Topic 2. Fluxes, Hyperspectral Remote Sensing, Models:
How do we produce new data products?

My background

Data-Driven Model (Empirical upscaling)
Remote Sensing (MODIS, AVHRR type)
Models (from LUE to BGC)
Model-Data Integration

Kazuhito Ichii
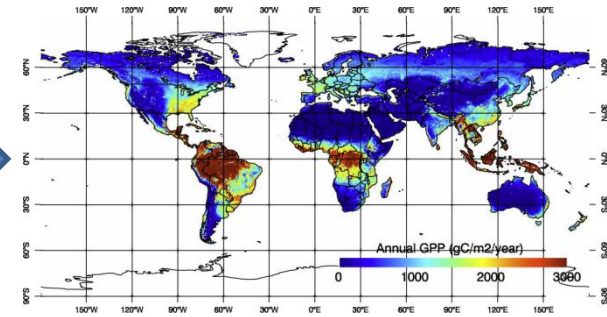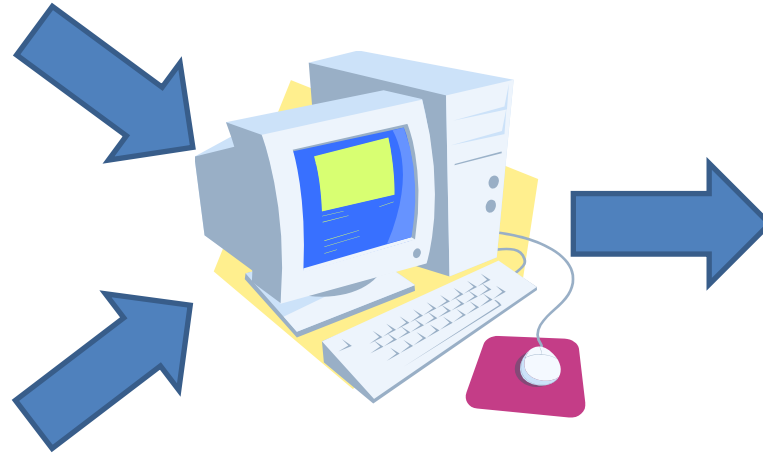**Fukushima University, Japan**
http://envmm.jp

1. Data-Driven Model (Empirical Upscaling)
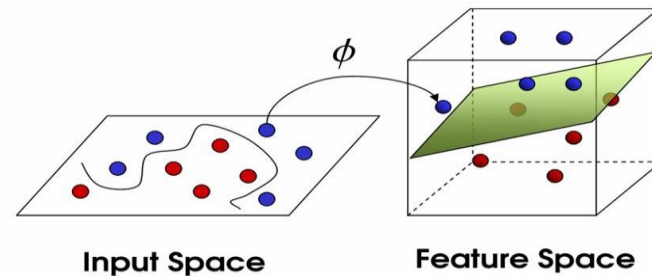

Input: RS, Clim, LC
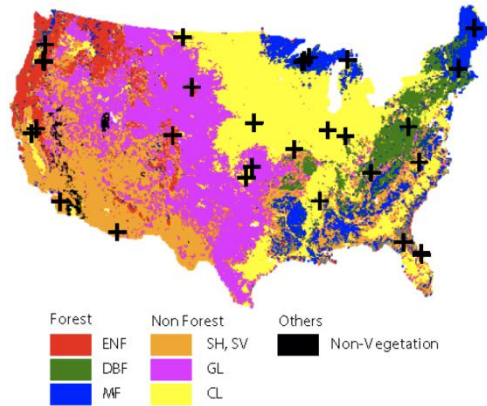
Fluxes

Annual GPP (gC/m2/year)

Neural Network [Papale et al. 2003]
Regression Tree [Xiao et al., 2008; 2010]
Model Tree Ensemble [Jung et al., 2009]
Support Vector Machine [Yang et al., 2006; 2007]

Our Approach:
Support Vector Machine-based regression
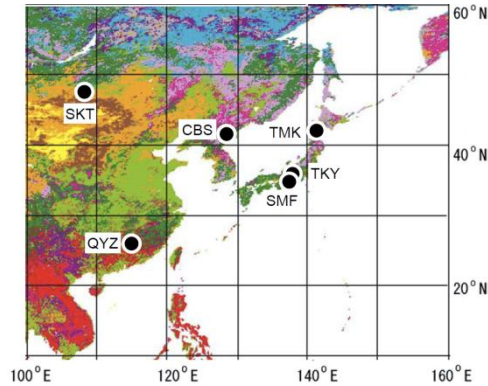Simple, RS-driven Inputs
(EVI, LST, Rad, Land Cover)

