Agricultural Decision Support System with Kids' Sensors

Seishi Ninomiya
Institute of Sustainable Agro-eco Services
Graduate School of Agriculture and Life Sciences
The University of Tokyo

Agriculture in 20th century was very successful in terms of supporting explosively growing population.

But it was fully based on high input of chemicals and energy

But its drawbacks are serious now…..

- **Serious impacts on environment**
  - Chemical fertilizer, pesticides etc
  - Water pollution, damage on ecosystem
  - Exhausted and unhealthy soil
- **High resource consumption**
  - Energy for machinery and chemicals
  - Water consumption
- **Food safety and reliability issues**

- **We are still facing food shortage crisis**
  - Population increases by 200,000 per day
  - Usage of food for bio-fuel
  - Meat consumption increase
  - Unstable and short water supply
  - Land shortage and degradation
  - Damage by global warming and frequent extreme whether conditions

- **Agriculture in 21st century has to secure several things simultaneously**
  - High productivity and profit performance of farmers
  - Sustainability
    - Low impact on environment, low emission
    - Sustainable resource management
  - Food safety
  - Robustness against global warming

Paradigm shift from maximization to optimization, harmonizing with ecosystem services while securing productivity, is needed

An example of such optimization

- **Reduction of pesticide application results in**
  - Cost reduction of materials and labor
  - Lower impact on environment
  - Lower CO2 output
  - Food safety

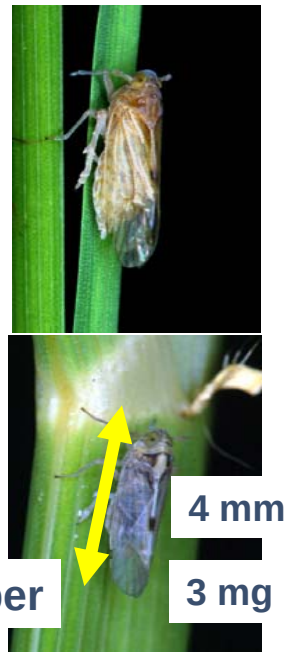
- **To reduce pesticide**
  - Timely and pinpoint protection (application)

- **For timely and pinpoint protection**
  - Prediction of pest emergence
  - Optimal crop management

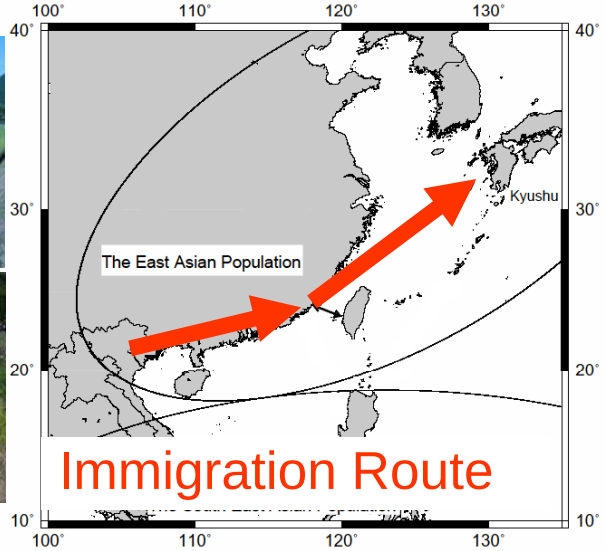
ICT can help these processes in many aspects

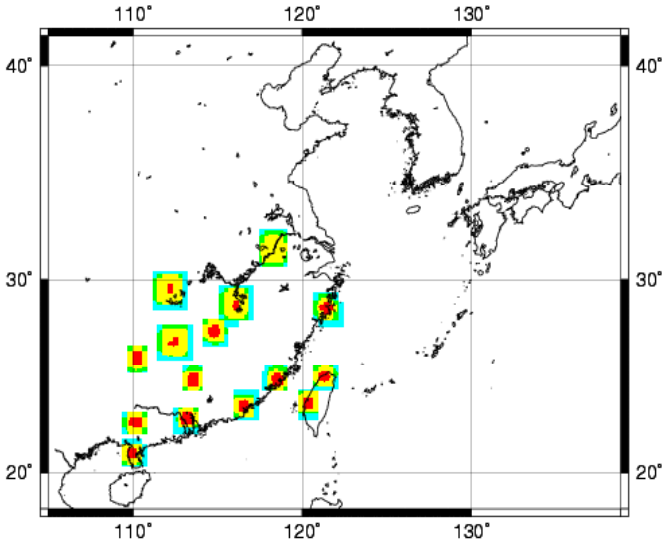
Airborne pest immigration prediction

- **Weather forecast to predict stream speed and direction**
- **Particle diffusion model to predict insect dispersion**
- **Identification taking-off origin**
  - Inverse simulation based on insect trap data to find candidates locations of origins
  - Satellite image analysis to identify paddies of origins among candidates
  - Crop growth model to estimate rice growth stage
- **Insect behavior model to estimate taking-off time**



