

Improvement of terrestrial carbon cycle model by effective use of various GCOM-C1 SGLI products

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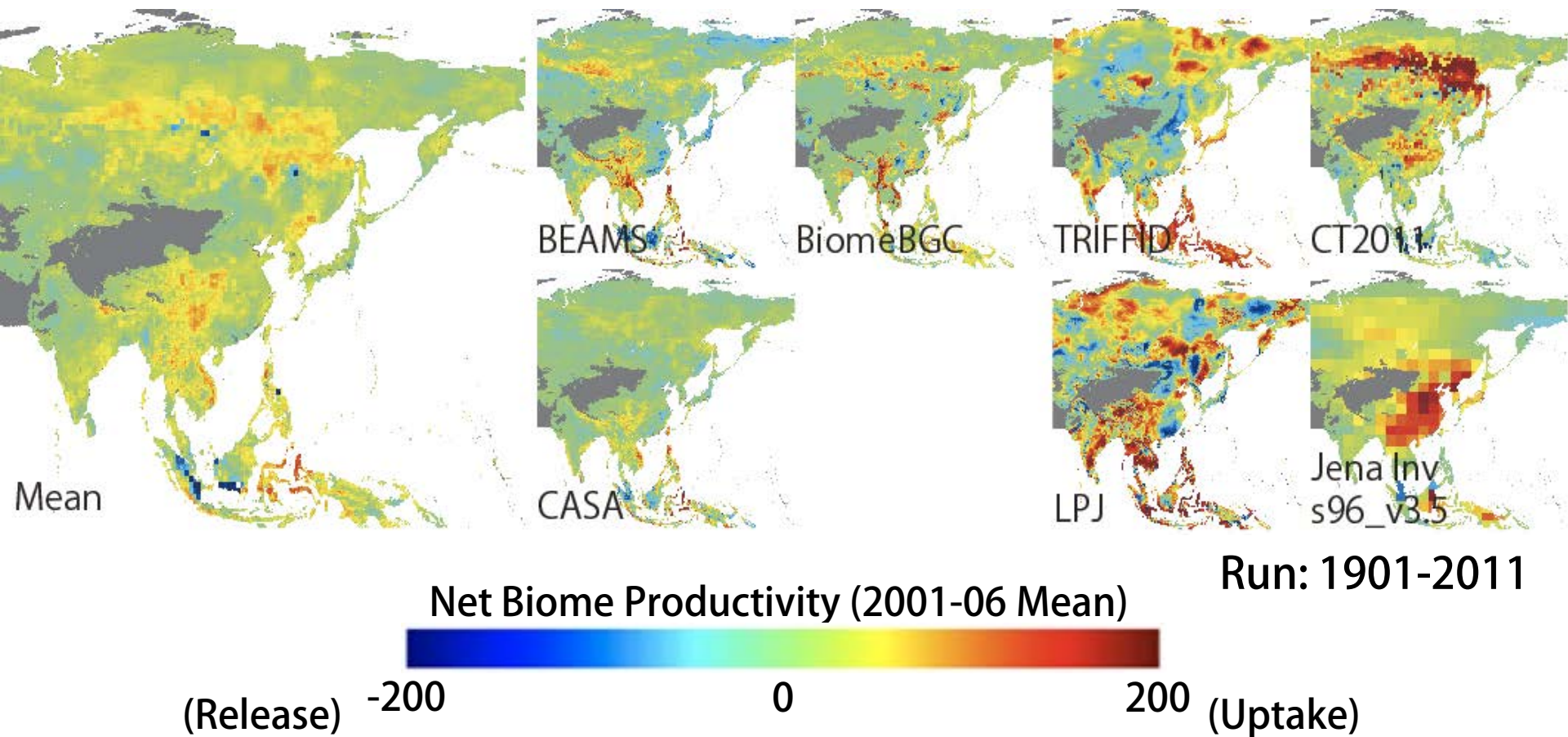
Joint PI WS of Global Environmental Observation Mission
2013.01.16 Tokyo, Japan



国立大学法人
福島大学
Fukushima University

Uncertainties in terrestrial carbon cycle models

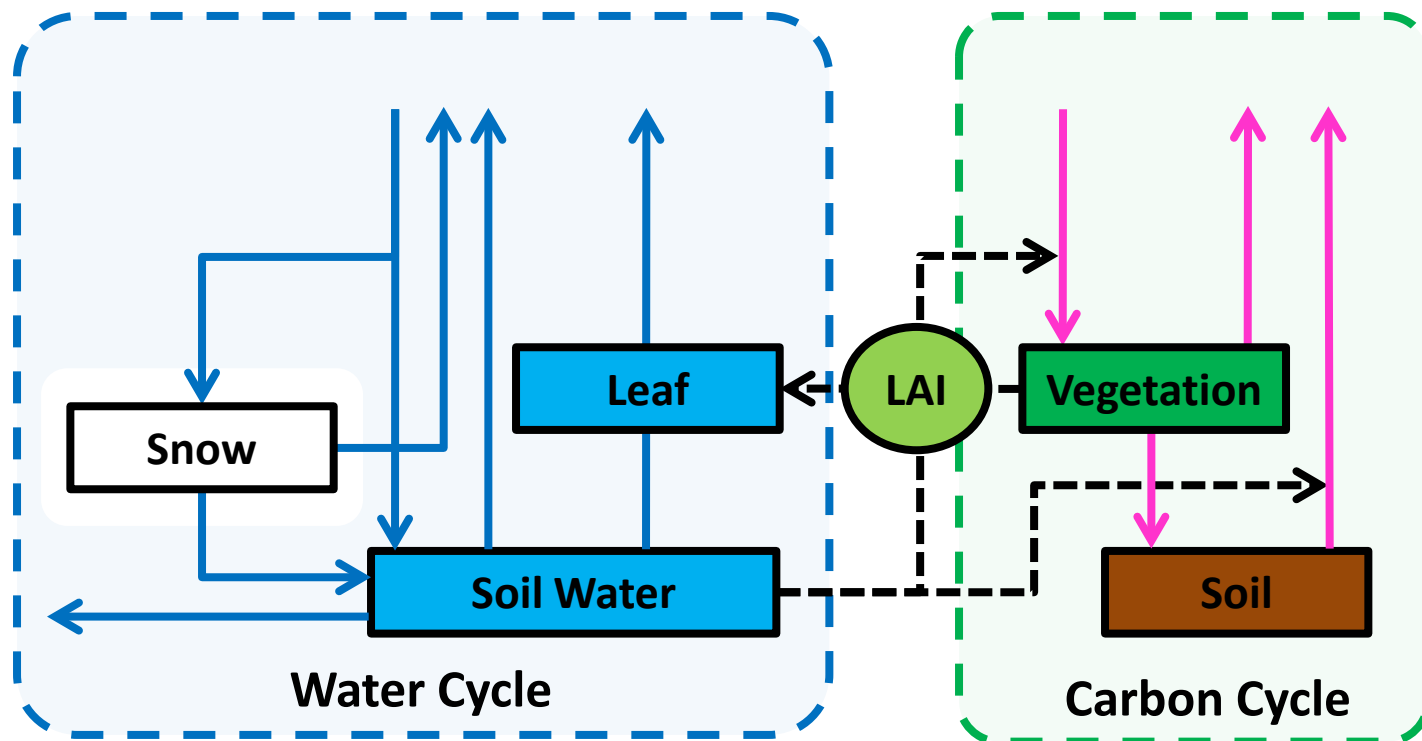
Terrestrial Carbon Budget (2001-06 average)



