

Calibration and validation for remote sensing data

► Geometry

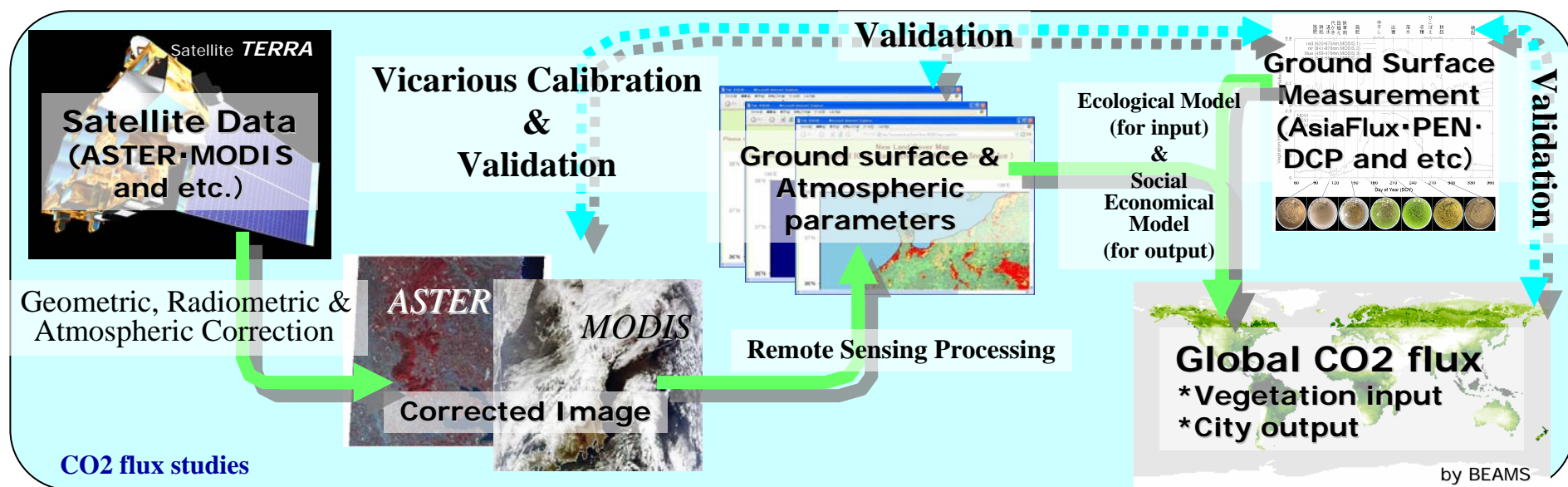
- ⊗ DEM: Comparison with the DSM by Laser Lidar and etc. (collaboration with GEON)
- ⊗ GCP: DCP (Degree Confluence Project) & Collection System

► Radiance

- ⊗ Vicarious Calibration and Cross calibration (collaboration with Taiwan, UoA and etc.)

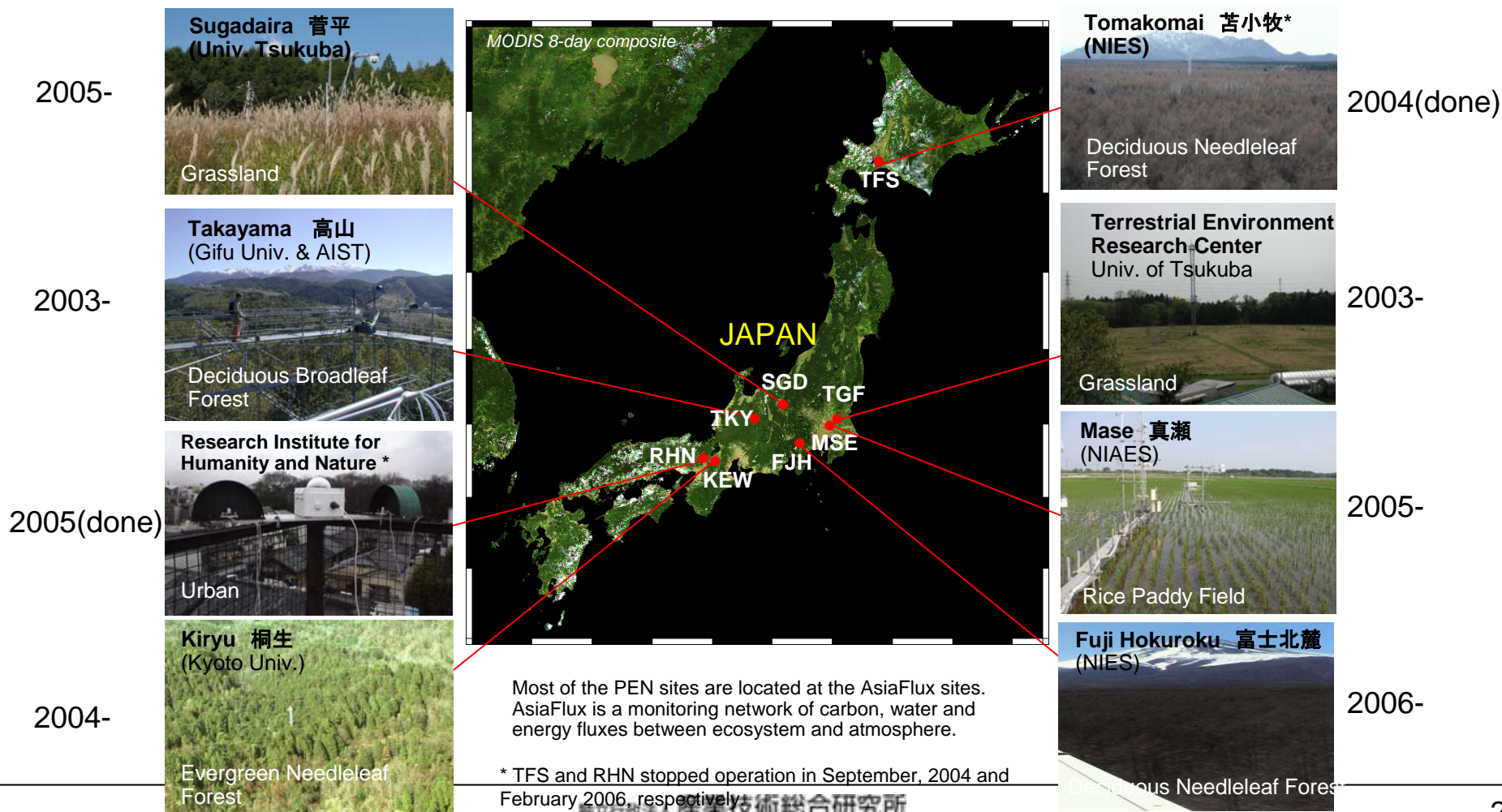
► Ground surface and atmospheric parameters (collaboration with NIES, UoT and etc.)