ϕ

Input Space   Feature Space
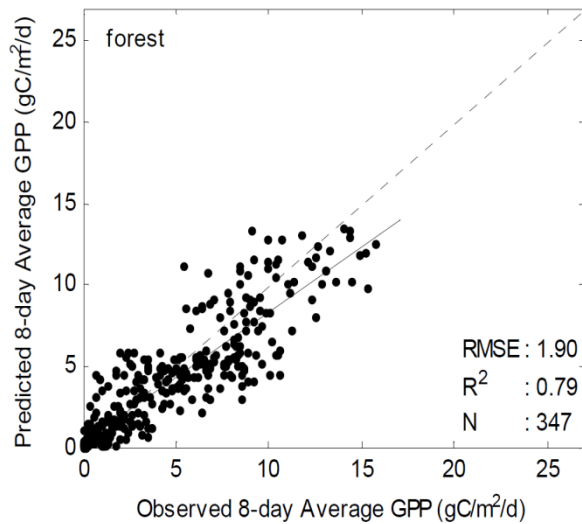
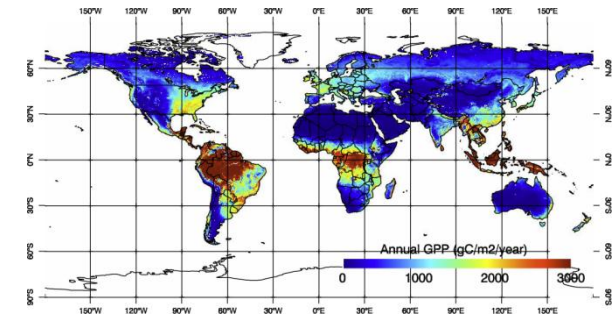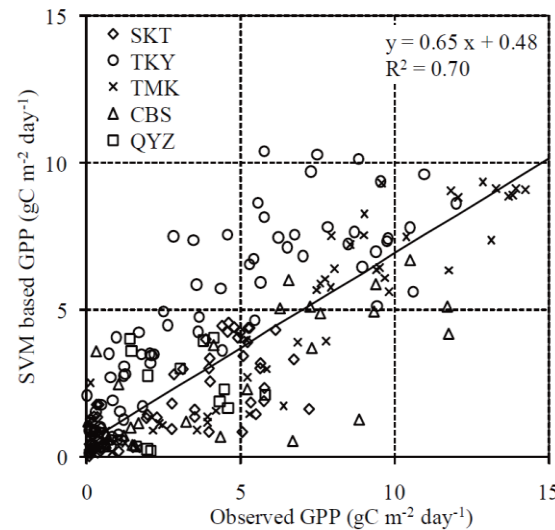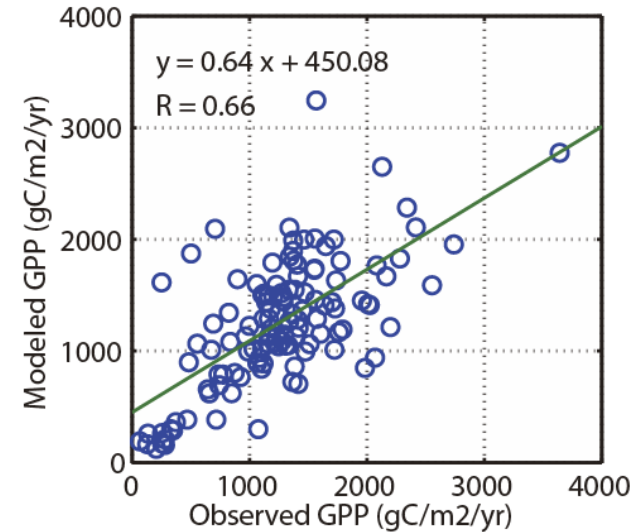# 1. Data-Driven Model (Empirical Upscaling)

US   EastAsia   Global (Experimental)