Need model refinement using available data
⇒ RS-based product

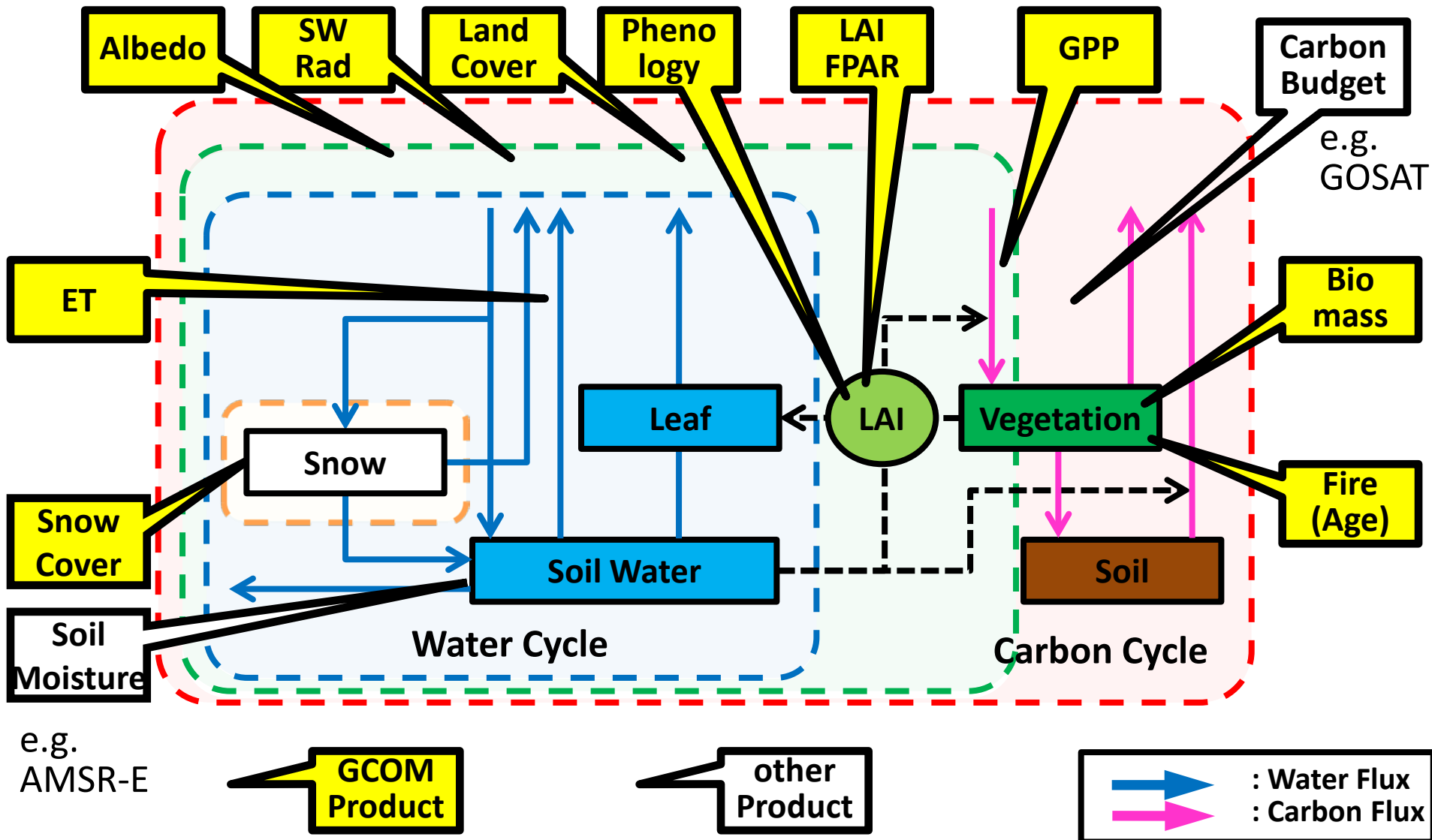
Basic structure of terrestrial ecosystem model

Ecosystem Model ; BEAMS, VISIT, BiomeBGC etc.



Role of GCOM-C1 SGLI Products on EcoMdl

Ecosystem Model ; BEAMS, VISIT, BiomeBGC etc.



Objectives for FY2013-2015

1. Data Collection for model evaluation and input
 - Search Available Useful Database

Useful data
for other groups

2. Empirical Upscaling Model
 - Refinement of Support Vector Regression
 - FLUXCOM project

Model evaluation
data

3. Potential Application of GCOM-C1 product
 - Application to Terrestrial C-Cycle Models
 - Energy, Water Cycle Data
 - Carbon Cycle Data

Current and Future
Simulation

Tasks of FY2013

1. Data Collection for model evaluation and input
 - TRY database
 - FLUXNET (AsiaFlux database)
2. Empirical Upscaling Model
 - Refinement of Support Vector Regression
 - FLUXCOM project
3. Potential Application of GCOM-C1 product
 - Snow, Solar Radiation Data
 - Evaluate Terrestrial C-Cycle Models

1. Data Collection

TRY: plant trait database

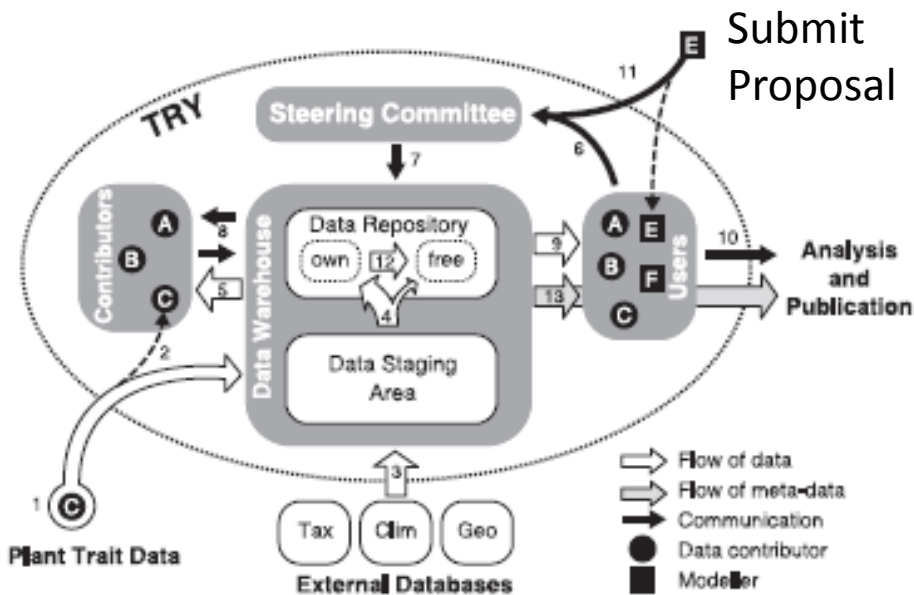


Collection of morphological, anatomical, biochemical, and phenological data of plants