- ⊗ Reflectance, Phenology, Aerosol, CO₂ flux, NDVI, PAR, LAI, PRI and etc
: Sensor Network (ex. **PEN**, **Asiaflux** and etc.)
- ⊗ Land cover/Land use : DCP (Degree Confluence Project) (collaboration with VAST & NIES)



Phenological Eyes Network (pheno-eye.org)

- Network of ground observation sites for long-term continuous validation of terrestrial ecological remote-sensing. Most sites are located at AsiaFlux sites



PEN observation system



Main instrument

- ▶ Automatic-capturing Digital Fisheye Camera (ADFC)
- ▶ HemiSpherical Spectro-Radiometer (HSSR)
- ▶ SunPhotometer (SP) with Surface Pressure



Other Measurements

- ▶ LAI : Litter trap, LAI2000 and laser profiling system
- ▶ Canopy level measurements : Incoming and transmitting PAR, shoot-phenology
- ▶ Leaf-level measurements : Physiology (LI6400), Optics (Field Spec + integrating sphere)
Pigments (SPAD and chemical extraction), C/N, Leaf-mass-per-area(LMA)
- ▶ Ecosystem-level measurement : NEE (CO₂ uptake), evapotranspiration, soil respiration etc by the AsiaFlux

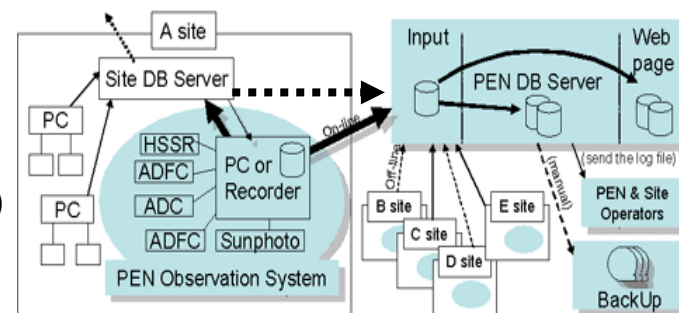
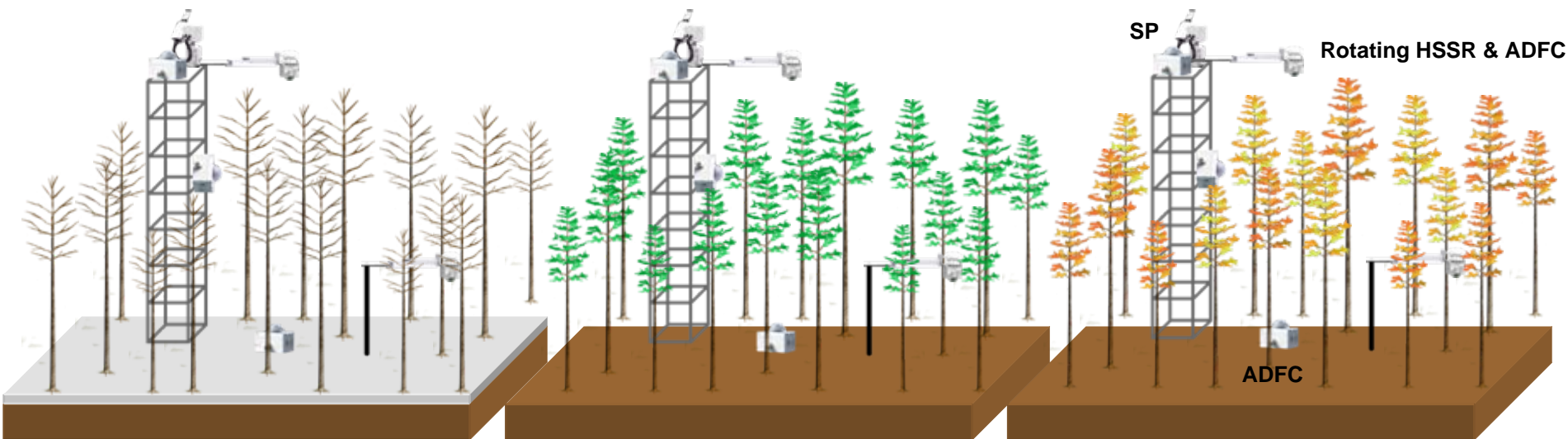


