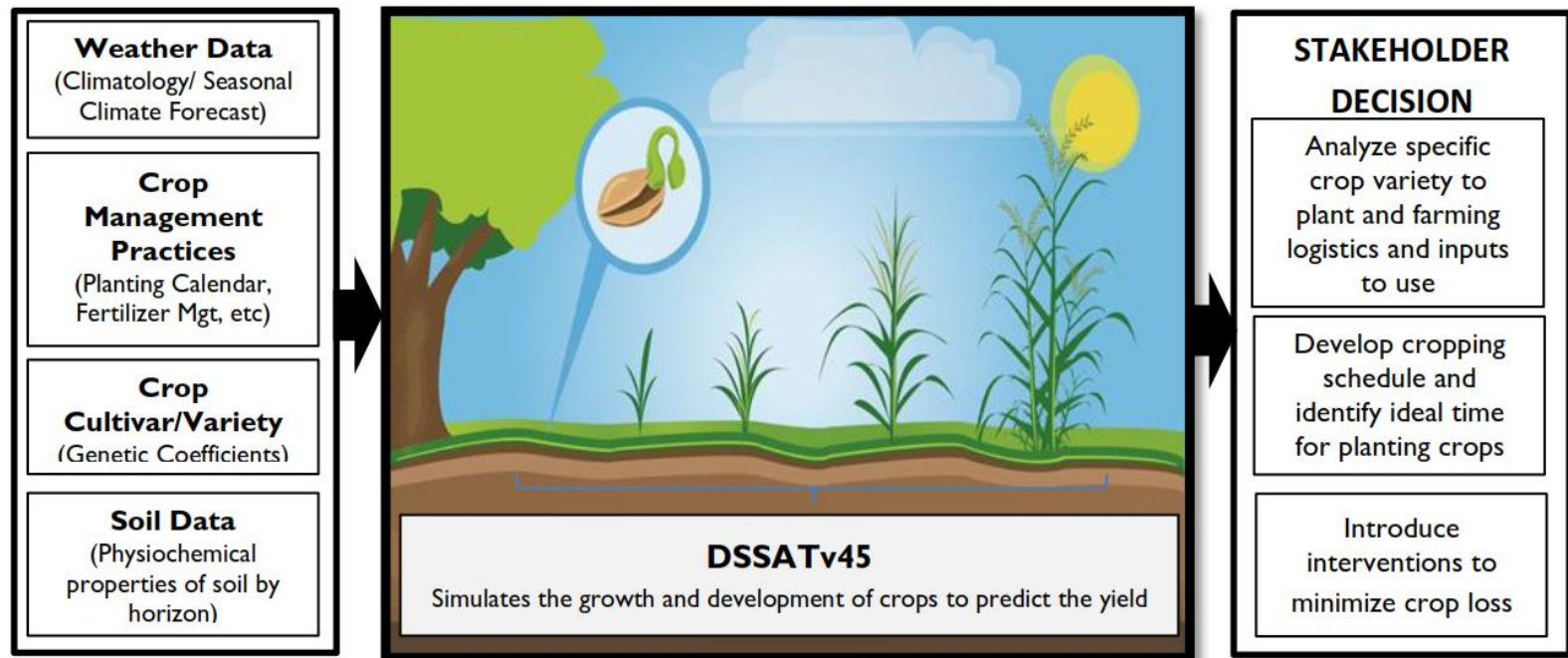
Short-term  
Mid-term  
Long-term  
Agricultural  
Tactics  
Strategies



# Agriculturally-relevant information

## Seasonal Rice and Pest Outlook

### Climate-Agriculture Model Decision Tools (CAMDT)



(By Dr. Amor Ines, Dr. Eunjin Han @ IRI)

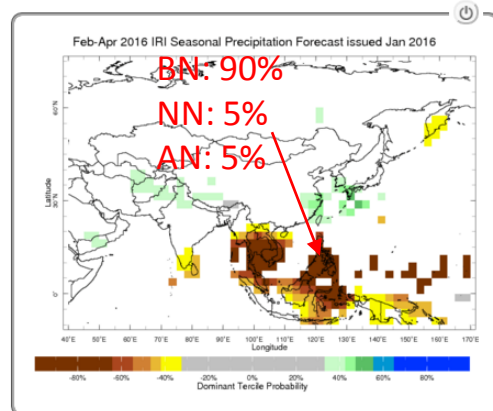


# Agriculturally-relevant information

## Probabilistic Seasonal Climate Forecasts

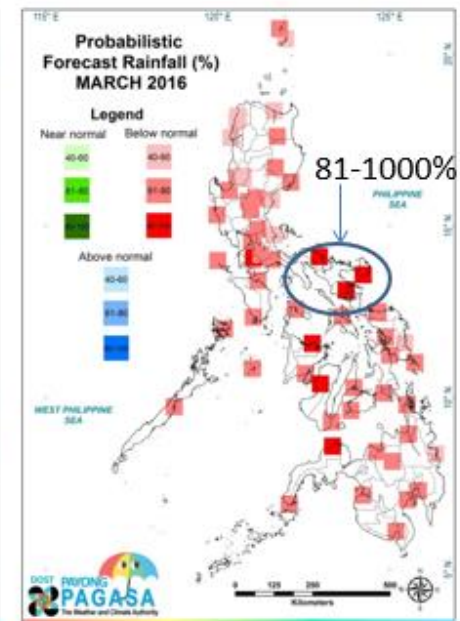
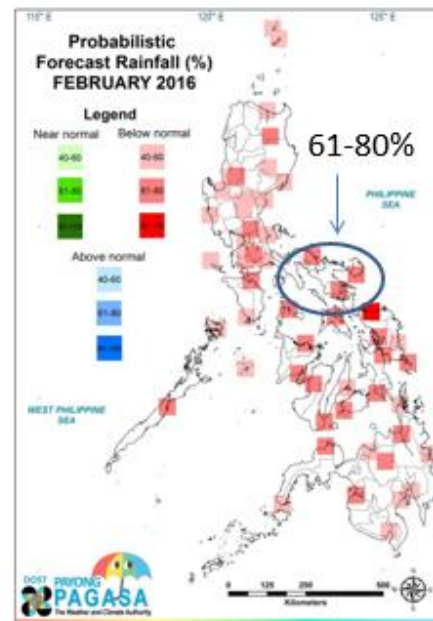
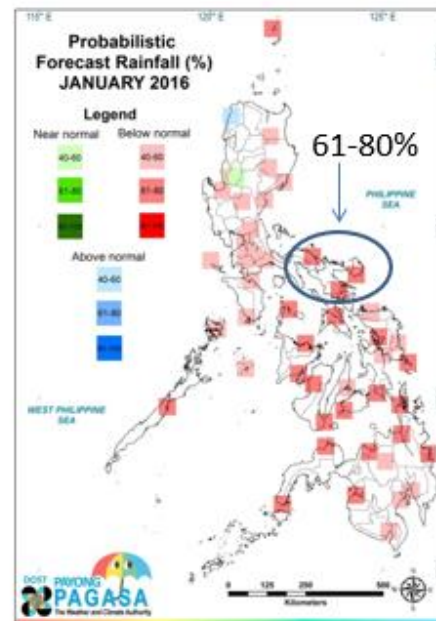
- **Tercile-probabilities** (Below -, Near - and Above Normal) at seasonal time scale (typically 3 months)