3 million trait entries for 69000 plant species

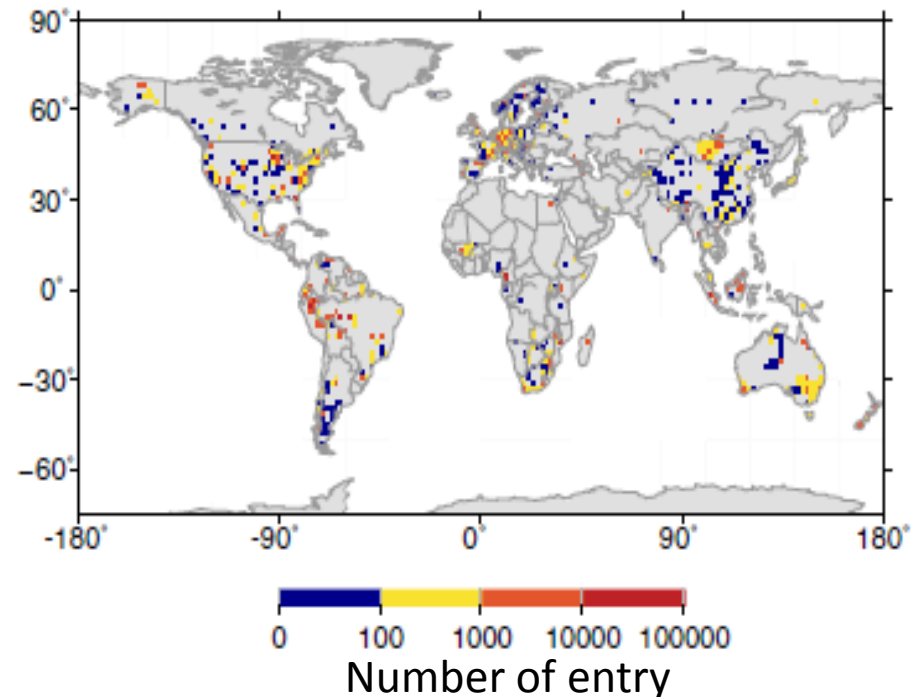
→ An ideal obs. data for constraining ecosystem models

