digiSoft CIS Based DSTs

Socioeconomic Benefits from Climate Forecasts for Action

BY Digitron Software

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Day 1, Session 1:

Introduction to Crop Capability Prediction Modelling as Decision Support System for Agriculture and Food Security in Malawi, Mozambique and Zimbabwe

Validation Workshop on:

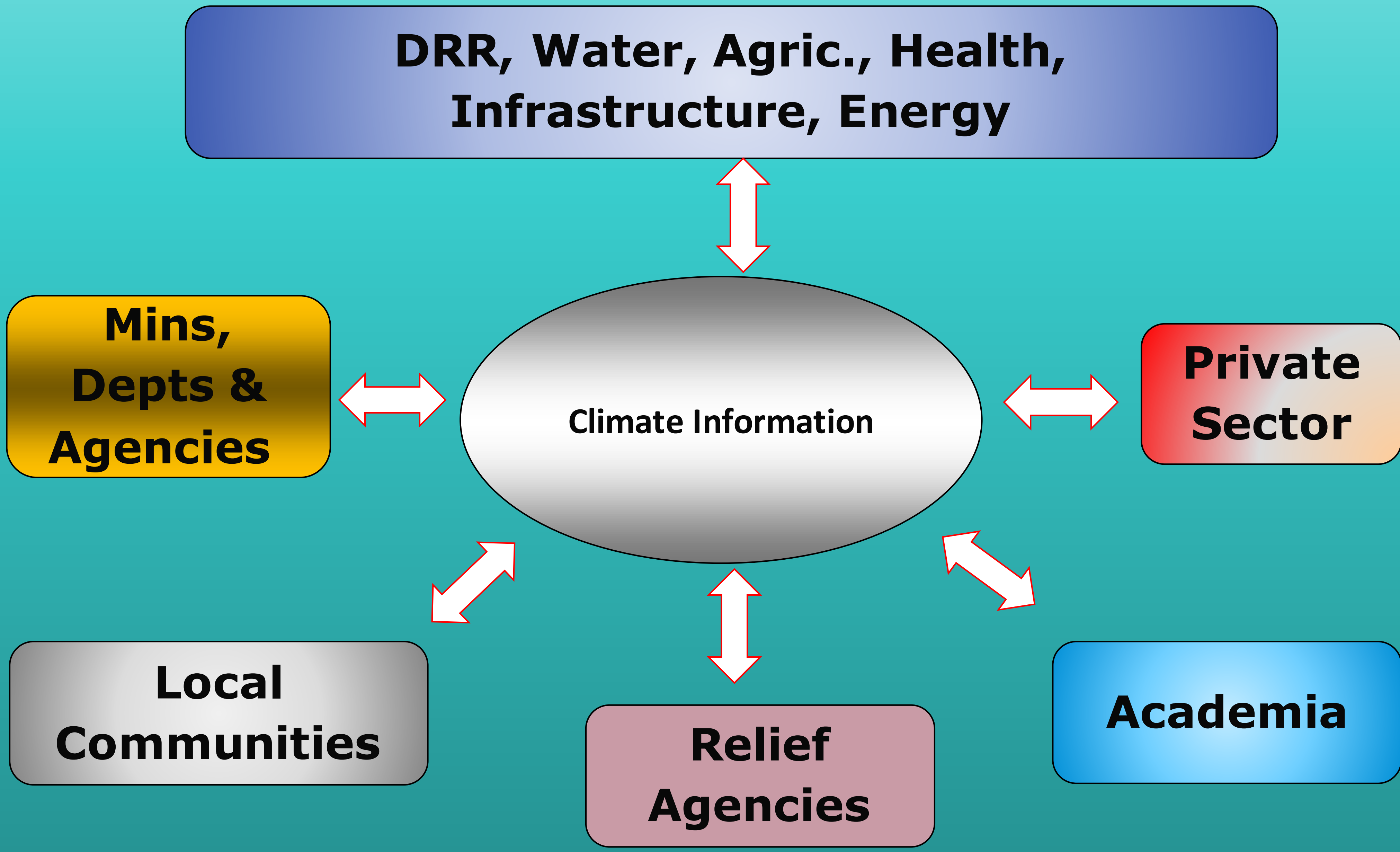
Analysing and Validating Crop Capability Prediction Model for Malawi, Mozambique and Zimbabwe

LILONGWE, Malawi

24 – 26 November 2021

CIS Based DST

Users of Climate Information



Back Next

Format of Presentation

- BACKGROUND
- CROP CAPABILITY PREDICTION MODEL
  - Overview of Weather and Climate Information Services and Their Utility for crop Yield Prediction
- Concepts and Application
  - Rationale for using CAMDT
  - Background of CAMDT/DSSAT
  - Key Steps in the CAMDT/DSSAT analysis

Global Economic Cost Of Hydrometeorological Hazards

- Hydrometeorological investment US$ .5 billion leads to up to US$ 30 billion per year in increases in global productivity and up to US$ 2 billion per year in reduced asset losses, Hallegatte (2012).