Rice Hopper





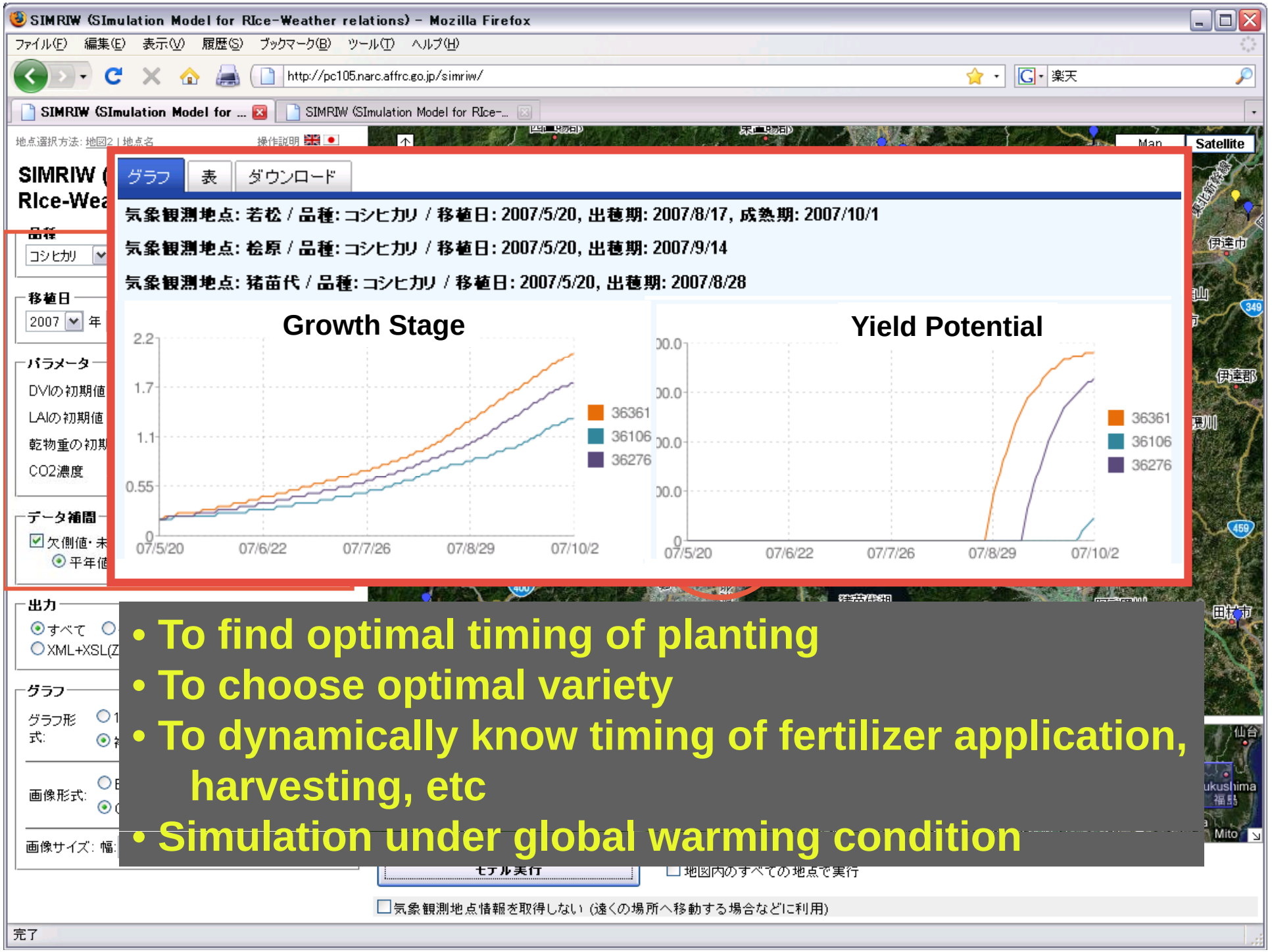
Another example of such optimization

- **Optimized reduction of fertilizer application results in**
  - Cost reduction of materials and labor
  - Lower impact on environment
  - Lower CO2 output

