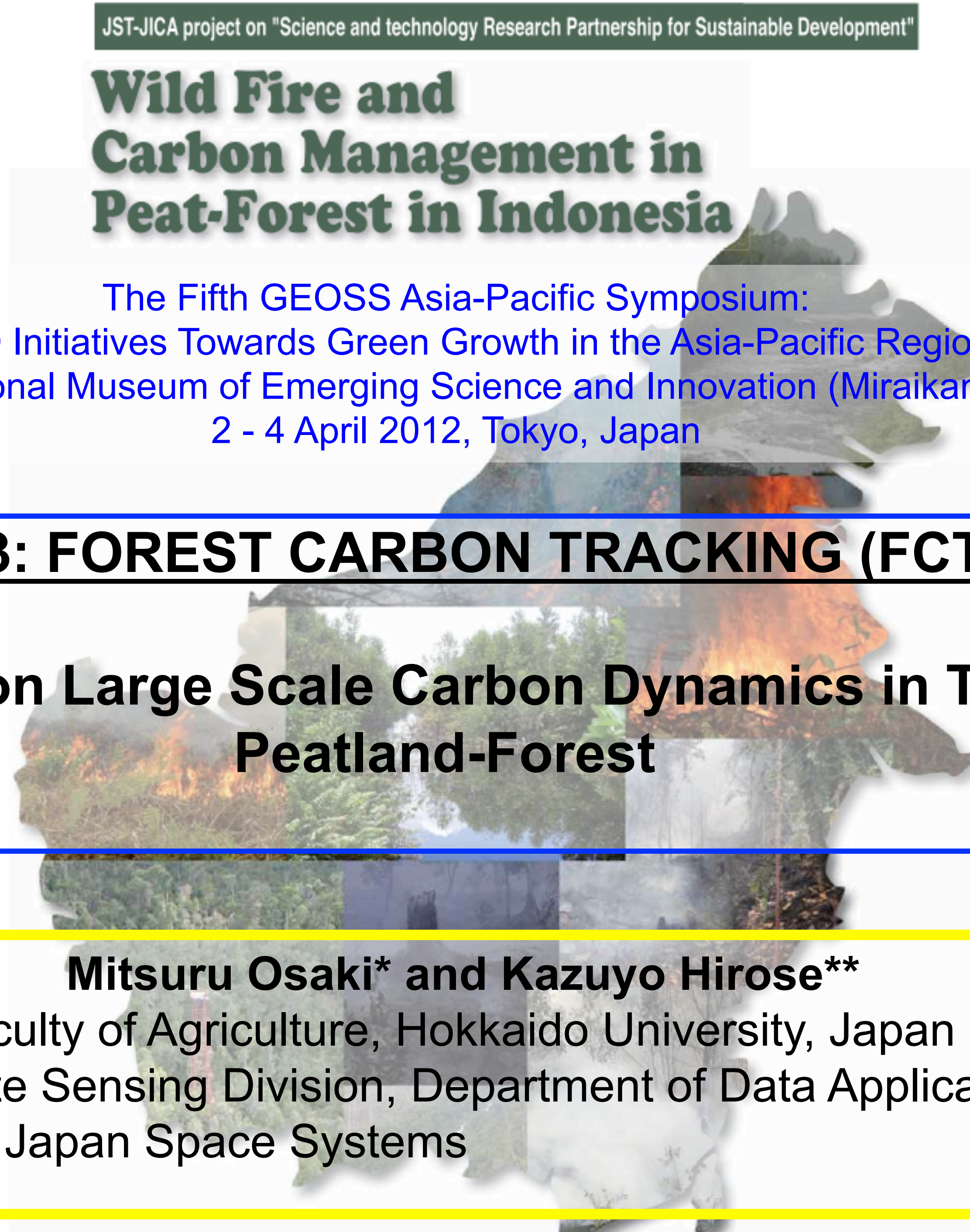


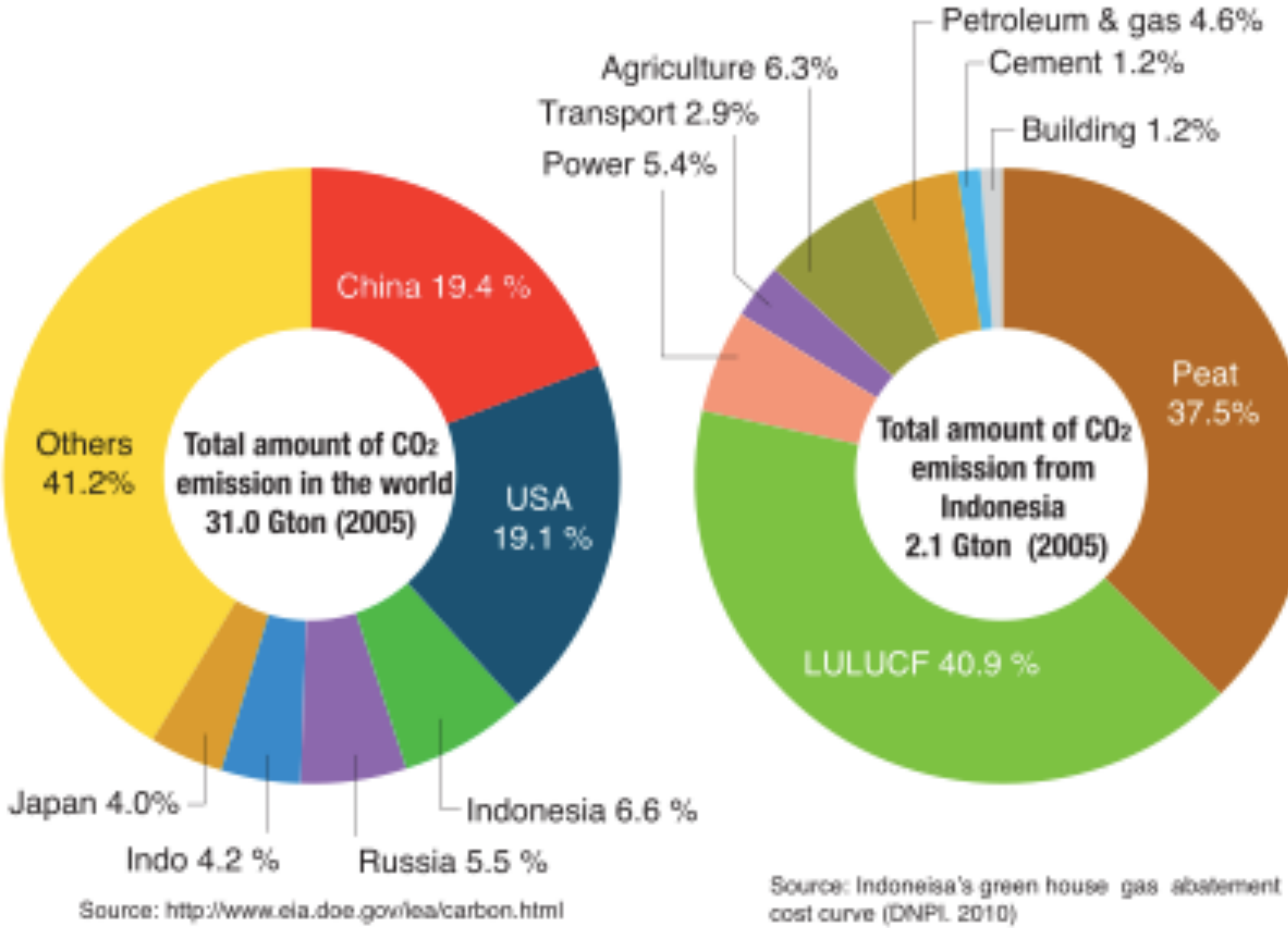
The Fifth GEOSS Asia-Pacific Symposium:
“GEO Initiatives Towards Green Growth in the Asia-Pacific Region”
National Museum of Emerging Science and Innovation (Miraikan)
2 - 4 April 2012, Tokyo, Japan

WG3: FOREST CARBON TRACKING (FCT)