Process of data sharing system



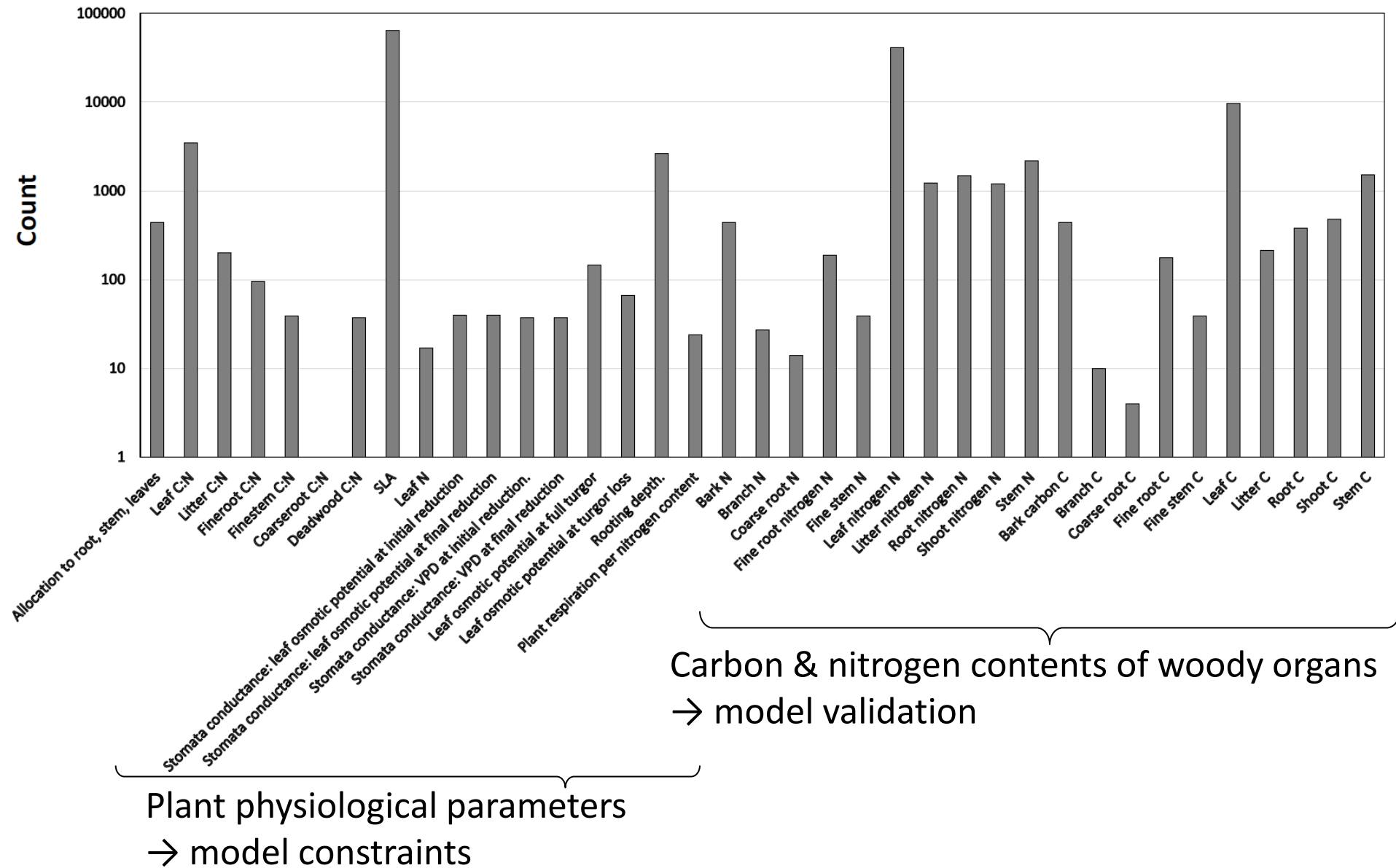
Kattge et al., 2011, GCB

Global distribution of plant trait data



1. Data Collection

Traits that can be used for constraining ecosystem models

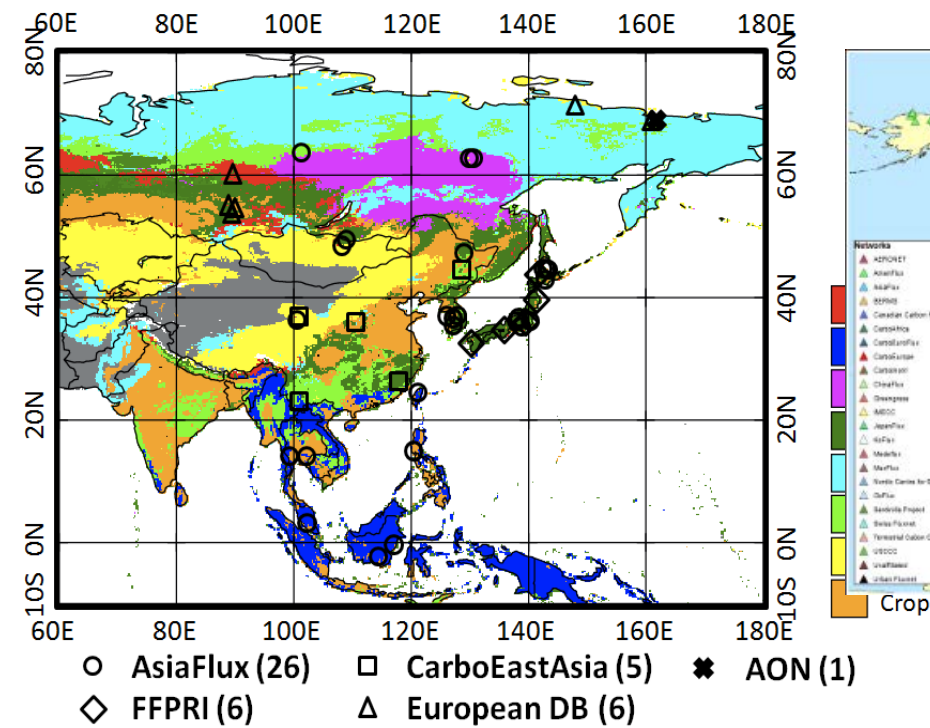


1. Data Collection

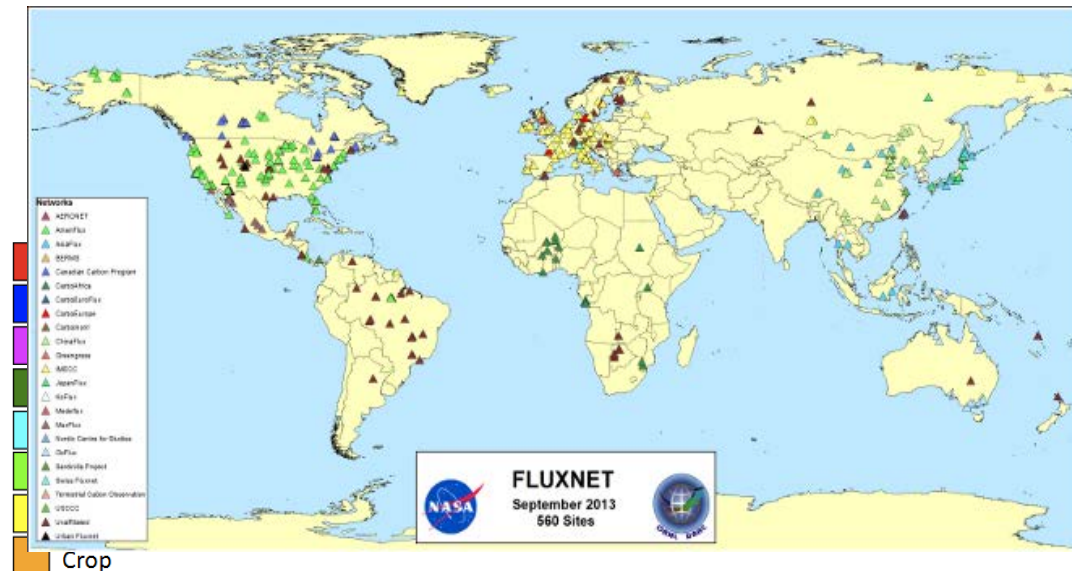
FLUXNET (e.g. AsiaFlux) Energy, Water, Carbon Fluxes

- Need consistent data preprocessing -

Integrate AsiaFlux + other DB FLUXNET gap-filled data



[QA/QC + gapfilling]



[Fair Use Data; 150 sites]

2. Empirical Upscaling

Empirical Estimation of GPP and ET

Site Obs (FLUXNET + CarboEastAsia)

RS: VIs, LST, Radiation, Land Cover



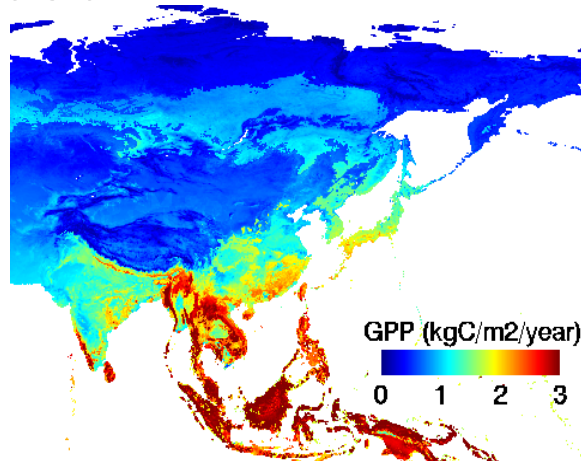
Support Vector Regression
(e.g. Yang et al., 2006, 2007)

