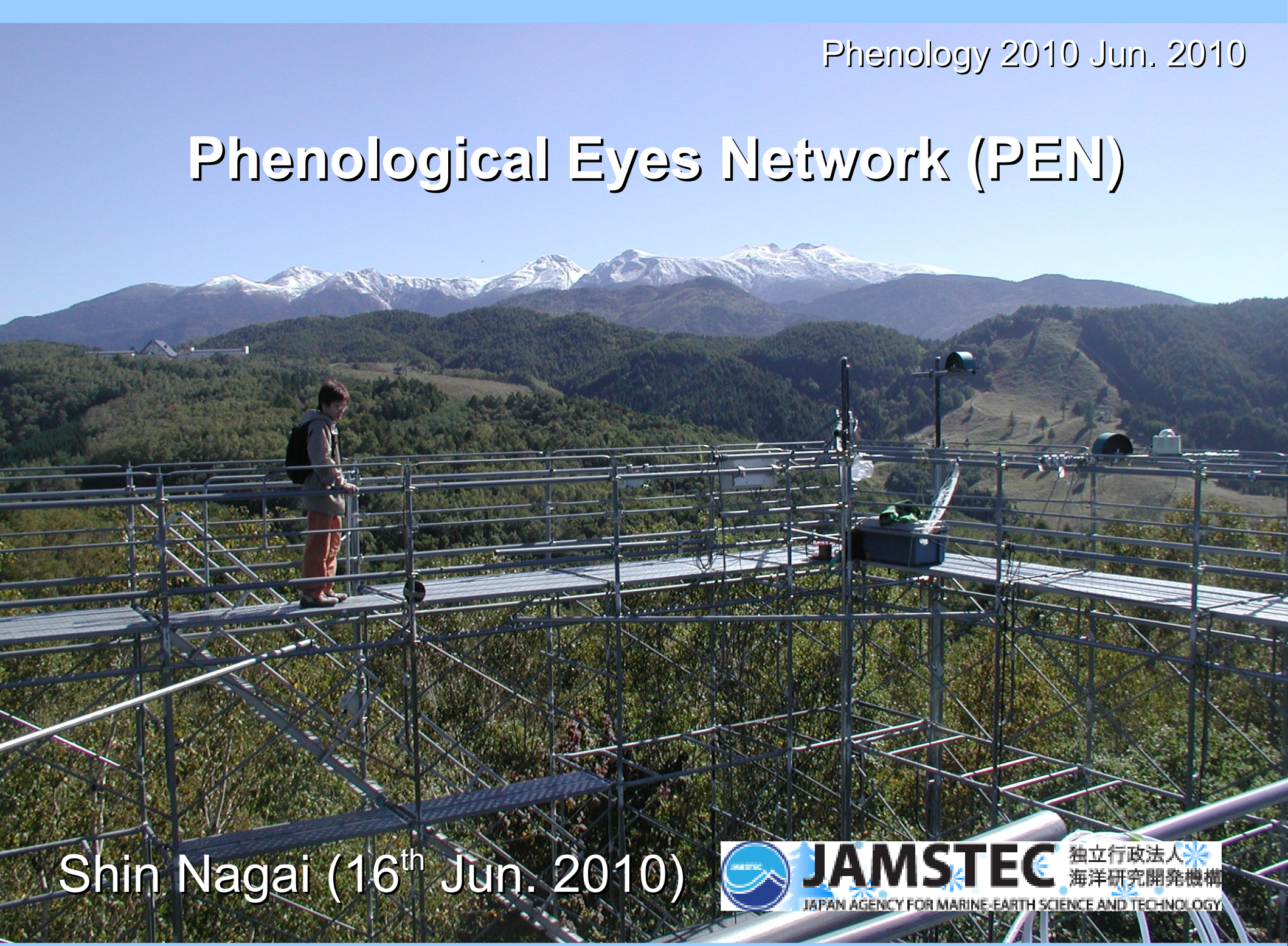
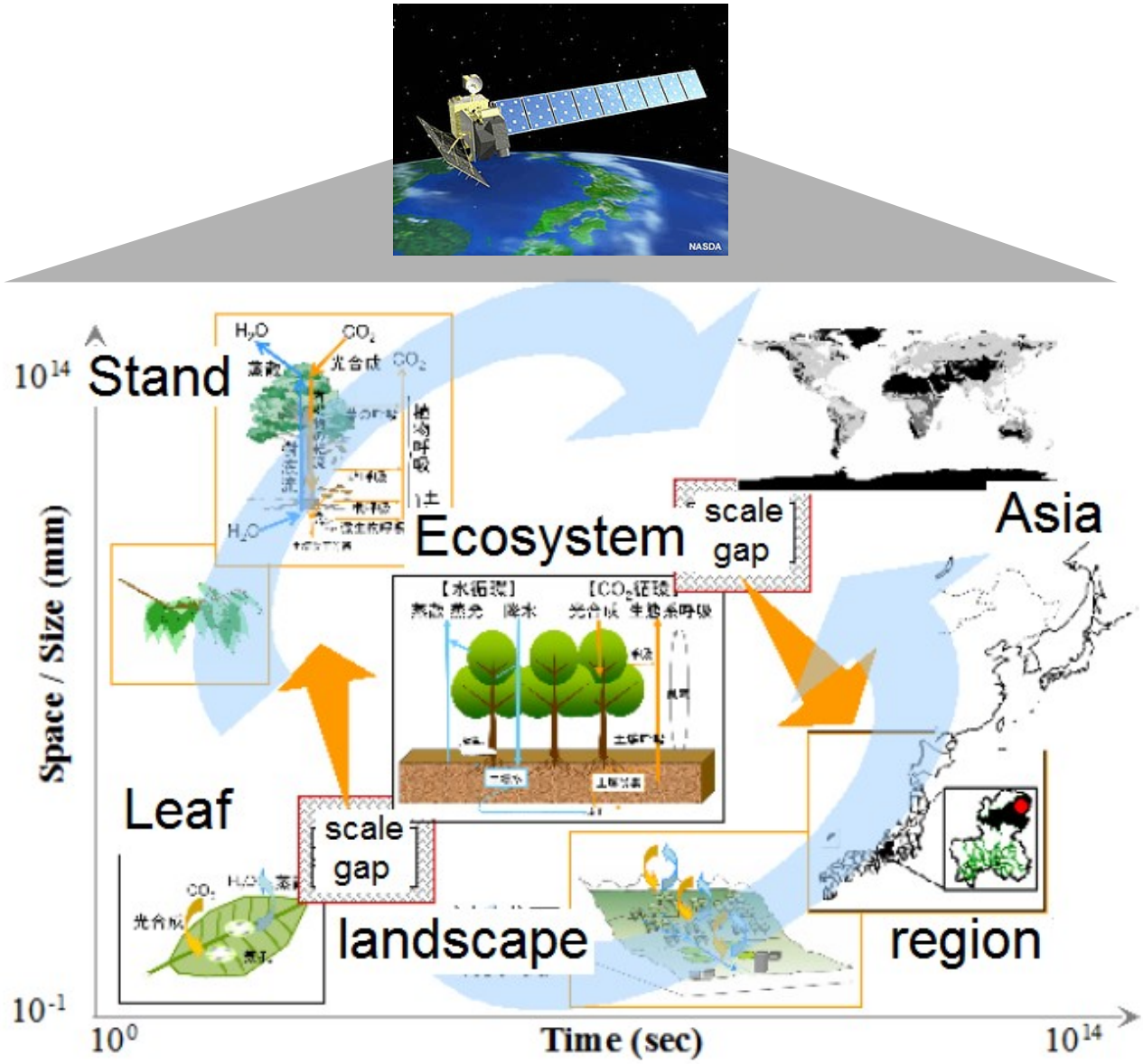
Phenological Eyes Network (PEN)



Shin Nagai (16th Jun. 2010)

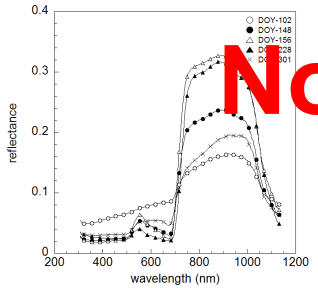
JAMSTEC 独立行政法人 海洋研究開発機構
JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY

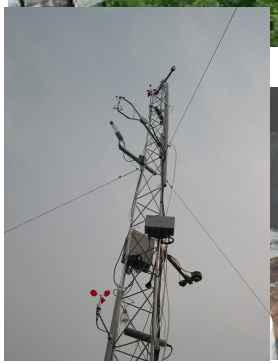
Satellite remote-sensing (RS) is a strong method to evaluate the ecosystem structure and functions for plot to global scales.



But, from the in situ ecological research viewpoint, the RS method has not been tested or validated by the ground-truthing observations.

Ground-truthing data



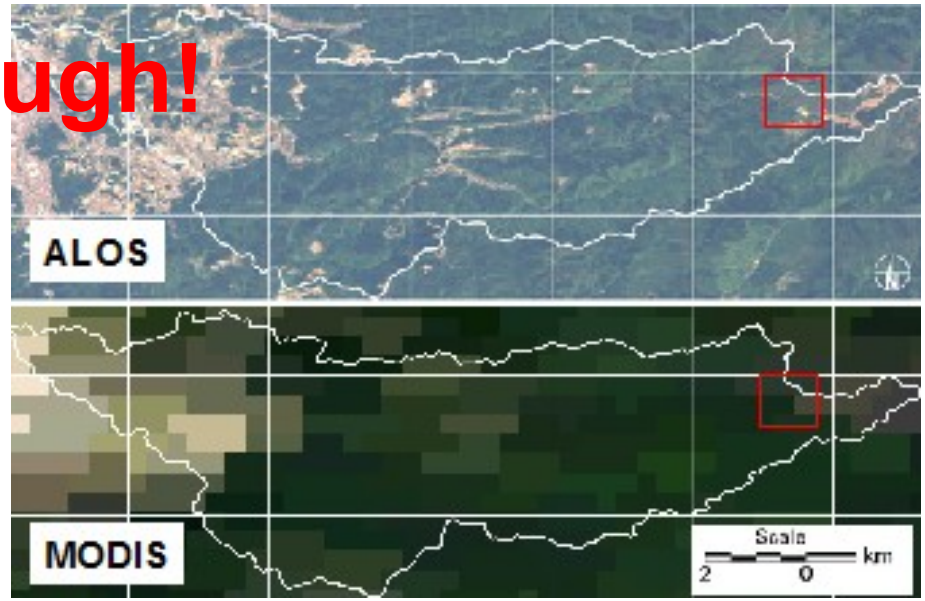


LAI, biomass, fluxes, phenology, spectrum (leaf, canopy-level)

v.s.

