Integrated Database for Agricultural Decision Support

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Contents

- Decision Support System for Agriculture
- Integrated Databases
  - MetBroker
- Crop Models
  - Agricultural Model Framework
- Conclusion

DSSAT

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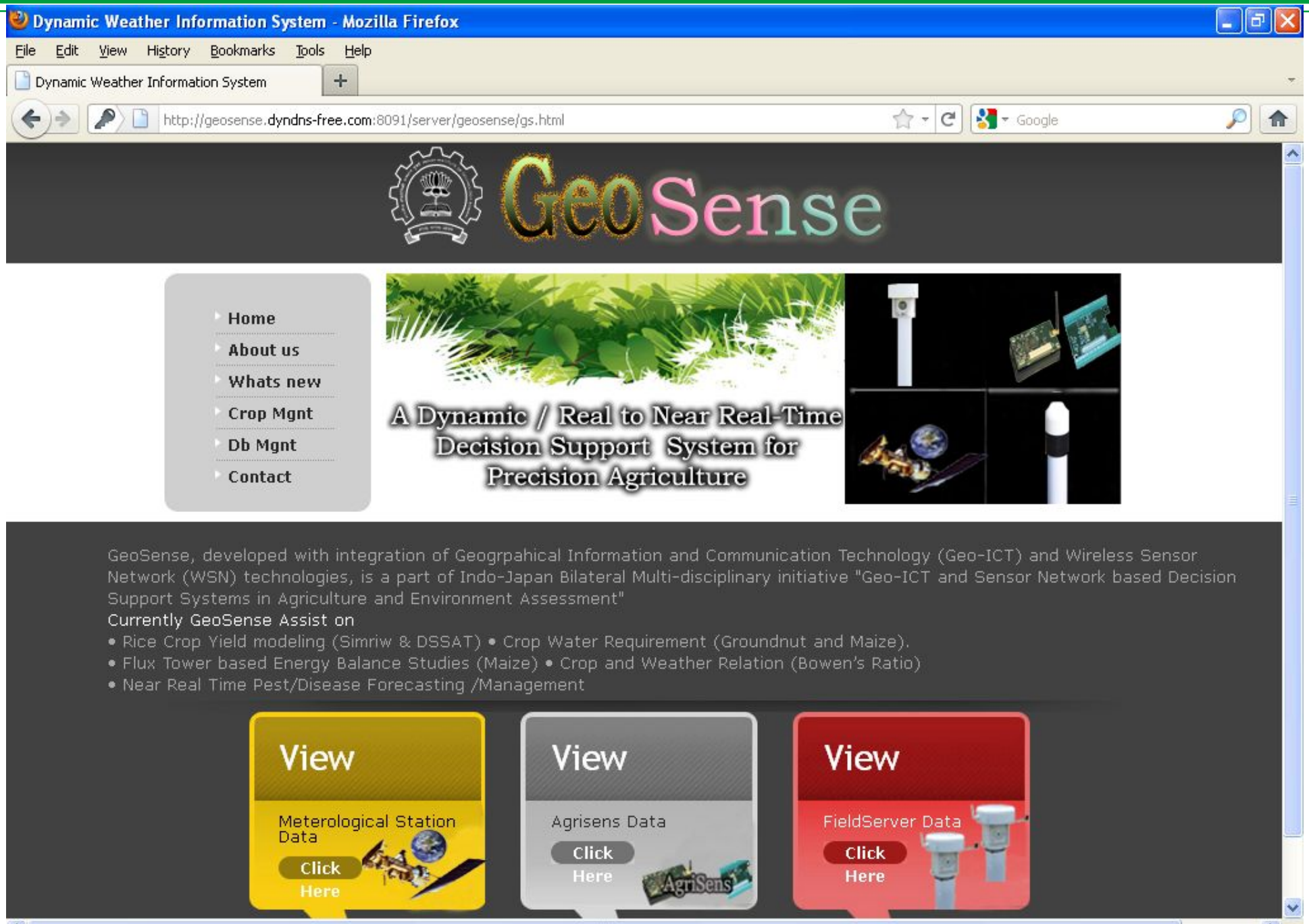
Decision Support Systems for Agrotechnology Transfer

- Developed by the International Benchmark Site Network for Agrotechnology Transfer (IBSNAT) project.
- Simulates crop growth and its development over time.
- Simulates soil water, carbon and nitrogen processes and management practices.
- A framework and plant modules
  - Support quick analysis/optimization of alternative options for decision makers.
  - Includes several plant modules e.g. rice, wheat, maize, potato..