Figure 1 Phenological Eyes Network (PEN) System

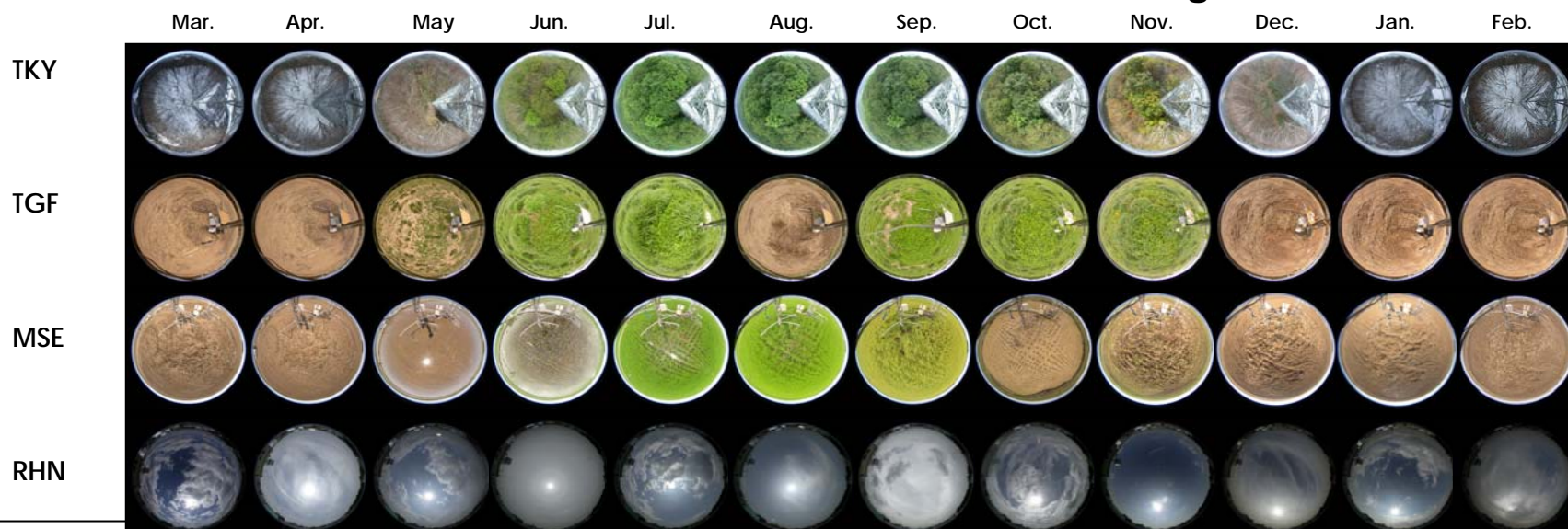


Automatic-capturing Digital Fisheye Camera (ADFC)

- Observation
 - ▶ Phenology
 - ▶ Sky and ground condition
 - ▶ Cloud cover
 - ▶ Leaf Area Index
- Fisheye (Calibrated) Image
- Short-time intervals (2-180min)
- Cost ~ US\$1,000 / 1set
- Operation : Remote Code or Computer
- Power: AC / DC
- Preparing NIR version (testing)