Not enough!

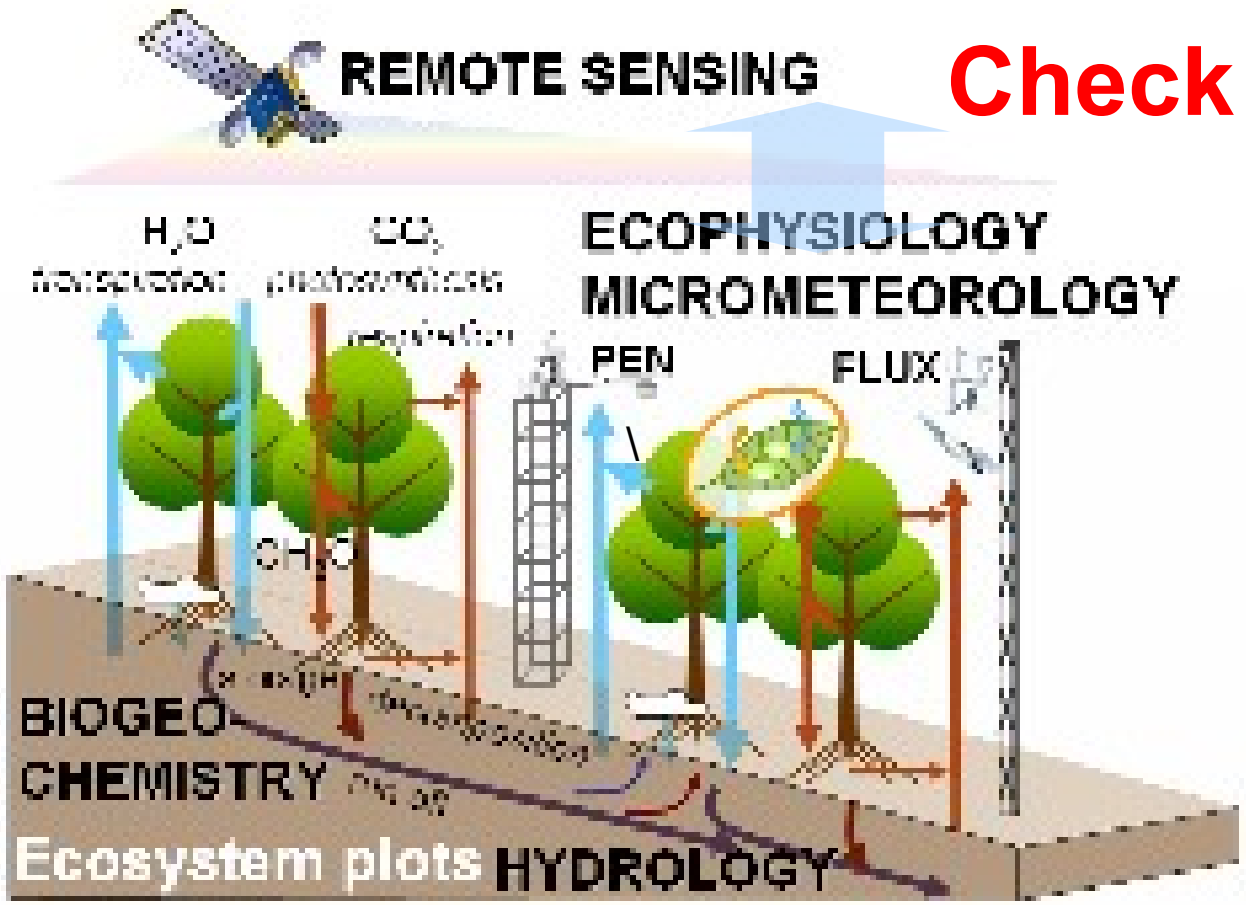
Satellite data



NDVI, EVI, LAI, FPAR, Land cover

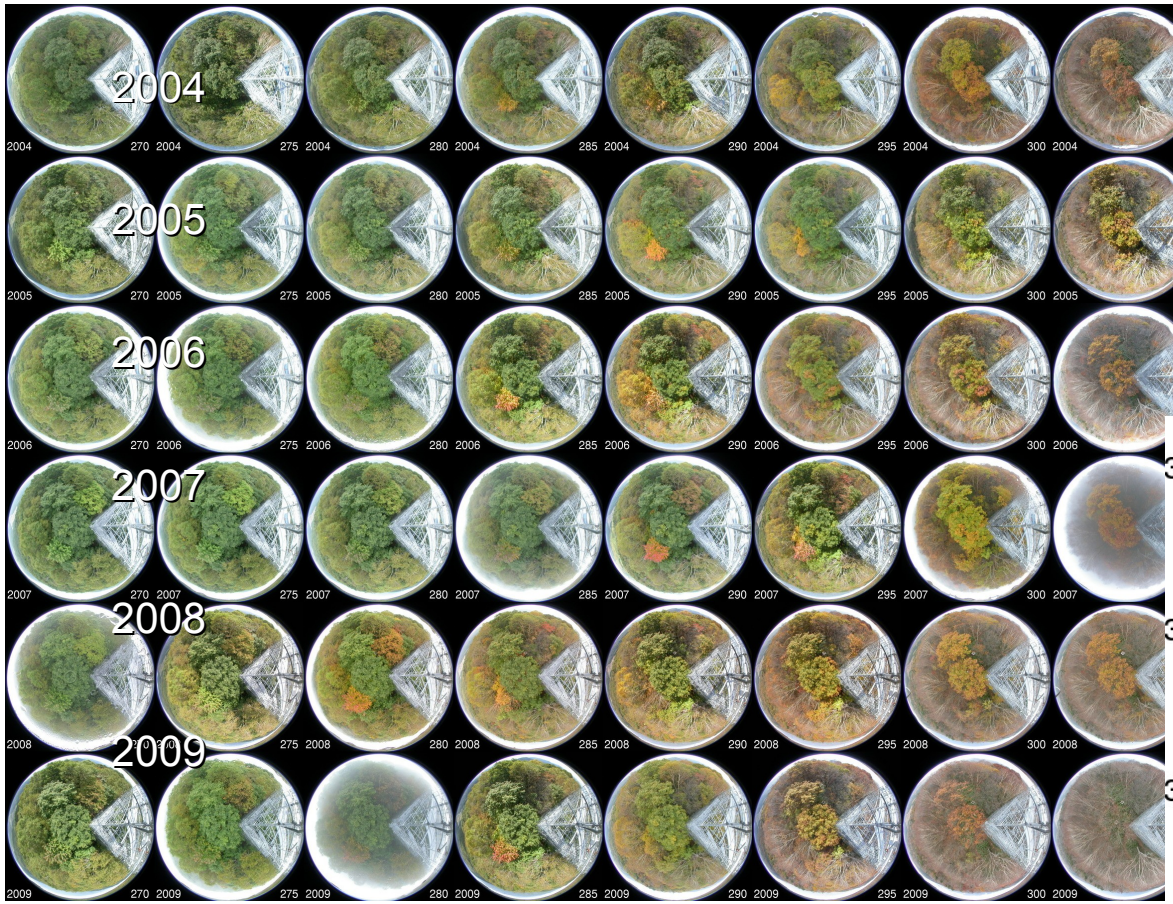
We should study

uniqueness, generality, and *robustness* of the relationship between the dynamics of the ecosystem structure and functions and its interpretation of the RS.

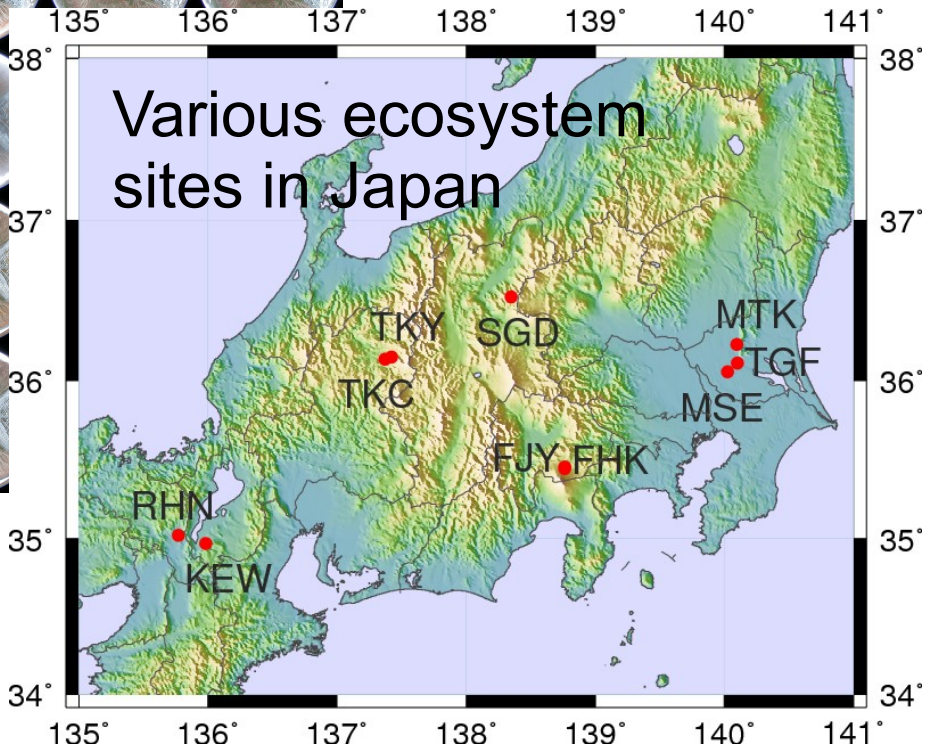


Check *uniqueness, generality, robustness!*

To check uniqueness, generality, and robustness,
we need the continuous, long-term,
and multi-ecosystem ground validation network.