Agricultural DSS, India



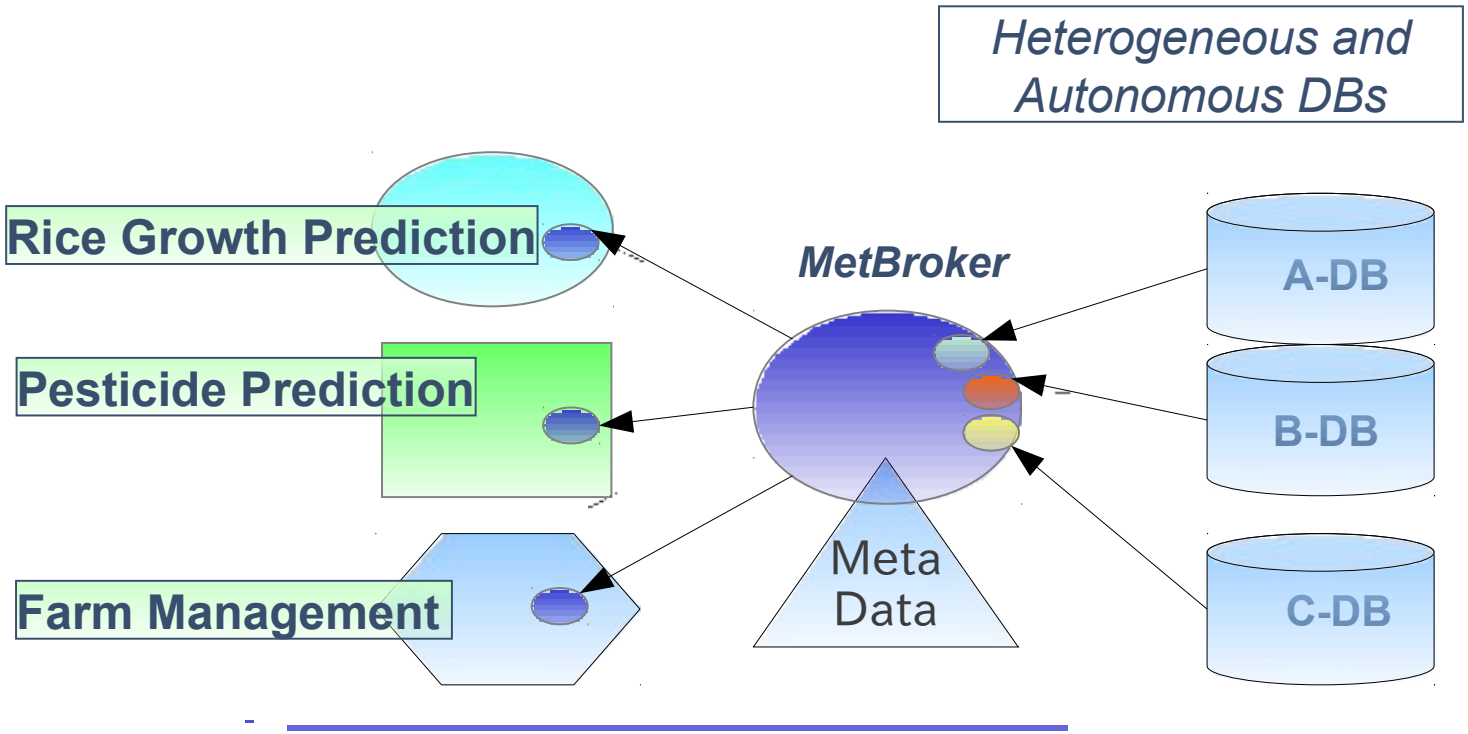
Agricultural DSS

- Data
  - Weather (Observation/Forecast)
  - Field Monitoring (Soil, Water, Crop)
  - Satellite Data
  - Agro Economy
  - etc.
- Crop Models
  - Rice, Wheat, Maze, Cassava, etc.
- Solution
  - Varieties, Cropping Systems, etc.