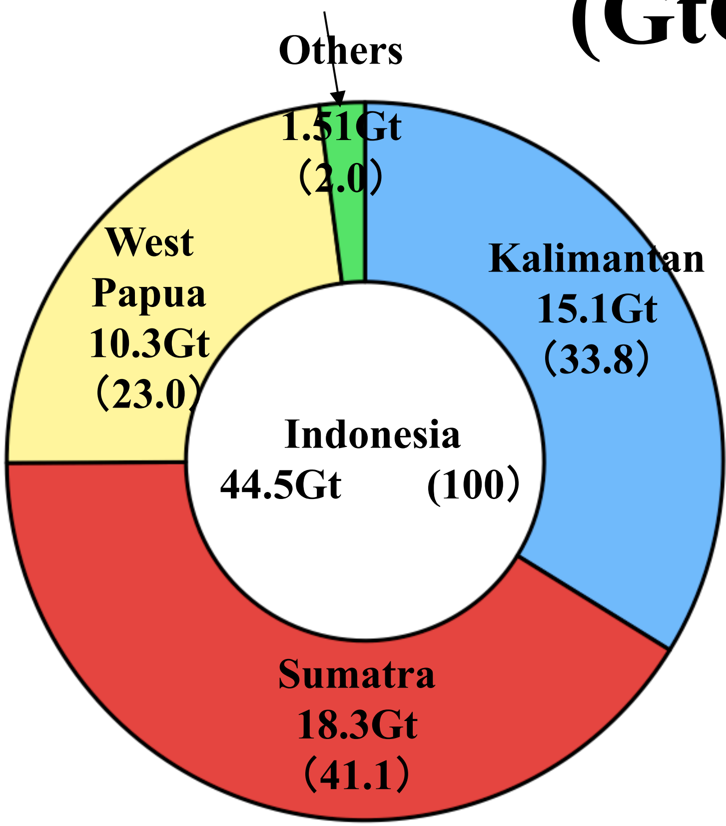
Estimate on Large Scale Carbon Dynamics in Tropical Peatland-Forest

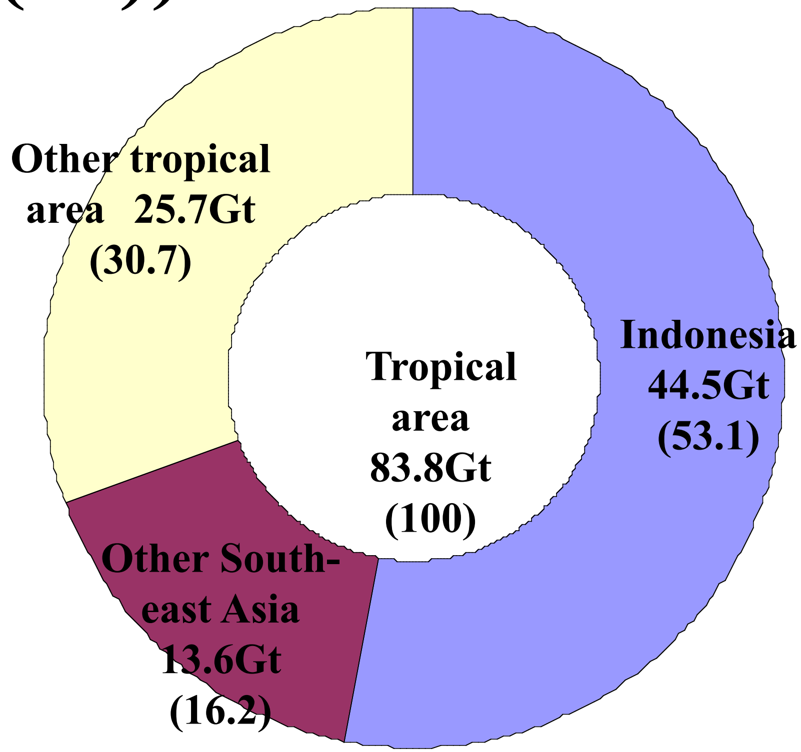
Mitsuru Osaki* and Kazuyo Hirose**
*Research Faculty of Agriculture, Hokkaido University, Japan
**Earth Remote Sensing Division, Department of Data Application and Development, Japan Space Systems