Long-term and continuous
canopy surface observation



We have organized

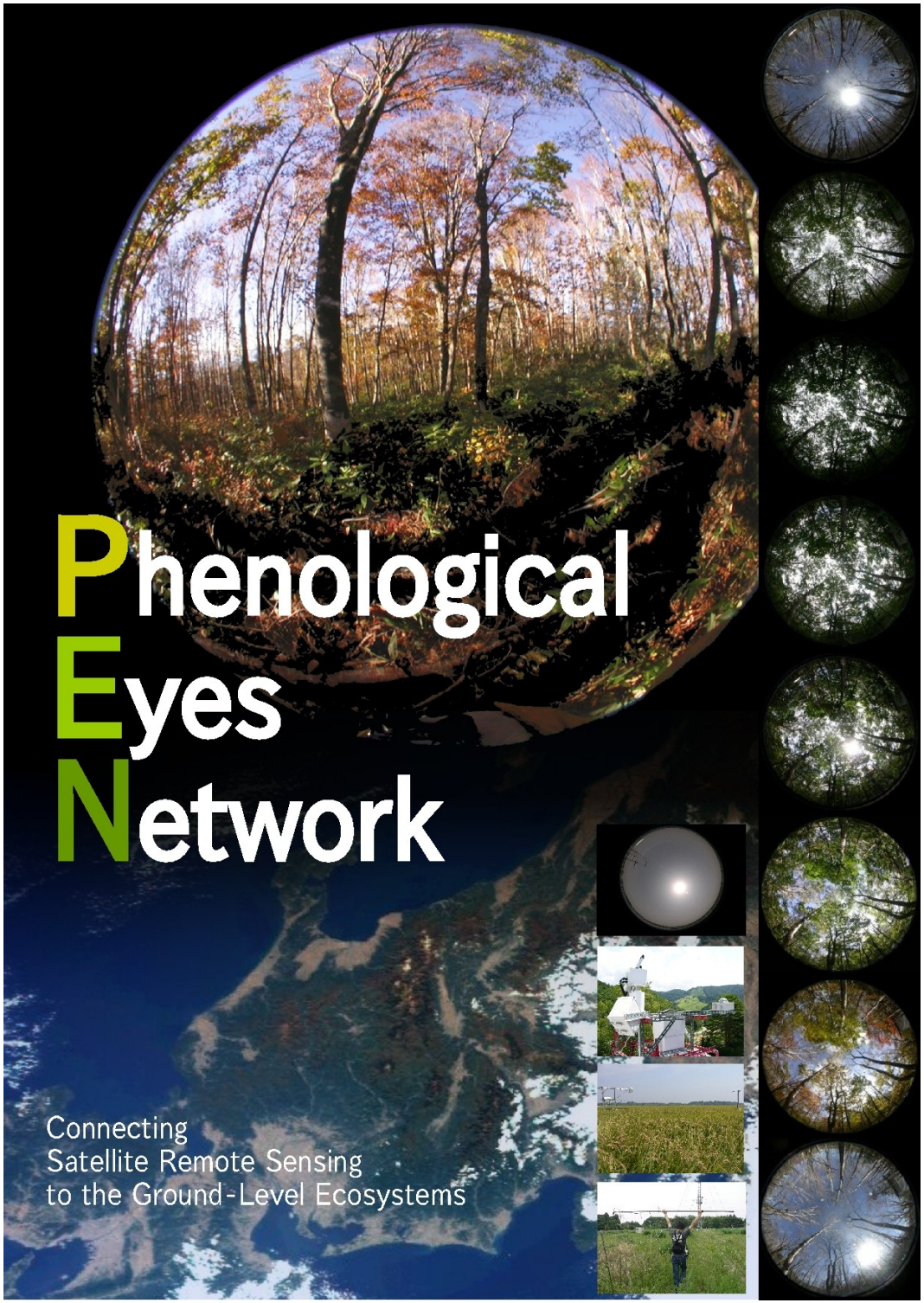
Phenological
Eyes
Network

since 2003
[http://www.pheno-eye.org].

Measurement systems
were developed by

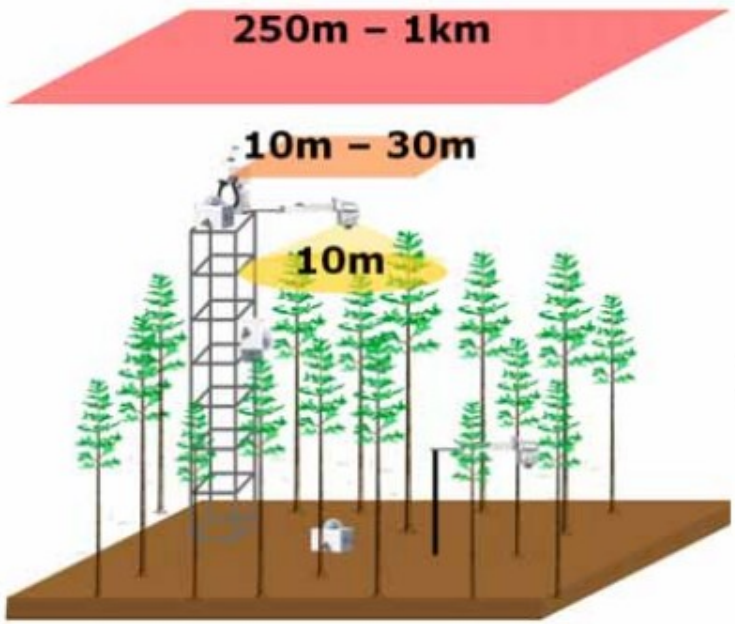
AIST NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)

and colleagues.

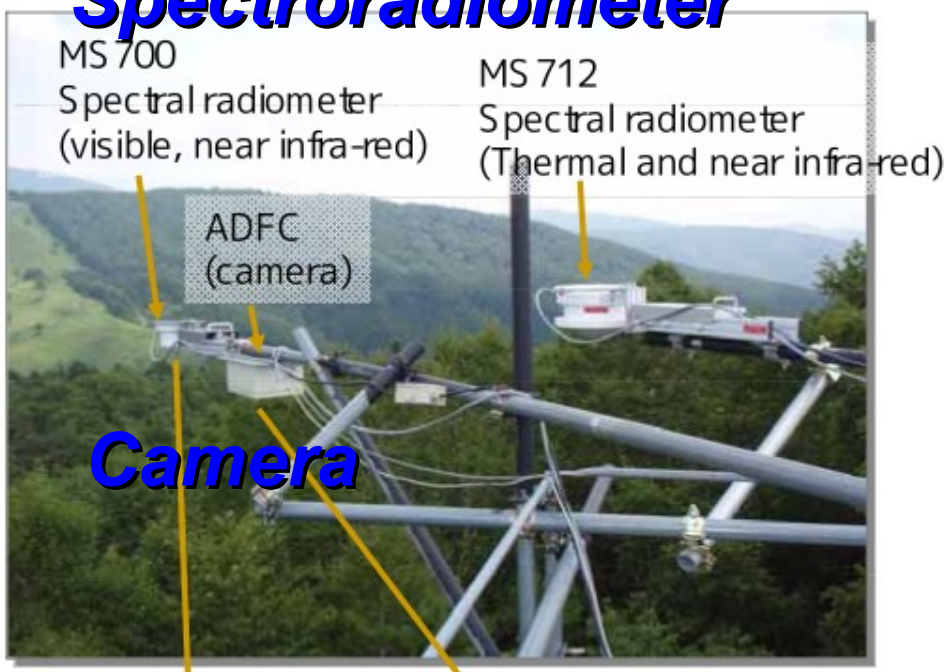


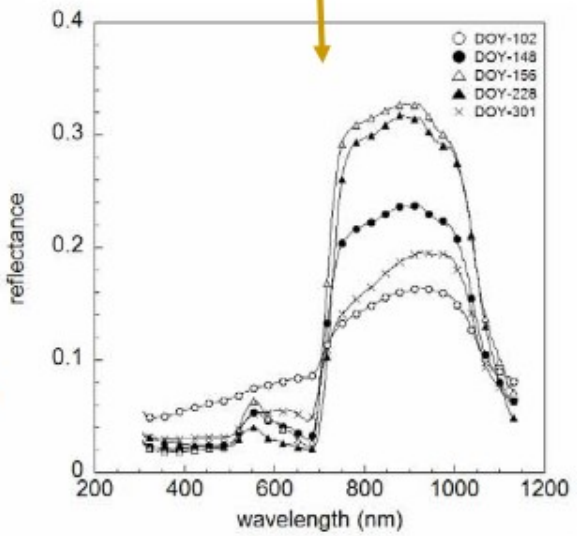
PEN consists of three observation systems:
① *camera*, ② *spectroradiometer*, & ③ *sunphotometer*.