Integrated Database

MetBroker

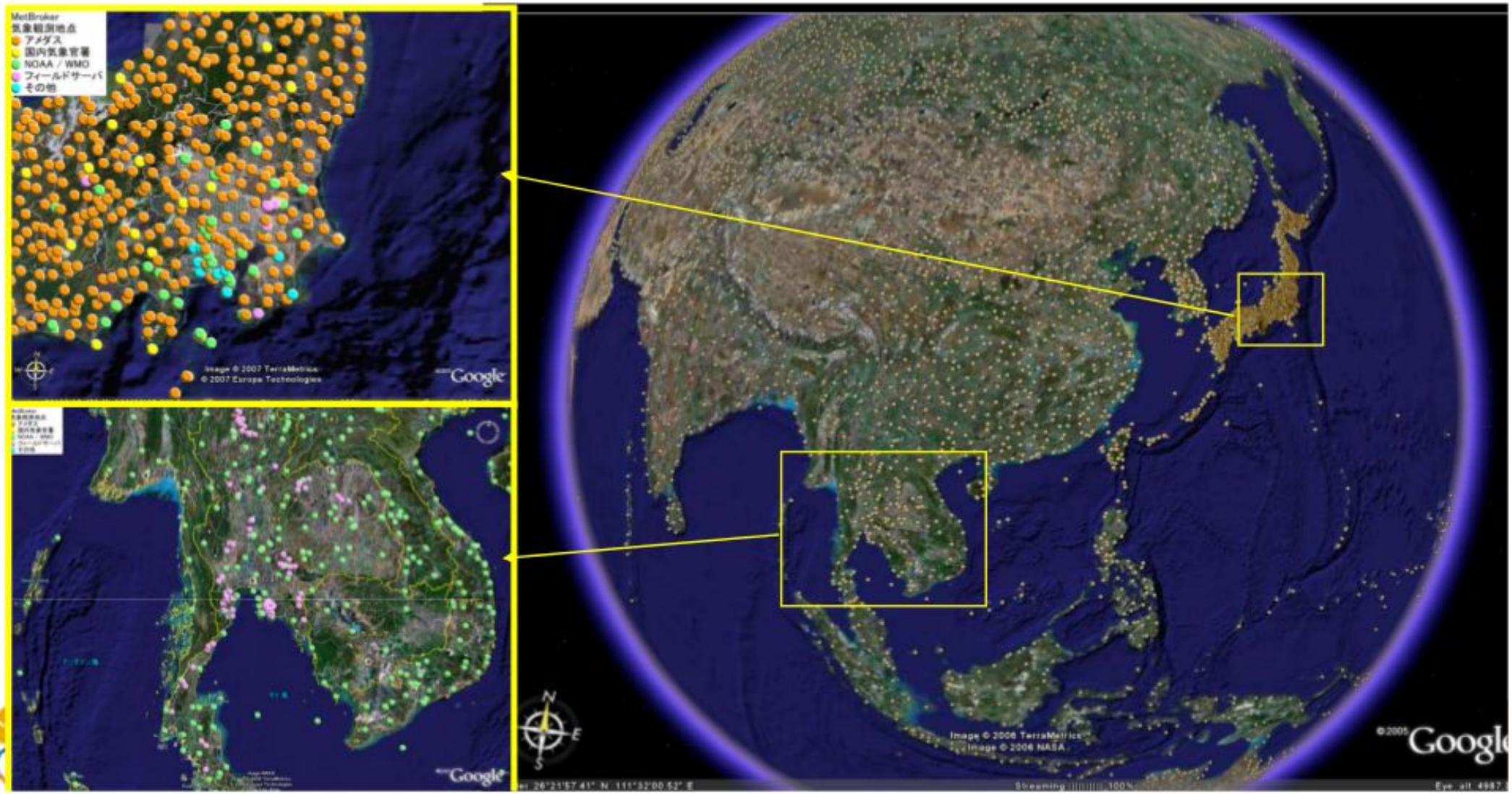
heterogeneity among data sources is a big issue in the Internet (structure, access methods, etc.)
Data brokers provide consistent access to those heterogeneous data sources



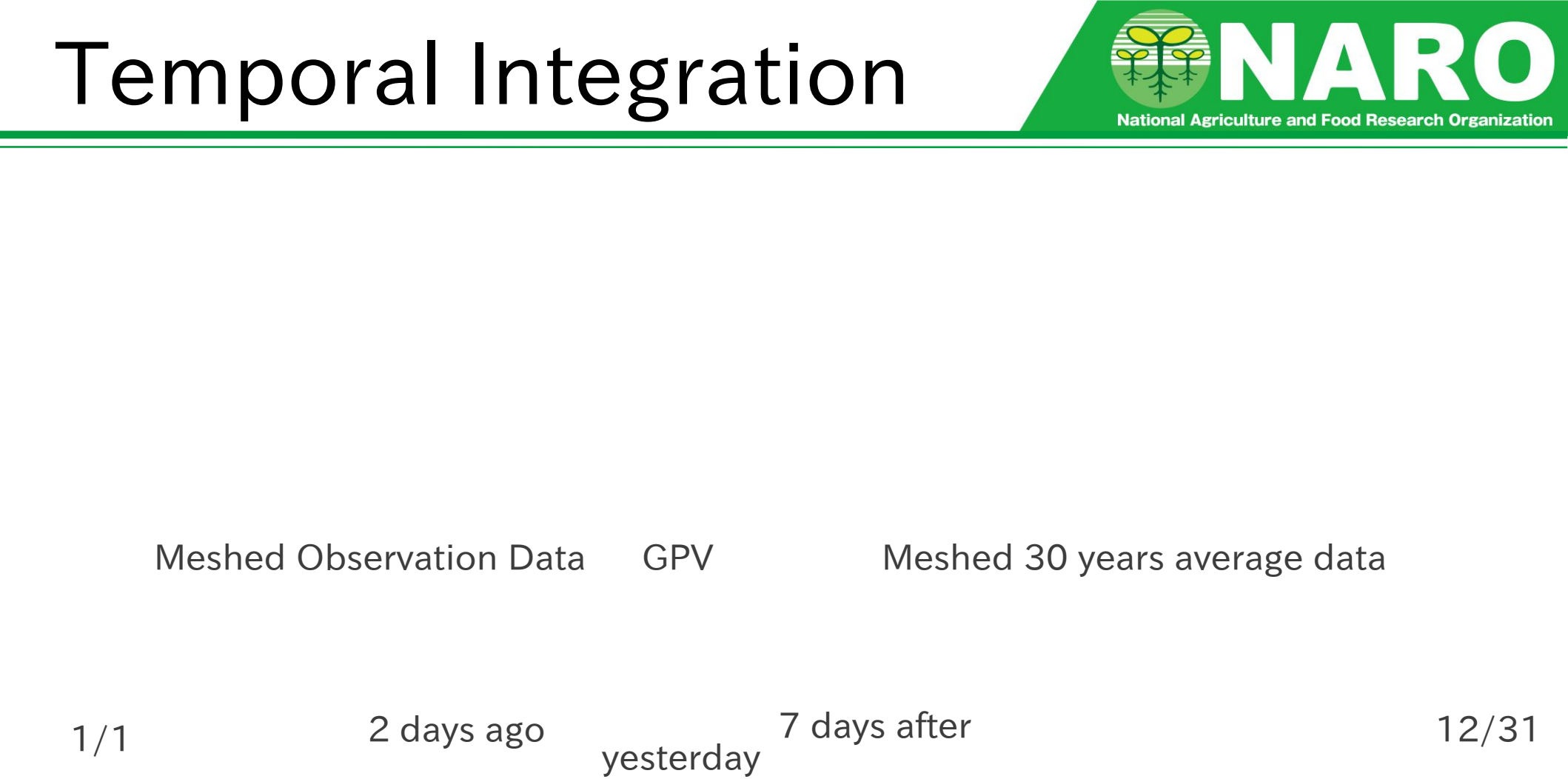
Heterogeneity is absorbed by brokers (mediators)