OBS: ET, GPP

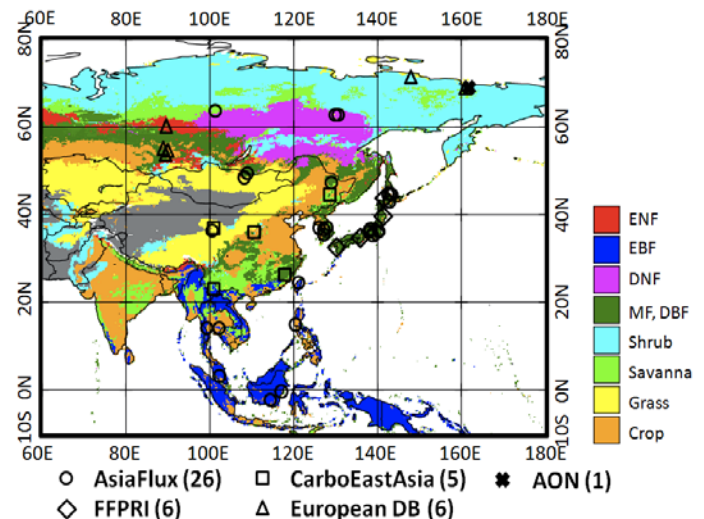
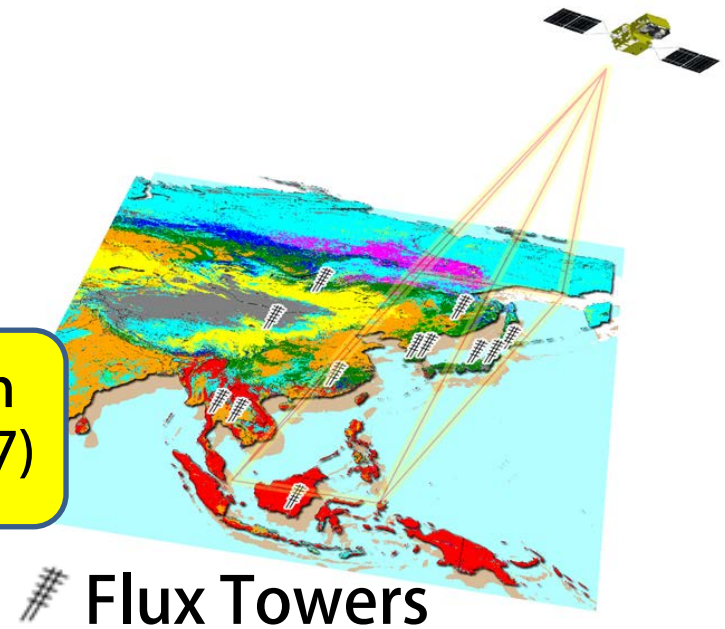
Extrapolation

Spatial

(e.g. 2000-2010 GPP from MODIS)



(Use 46 sites in
Updated Asia DB)



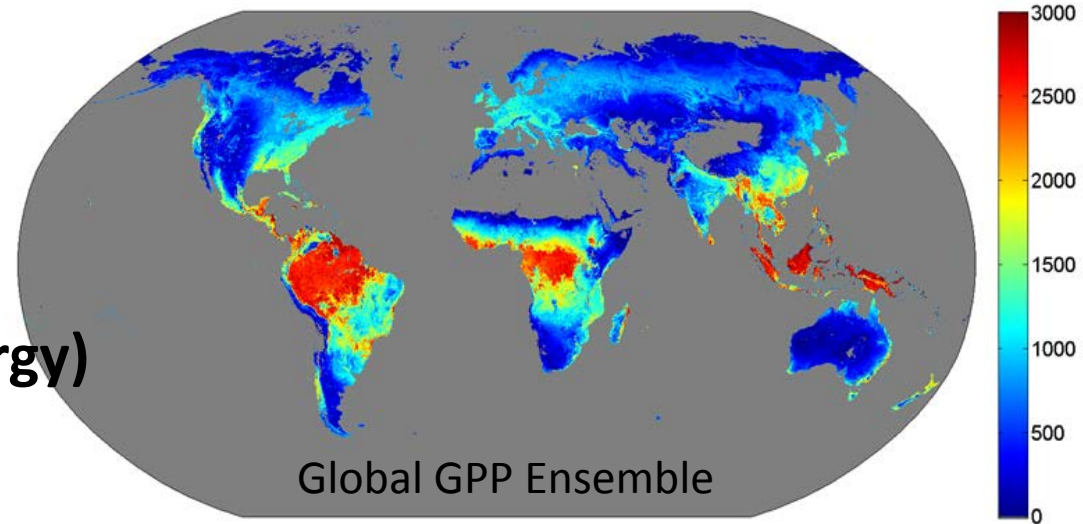
Integrated Asia DB

2. Empirical Upscaling

FLUXCOM activity

New Attempt: Model Intercomparison of Empirical Estimation of Global Fluxes (CO₂, H₂O, Energy)

Ichii : SVR method
Provide JAXA-RS as input



	Kernel methods				Tree methods		
Flux	ANN (DP)	GPR (SS)	KRR (GCV)	SVR (KI)	MTE-WLR (MJ)	MTE (MJ)	RF (MJ)
GPP _{MR}	0.7	0.7	0.7	0.7	0.71	0.69	0.72
GPP _{GL}	0.7	0.7	0.7	0.69	0.7	0.68	0.72
TER _{MR}	0.6	0.6	0.62	0.6	0.61	0.6	0.64
TER _{GL}	0.56	0.56	0.57	0.57	0.57	0.55	0.6
NEE	0.43	0.38	0.43	0.42	0.47	0.44	0.49