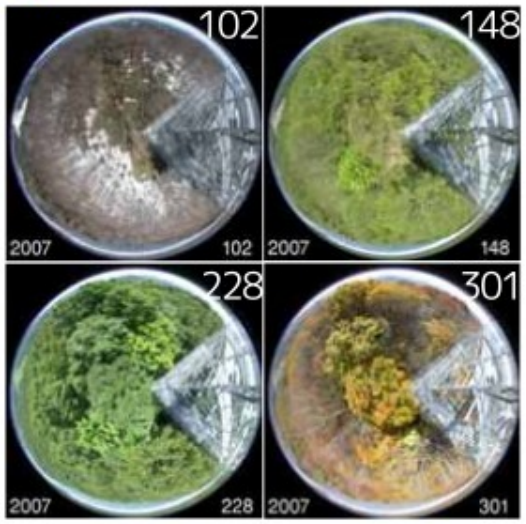
Sunphotometer



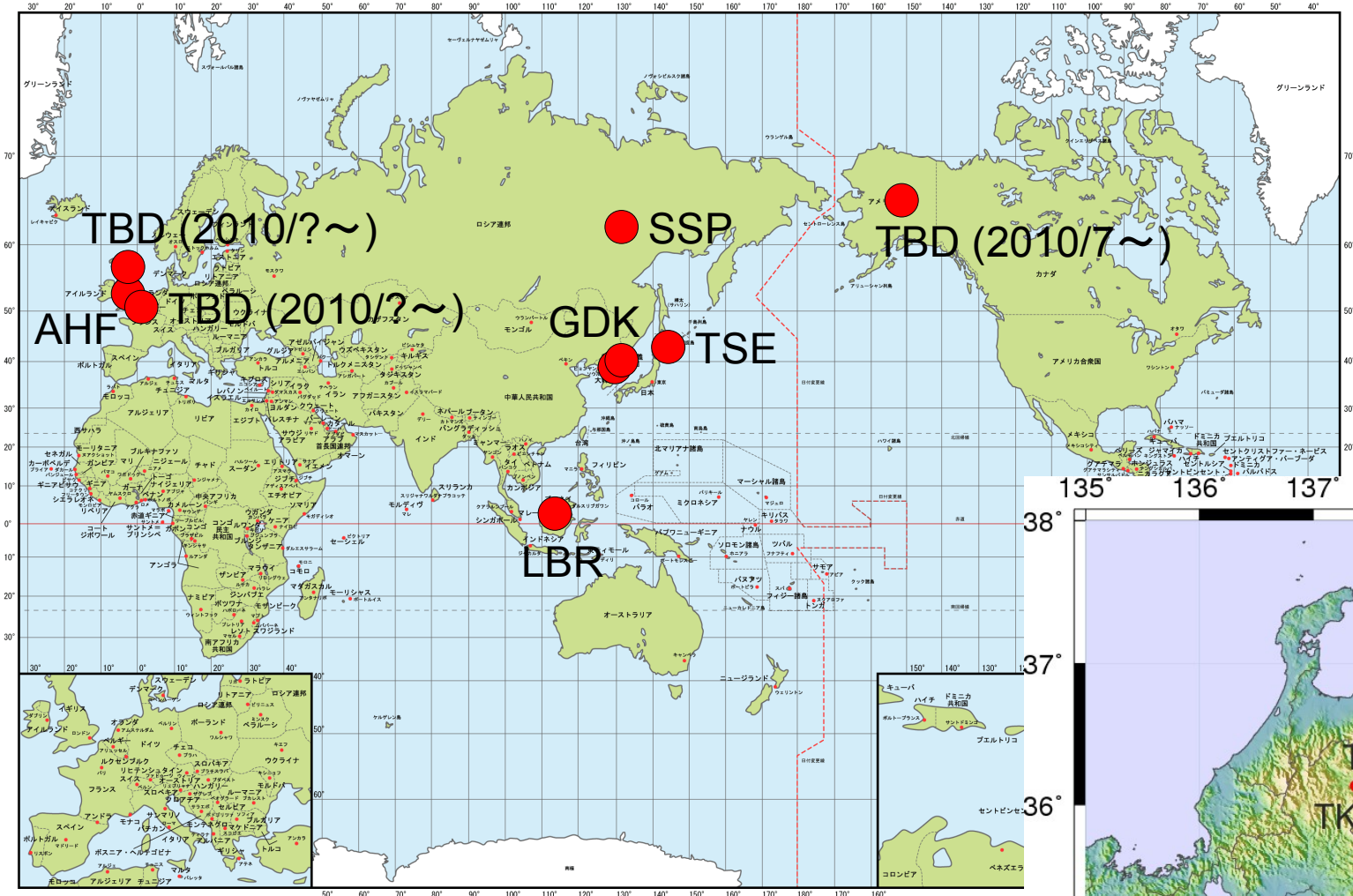
Spectroradiometer



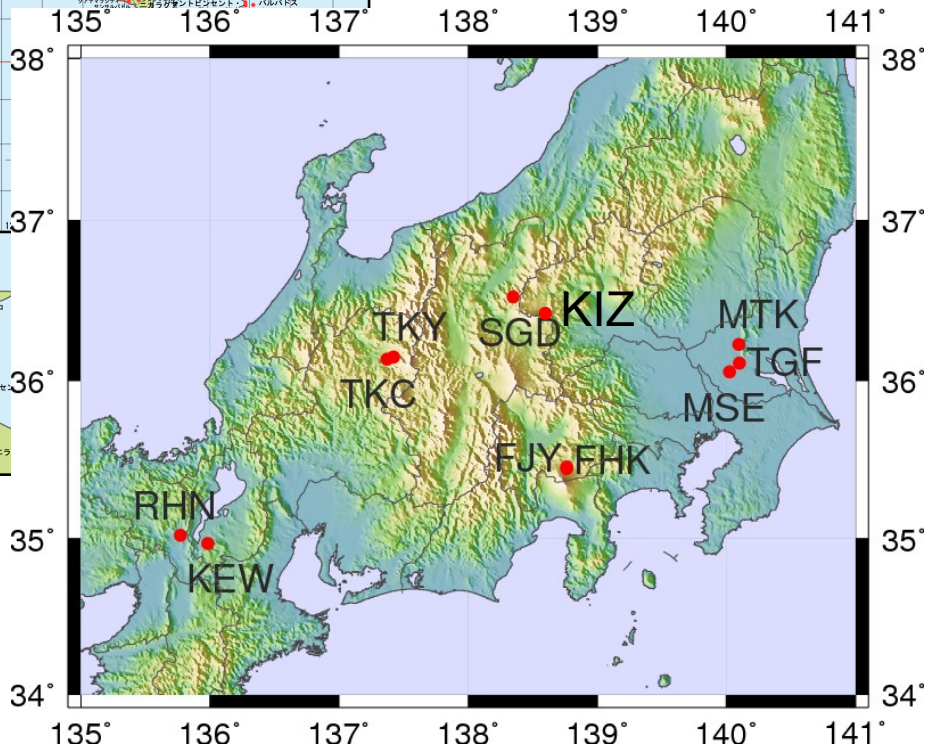




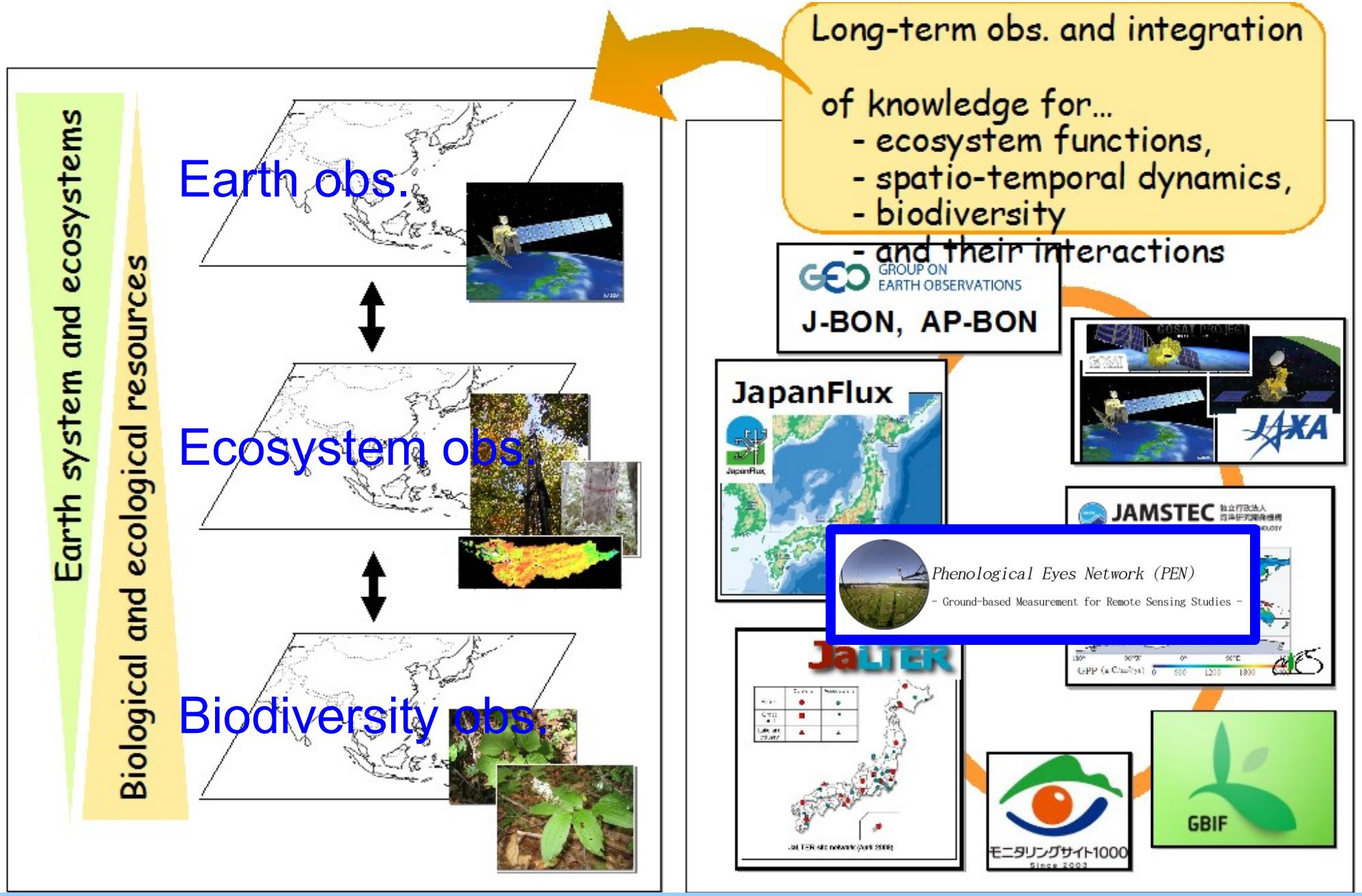
PEN sites have been expanded for various ecosystems over the world.