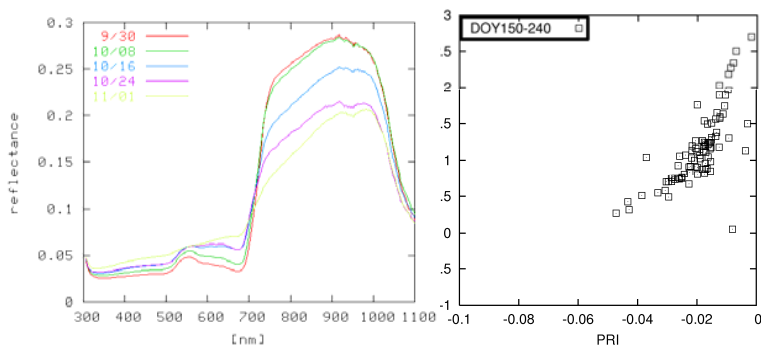


2005 - 2006 ADFC images



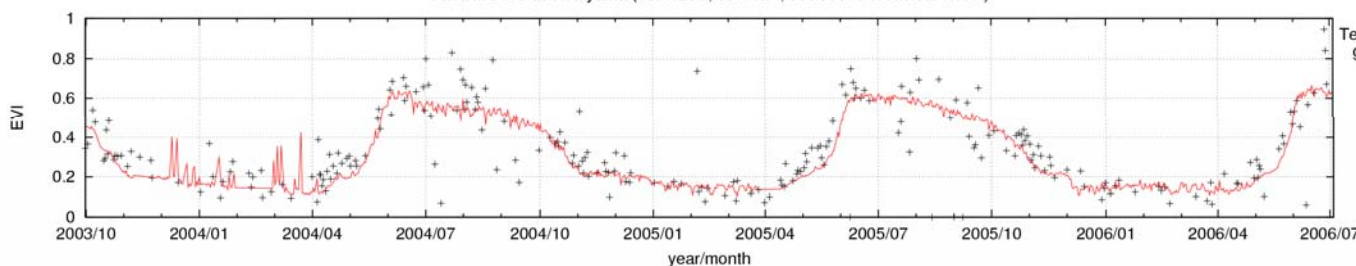
HemiSpherical Spectro-Radiometer (HSSR)

- Observation
 - ▶ Spectral reflectance for validation for the satellite multi-spectral sensors
 - ▶ Spectral Irradiance and PAR
- Spectral (Hemispherical-H.) Reflectance
 - ▶ A set of spectral pyranometers for downward and upward radiation
 - ▶ Rotating pyranometer (no necessary cal.)
- Spectral Pyranometer
 - ▶ Wavelength: 300 - 900nm or 300 - 1100nm
 - ▶ Half Band Width : ~3 or ~10nm
 - ▶ Channel interval : 2 to 3 nm



In order to avoid complex mechanical manoeuvres and save weight, the next generation HSSR system is under development

Terra/MODIS at Takayama (137.423E, 36.146N; deciduous broadleaf forest)

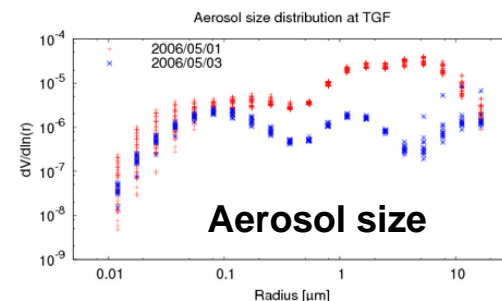
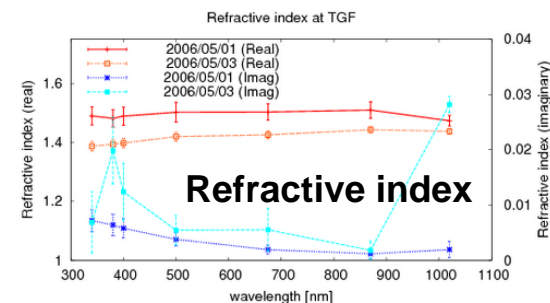
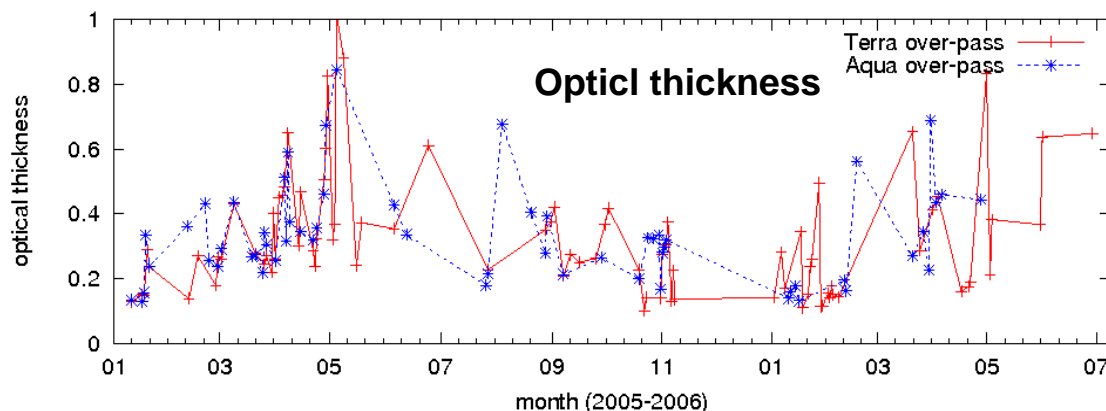


Terra MOD09 ground obs. By combination of HSSR and

ADFC, we can check the phenology detection algorithms with the spectral indices.

SunPhotometer (SP)

- Observation
 - ▶ validation of the atmospheric correction of satellite data
 - ▶ monitoring of atmospheric pollutions
- Directional sky/surface radiance
 - ▶ Aerosol parameters (optical thickness, refractive index and size distribution) for atmospheric correction.
 - ▶ Solar direct and diffuse radiations for the photosynthesis study
 - ▶ Surface directional radiation for the vegetation BRDF & Hot Spot study
- SkyRadiometer
 - ▶ Center Band Wavelength: 340nm, 380nm, 400nm, 500nm, 675nm, 870nm, 940nm, 1020nm, 1225nm, 1600nm, 2200nm
 - ▶ Half Band Width: ~10nm
 - ▶ Field of View : 1 degree