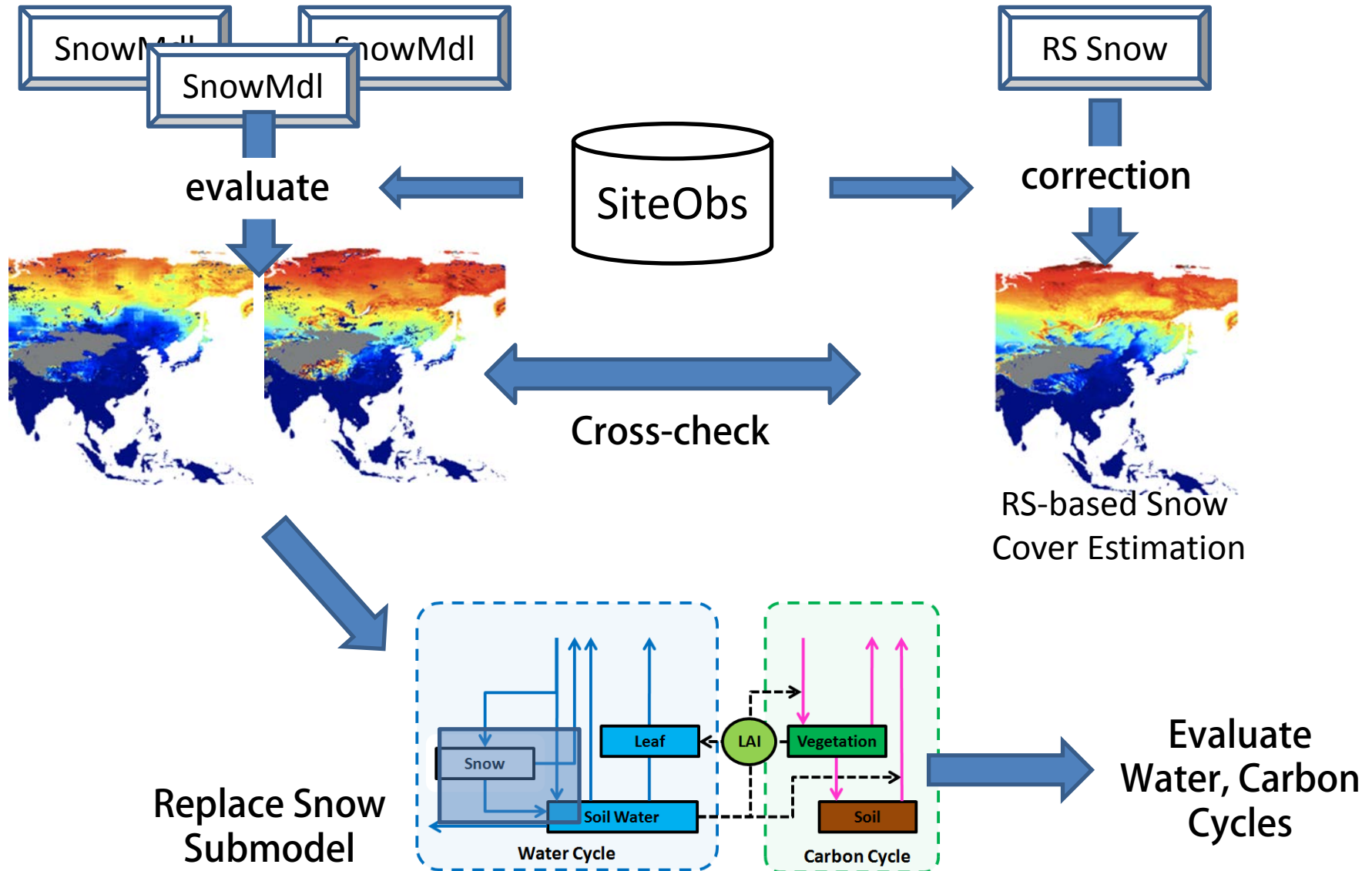
Model Efficiency

$$E = 1 - \frac{\sum_{t=1}^T (Q_o^t - Q_m^t)^2}{\sum_{t=1}^T (Q_o^t - \overline{Q_o})^2}$$

Leader: Dr. M. Jung (Max Planck Institute for Biogeochemistry)

3. Application

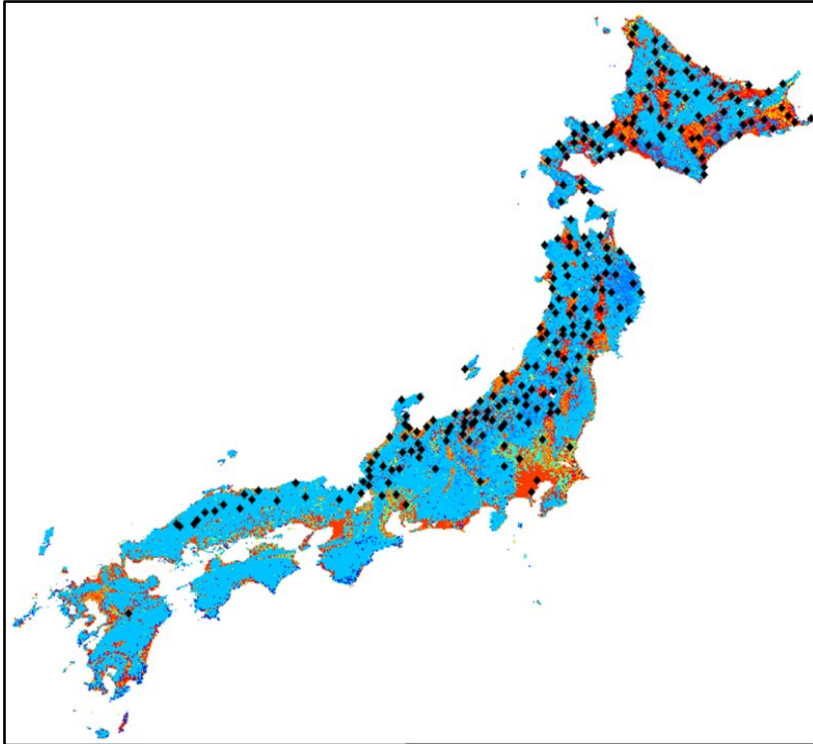
Snow Submodel Evaluation



3. Application

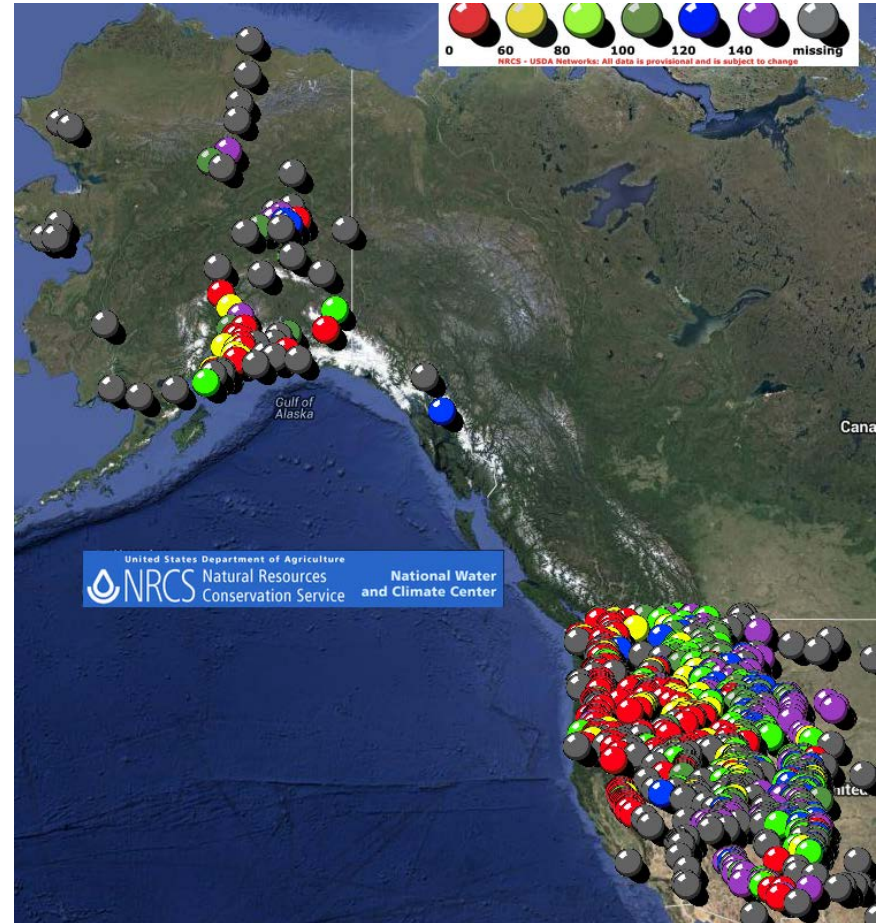
Snow Submodel Evaluation: Site-Data

AMeDAS (>200 sites)



Snow Depth (mm) only

SNOTEL (>700 sites)