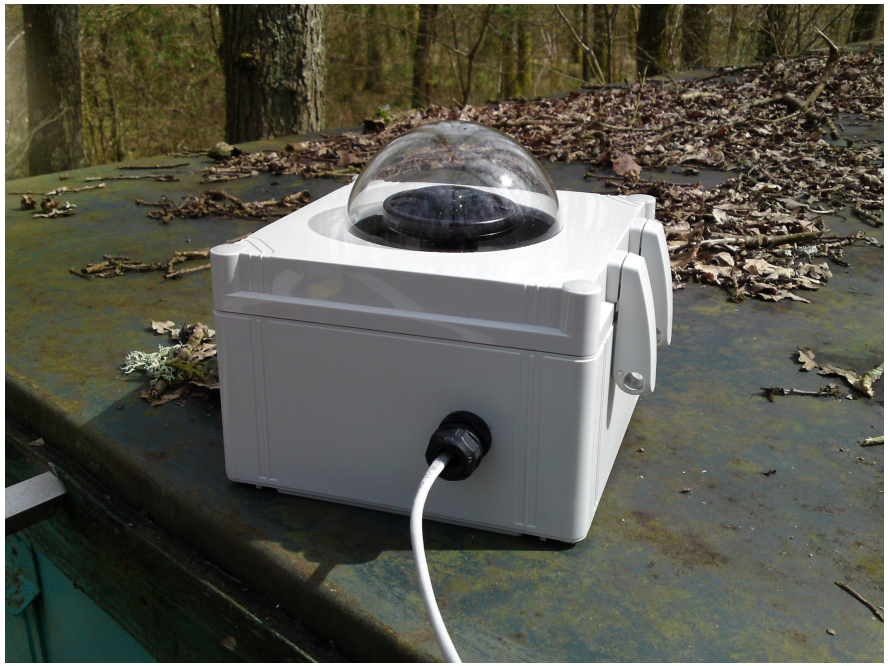
Japan



PEN contributes to interdisciplinary networks for multiple observations.



Let's check the ***camera*** system!



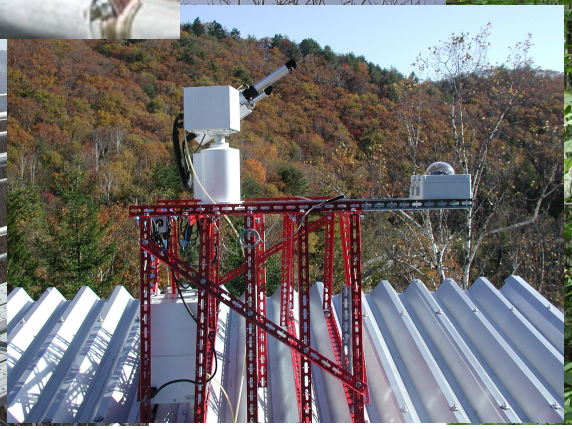
We have installed camera system in various places.







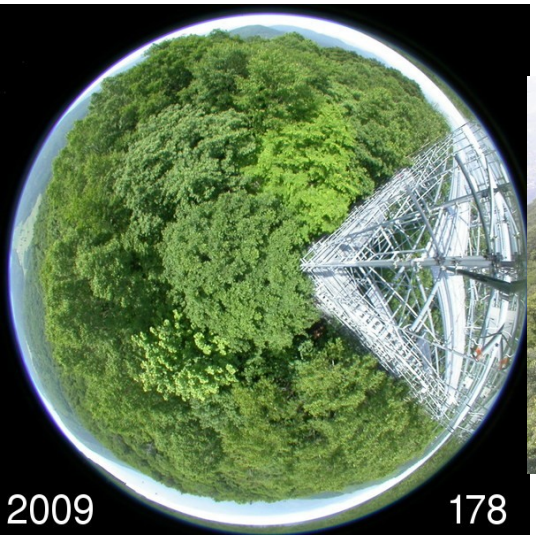



Canopy surface images for various ecosystems

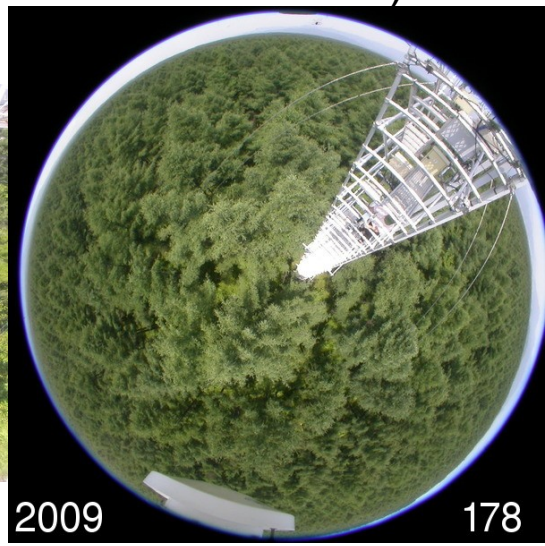
AHF (deciduous broad-leaved forest)

TKY (deciduous broad-leaved forest)



MTK (mixed forest)

FHK (deciduous coniferous forest)

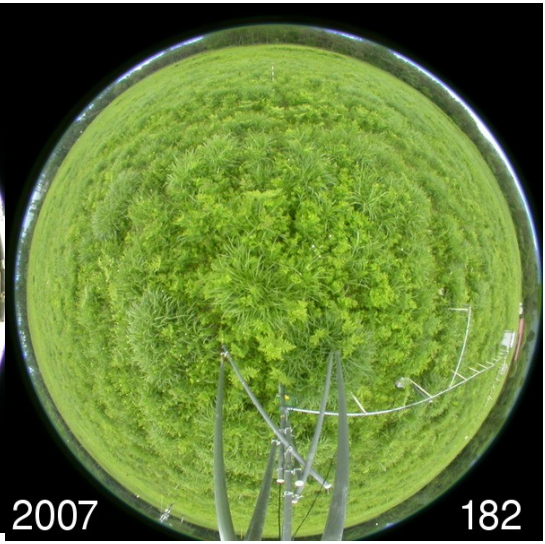


TKC (evergreen coniferous forest)

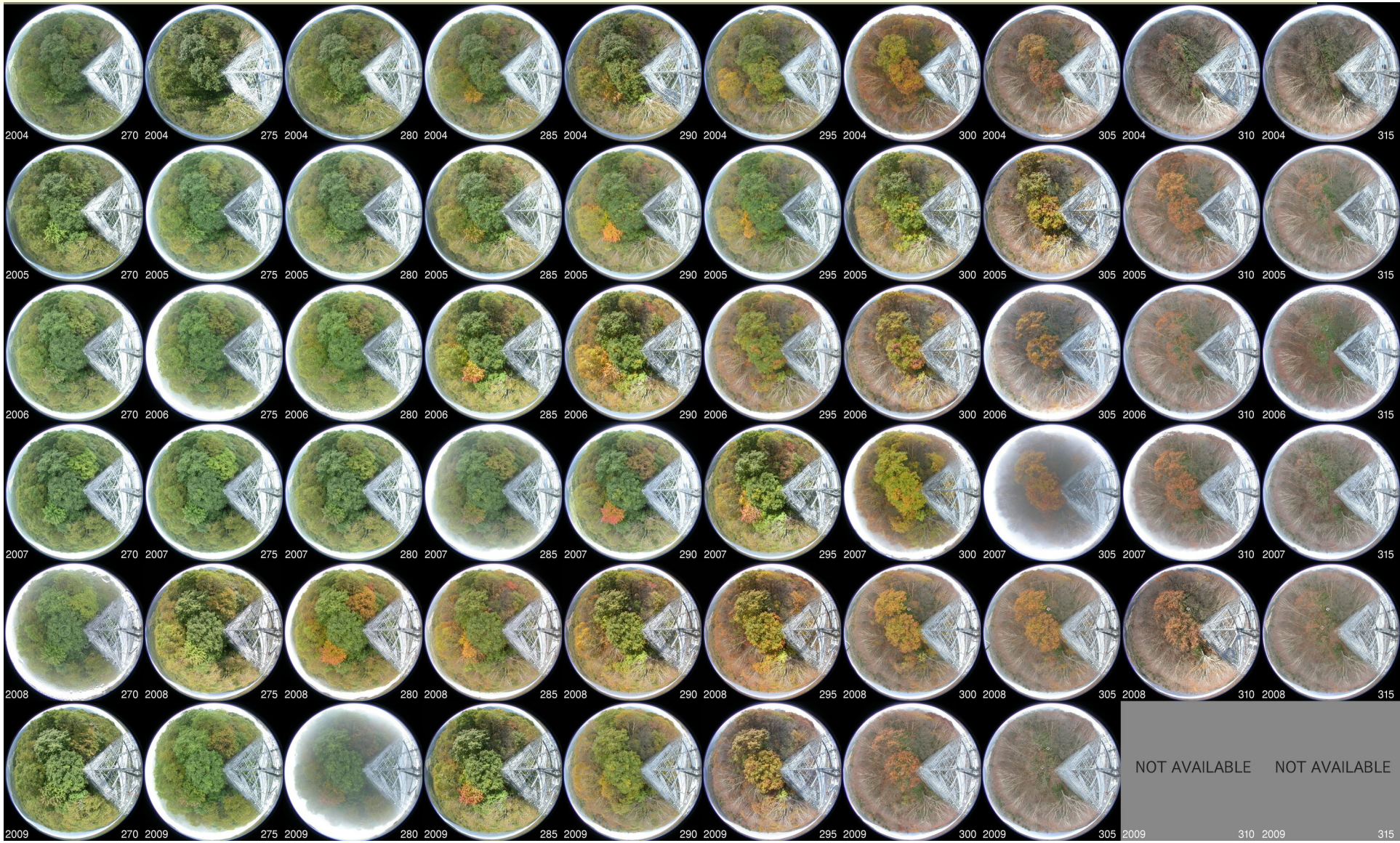
LBR (evergreen broad-leaved forest)

MSE (paddy)

SGD (grassland)



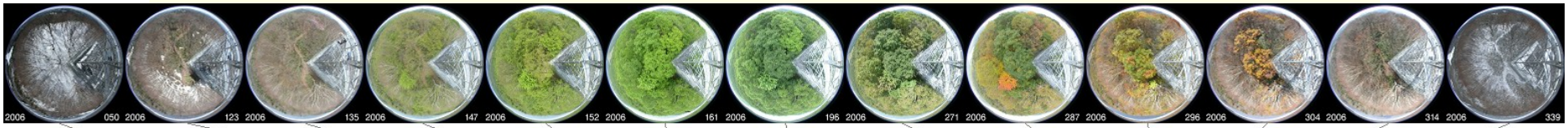
Long-term continuous phenology observation in autumn at TKY (deciduous broad-leaved forest) in Japan