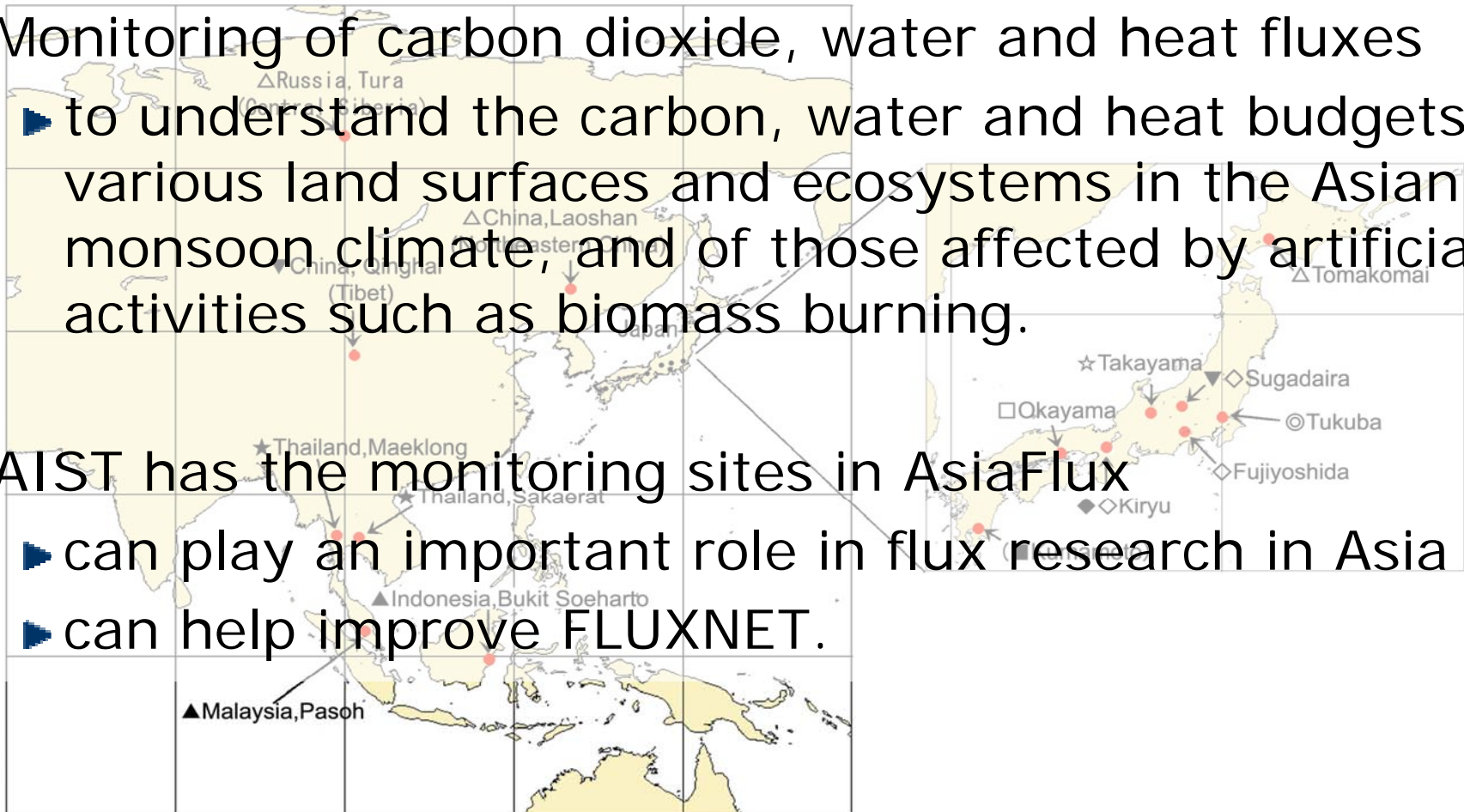
AsiaFlux

Monitoring of carbon dioxide, water and heat fluxes

- to understand the carbon, water and heat budgets of various land surfaces and ecosystems in the Asian monsoon climate, and of those affected by artificial activities such as biomass burning.

AIST has the monitoring sites in AsiaFlux

- can play an important role in flux research in Asia
- can help improve FLUXNET.