Http://www.agmodel.org/

Spatial Integration



Temporal Integration



MetBroker Applications

Data Schema

Data Schema for Agri.

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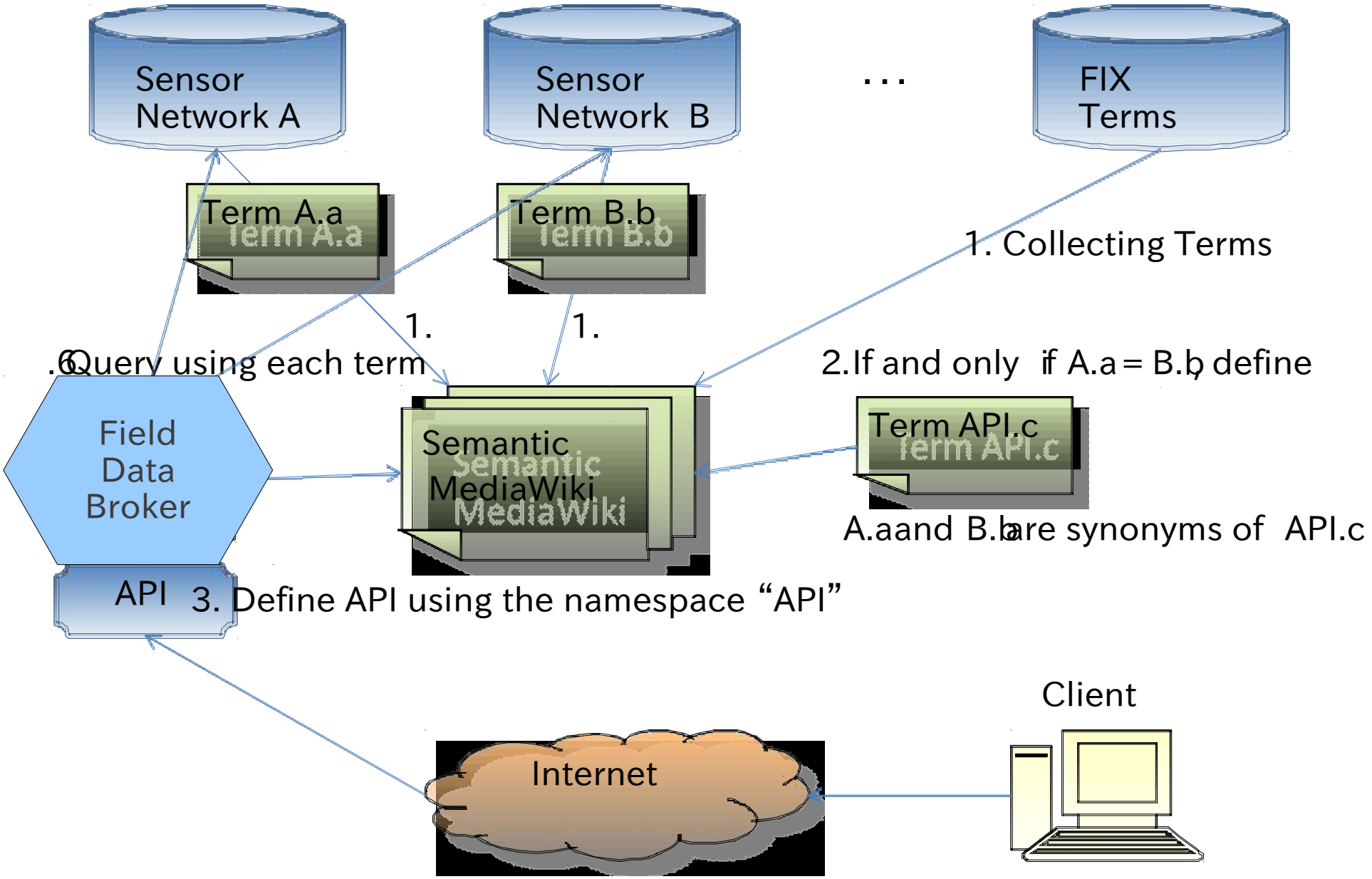
- AgroXML
  - http://www.agroxml.de/
- AgXML
  - http://www.agxml.org/
- BIX-pp (Bio-Information Exchange for plant production)
  - http://bix-pp.info/index.htm
- Data Schema for agricultural field observation data?