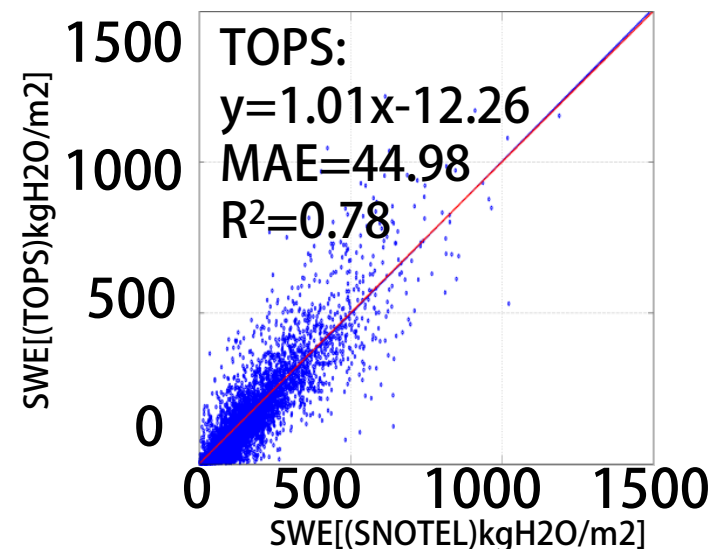
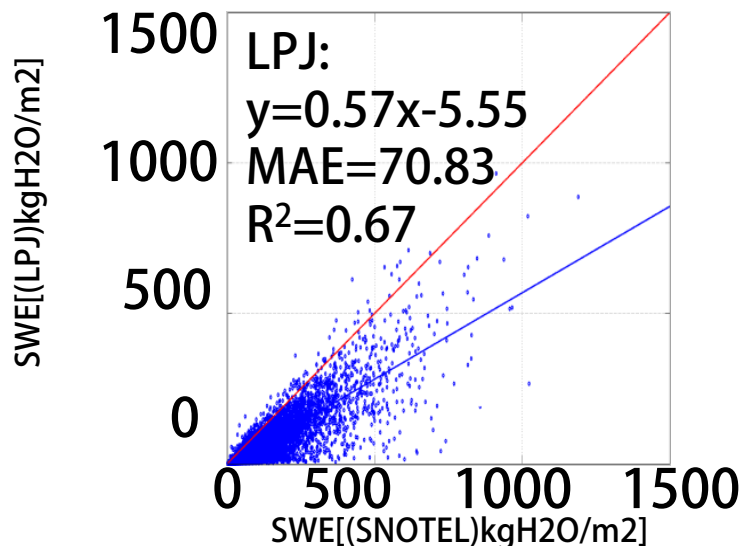
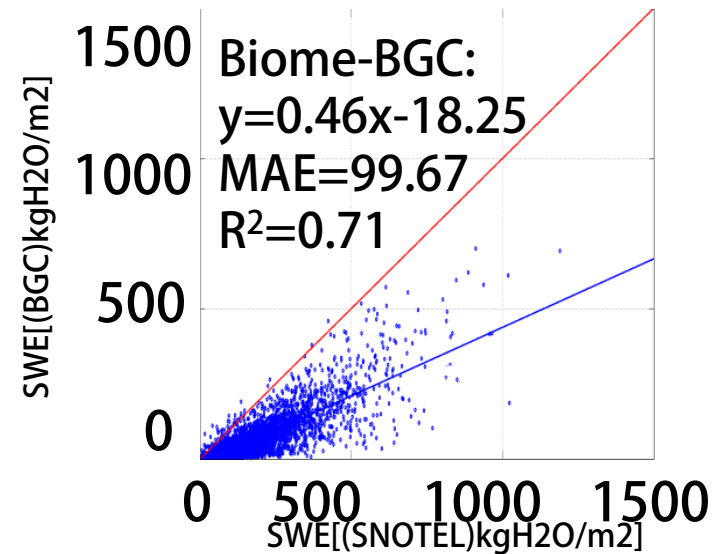
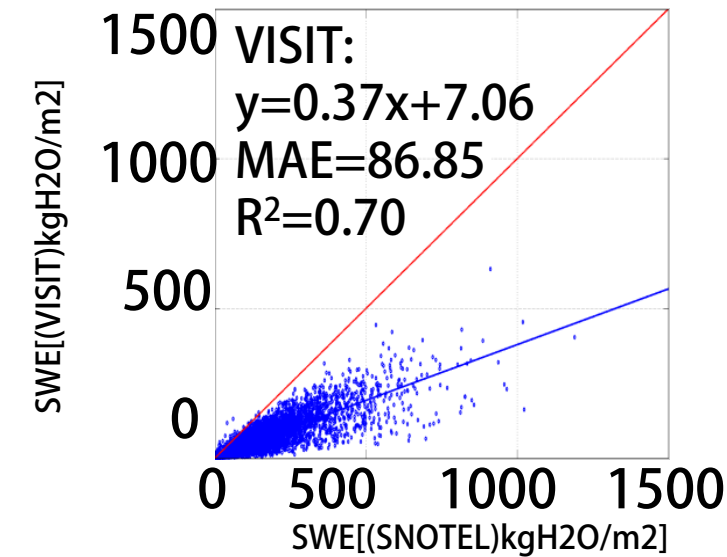


Snow Water Equivalence
($\text{kgH}_2\text{O}/\text{m}^2$)