- **To reduce fertilizer**
  - Timely and pinpoint application
  - Use of the most optimal variety

- **For timely and pinpoint application**
  - Prediction of rice growth to know the best timing
  - To know the most optimal variety and growing season

ICT can help these processes in many aspects


SIMRIW (SImulation Model for RIce-Weather relations) - Mozilla Firefox
http://pc105.narc.affrc.go.jp/simriw/
グラフ
表
ダウンロード
気象観測地点: 若松 / 品種: コシヒカリ / 移植日: 2007/5/20, 出穂期: 2007/8/17, 成熟期: 2007/10/1
気象観測地点: 桧原 / 品種: コシヒカリ / 移植日: 2007/5/20, 出穂期: 2007/9/14
気象観測地点: 猪苗代 / 品種: コシヒカリ / 移植日: 2007/5/20, 出穂期: 2007/8/28
Growth Stage
Yield Potential
36361
36106
36276
07/5/20
07/6/22
07/7/26
07/8/29
07/10/2
• To find optimal timing of planting
• To choose optimal variety
• To dynamically know timing of fertilizer application, harvesting, etc
• Simulation under global warming condition

Simulator for Cultivation Possibility of Rice

Top Help

Yield for each cultivar | Cultivar in max yield

Cultivar

- Ishikari
- Sasanishiki
- Koshihikari
- Nipponbare
- Mizuho
- IR36
- IR64
- IR58