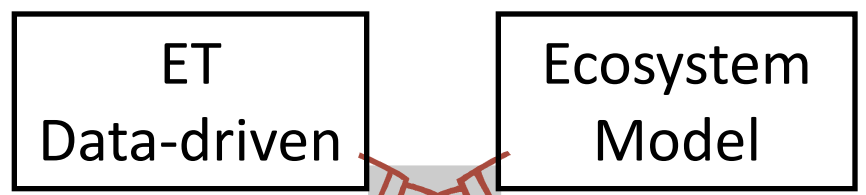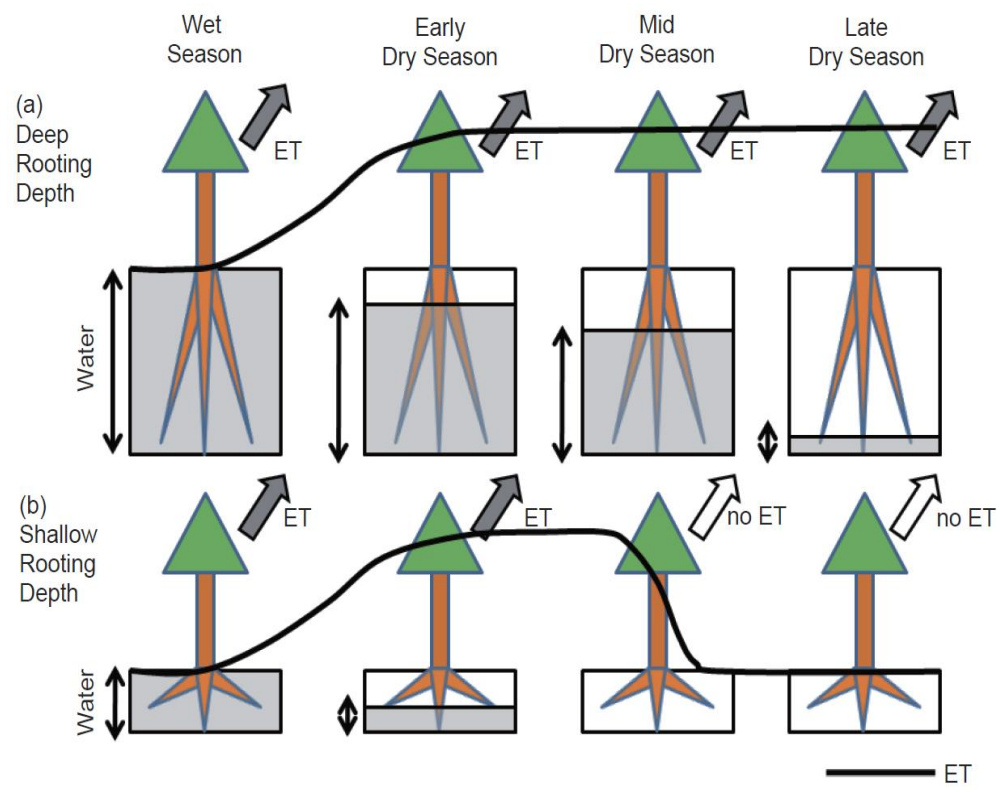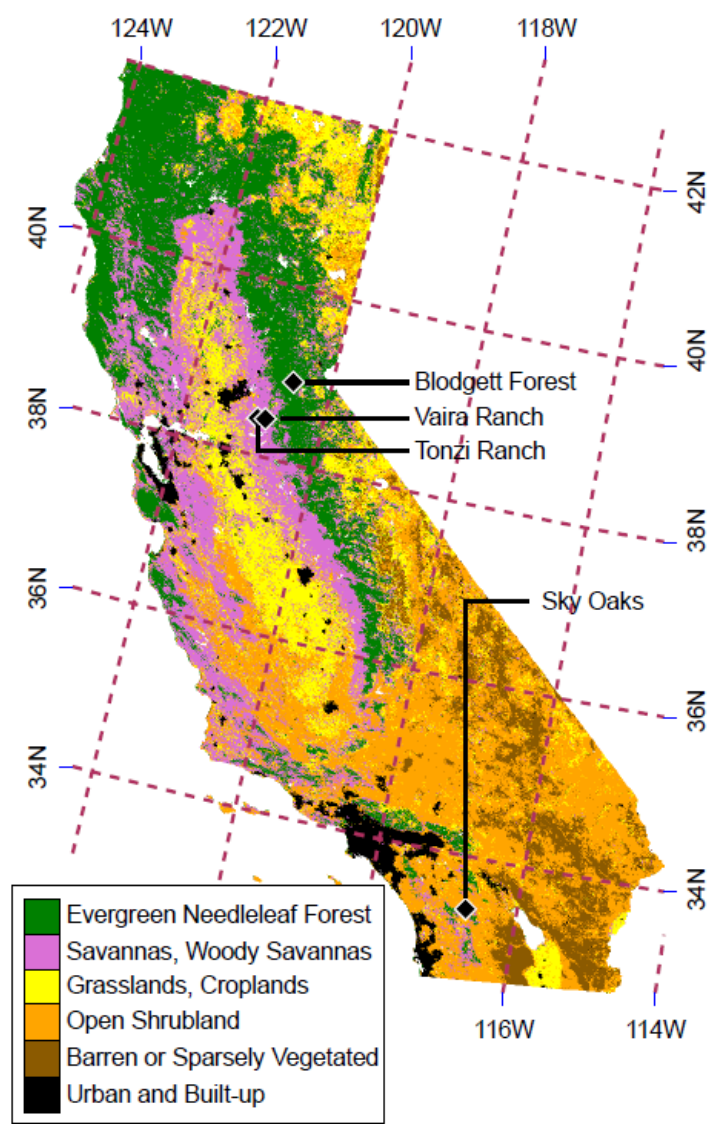[Yang et al., 2007]   [Saigusa et al., 2010]   [See Poster]