IRI Climate Forecasts Region: Asia  
Target Time: Feb-Apr 2016  
Description Dataset Documentation Dataset Contact Us



IRI Seasonal Precipitation Forecast

## PROBABILISTIC RAINFALL FORECAST



# Agriculturally-relevant information

Linking probabilistic seasonal climate forecasts with crop models

- Crop models require **daily** weather inputs for simulating crop growth

Example DSSAT plant growth **output**

Example DSSAT weather **input**

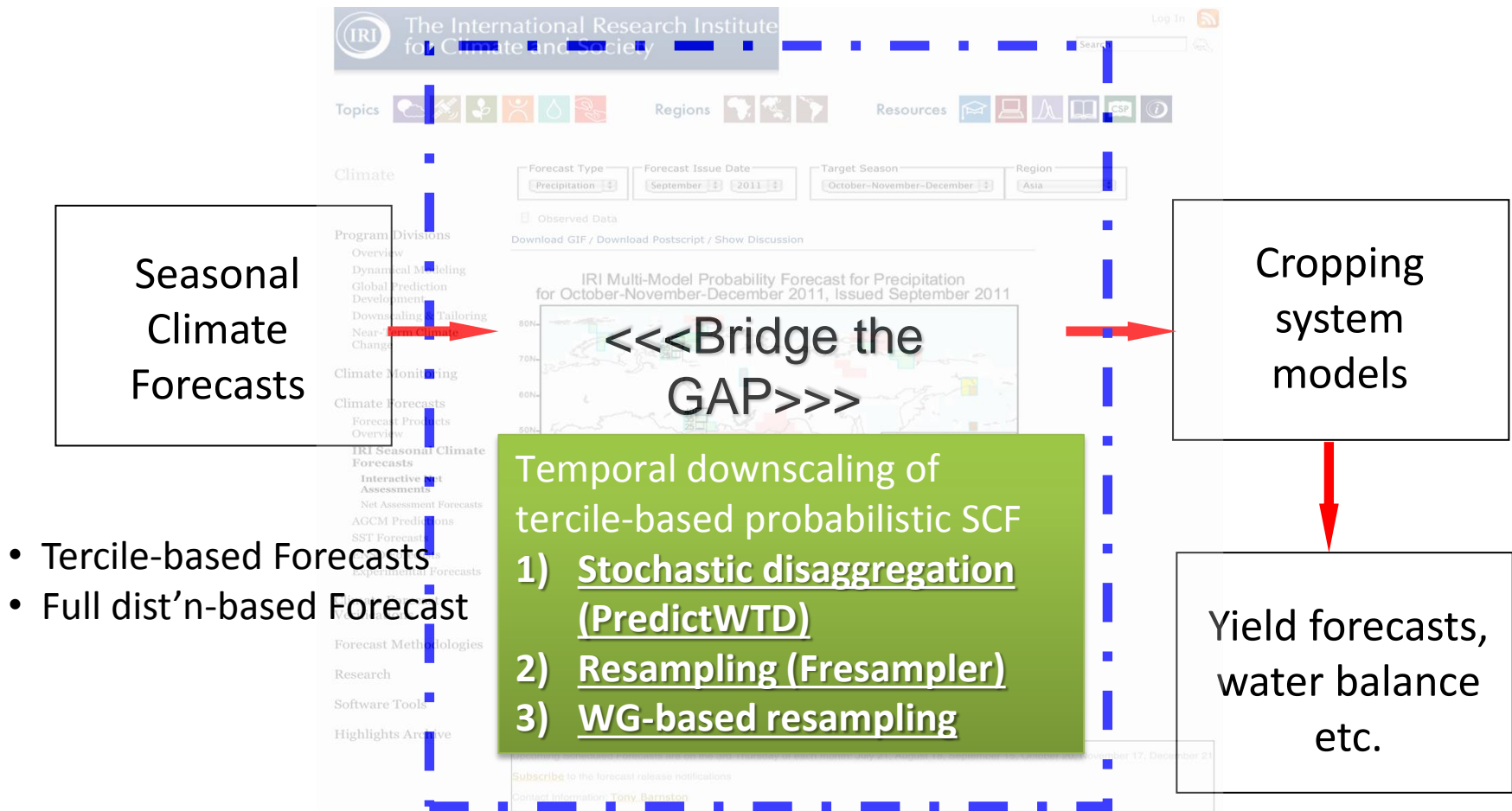
```
00820901.WTH x
*WEATHER DATA : PILI
@ INSI      LAT      LONG  ELEV  TAV
PILI      13.567  126.250  89  27.3
@ DATE SRAD  TMAX  TMIN  RAIN
09001  12.7  32.0  19.5  0.0
09002  12.7  32.5  21.0  0.0
09003  19.8  33.0  21.0  0.0
09004  14.8  33.3  19.5  0.0
09005  11.9  33.0  21.0  0.0
09006  16.0  30.7  19.0  0.0
09007  16.0  28.0  20.2  0.0
09008  15.4  28.0  20.5  0.0
09009  16.7  28.0  21.5  0.0
09010  12.2  27.5  18.0  0.0
09011  19.3  28.5  18.5  0.0
09012  12.4  28.5  21.3  0.0
09013  17.4  29.8  20.5  2.4
09014  11.2  27.8  21.5  8.6
09015   7.5  28.5  22.0  0.6
09016   5.8  27.2  21.0  14.8
```

YYDOY

```
PlantGro.OUT x
*GROWTH ASPECTS OUTPUT FILE
*DSSAT Cropping System Model Ver. 4.5.1.023 -Stub      FEB 06, 2015; 11:
*RUN 1 : Run1      RICER045 IRUP0001 1
MODEL : RICER045 - Rice
EXPERIMENT : IRUP0001 RI BAWP EXPERIMENTS
DATA PATH : C:\DSSAT45\Rice\
TREATMENT 1 : Run1      RICER045
!YR      Days  Days      Leaf <----- Dry Weight ----->
! and   after after  Leaf  Grow  Area <----- kg/Ha ----->
!      DOY start plant  Num Stage Index  Leaf  Stem Grain  Root Panic Crop
@YEAR DOY  DAS  DAP  L#SD  GSTD  LAID  LWAD  SWAD  GWAD  RWAD  EWAD  CWAD
2009 061  31   0  3.0   1  0.14  66   7   0   32   0   73
2009 062  32   1  3.0   1  0.14  66   7   0   35   0   73
2009 063  33   2  4.0   1  0.14  67   7   0   41   0   74
2009 064  34   3  4.0   1  0.14  67   7   0   51   0   75
2009 065  35   4  4.0   1  0.14  68   7   0   61   0   76
2009 066  36   5  5.0   1  0.14  69   7   0   74   0   76
2009 067  37   6  5.0   1  0.14  69   7   0   88   0   77
2009 068  38   7  5.0   1  0.15  71   7   0  106   0   78
2009 069  39   8  5.0   1  0.15  72   7   0  126   0   79
2009 070  40   9  5.0   1  0.15  74   7   0  148   0   81
```