△Larch

▲Tropical rain forest

★Tropical seasonal forest

☆Broadleaf deciduous forest

◇Red pine

◆Cypress

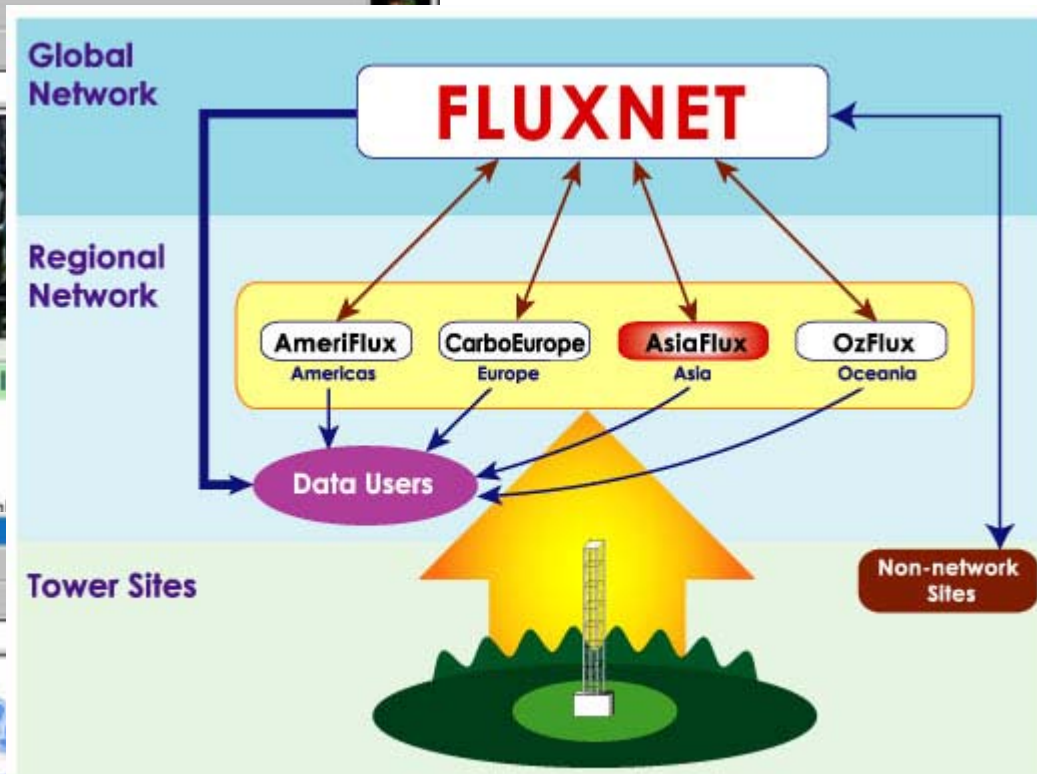
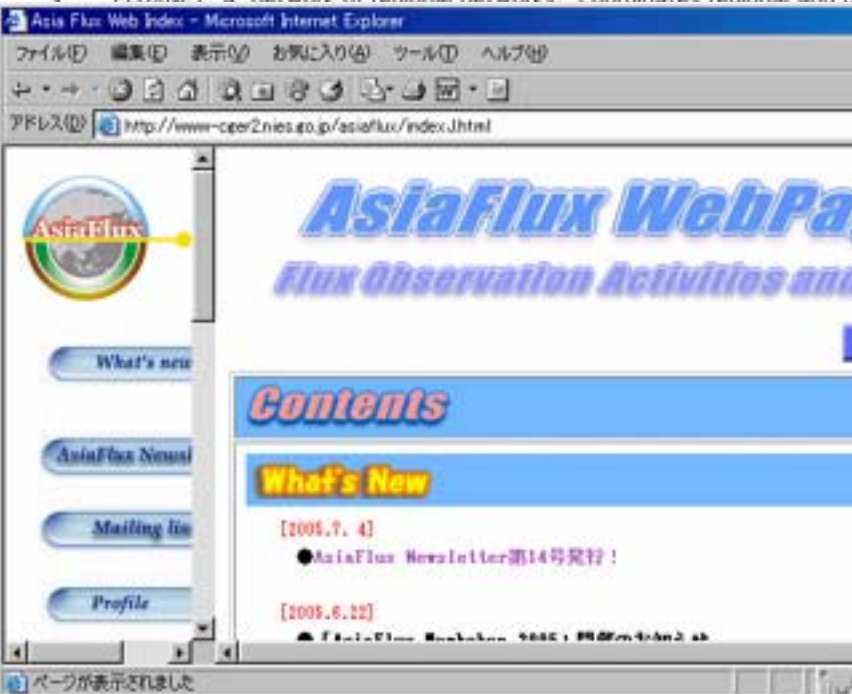
□Rice paddy

■Maize

▼Alpine grassland

◎Grassland

AsiaFlux in FLUXNET



Architecture of Global/Regional Flux Networks

Related web sites:

<http://www-cger2.nies.go.jp/asiaflux/>
<http://www.aist.go.jp/RIODB/PXECO/>
<http://www.suiri.tsukuba.ac.jp/~s-1pro/>

