W1-6:
Development of Information Platform to Design Adaptation and Mitigation Strategies of Major Crops against the Predicted Climatic Changes in Asian Monsoon Region

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Introduction

Agriculture in Asian monsoon region is not only influenced by global climate change, but also contributes to climate change by acting as a source for greenhouse gases (GHG).

- Variations in temperature and precipitation due to climate change strongly influence crop productions.
- CH$_4$ and N$_2$O emitted from agricultural sector are two of major GHG.

The necessity for designing adaptation and mitigation strategies of agriculture against the predicted climatic changes is increasing.
Database for planning adaptation and mitigation strategies (Japan)

(Osawa et al, 2012)
1. Agro-Meteorological data
   (1) MeteoCropDB
   (2) 1km grid data

2. Soil data

3. Greenhouse gases data
   (CH$_4$, N$_2$O)

4. Agricultural statistics data
Soil Database for agricultural land (Japan) (Takata et al., 2009, 2011a,b)
Database for Agricultural Statistics

(1kmX1km grid data in Japan) (Kohyama et al., 2003)
Structure of Agro-meteorological database (MeteoCrop DB)

- **Meteorological Data**
  - AMeDAS
  - Meteor. stations

- **GIS Data**

- **Crop database**

- **Crop exp. Data**
  (+ management)

- **Soil database**

- **Crop database**
  (+ management)

- **Crop exp. Data**

- **Meteorological Database**
  - Micro-meteor. model
  - Rice growth model
  - Water temperature
  - Panicle temperature
  - Growth stage ...

- **Soil Data**

- **Daily Meteorological Data**
  - AMeDAS (~850 sites)
  - Meteor. stations (~156 sites)

1. Analysis of effect of recent climate change on rice production
2. Development of rice growth model (validation of the model, etc.)

- Risk assessment for future rice production
- New technologies (breeding, soil and crop management)

(Kuwagata et al., 2011)
<AMeDAS and surface meteorological observatories>
Procedure for evaluating panicle temperature

(Input meteorological data)

1. solar radiation
2. downward long-wave radiation
3. wind speed
4. Air temperature
5. humidity (above canopy)

Sub-model for panicle heat balance

Tw: water temperature
TL: lead temperature
Tp: panicle temperature

Micro-meteorological model of rice canopy

canopy structure (LAI)

Temperature Humidity

(TYoshimoto et al, 2011)
Daily Agro-Meteorological data in the database (MeteoCrop DB)

(about 850 AMeDAS sites in Japan, 1977–2012)
Agro-Meteorological database (MeteoCrop DB) for estimating water and panicle temperature of rice

Fig. 1 Example of calculating growth stage (DVI) and water temperature ($T_w$).

Fig. 2 Example of calculating rice leaf ($T_L$) and panicle ($T_P$) temperatures.
Evolution of air and water temperature in rice paddy (Miyazaki, 2002)

(a) Saito (observation) year: 2002

(b) Saito (MeteoCrop DB) year: 2002

Evolution of air and water temperature in rice paddy (Miyazaki, 2002)
Development of Information Platform to Design Adaptation and Mitigation Strategies of Major Crops against the Predicted Climatic Changes in Asian Monsoon Region (GRENE-ie program) (Agricultural Effect Research Team 3; AER-3) (NIAES)

2011 - 2014
- Collecting data of meteorology, soil, land cover and agriculture
- Evaluation of soil temperature and moisture of cropland
- Compilation of agro-climate change scenarios
- Development of information platform for adaptation and mitigation strategies

2012 - 2014
- Foreign Institutes for joint research

2014
- Measurement of greenhouse gas emissions from cropland
- CCR-1
- Rice field
- Database for planning adaptation and mitigation strategies
- CCR-2
- AER-1, 2

2015
- Foreign Institutes for joint research
Summary

(1) The necessity for designing adaptation and mitigation strategies of agriculture against climatic changes is increasing.

(2) We introduce agro-environmental database for this purpose in Japan. MeteoCrop DB is the agro-meteorological database for studying the impacts of climate change on rice in Japan.

(3) Now, we start to construct the information platform for adaptation and mitigation strategies against climatic changes in Asian monsoon region.

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Thank you