# Agriculturally-relevant information

## Linking SCF with crop models

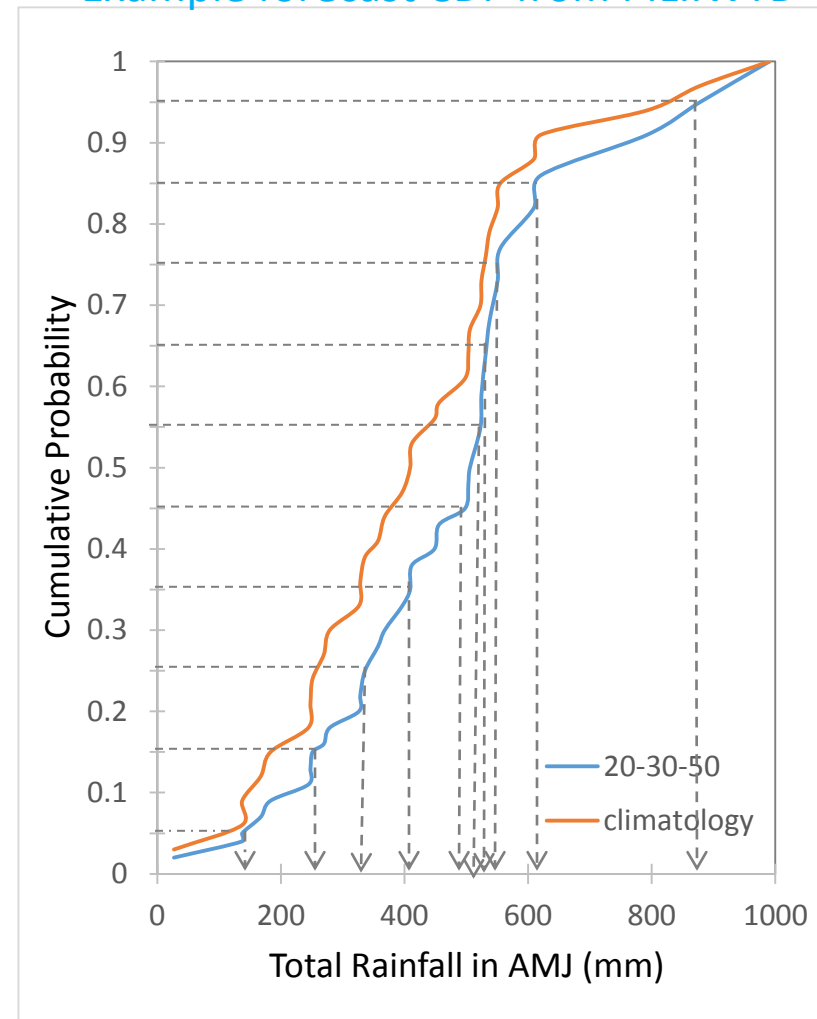


# Agriculturally-relevant information

## Stochastic Disaggregation Tool (PredictWTD)

- Conditioned weather generator
- Parameterizes long-term observed weather
- SCF is translated into monthly target values either as rainfall amount, frequency or intensity which are used to constrain the weather generator for generating daily forecast realizations.
- Precipitation is modeled by a two-state second-order hybrid Markov chain.

Example forecast CDF from PILI.WTD



# Agriculturally-relevant information

## Resampling tool (FResampler1)

- Uses the concept of '**conditional block sampling**' of weather data, based on probabilities of rainfall forecast categories
- Conditional block sampling is a way of randomly drawing, from historical records, time series of daily weather parameters e.g., rainfall,  $T_{\min}$ ,  $T_{\max}$  and  $S_{\text{Rad}}$ , for the season of interest from years that belong to a certain rainfall tercile category e.g., being BN, NN and AN.
- Block sampling also preserves the covariance of other weather parameters with rainfall as if conditionally sampling  $T_{\min}$ ,  $T_{\max}$  and  $S_{\text{Rad}}$  if that day is wet or dry.

# Agriculturally-relevant information

## Resampling tool (FResampler1)

### Long-term weather data (WTD file)

At least 30 years daily weather containing

- solar radiation (MJ/m<sup>2</sup> day)
- maximum temperature (°C)
- minimum temperature (°C)
- rainfall (mm)

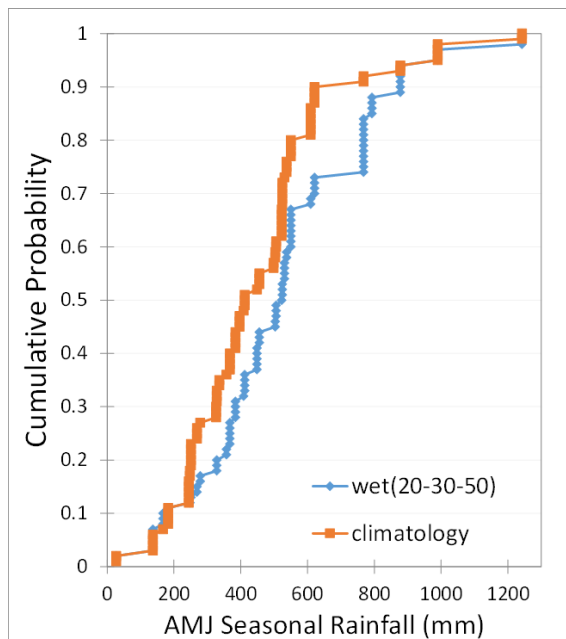
Example WTD file

ID	DATE	SRAD	TMAX	TMIN	RAIN
1975244		18.6	32.9	23.5	0.0
1975245		14.4	28.0	23.2	12.4
1975246		15.5	30.7	23.1	3.3
1975247		13.9	32.5	23.4	18.0
1975248		15.6	32.5	24.5	0.2
1975249		14.4	32.0	23.0	1.3
1975250		16.0	32.5	22.8	0.8
1975251		14.8	32.8	23.4	4.6
1975252		14.7	32.8	24.6	2.0
1975253		15.5	32.8	24.1	0.0
1975254		16.3	33.0	23.8	2.8
1975255		14.2	32.8	23.4	44.4
1975256		14.1	32.8	24.1	2.5
2013356		6.6	31.8	24.5	6.5
2013357		16.1	31.6	23.0	31.0
2013358		9.7	30.7	23.6	1.8
2013359		9.7	31.2	24.3	4.4
2013360		13.6	30.5	23.8	1.5
2013361		9.2	30.2	23.1	52.4
2013362		9.9	30.0	23.7	0.0
2013363		9.8	29.2	23.0	0.0
2013364		11.1	30.4	22.8	0.0
2013365		14.6	30.6	21.2	0.0

# Agriculturally-relevant information

## Resampling tool (FResampler1)

- ✓ four auxiliary output files:
  - Resampled-belowN.txt – stores the years sampled for below normal category
  - Resampled-nearN.txt – stores the years sampled for near normal category
  - Resampled-aboveN.txt – stores the years sampled for above normal category



### Example auxiliary output from FResampler1

Resampled-aboveN.txt	Resampled-nearN.txt	Resampled-belowN.txt
2010	1994	2005
2011	1996	2007
2010	2012	1984
1985	1981	1987
1979	1994	2005
2010	2003	2005
2010	2003	1998
1989	1991	1984
1979	2003	1983
2004	1994	1998
1982	1981	1999
1976	1981	1993
1982	1988	2005
2010	1994	2006
1982	1981	1987
1979	2012	1993
2009	1986	2006
1979	1981	1977
1985	1991	1993
2001	1978	1984
2004	2012	
2001	1978	
2010	1988	
1976	1991	
2010	2012	
1990	2000	
2010	1996	
1989	1996	
2009	1996	
1989	1996	
1976		
2001		
2001		
1979		
2010		
2001		
2004		
2001		