Incremental temperature

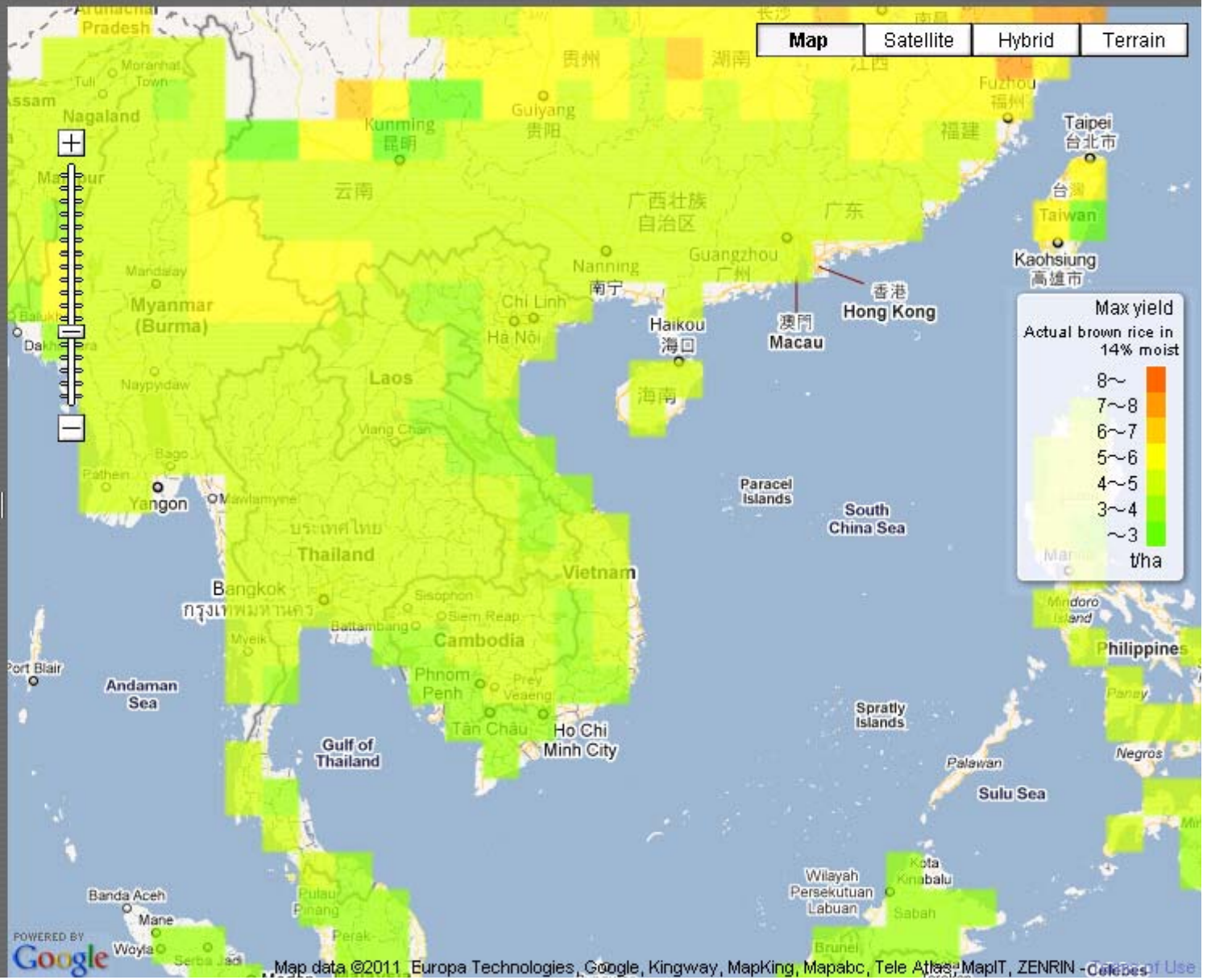
0℃ 2℃ 4℃

CO2 concentration

350ppm 525ppm

Download world wide data (zip file: about 550KB)

Download



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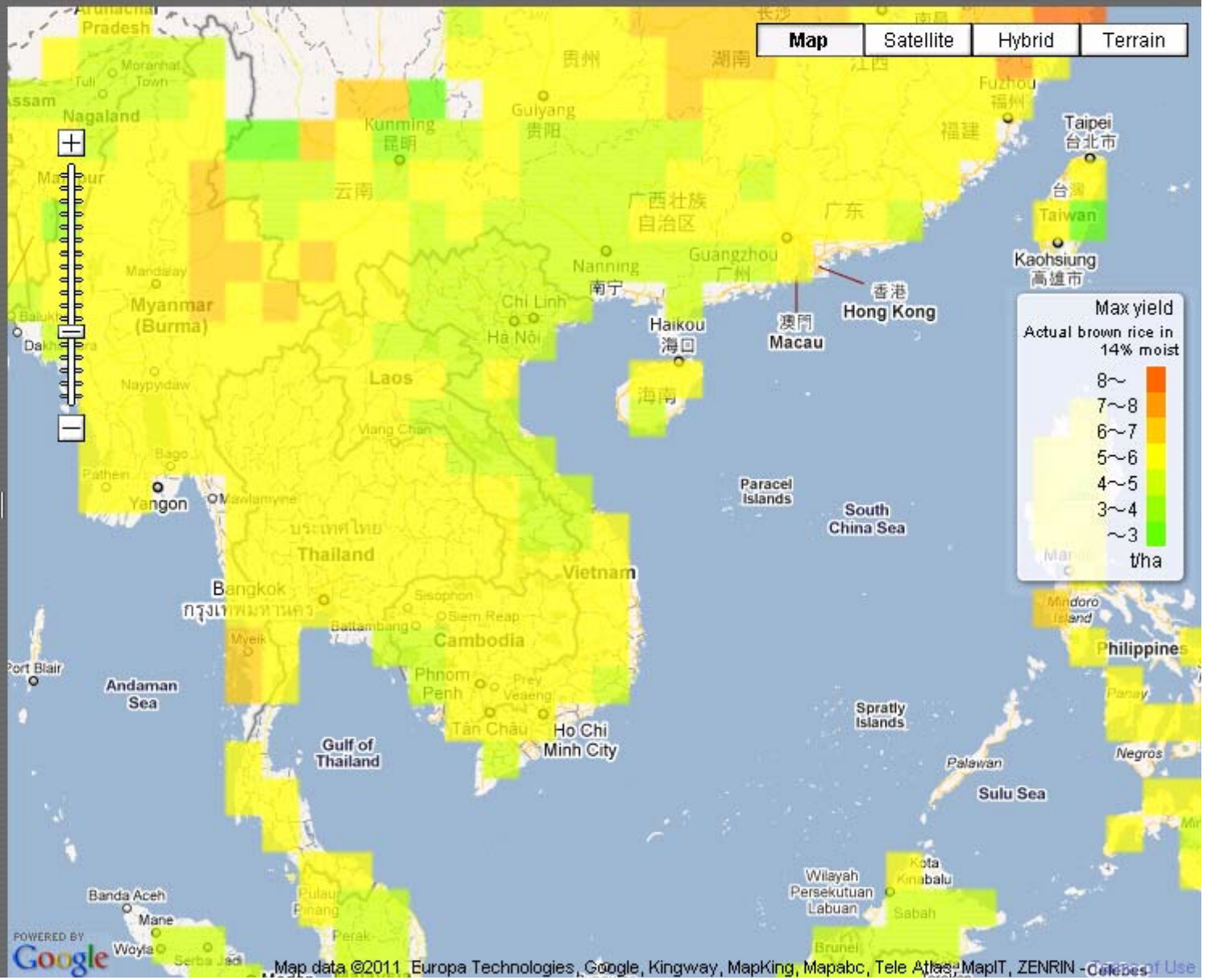