- Climate Information Systems has potential to yield 10 times in returns of such investment, UNECA (2020). Agriculture is a major beneficiary of a well-developed CIS.

- It is also estimated that in developing nations losses are typically 10-14 % of GDP, Abramovitz, (2001)

- This continues unabated as demonstrated by devastation of recent cyclonic activity

Variability of Climate & Weather

Variability of Climate in form of drought/floods controls many facets of agricultural production systems:

- **It affects 70% of the production costs.**
- **There is beneficial use of seasonal climate forecasts (SCF) in the prediction of crop yields for the food security and agricultural sector.**

SSA agricultural productivity

In Malawi, Mozambique and Zimbabwe, agriculture plays a key role in both food security and employment areas:

with contributions to GDP typically between 15 and 40%.

Productivity is only 1MT/Ha compared to 5-10 MT/Ha elsewhere:

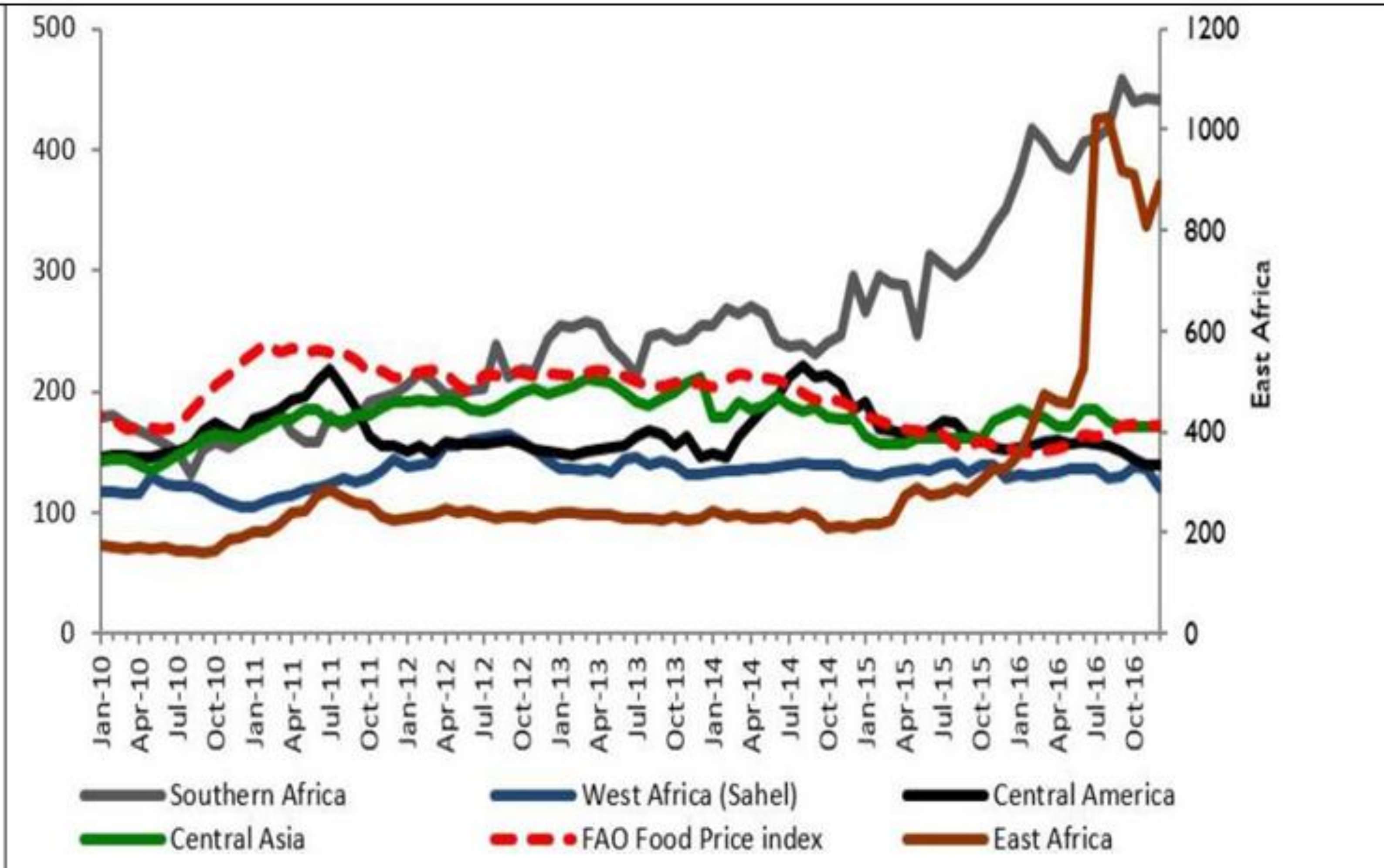
low productivity => very the high cost of production, making it sub-economic;