AN: 50%      NN: 30%      BN: 20%

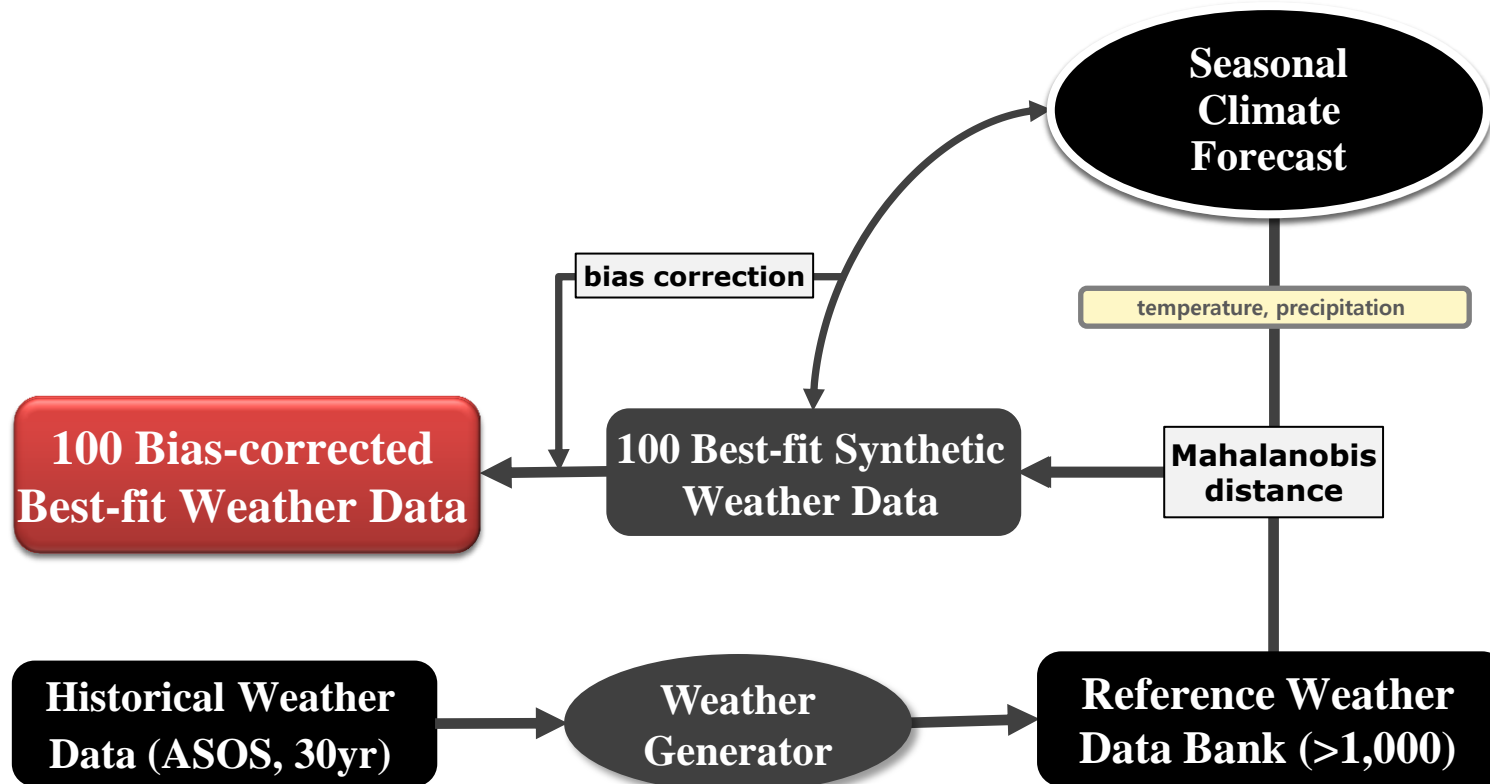
# Agriculturally-relevant information

## WG-base Resampling tool

### Similar to the 'FResampler1'

But using weather generator, more than 300 weather realizations with the similar parameters are generated.

And sampling takes place from the weather pool with more than 300 weather data.



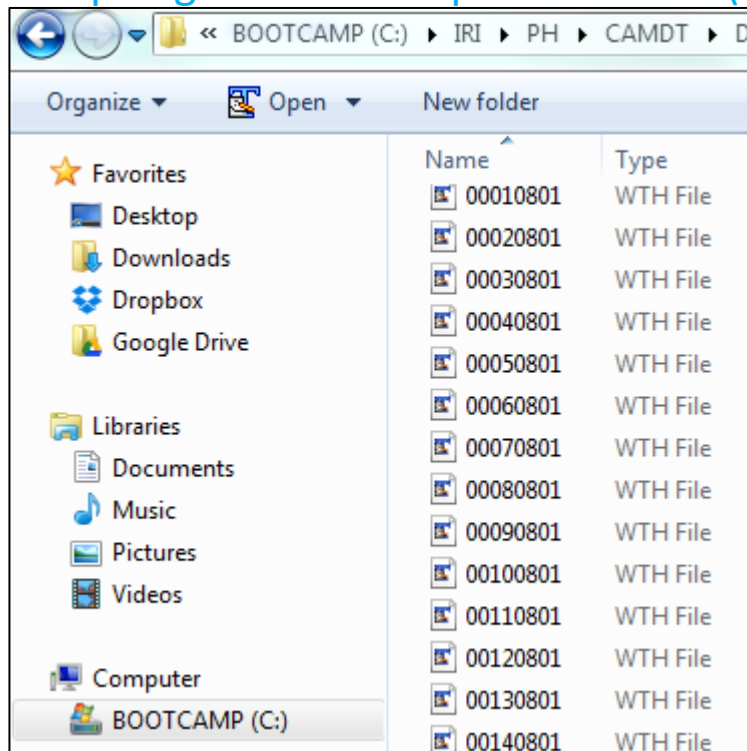
# Agriculturally-relevant information

## Outputs of PredictWTD, FResampler1, WG-based sampling

- Output:  $n$  realizations of Agro-Model-compatible weather file (\*.WTH)

Example: generated output WTH files (2008)

Example WTH file



A screenshot of a text editor window titled '00010801.WTH'. The content is a weather data file for PILI. It starts with a header line: '\*WEATHER DATA : PILI'. Below this, there are two sections of data. The first section lists station parameters: INSI (PILI), LAT (13.567), LONG (126.250), ELEV (89), TAV (27.3), AMP (1.6), REFHT (-99.0), and WNDHT (-99.0). The second section lists daily weather data for dates from 08035 to 08048, with columns for SRAD, TMAX, TMIN, and RAIN.