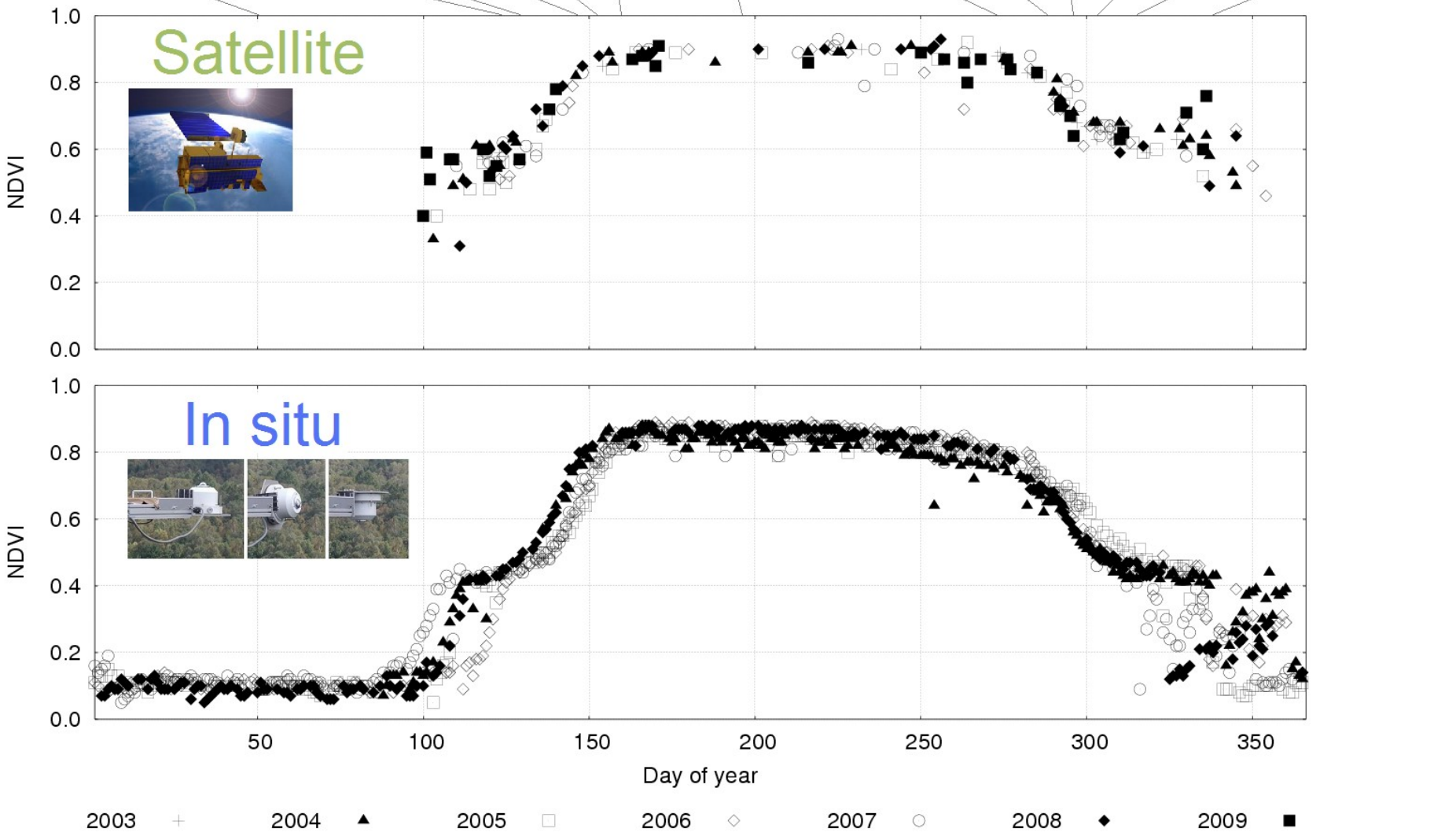


Early leaf-colouring: 2004, 2008, 2009

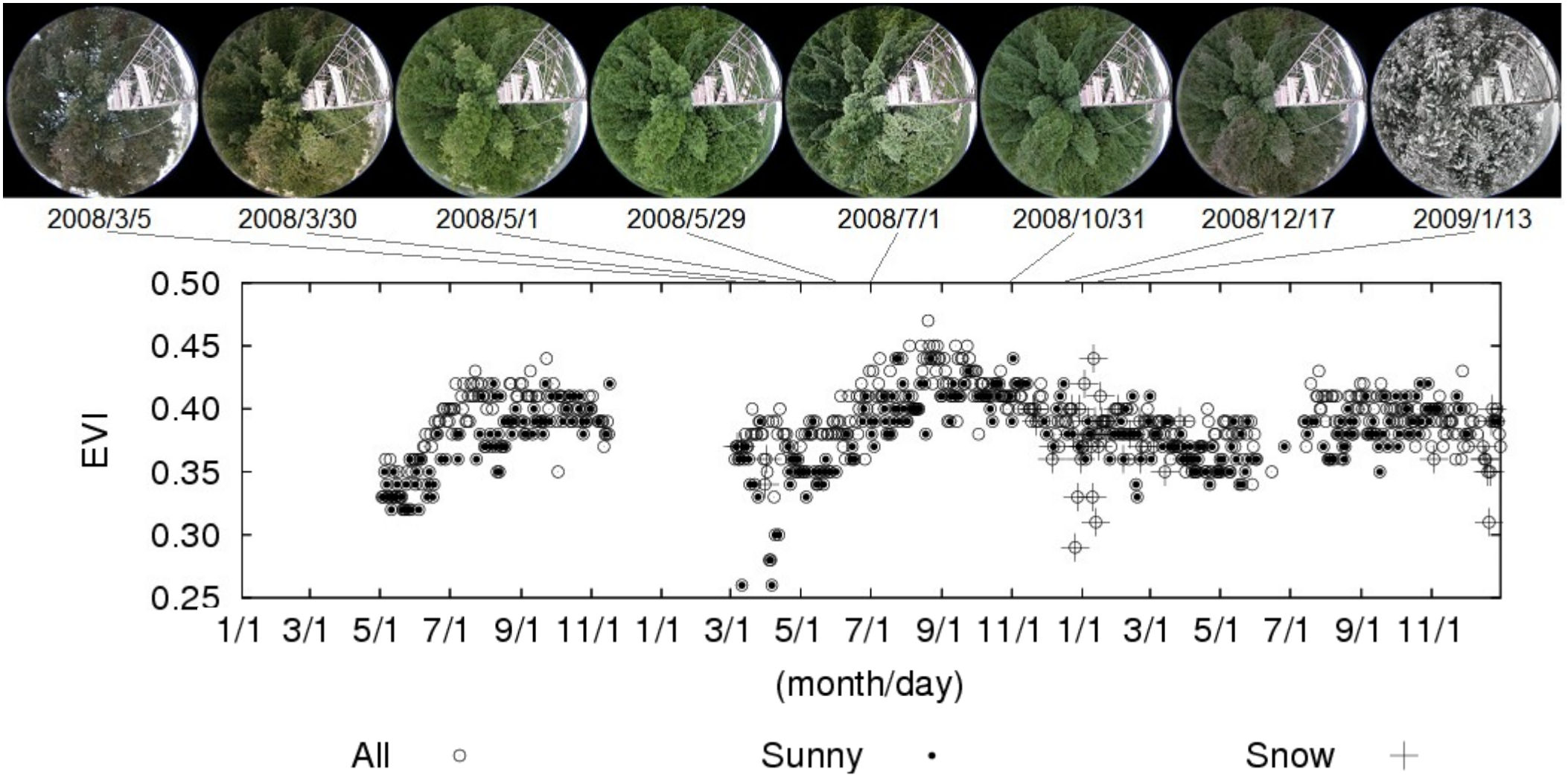
Let's check
the ***spectroradiometer*** system!

In situ- and satellite-observed NDVI at TKY (deciduous broad-leaved forest), Japan





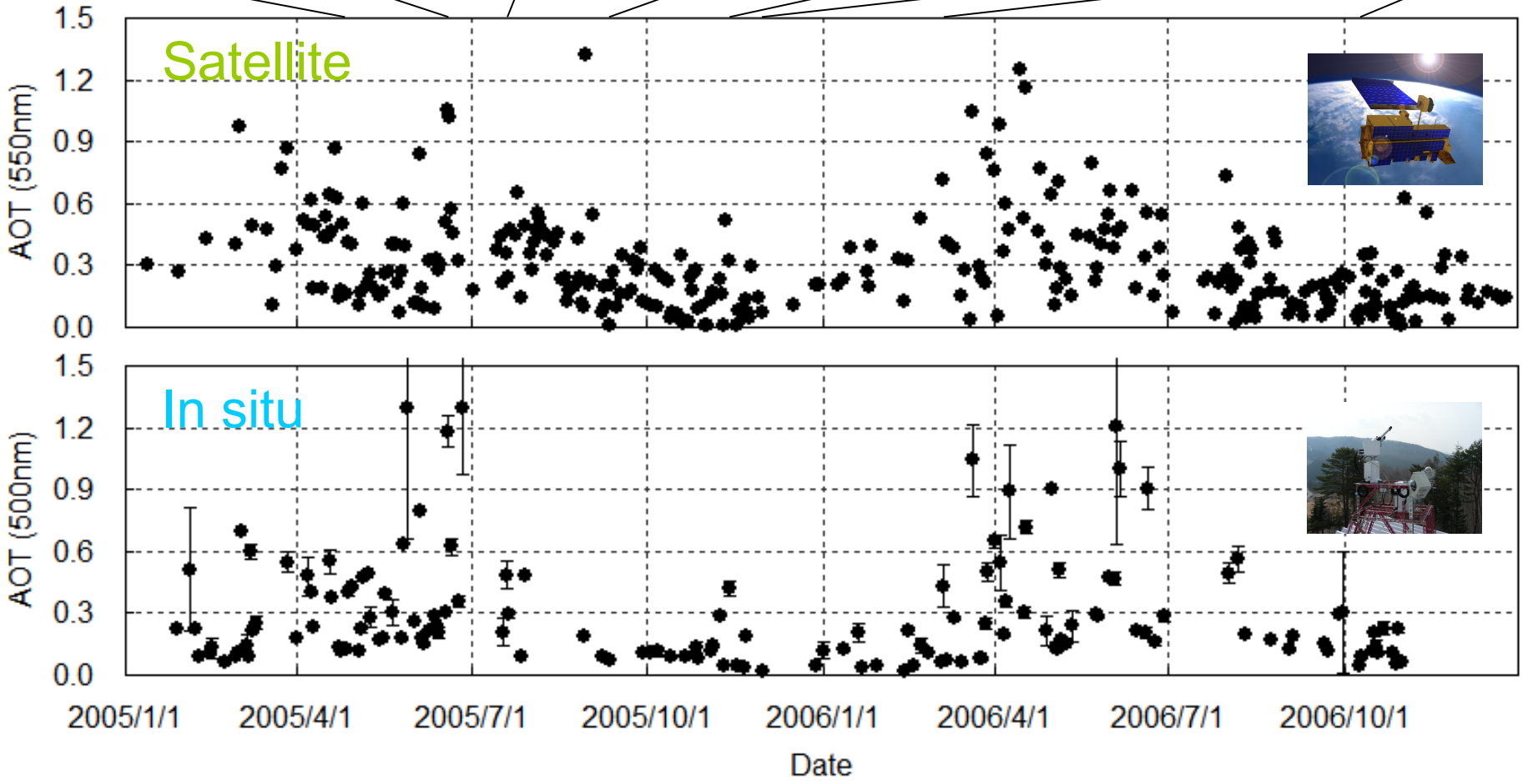
EVI (enhanced vegetation index) at TKC (evergreen coniferous forest), Japan