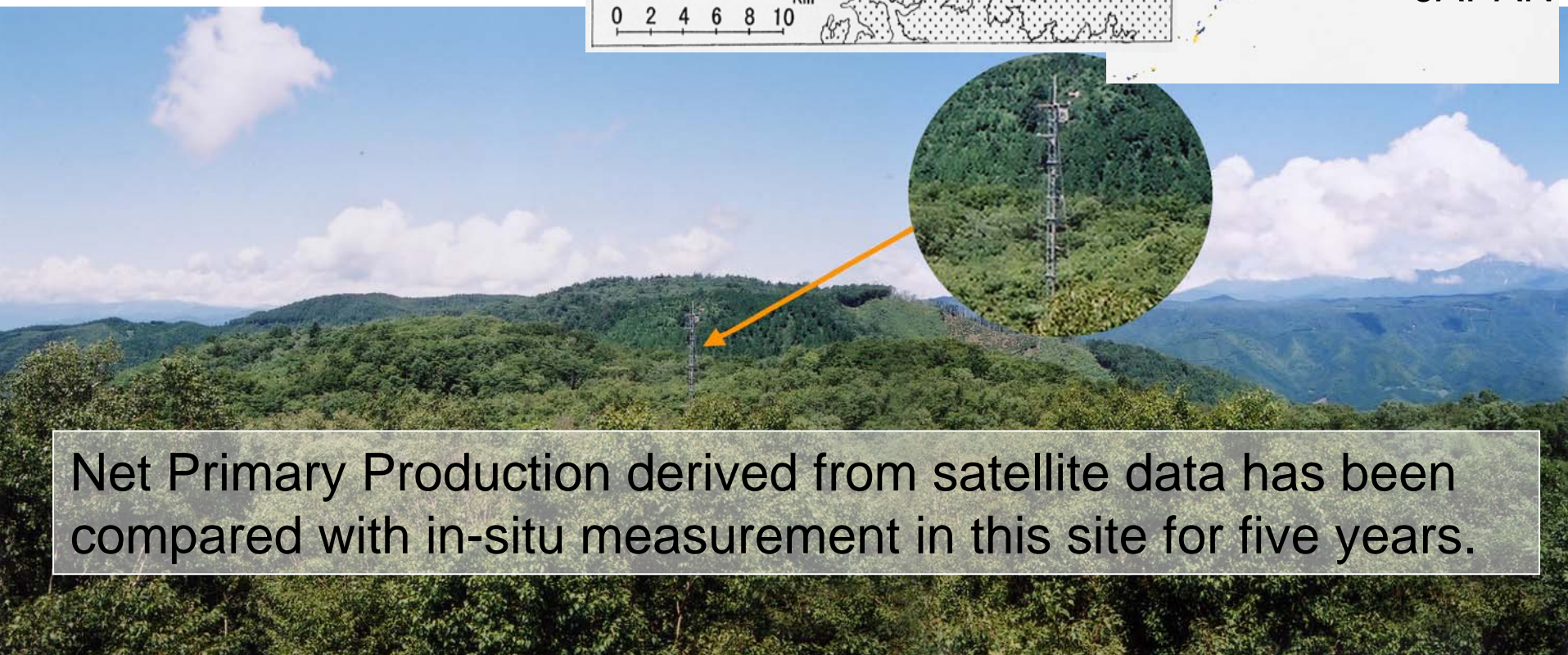
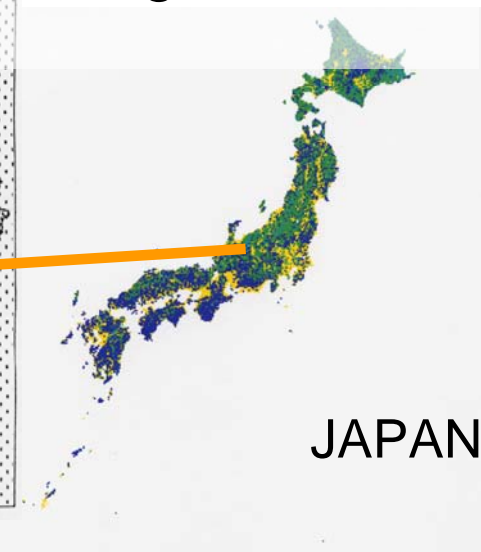
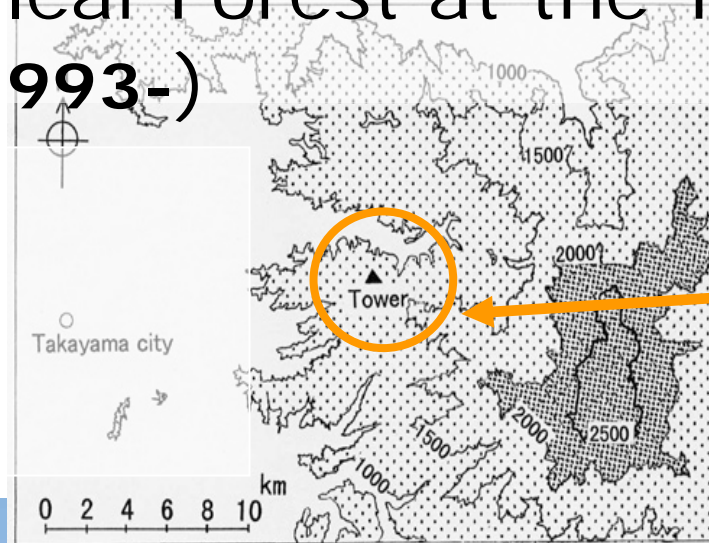
Deciduous broadleaf Forest at the Takayama area in JAPAN (1993-)