INSI	LAT	LONG	ELEV	TAV	AMP	REFHT	WNDHT
PILI	13.567	126.250	89	27.3	1.6	-99.0	-99.0

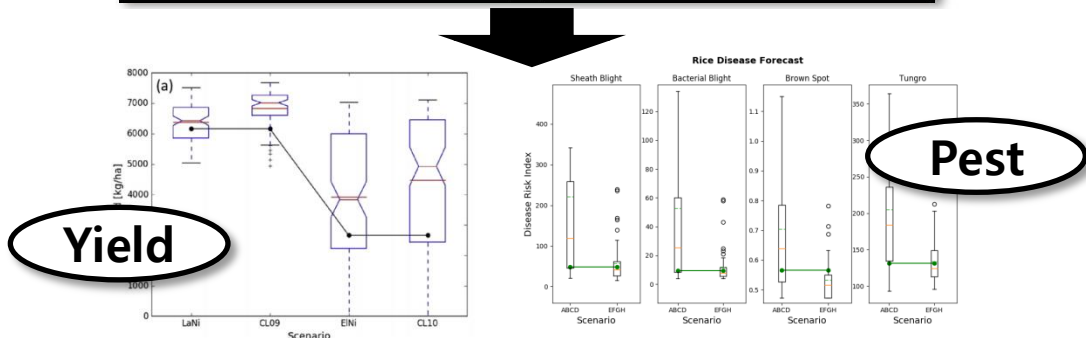
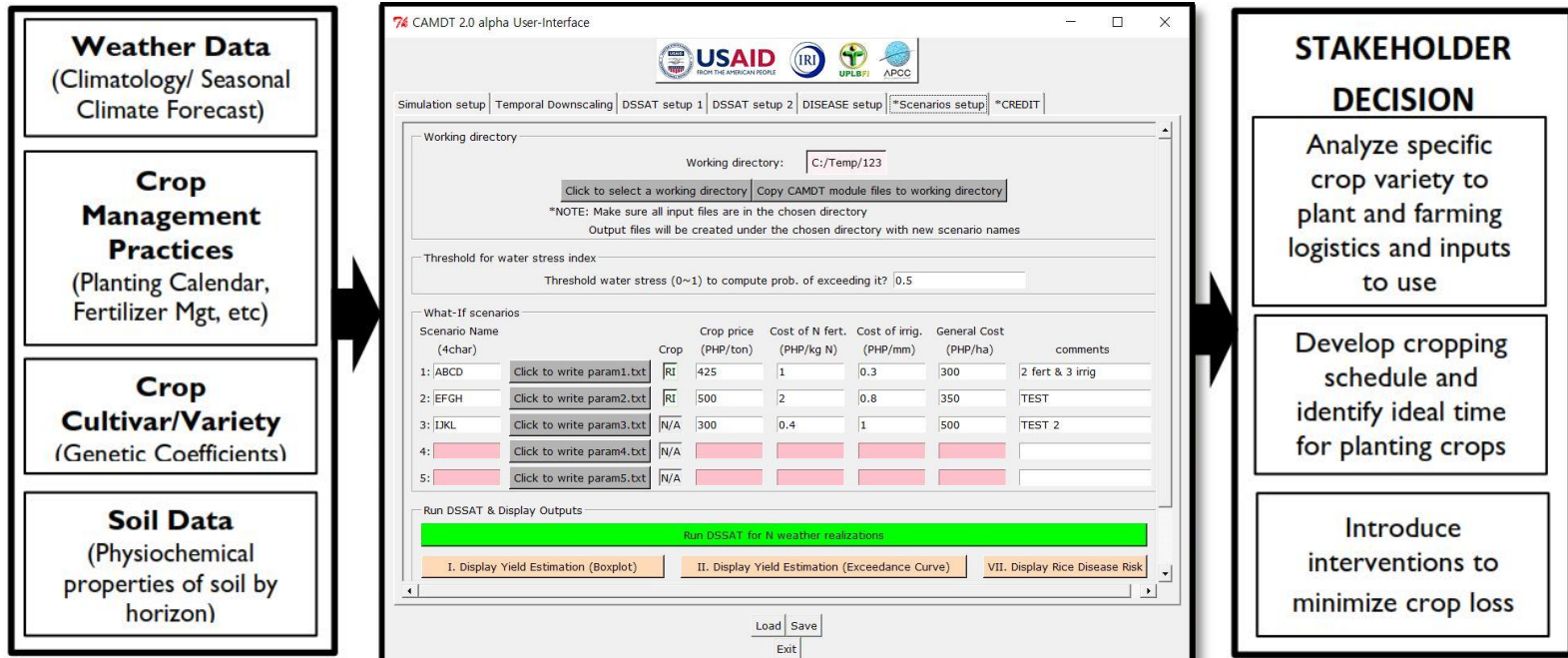
  

DATE	SRAD	TMAX	TMIN	RAIN
08035	18.1	31.5	20.8	0.0
08036	16.3	32.0	22.0	0.0
08037	19.8	32.0	21.5	15.8
08038	17.9	31.8	22.0	12.6
08039	16.1	30.0	22.0	8.6
08040	12.7	29.4	22.0	0.0
08041	12.4	30.0	22.5	0.0
08042	12.7	28.3	19.0	0.0
08043	16.6	30.0	21.5	0.0
08044	9.5	30.0	22.8	1.8
08045	7.2	26.0	21.0	7.8
08046	8.4	26.5	21.5	0.5
08047	8.4	28.0	22.0	2.6
08048	5.3	25.8	22.0	8.8