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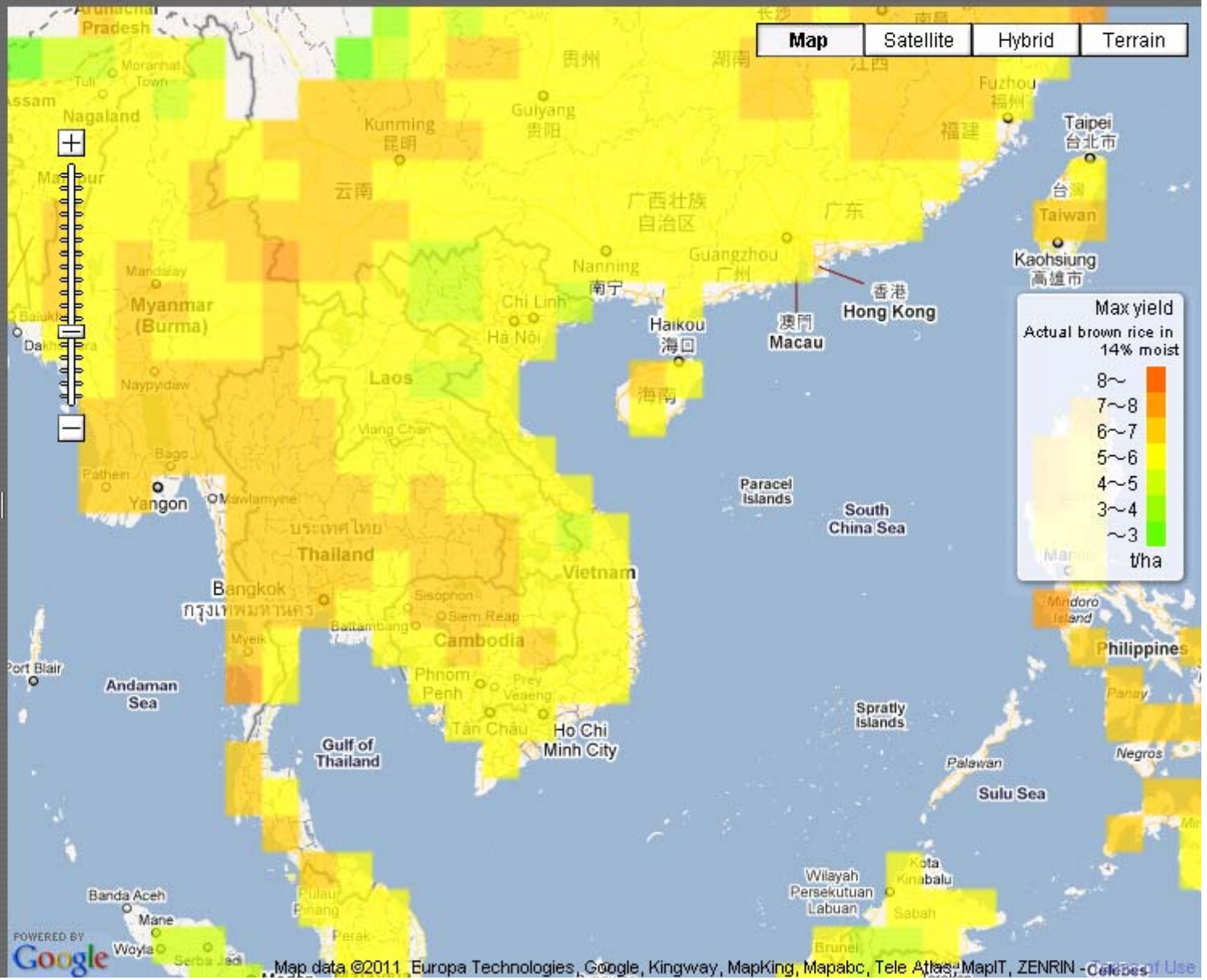