US: Yang et al., 2006 IEEE TGARS; Yang et al., 2007 RSE; Ichii et al., 2009 AgForMet
Asia: Saigusa et al., 2010 BG; Ichii et al., 2010 BG
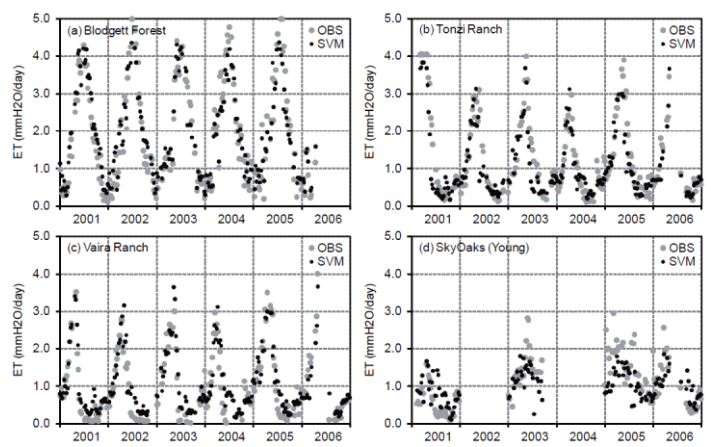
2. Model-Data Integration
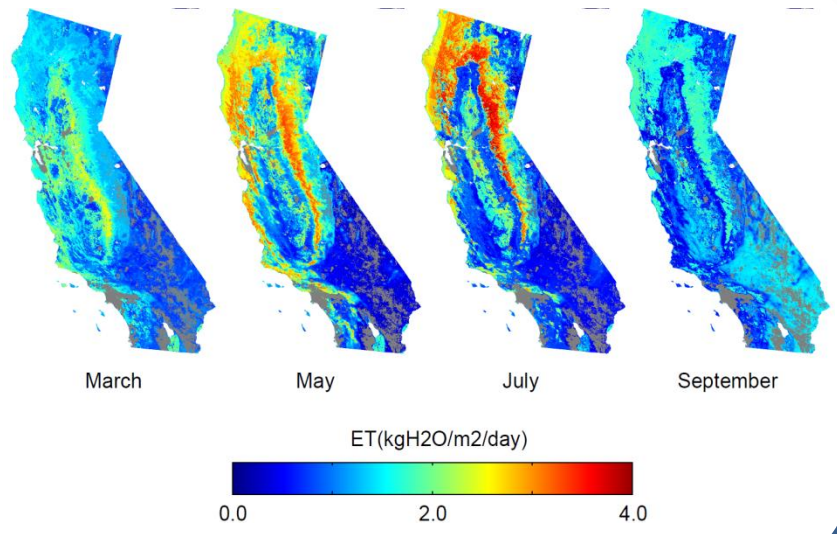
See Belowground from Satellite

[Ichii et al., 2009; AgForMet]