# Agriculturally-relevant information

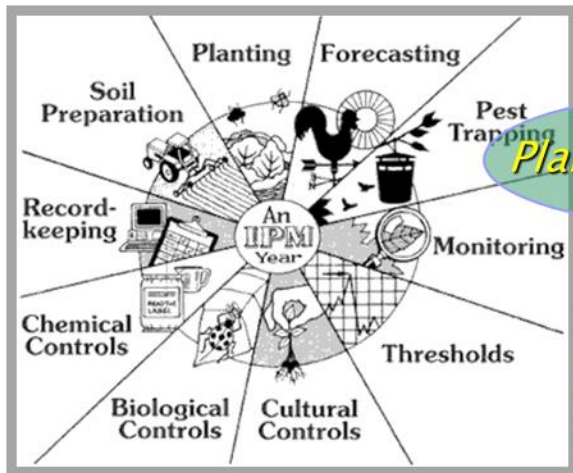
## Seasonal Rice and Pest Outlook

### Climate-Agriculture Model Decision Tools (CAMDT)

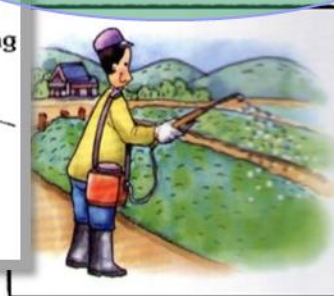


# Agriculturally-relevant information

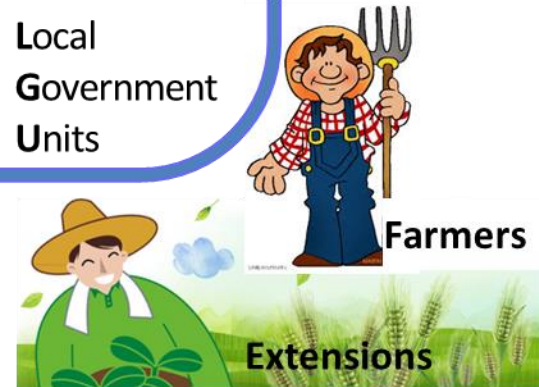
## ○ Seasonal Rice and Pest Outlook



*Planning/Adaptation*



Local Government Units



# Agriculturally-relevant information

## Climate Services for Agriculture

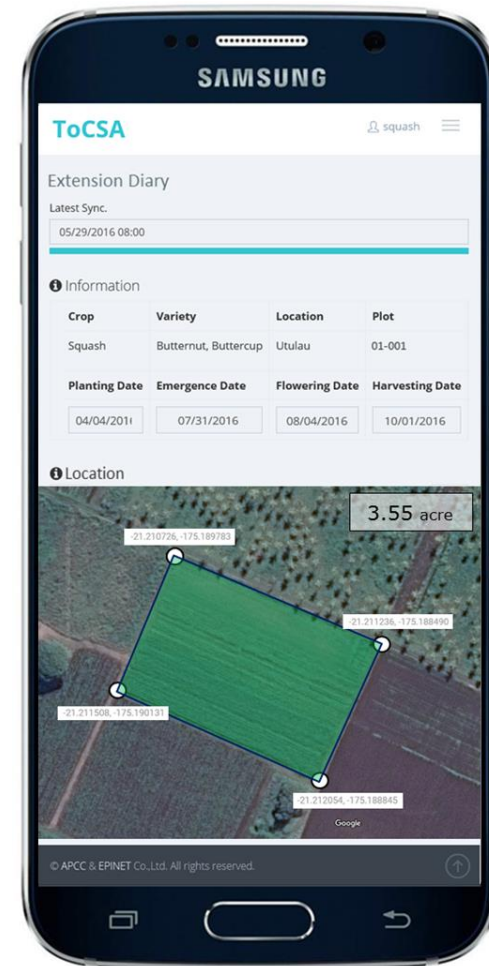
### Tonga Climate Service for Agriculture (ToCSA)

The screenshot shows the ToCSA web interface. At the top, there is a 'Login' button and the 'ToCSA' logo. Below the navigation bar, the main heading is 'Climate Smart Farming'. A breadcrumb trail reads 'Home > AgroMet Service > Climate Smart Farming'. A 'Question' section asks: 'Which island group are you cropping in?', 'What crop are you growing?', and 'Which cropping phase of your crop?'. A 'Seasonal Rainfall Forecast for the next 3 months' section shows 'Dec to Feb : Normal (56 %)'. Below this are three dropdown menus: 'Crop' (selected: Talotonga/Taro), 'Cropping Phase' (selected: Land Preparation), and 'Activity' (selected: Planting Material). A 'Recommendations' section provides advice on handling harvested corms.

Web-based, mobile-compatible  
Decision Support System

- Crop Yield Prediction (SCF-based)
- Weather/Climate Information
  - Historical and Forecast (WF&SCF) Data
- AgroMet Indices (SCF-based)
- Crop Disease Spray Planner
- Crop Management Simulator (SCF-based)
- Climate Smart Farming (SCF-based)  
= traditional knowledge inventory
- Text message, push alarm, easy bulletin
- Extension Diary

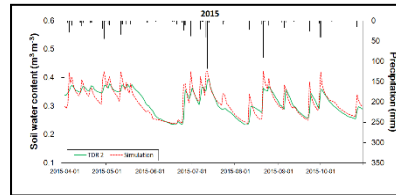
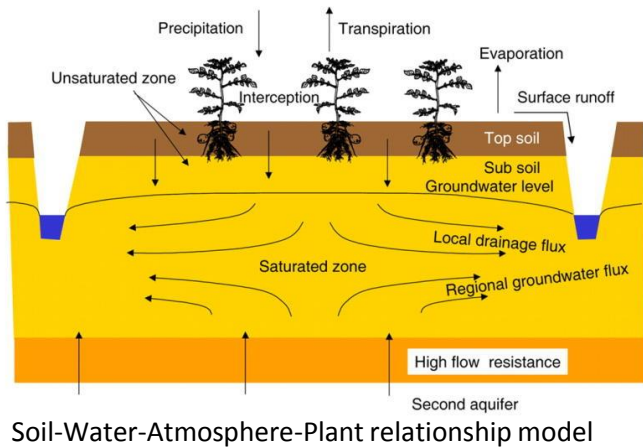
(<http://met.gov.to:2016>)