3. Application

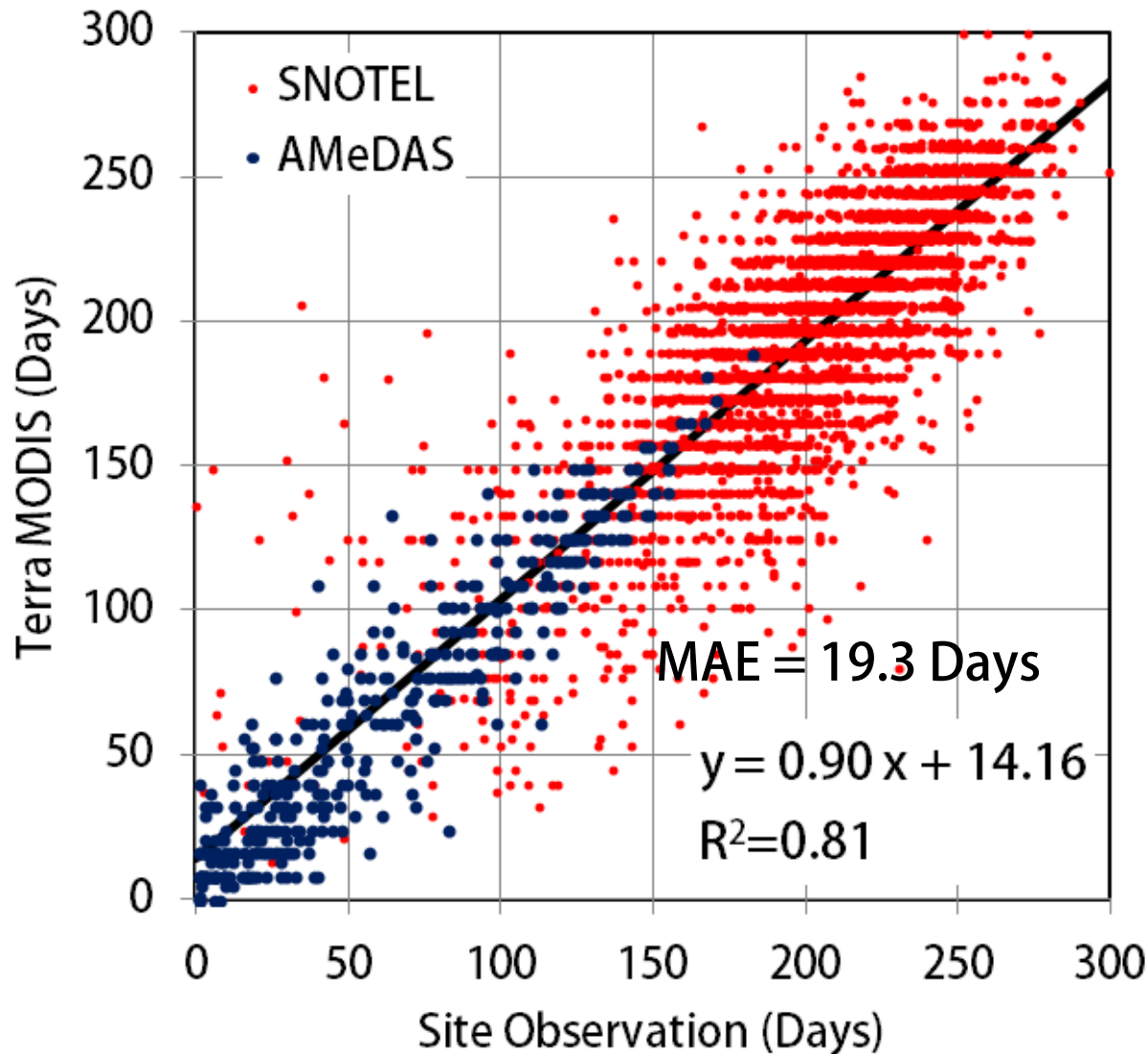
Evaluation of snow submodel SNOTEL ~700 sites

[Ohtake, Fukushima Univ]



3. Application

Snow : Evaluation of RS-snow product (Snow Season Length)



Correction:

LST < 14degC

Cloud flag

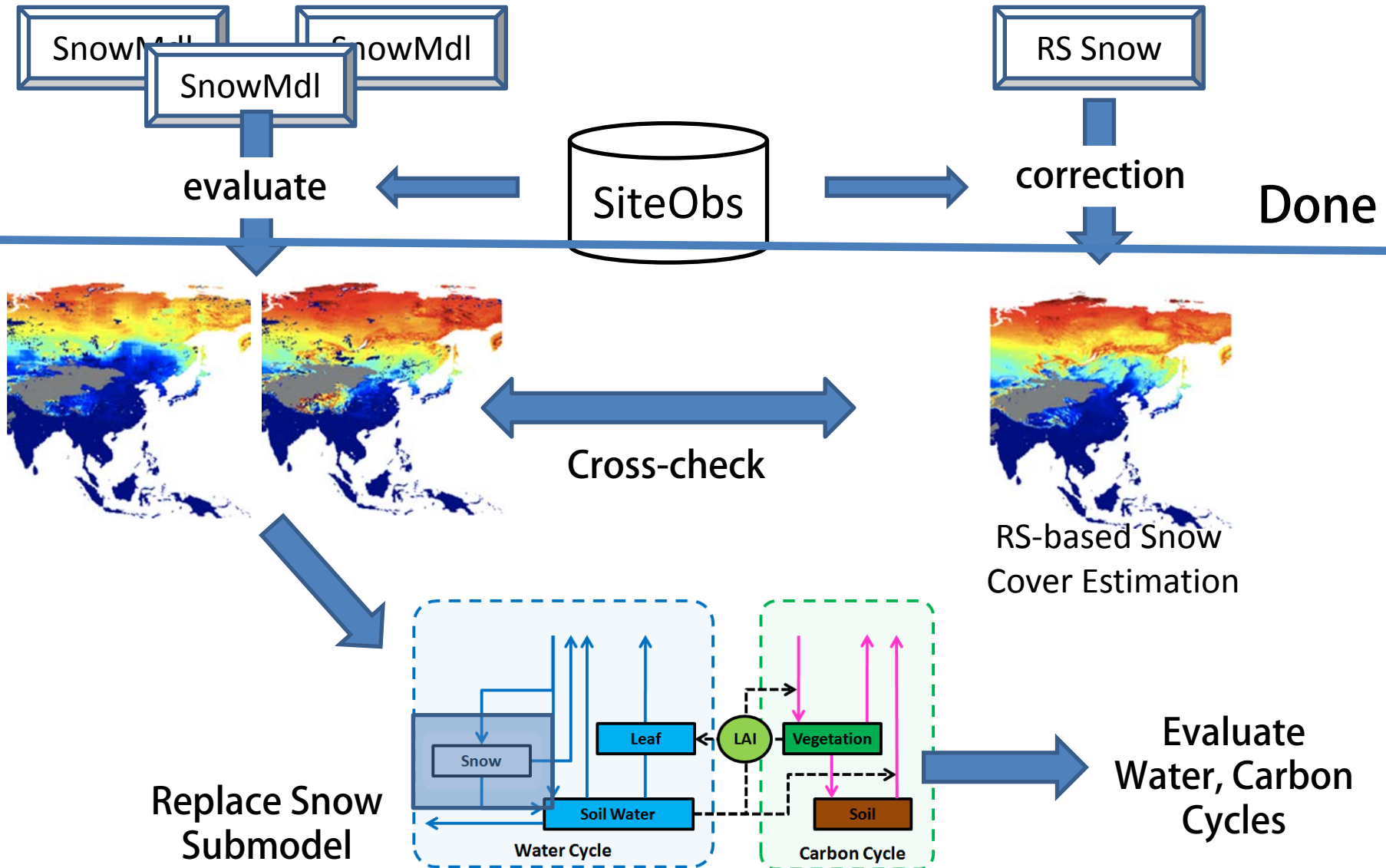


Snow

[Ohtake, Fukushima Univ]

3. Application

Snow Submodel Evaluation



Summary

1. Data Collection for model evaluation and input
 - TRY database
 - FLUXNET (AsiaFlux database)
2. Empirical Upscaling Model
 - Refinement of Support Vector Regression
 - FLUXCOM project
3. Potential Application of GCOM-C1 product
 - △ Snow, △ Solar Radiation Data
 - △ Evaluate Terrestrial C-Cycle Models

Tasks for FY2015

1. Data Collection for model evaluation and input
 - Data Update (TRY, FLUXCOM)

2. Empirical Upscaling Model
 - Refinement of Support Vector Regression
 - FLUXCOM project

3. Potential Application of GCOM-C1 product
 - Energy, Water Cycle Data
 - Carbon Cycle Data
 - Application to Terrestrial C-Cycle Models