Elevation 1420 m

Annual temp 6.4 °C

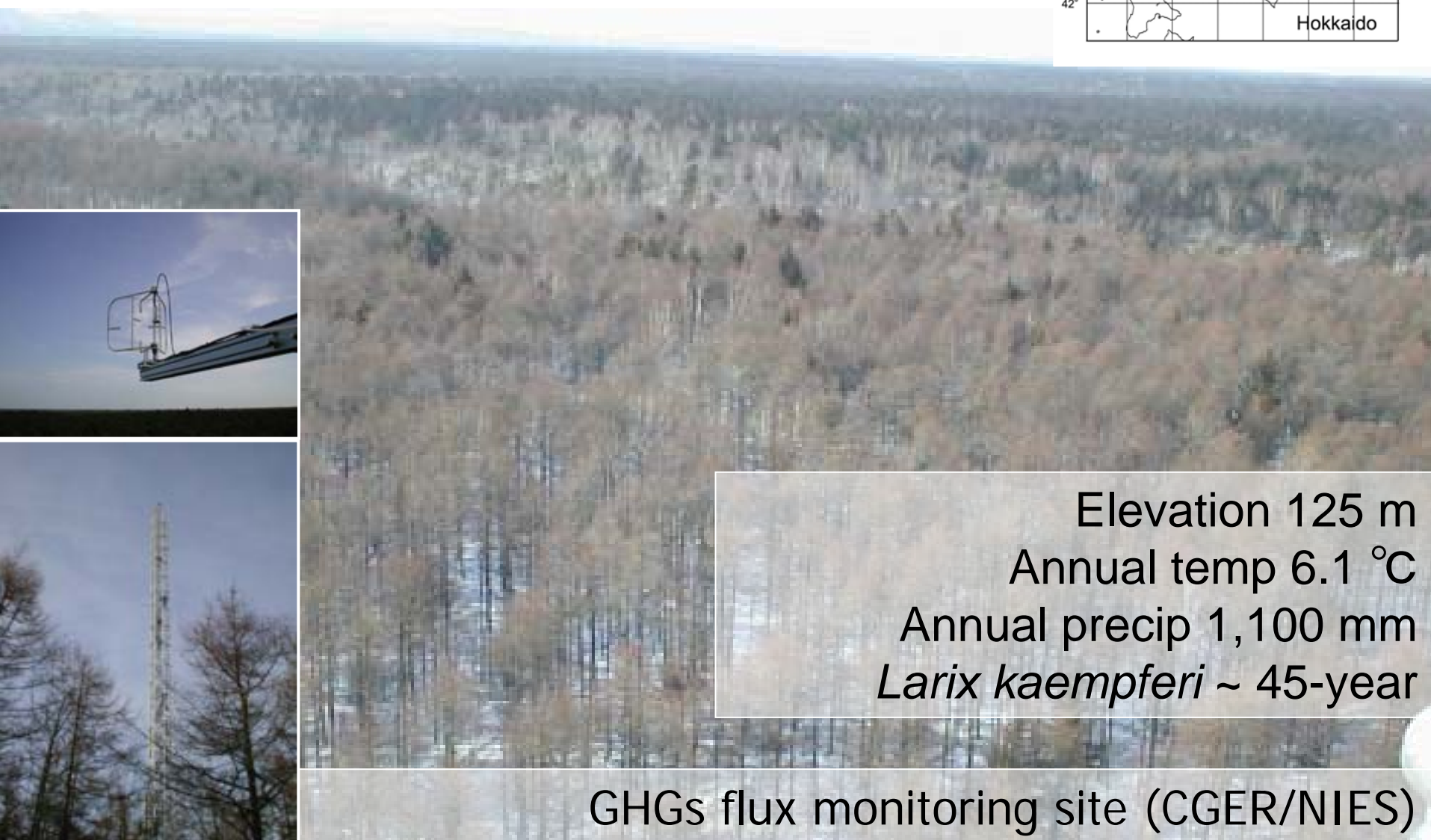
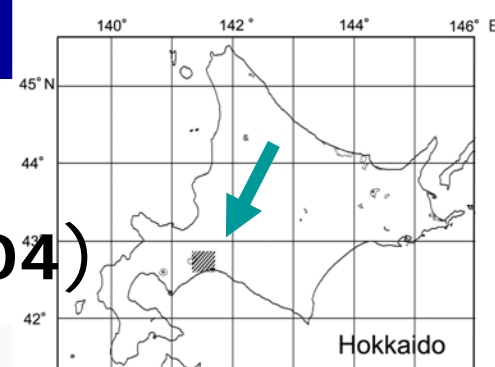
Annual precip 2,300 mm

~ 50-year

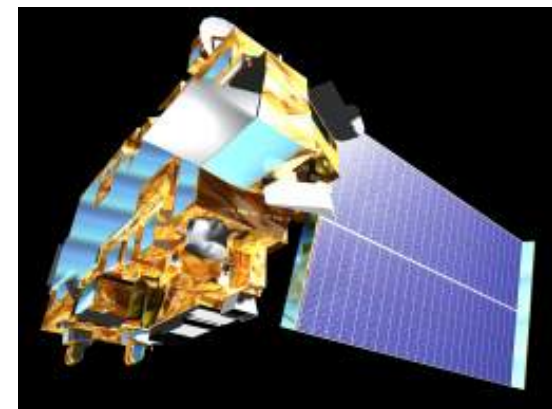
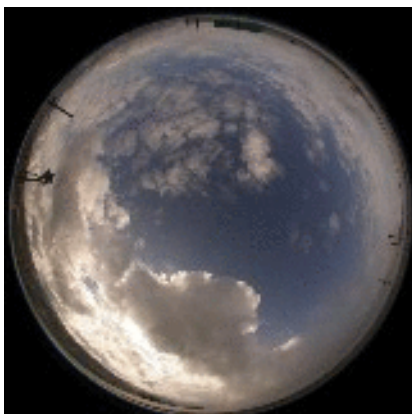


Net Primary Production derived from satellite data has been compared with in-situ measurement in this site for five years.

Deciduous Needleleaf Forest at the Tomakomai area in JAPAN (2000-2004)



GHGs flux monitoring site (CGER/NIES)



**Thank you very much
for your attention !**