# Agriculturally-relevant information

## Climate Services for Agriculture

- Climate smart irrigation using the crop water stress index



**Crop water stress index**  
Forecast-based  
irrigation management



# Agriculturally-relevant information

## Climate Services for Agriculture

- Seasonal market price estimation based on seasonal climate forecast

Home

Weather Service

AgroMet Service

Farm Diary

Communications

Config Menu

### Seasonal Market Price Estimation

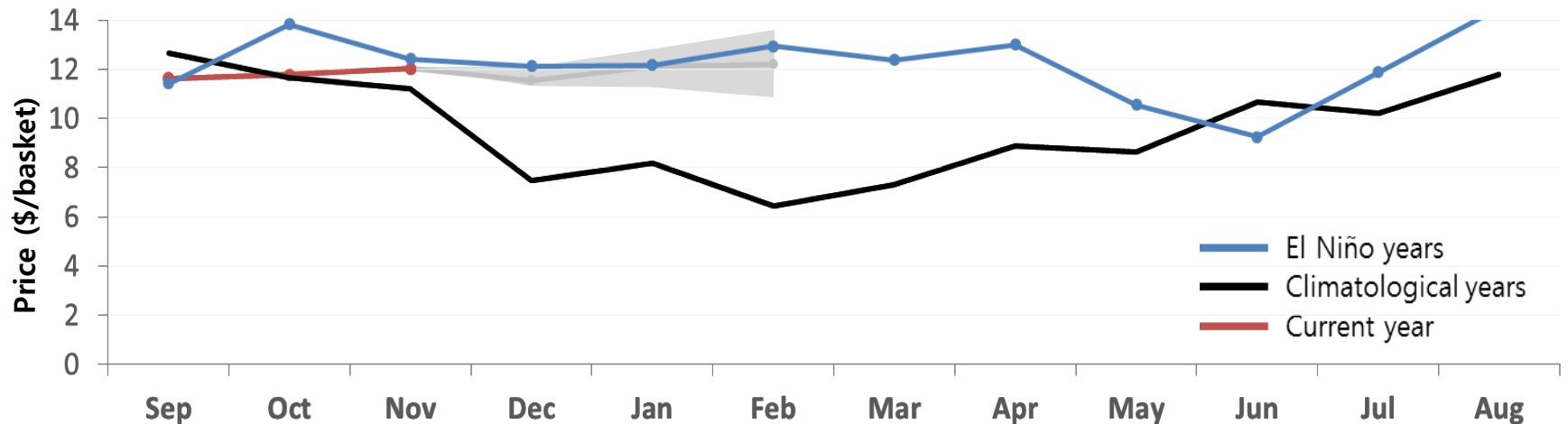
Station

Tongatapu and 'Eua

Crop

Talotonga/Taro

### Swamp Taro Market Price (\$/basket)

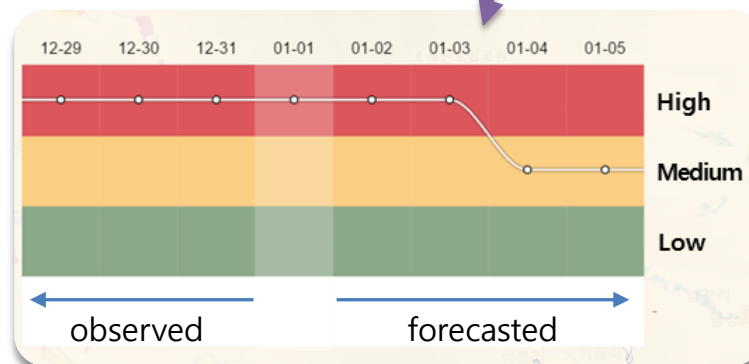
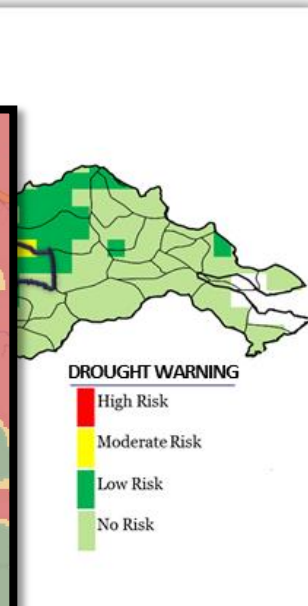
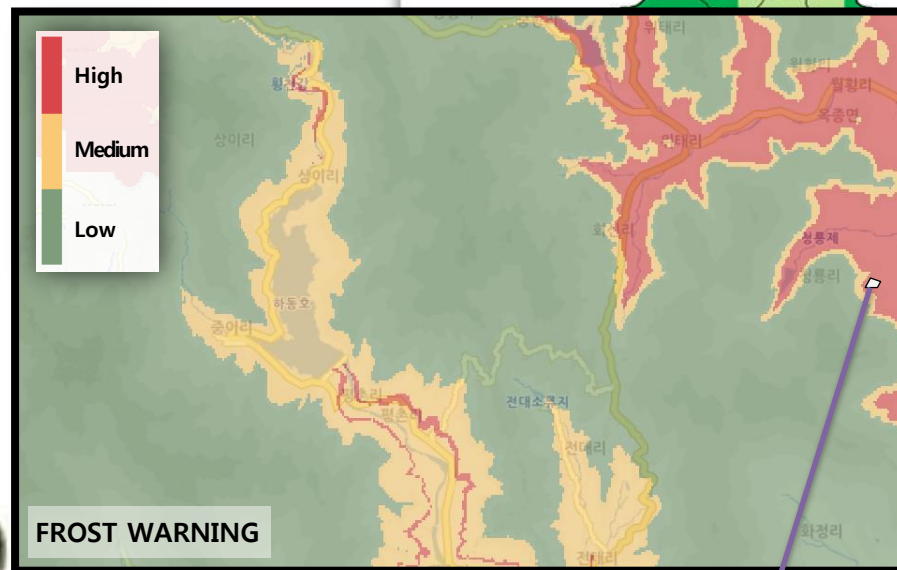


# Agriculturally-relevant information

## ○ Early Warning for Agricultural Disasters

- AgroMet Disasters Warning

- Drought
- Flood
- Frost
- Freeze
- Heat
- Wind

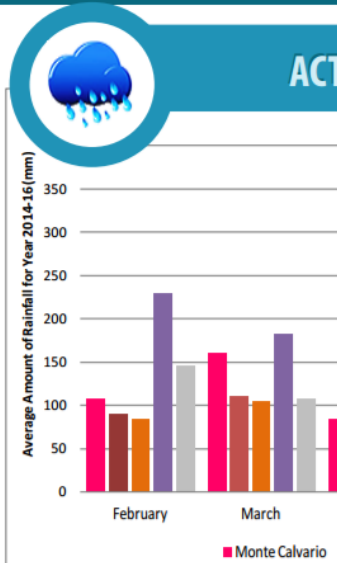


# Agriculturally-relevant information

## Agro-Advisory

### CLIMATE FORECAST AND EXTENSION ADVISORY

FEBRUARY 2017- JULY 2017 / (CLIMATE 10 2017, DRY SEASON, DULUT, CALABINEG, CUB)



#### Average Rainfall

The variability of rainfall within the rainfall collected through raingauges Sta. Cruz had the highest amount of Jun. Downward trend of the rainfall trend from May to Jul.

#### FORECAST 2017



#### EL NIÑO SOUTHERN OSCILLATION (ENSO) & LA NIÑA

The province of Can may experience weaker with a 59% chance of reaching ENSO

RAINFALL FORECAST	RICE	OTHER CROPS	LIVESTOCK	FISHERIES
 <b>Below Normal</b>	<p>Repair water systems including leaks at the source and along the line</p> <p>Use early maturing/drought tolerant varieties.</p>	<p>Prepare a tank or pond near the crops for extra water</p> <p>Plant crops that are resilient to dry conditions:</p> <ul style="list-style-type: none"> <li>- Root crops such as cassava</li> <li>- Legumes like cowpea, winged bean and mungbean</li> </ul> <p>Plant indigenous cover crops or practice conservation fallow period and use mulch (plastic, rice straw, etc.) to improve soil fertility and conserve soil moisture</p>	<p>Provide drinking water to livestock:</p> <ul style="list-style-type: none"> <li>- Large ruminant, give daily water in the afternoon</li> <li>- Small ruminant, give water twice a day (noon/1pm)</li> </ul> <p>Practice Cut and Carry to augment / supplement pasture grasses</p>	<p>Limit the numbers of fingerlings to avoid overcrowding specially on dry season.</p> <p>Also reduce the amount of feeds to avoid fish kill</p>
 <b>Near Normal</b>	<p>Direct seeding is not recommended for places that can be easily flooded. The expected rains for February is favorable for land preparation especially for the upland and rainfed areas.</p> <p>Use early maturing/submergent tolerant varieties.</p> <p>Open drainage outlets to prevent water stagnation, transplant (or expect to use) older seedlings that may require closer planting distance due to the reduced ability to tiller.</p>	<p>Plant crops that can tolerate near normal rainfall:</p> <ul style="list-style-type: none"> <li>- Legumes like cowpea, winged bean, mungbean and other crops like okra and squash</li> </ul> <p>Store food and next year seed in a secure and air tight container to avoid pest</p> <p>Plant local cover crops during fallow period. Use mulch (plastic, hay, others) to preserve humidity and fertility of soil and to avoid erosion on sloping areas.</p>	<p>Improve housing design using insulation materials to cushion effects of changing temperature</p> <p>Be alert on diseases and infections. Be ready to use medicines, vitamins and minerals and vaccination of the animals.</p> <p>Keep animals confined. Practice cut and carry.</p>	<p>Construct higher dikes and reinforce cages to prevent wash-outs</p>
 <b>Above Normal</b>	<p>Apply just the required amount of fertilizer to prevent lodging and pest and disease occurrence.</p> <p>To avoid loss of PH (or acidity) of the soil use FBD, RPC and VTDs.</p> <p>Use transplanting of seedling that'll need closer distance on planting to compensate if unable to use tiller.</p>	<p>Practice Integrated Pest Management (IPM), to prevent spread of diseases and infections and other pests (example; snails, fungal infections and others.)</p>	<p>Create silage for both small and big ruminants.</p>	

# Capacity Building Opportunity

## ○ Farmer Field School, Extension Meetings, Trainings



Tonga Farmer Field School

- Face-to-face comm.
  - knowledge exchange
  - training of trainers
- Applied climate education
- Working with local NGOs and champion farmers