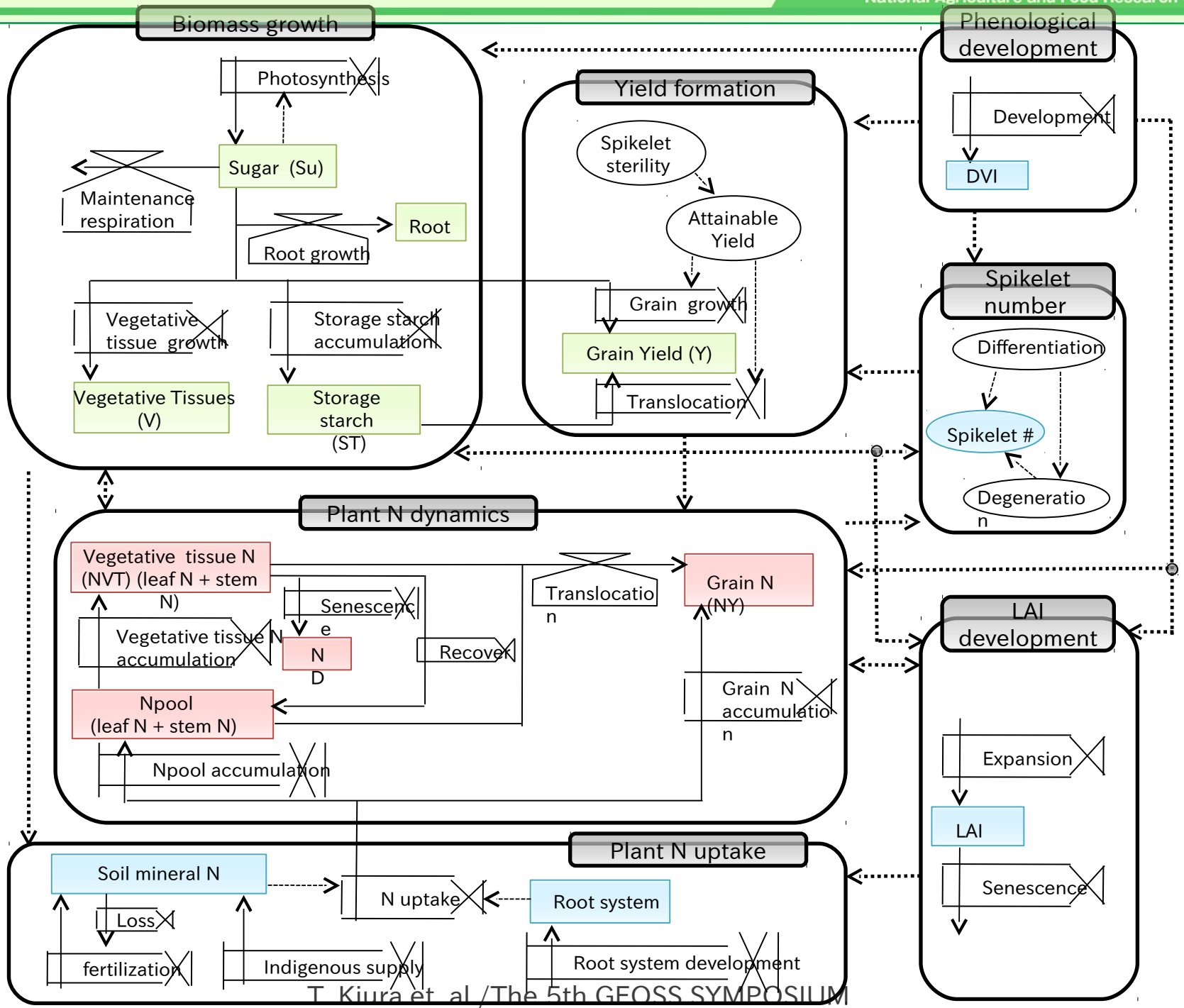
Farming Data Exchange (FIX)