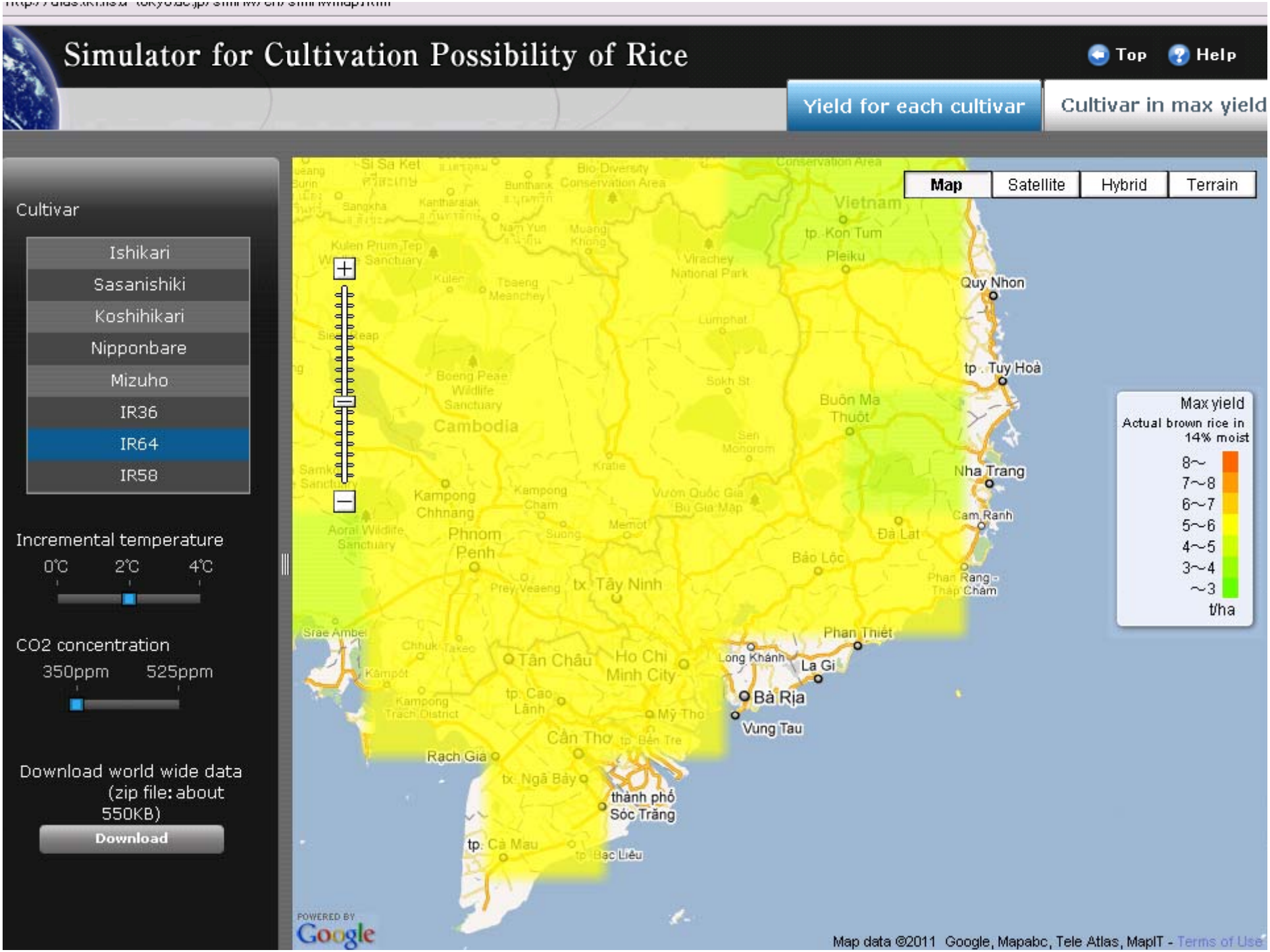
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Download world wide data
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Download
Map
Satellite
Hybrid
Terrain
Max yield
Actual brown rice in
14% moist
8~
7~8
6~7
5~6
4~5
3~4
~3
t/ha
Vietnam
Cambodia
Quy Nhon
tp. Tuy Hoà
Nha Trang
Cam Ranh
Đà Lạt
Buôn Ma
Thuột
Pleiku
tp. Kon Tum
Phan Thiết
La Gi
Bà Rịa
Vung Tau
Long Khánh
Ho Chi
Minh City
Tân Châu
tx. Tây Ninh
Phnom
Penh
Kampong
Chhnang
Kampong
Cham
Cần Thơ
Rạch Giá
tx. Ngã Bảy
thành phố
Sóc Trăng
tp. Cà Mau
tp. Bạc Liêu
Mỹ Tho
tp. Cao
Lãnh
Bảo Lộc
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To run DSS, we need ground weather data etc.