(but) this may be the difference between starving and food secure.

A great potential of increasing the productivity, particularly as the agricultural sectors utilize CIS in supporting on-farm strategic and tactical decisions.

Some missed opportunities

Figure 14.2 FEWSNET regional price indices and FAO Food Price Index, Jan 2010-Dec2016



Source: FAO and FEWS NET.

Climate information services in Agriculture:

Applying knowledge of climate and its impacts on crops, livestock, fisheries and management practices:

- **Helps reduce and/or manage risks;**
- **Assists farmers to make informed decisions.**

We need to develop simple and robust scientific tools to guide planning and policy to better understand climate impacts on food security and livelihoods.

Weather and climate services for agriculture

Developments in High Performance and Personal Computers allow synthesizing detailed knowledge on plant physiological processes in the functioning of crops as a whole.

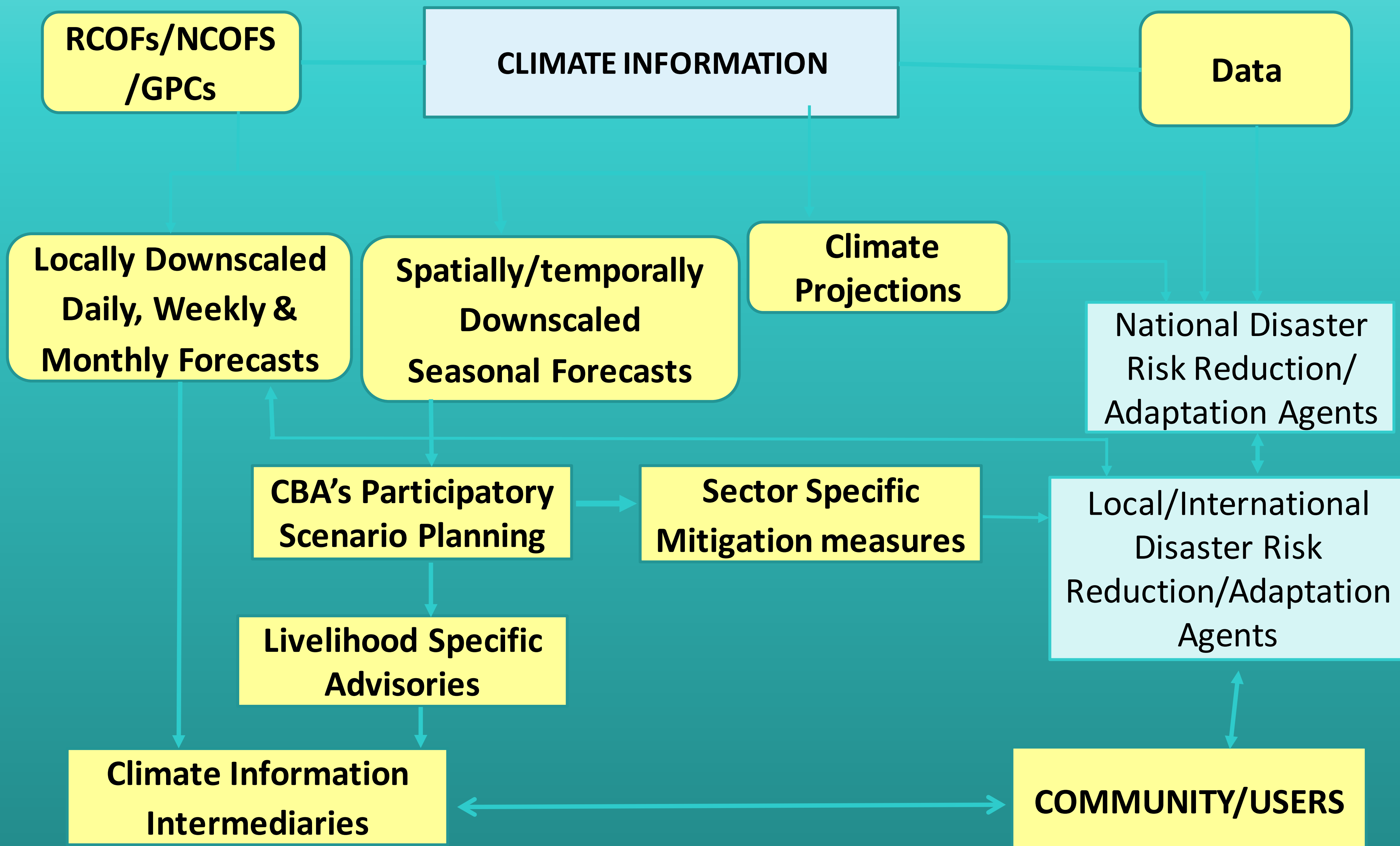
- **Crop growth is more complex and occurs continuously in time, thus requiring at least daily inputs of weather parameters;**
- **Crop growth models are used in combination with seasonal climate forecasts (SCF) as input for the purposes of generating crop yield projections.**