# What needed to be climate-smart?

- 1. Tailored weather/climate information** (Observed, Forecasted)
  - Available, Accessible, Usable and Fairly Accurate
- 2. Agriculturally-relevant, translated information**
  - Crop Yield, Pest/Disease Risk, Market Price Predictions
  - Heat/Water Stress Index, AgroMet Index, Spray Index
  - Agro-Advisories, Early Warnings
- 3. Capacity building opportunity**
  - Climate Field School, Extension Meetings
  - National/Local Climate Outlook Forum
- 4. Success story** 
  - 'Farmer Smart' (Champion Farmers)
  - Knowledge/Technology Sharing Platform
- 5. Institutional/governmental support**
  - Safety Net, Incentive, Policy, Market Access, Extension
  - Inter-Departmental Collaboration



# Holistic Approach for Climate-Smart Agriculture



## Tonga AgroMet Project - Improving agricultural productivity through ensuring data availability and enhancing agro-climate services

### Climate Information Services

- Tonga Meteorological Service: historical weather data, nowcast, warnings, weather/climate forecasts
- Installation of agro-met station
- Delivery: radio, TV, email, apps
- National Climate Outlook Forum

### Climate Smart Technologies

- Agromet index-based crop phenology and yield prediction
- ICT technologies for data collection & analysis, and information delivery
- Crop model-based decision support tool
- Crop pest spray tools

### Tonga Agricultural Community

### Agricultural Development Plan

- Tonga Agriculture Sector Plan (2016-20)
- Cooperation with local NGOs for community level adaptation strategy
- National Agriculture Data Management Plan by the MAFFF

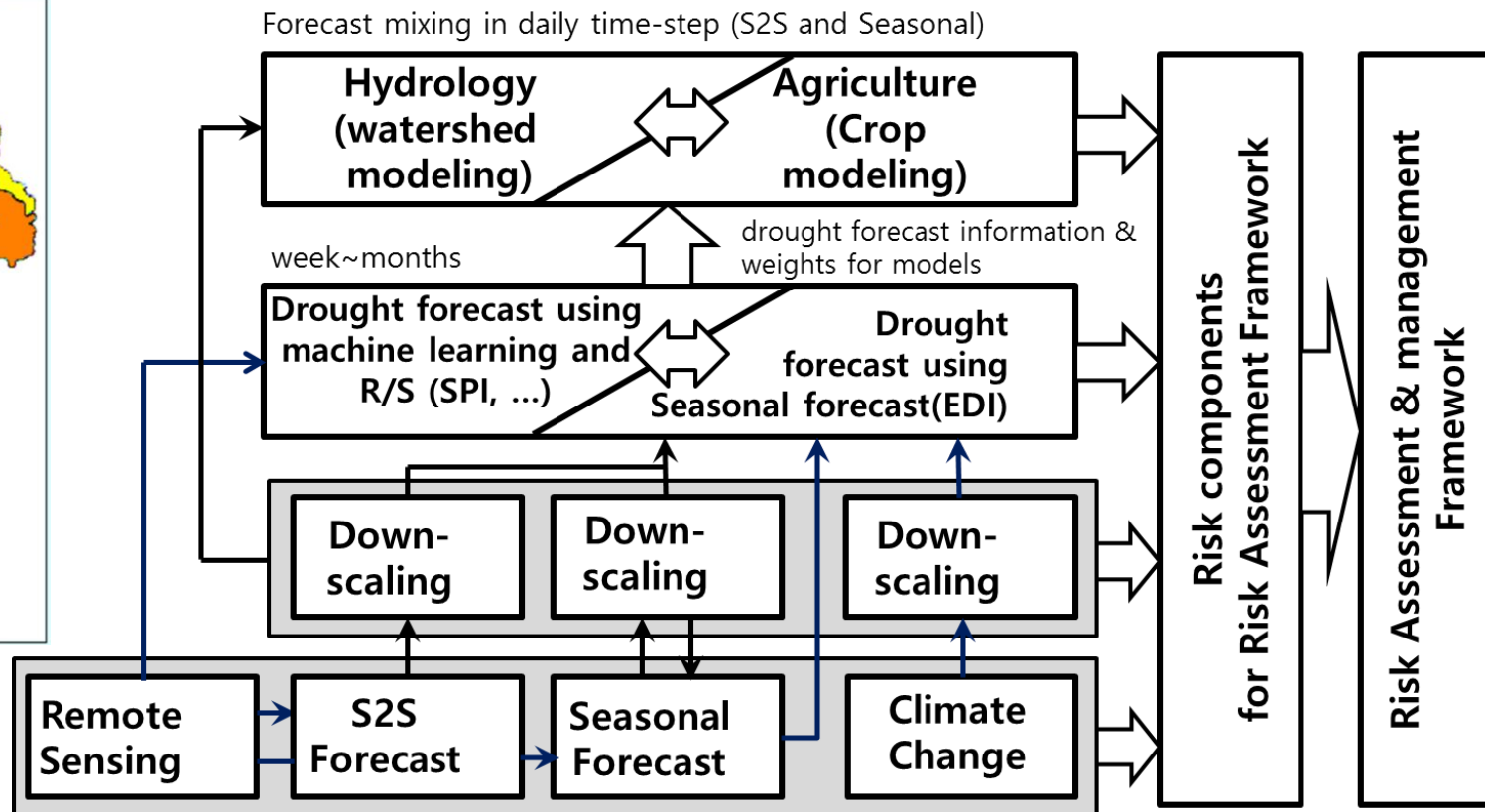
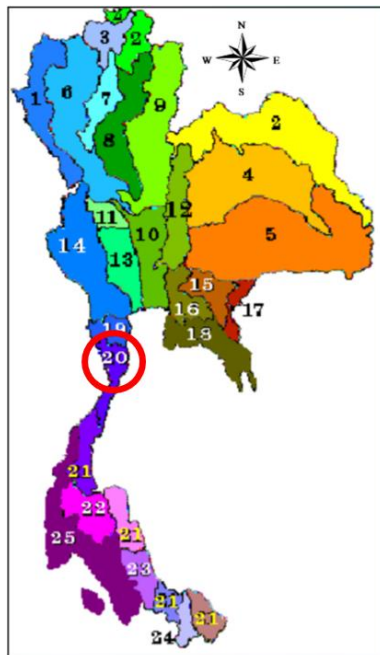
### Local Knowledge and Institutions

- Establish AgroMet Working Group
- Capacity building for extension, NGOs, commercial farmers
- Farmer field school or national forum
- Traditional knowledge and know-how sharing

# Holistic Approach for Climate-Smart Agriculture



**Thailand Agri-Water Project - Utilization of multi-range climate information for risk assessment on agriculture-water resources**



# To Summarize

1. Climate-Smart Agriculture needs: tailored weather/climate Information; agriculturally-relevant, translated information, capacity building opportunity; institutional/governmental support; many success stories
2. ICT is a key supporting component for effective/efficient Implementation of the five areas for CSA
3. To facilitate the uptake of CSA:
  - Demand-driven, Local-specific, User-friendly
  - New CSA built on existing capacity and a gradual upgrade into more sophisticated one
  - Very close involvement of stakeholders such as extension workers, farmers, and relevant ministries
  - Regular participatory meetings for feedback
  - Long-term sustainability mattered



# Thank-you

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