© JAMSTEC

Let's check
the ***sunphotometer*** system!

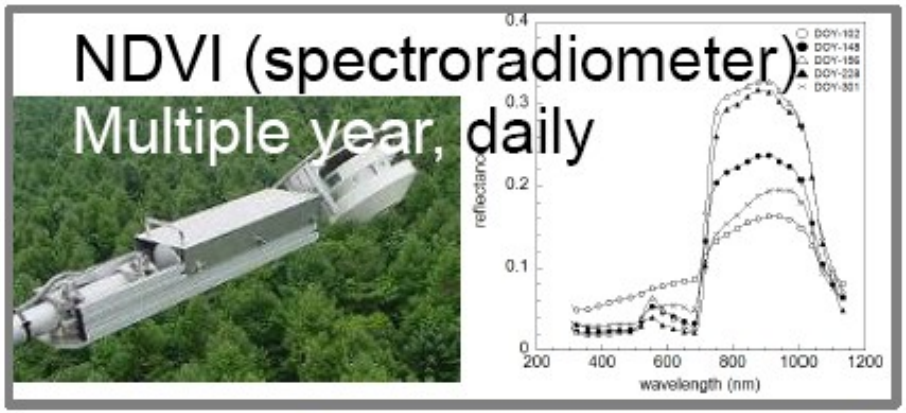
In situ- and satellite-observed AOT (aerosol optical thickness at TKY, Japan

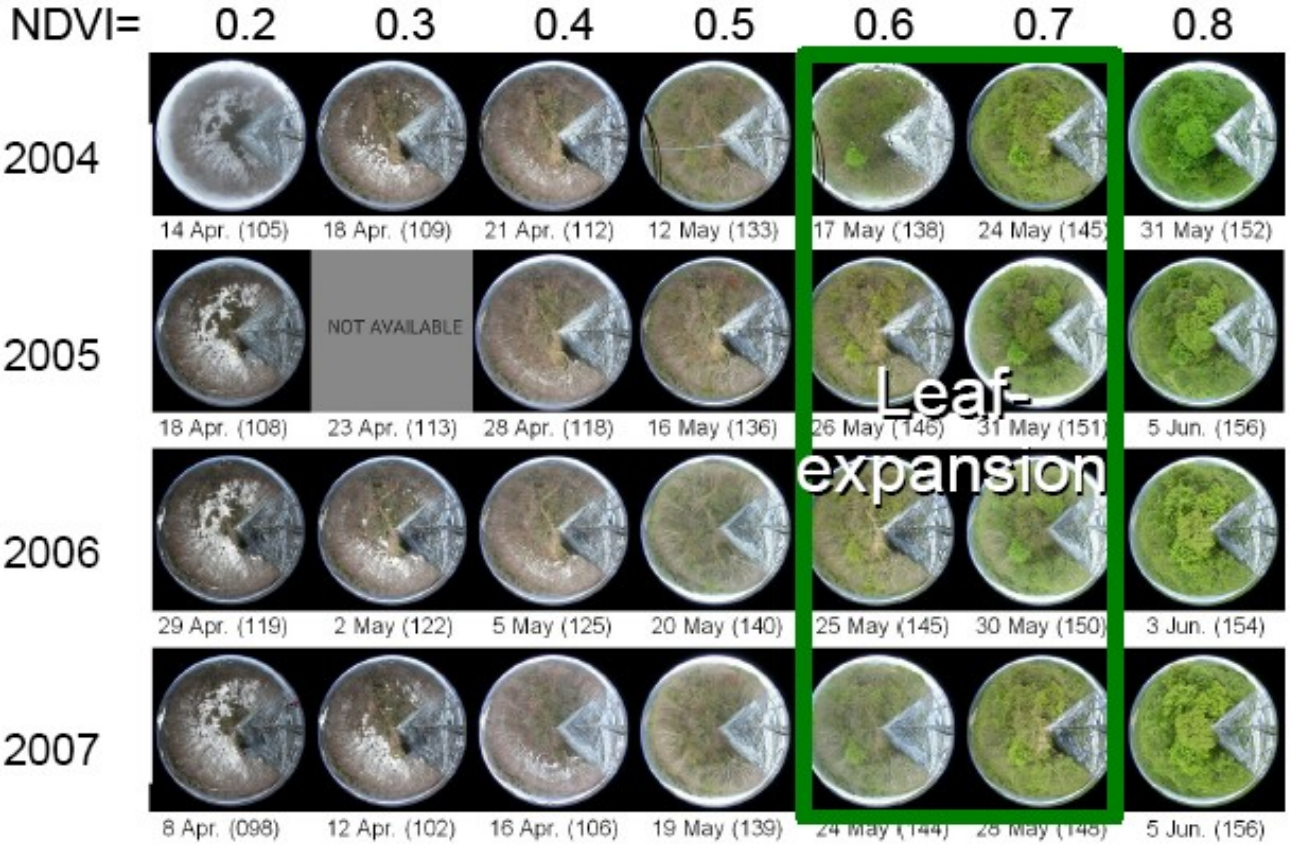


Finally, let's check some ***papers using PEN data***!

Check for the criterion of the timing of leaf-expansion by using NDVI in a deciduous broad-leaved forest

v.s.





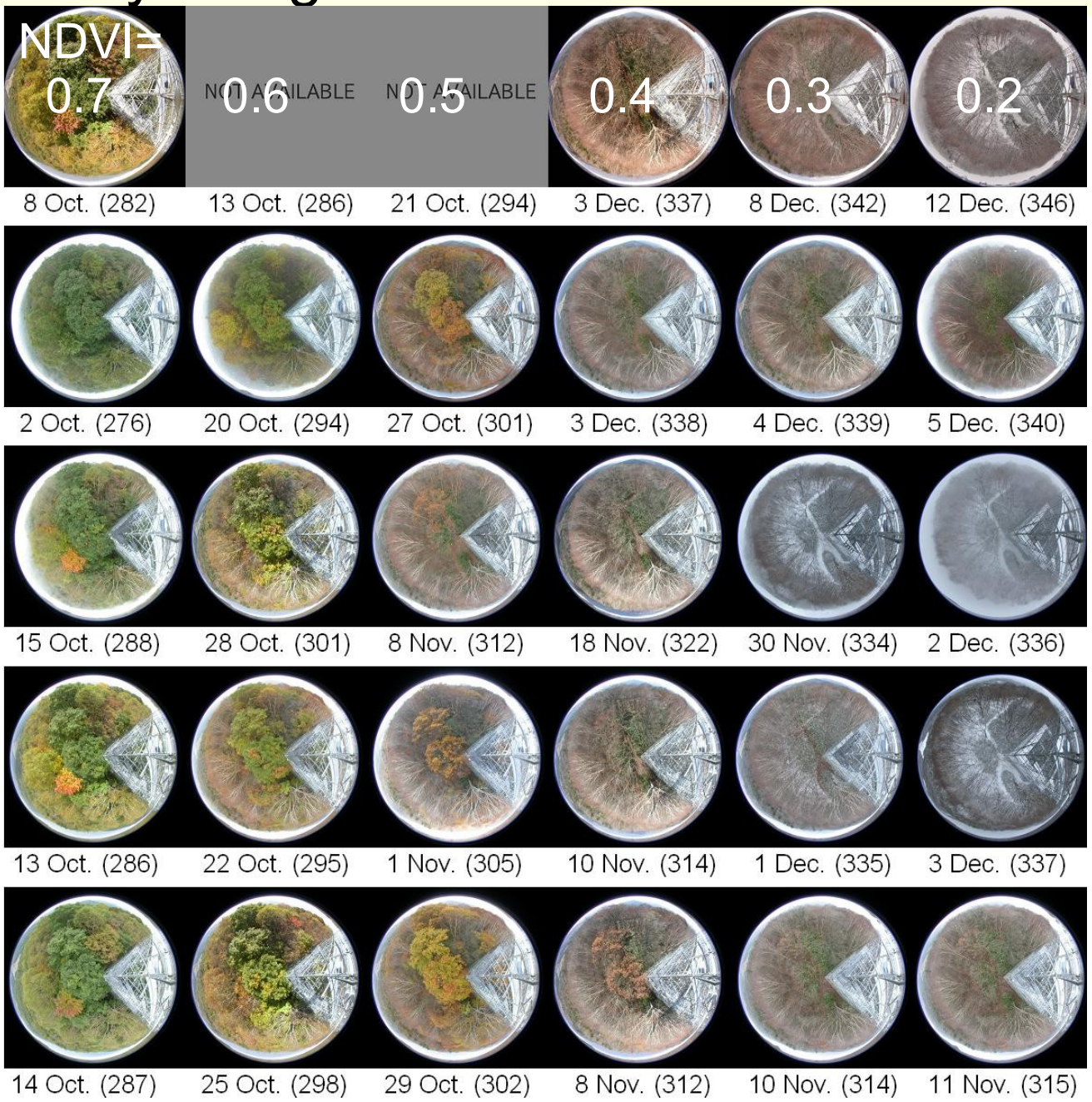
Criterion of leaf-expansion:

NDVI=0.6-0.7

Previous study (midpoint, maximum growth): misleading!