Cell phone with GPS and camera

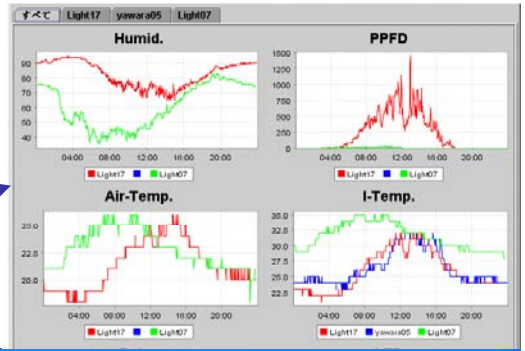
[施肥履歴の追加]

施肥履歴

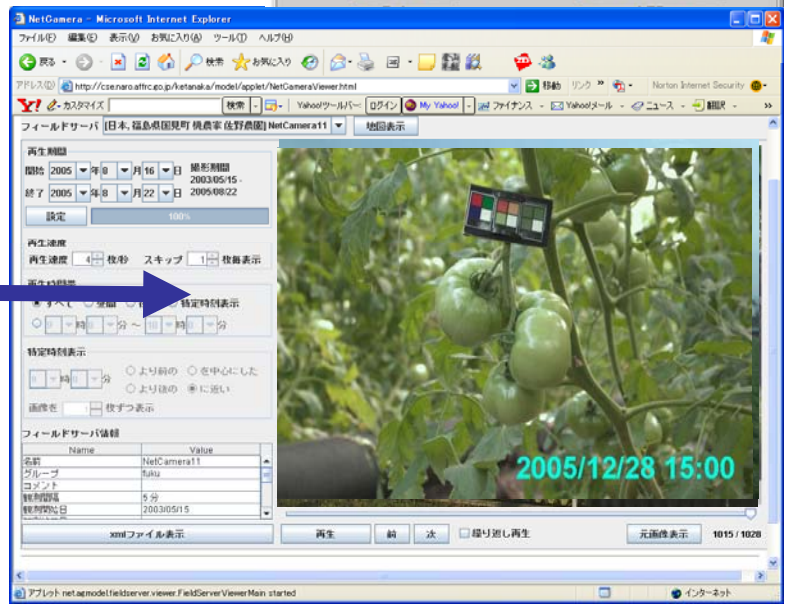
	使用年月日	肥料名(コード)	施用量	TN	TP	TK	TMg	データ入力日時
○	平成19年 4月27日	S121(A-128)	50kg/10a	5	10	5	1.5	2007/06/15 17:02:28
○	平成19年 6月20日	S444(A-136)	20kg/10a	2.8	0.8	2.8	1.2	2007/06/15 17:03:04

→選択した履歴を 編集する 実 行

N施用量: 7.8kg/10a, P施用量: 10.8kg/10a, K施用量: 7.8kg/10a, Mg施用量: 2.7kg/10a



- Air temp., humidity, solar radiation,
- soil moisture, CO2, etc.
- Camera (0.3 to 10 M pixels)
- WIFI hot spots



In YMC Viet, kids work as sensors

Air temperature and humidity

Plant height, leaf color, pests

Plant images

- **Kids’ sensors will provide spatially high density weather information**
  - Low cost and maintenance free
  - Outlier can be easily found
  - Very useful for reliable decision support
- **Long-term continuous observation makes decision support more reliable through tuning**
  - By overcoming site-specificity of agriculture

http://www.agmodel.net/DataModel/

二宮正士　snino@isas.a.u-tokyo.ac.jp