2. Model-Data Integration

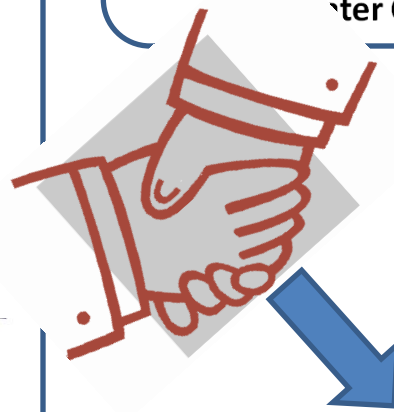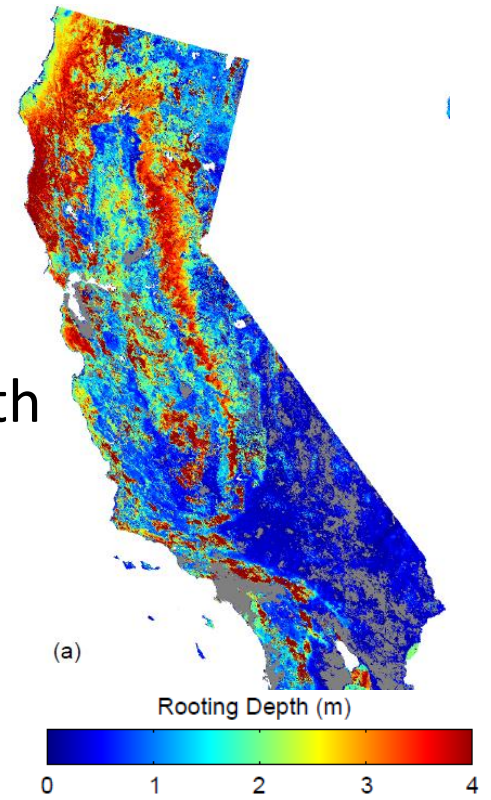## Data-Driven Product

Ecosystem Model

Water Cycle   Carbon Cycle

Spatial Extrapolation

March   May   July   September

ET(kgH2O/m2/day)

0.0   2.0   4.0

Rooting Depth

Rooting Depth (m)

0   1   2   3   4
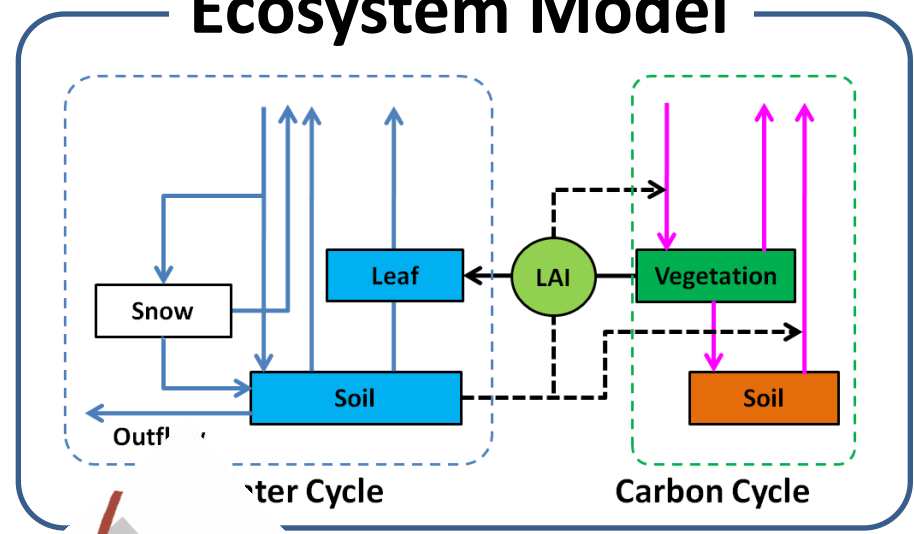
Discussion Topics?

1) Pros/Cons of Data-driven model, LUE model, More mechanistic model ?

    Data-driven   might be the best near sites, but unknown for areas with sparse network.
                                extrapolation ability?
    LUE (diagnostic)   expect better performance for areas with sparse network.
    Mechanistic   prediction

2) Ecosystem Respiration by Data-driven model?

    Potential problems Lack of biomass, stand age, soil information.
                  How to get them?

3) Expected accuracy of models?

    I don't know. But quantification, comparison are needed.

4) Application of products from data-driven model

    Integrated to ecosystem models.
    Short-term (seasonal – few years) is fine, but long-term?