Approaches

In order to mitigate the negative effects of hydrometeorological hazards; and to benefit the economy when favourable conditions are anticipated there is need to:

- **provide the tools for producers of CIS and the end user community in agricultural and other climate-sensitive related sectors; and**
- **train producers and end users in proper application of CIS.**

Summary DSTs in Action



DSSAT

- **Crop simulation model used with CAMDT is Decision Support System for Agrotechnology Transfer (DSSAT), developed at the University of Florida, USA**

- **CAMDT is used to drive DSSAT which combines crop, soil, and weather databases with crop models and application programmes to simulate outcomes of crop management strategies on a daily step basis**

CAMDT/DSSAT will help to:

- **Improve the forecast and information interpretation capacity of policymakers and user community for strategic provision of appropriate inputs to the Agriculture and Food Security Sector;**

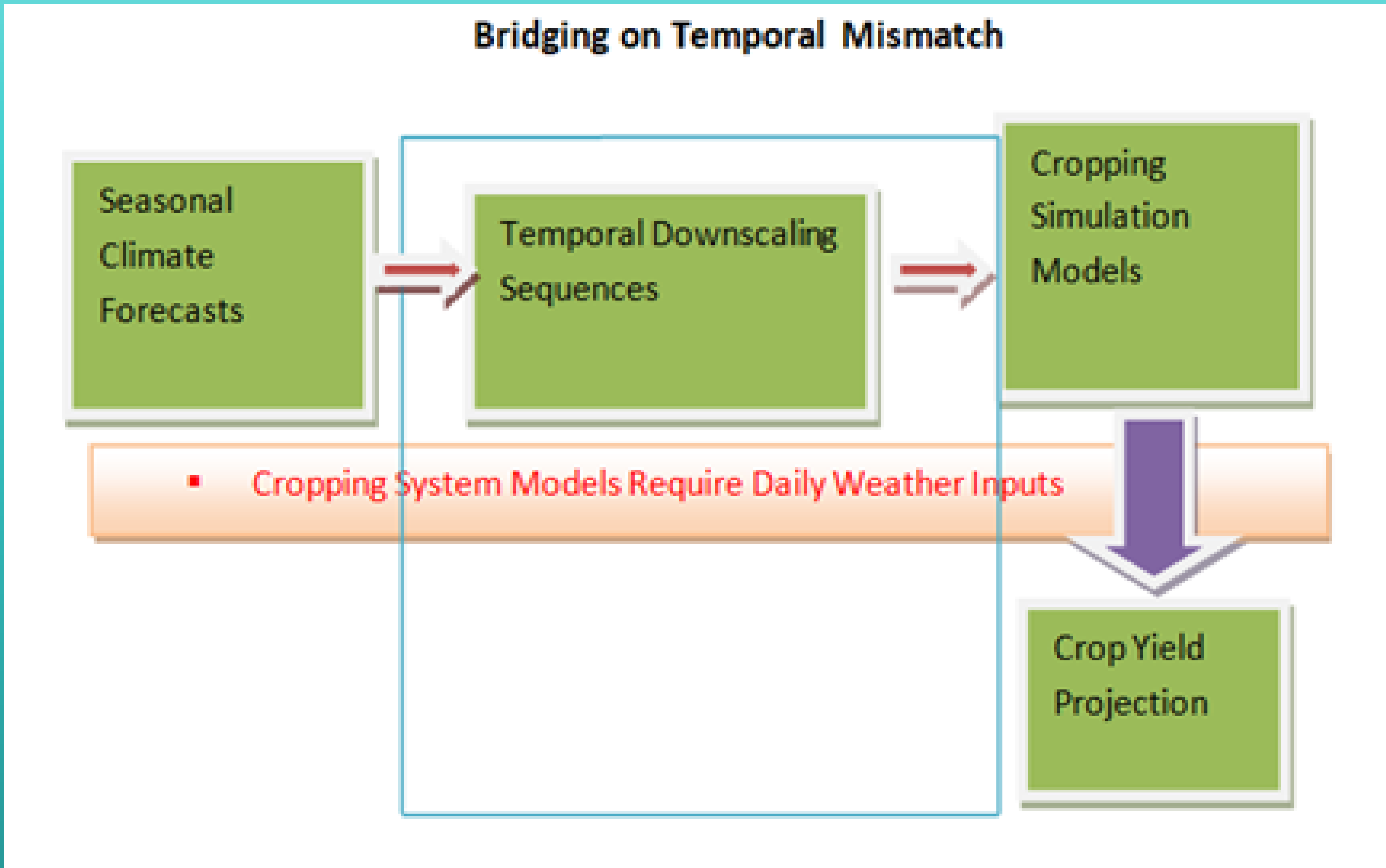
- **Develop a methodology for predicting crop capability in the various agro-ecological zones/ homogeneous rainfall zones in order to enhance agricultural productivity and food security;**