FIX Data Stricture

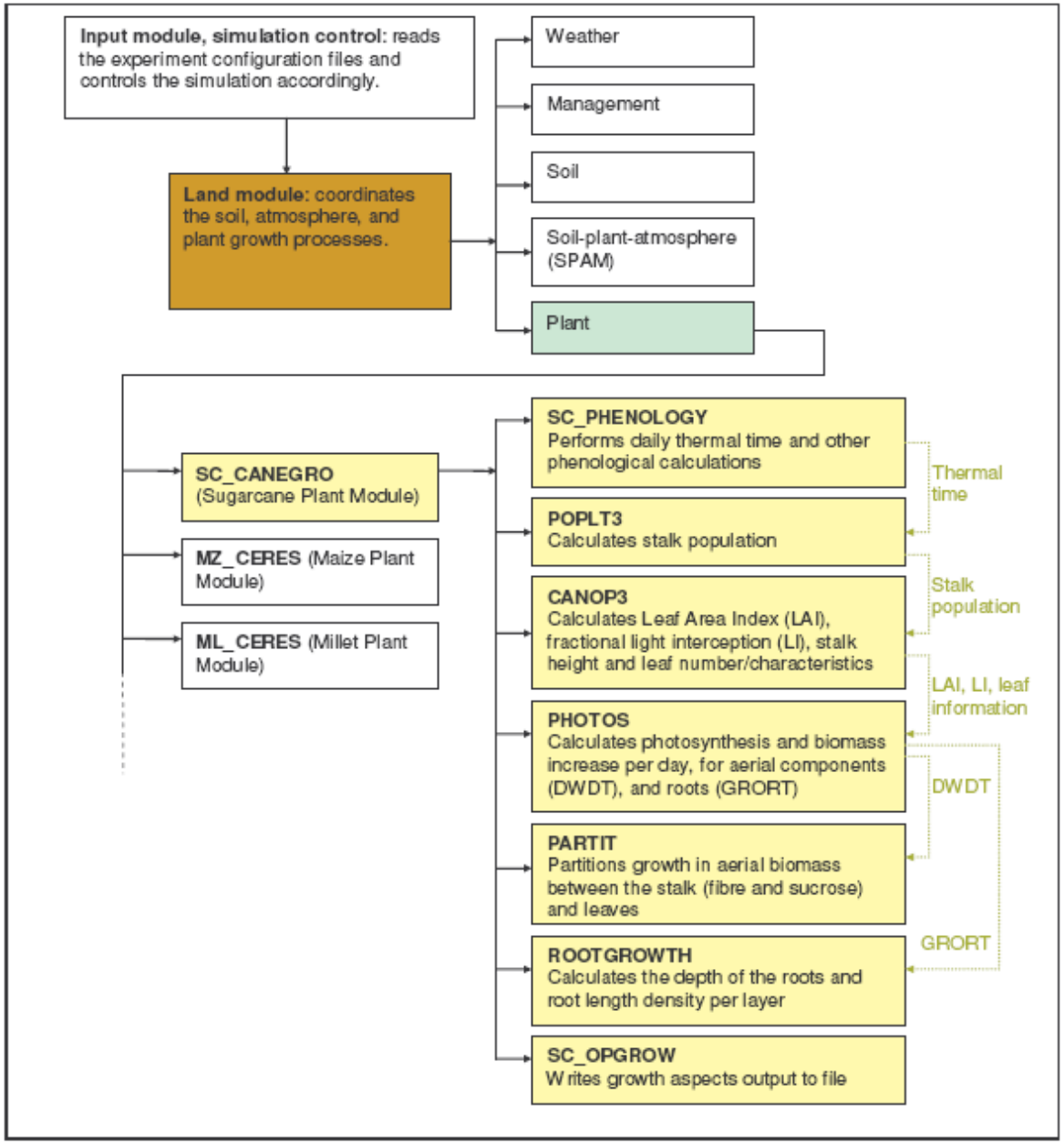

Sensor Network A
Sensor Network B
...
FIX Terms
Term A.a
Term B.b
1. Collecting Terms
1.
1.
.6Query using each term
2.If and only if A.a = B.b, define
Field Data Broker
Semantic MediaWiki
Term API.c
A.aand B.bare synonyms of API.c
API
3. Define API using the namespace “API”
Client
Internet

Crop Model

Rice Model


Biomass growth
Photosynthesis
Sugar (Su)
Maintenance respiration
Root
Root growth
Vegetative tissue growth
Storage starch accumulation
Vegetative Tissues (V)
Storage starch (ST)
Yield formation
Spikelet sterility
Attainable Yield
Grain growth
Grain Yield (Y)
Translocation
Phenological development
Development
DVI
Spikelet number
Differentiation
Spikelet #
Degeneration
Plant N dynamics
Vegetative tissue N (NVT) (leaf N + stem N)
Senescence
Vegetative tissue N accumulation
ND
Recover
Translocation
Grain N (NY)
Npool (leaf N + stem N)
Npool accumulation
Grain N accumulation
LAI development
Expansion
LAI
Senescence
Plant N uptake
Soil mineral N
Loss
fertilization
Indigenous supply
N uptake
Root system
Root system development