[Nagai et al. Agric For Met 2010]

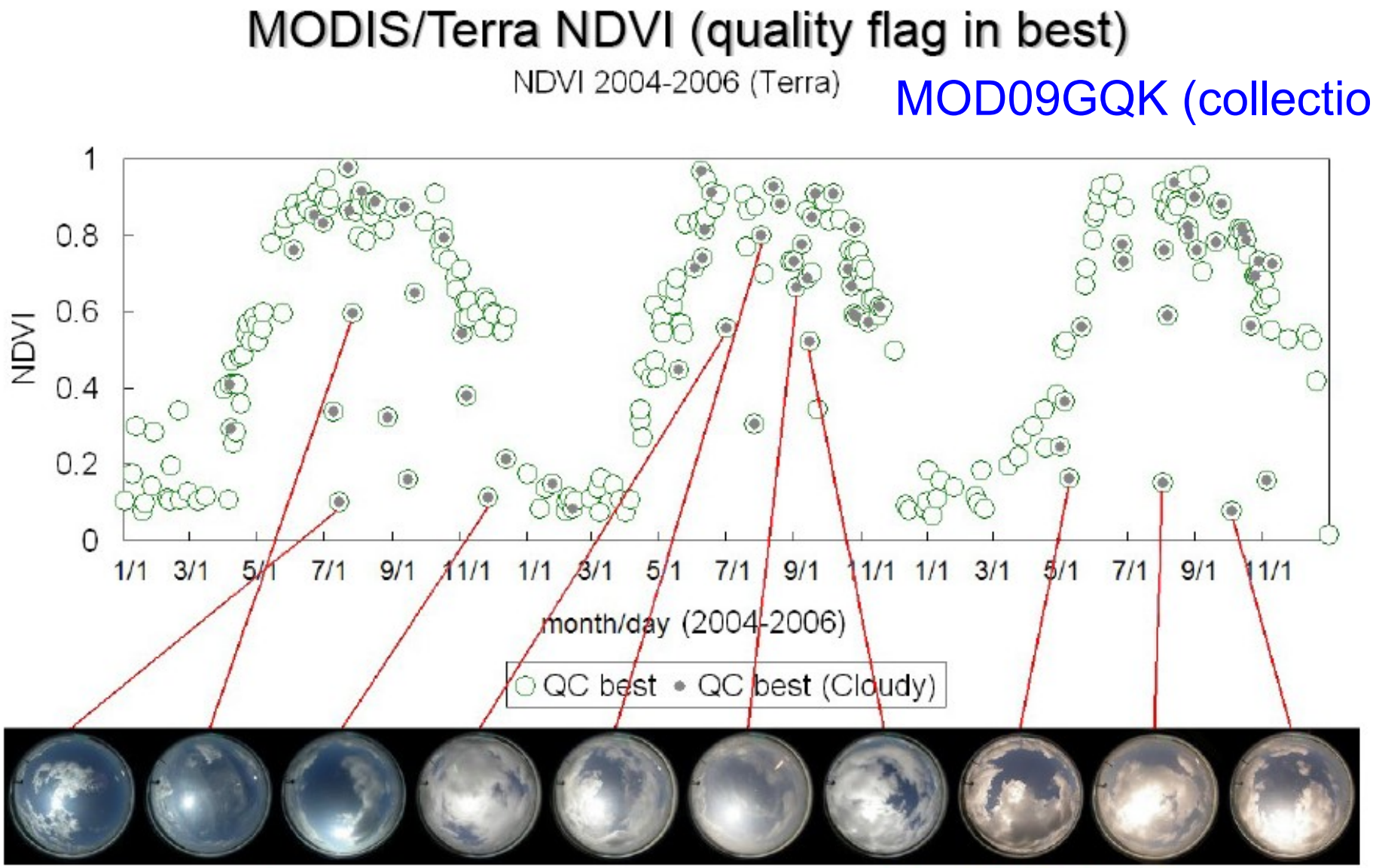
Check for the criterion of the timing of defoliation by using NDVI in a deciduous broad-leaved forest



Criterion of defoliation: No NDVI values!

[Nagai et al. Agric For Met 2010]

Check for the quality flag in MODIS daily data



There are many unreasonable NDVI data due to cloud contamination.

Validity of the quality flags of MODIS/Terra & Aqua

(MOD/MYD09GQK “collection 4”)

2004-2006	Best quality in Terra NDVI	in Aqua NDVI
	154/229 days (67%)	111/186 days (60%)
	75/229 days (33%)	75/186 days (40%)

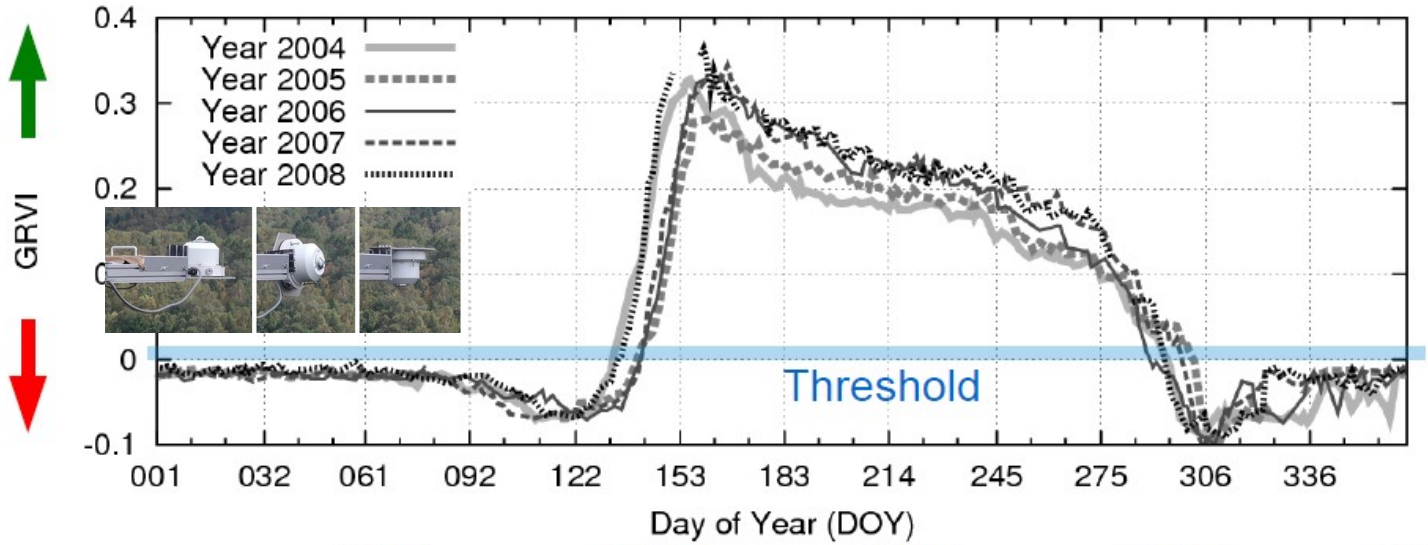
The validity of the quality flags of MODIS products is about 60-70%.

[Nagai et al. Eco Res 2010]

Develop a new vegetation index GRVI (green-red ratio vegetation index)

[Motohka et al. submitted]

$$GRVI = \frac{Green - Red}{Green + Red}$$

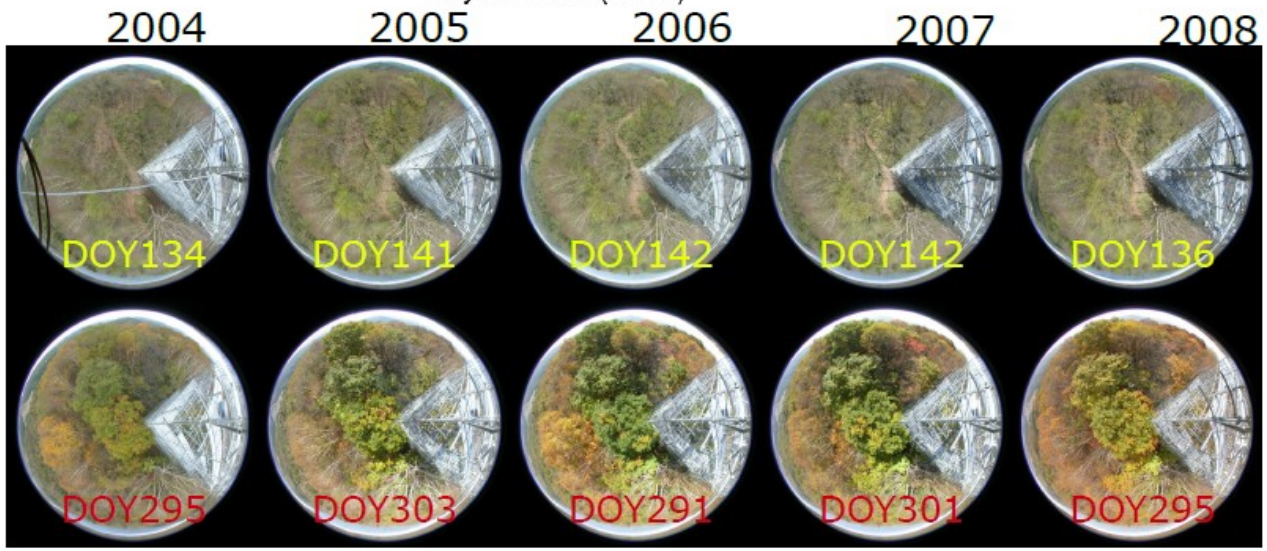


Spring

GRVI=0

Autumn

GRVI=0




Thank you for your attention,
all PEN members,
and UK-Japan Collaboration Project!
WWW.UKJAPAN2008.JP