(…continue…)

(…continued…)

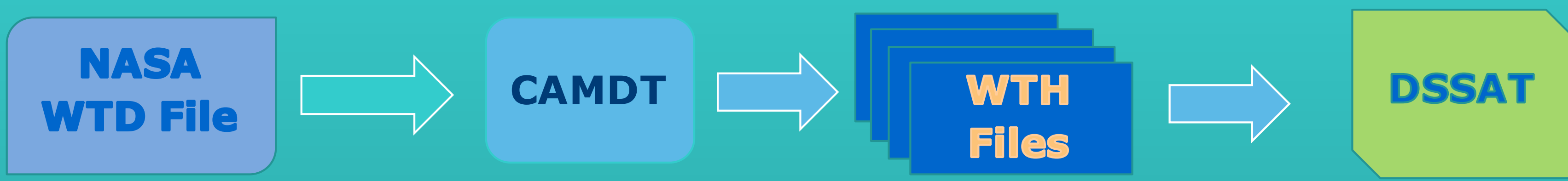
- **Strengthen capacity for improved production, better access and sustainable operations for CIS; and**

- **Strengthen the platform for collaboration by key stakeholders involved in the production and application of timely climate information.**

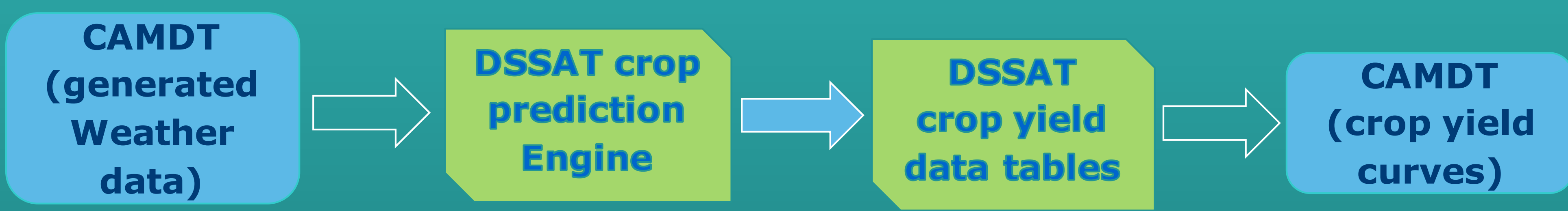

Bridging on Temporal Mismatch
Seasonal Climate Forecasts
Temporal Downscaling Sequences
Cropping Simulation Models
Cropping System Models Require Daily Weather Inputs
Crop Yield Projection

Meteorological Data Acquisition

- ❑ Daily weather station ground recordings at each station ;
- ❑ NASA and other terrestrial satellite recordings:



- ❑ CAMDT and DSSAT Data Interchange:



Key Steps in CAMDT/DSSAT Analysis

1. Identify the target meteorological station and desired data range (required input years)

2. Set the planting season (3 month block) and the model simulation horizon

3. Connect to the NASA Data Climate Web Portal and download the desired data (Note the key weather parameters)

STEPS FOR DOWNLOADING DATA FROM NASA

1. Download data from NASA (National Aeronautics and Space Administration) website: (https://power.larc.nasa.gov/data-access-viewer/)

2. Select following 7 fields as required to run CAMDT:

   a) Geolocation
   b) Application (e.g. Agro-climate)
   c) Data Scaling unit (e.g. Daily)
   d) Desired date range
   e) Solar Radiation
   f) Minimum Temperature (2m above ground)
   g) Maximum Temperature(2m above ground)
   h) Precipitation

2. Download daily climatological data in MS Excel CSV format.
3. Steps to be followed in order to make the data formats compatible with CAMDT/DSSAT are presented in the below:
   a. Open NASA data with MS Excel
   b. Format Date Column to combine YEAR with Day Of Year (DOY)
   c. Format rest of columns to one decimal place

3. Save File in printer format (*.PRN)
4. Open *.PRN with MS VS Code and align columns separated by 2 spaces
5. Save Aligned file as *.WTD ready for CAMDT

4. Download the digiSoft VBA software tool used in MS Excel to split the *.WTD (global data) file into *.WTH (yearly data) files

5. Download and Install the two (2) software Utilities used to assist MS Excel to format NASA DATA

https://code.visualstudio.com/sha/download?build=stable&os=win32-x64-user

https://www.bulkrenameutility.co.uk/Download.php

Variability of Climate & Weather

6. Download and Install the Python software, which provides a platform for running CAMDT modelling
https://www.python.org/downloads/release/python-383/

7. Format and export the daily climatological data from NASA website using Excel and Export to Text format ready for CAMDT/DSSAT ingestion:
    a. Prepare the Global Data file *.WTD for all the target years)
    b. Split the WTD file into individual year by year data (*.WTH) files

8. Run the CAMDT weather generator
   a. CAMDT Folders Setup
   b. Copy Weather data into Working Directory
   c. Run Rice Automated Modelling
   d. Run Rice Crop Yield Simulation Graphs

9. Running CAMDT/DSSAT crop modelling for non-rice cereals

   a. Automated Modelling of Rice vs Manual Modelling of Other Crops
   b. Running RICE Automated Dummy Model at CMD SHELL
   c. Use MS VS Code to Create a CAMDT Crop YIELD.txt file
   d. Running Crop Modelling for 45AN-20BN tercile
   e. Generate CAMDT Crop Yield Graphs

CAMDT

Crop yield prediction models require daily weather realizations using weather generating algorithms.

- **One such algorithm is Climate-Agriculture-Modelling and Decision Tool (CAMDT) developed by IRI, USA.**
- **CAMDT was developed for yield projections of RICE cultivars grown in the Philippines.**

Digitron made significant efforts in modifying CAMDT so that it can:

- **generate yield projections of other cereals**
- **extend yield projection LEAD TIME, before planting**

SEASONAL RAINFALL FORECAST/CROP YIELD PREDICTION

EXAMPLES OF ADVICE TO FARMERS

Above normal

ZONE 1

70-80% of cropping land for ***long-season seed varieties***; 20-30 % medium-seed varieties

Near normal

50-70% of cropping land for ***medium seed varieties***; 15-20% short-season seed varieties; 15-20% long-season seed varieties

Below Normal

30-40% of cropping land for ***medium seed varieties***; 50-60% short-season seed varieties

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ZONE II

70-80% of cropping land for medium-season seed varieties; 20-30% short seed varieties.

60-80% of cropping land for short-season seed varieties; 15-20 % medium- season seed varieties

50-60% of cropping land for short-season seed varieties; consider letting 30% land unplanted.

ZONE III

70-90% of cropping land for short-season seed varieties; 10-20% medium seed varieties

60-80% of cropping land for short-season seed varieties; 15-20% medium- season seed varieties

30-40% of cropping land for short-season seed varieties; consider letting 60% land unplanted digiSoft AgroMeteorology Science

Thank You; Merci; Obrigado; Zikomo; Siyabonga; Tatenda

11/24/2021

Digitron-CAMDT/DSSAT

CROP YIELD PREDICTION MODELLING

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