DSSAT-Canegro Sugarcane Model



Agricultural Model Framework

DDSAT Framework

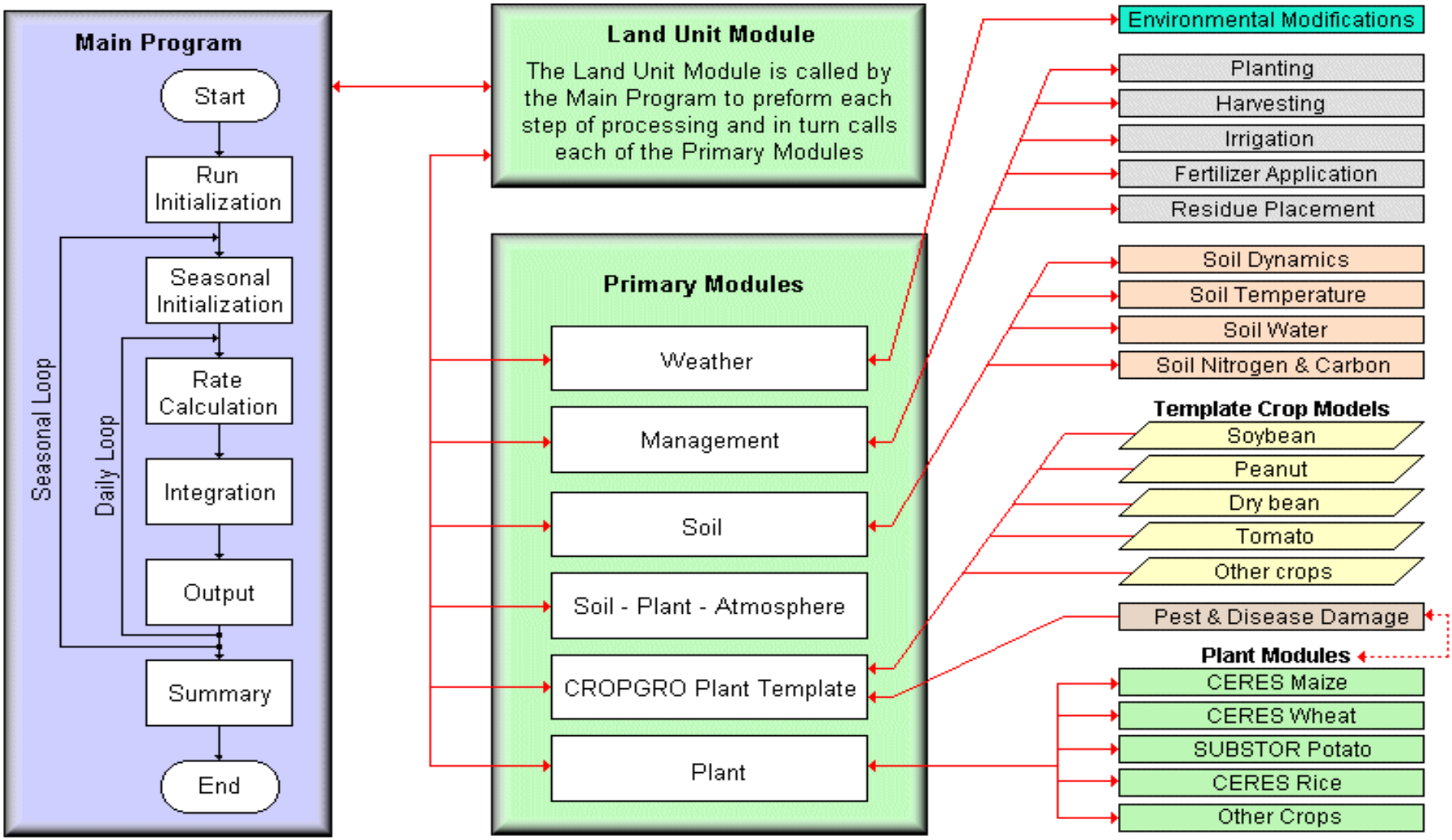


Figure 1. Overview of the components and modular structure of the DSSAT cropping system model.

Agricultural Model Framework

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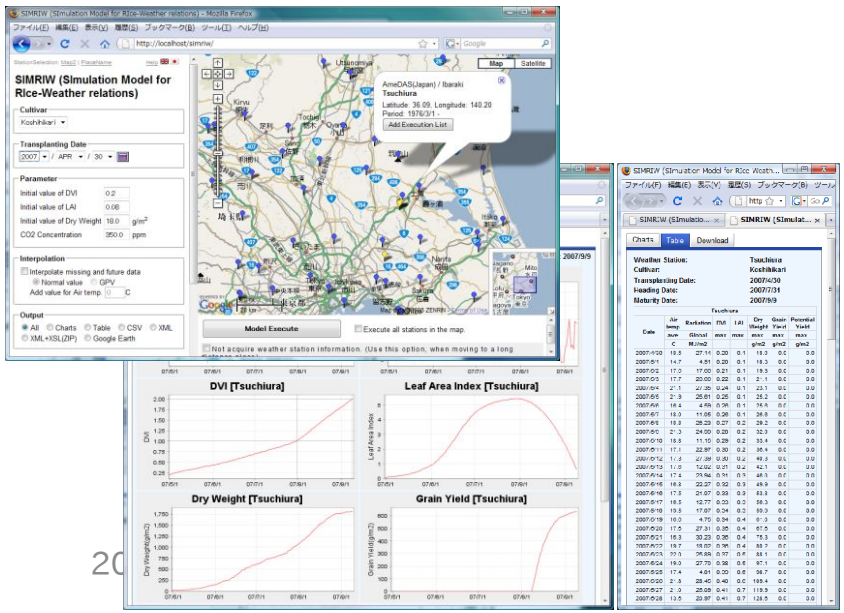
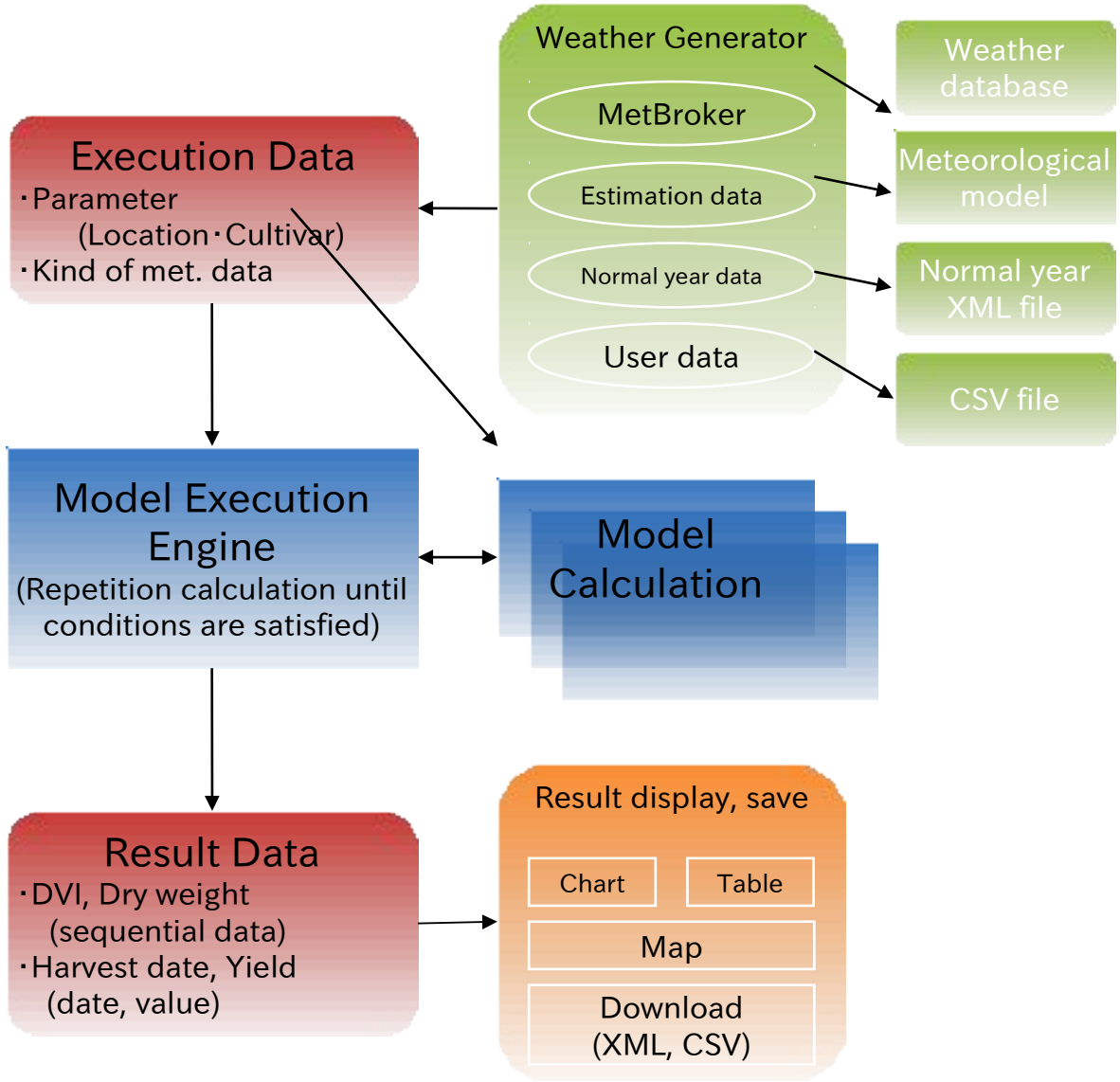
The functions provided by the framework

- Model Execution Engine
- Data Structure
- Weather Generator
- GUI Components





Agricultural Cloud

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AER2: Elucidation of the effects of climatic changes on major crops in Asian monsoon region - Construction of an Evaluation System Using Meteorological Data and Crop Models - **(NARO)**

2011 **Collecting crop models & params.**
(for Asian Monsoon Region)

Rice Cultivar A	Rice Cultivar B	・・・
Spinach	Cassava	・・・


Rain Fed Rice Field

Previous Results
- Clop models
- Web applications
- Framework for developing applications

2012 **Developing cultivation simulators**
with flexibility which can exchange a crop model

Improvement of the framework

Rice cultivation possibility prediction tool

2013 - 2014 **Simulator execution** ← Verification Correction
↓
Climate change evaluation

Results of Climate Change Research
Meteorological Data + Climate Change Coef.

Improvement of simulators

2015 **Implementing Web applications**
→ **Deploying to DIAS**

2012/2/16 APAN2012, Chiang Mai 8

Conclusion

- Creating Integrated Database my be difficult and time consuming work. So virtually integrated databases. But it is still hard work. API, ensure interoperability of data, is required.
- Crop Models are developing independently and difficult to check their performance. Agricultural Crop Model Framework is required.

Thank you.

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“Nosyo NAVI” supported by MAFF

Japan

APAN AG-WG

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- Asia-Pacific Advanced Network (http://www.apan.net) Agricultural Working Group
  - Sensor Network Interoperability
  - Weather Data Interoperability
  - Crop Model Interoperability

  - Create Demo Site