Total amount of CO_2 emission

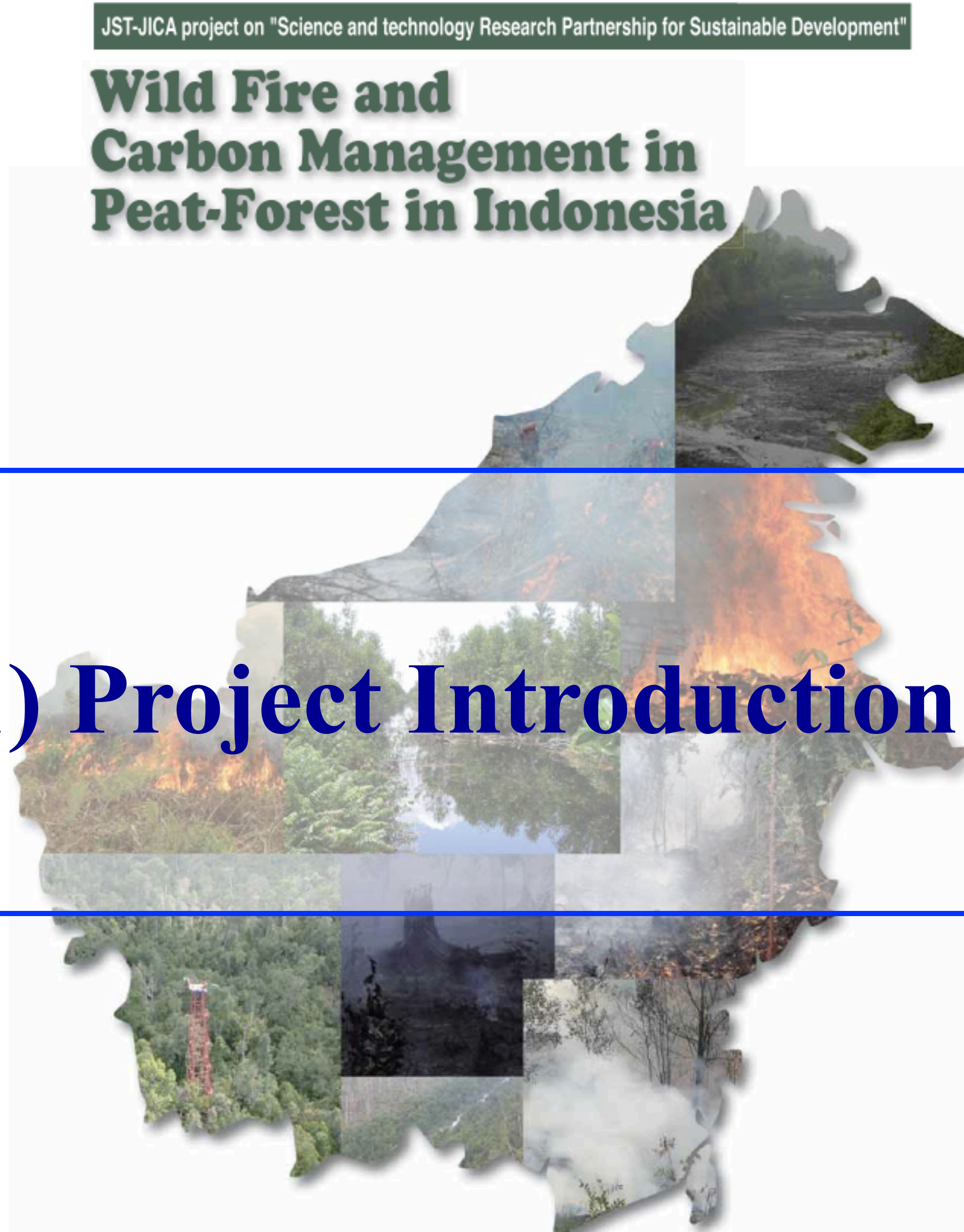


Amount of Carbon in Tropical Peat (GtC (%))





（From Maria Strack ed., 2008: Peatlands and Climate Change. International Peat Society, 223pp.）

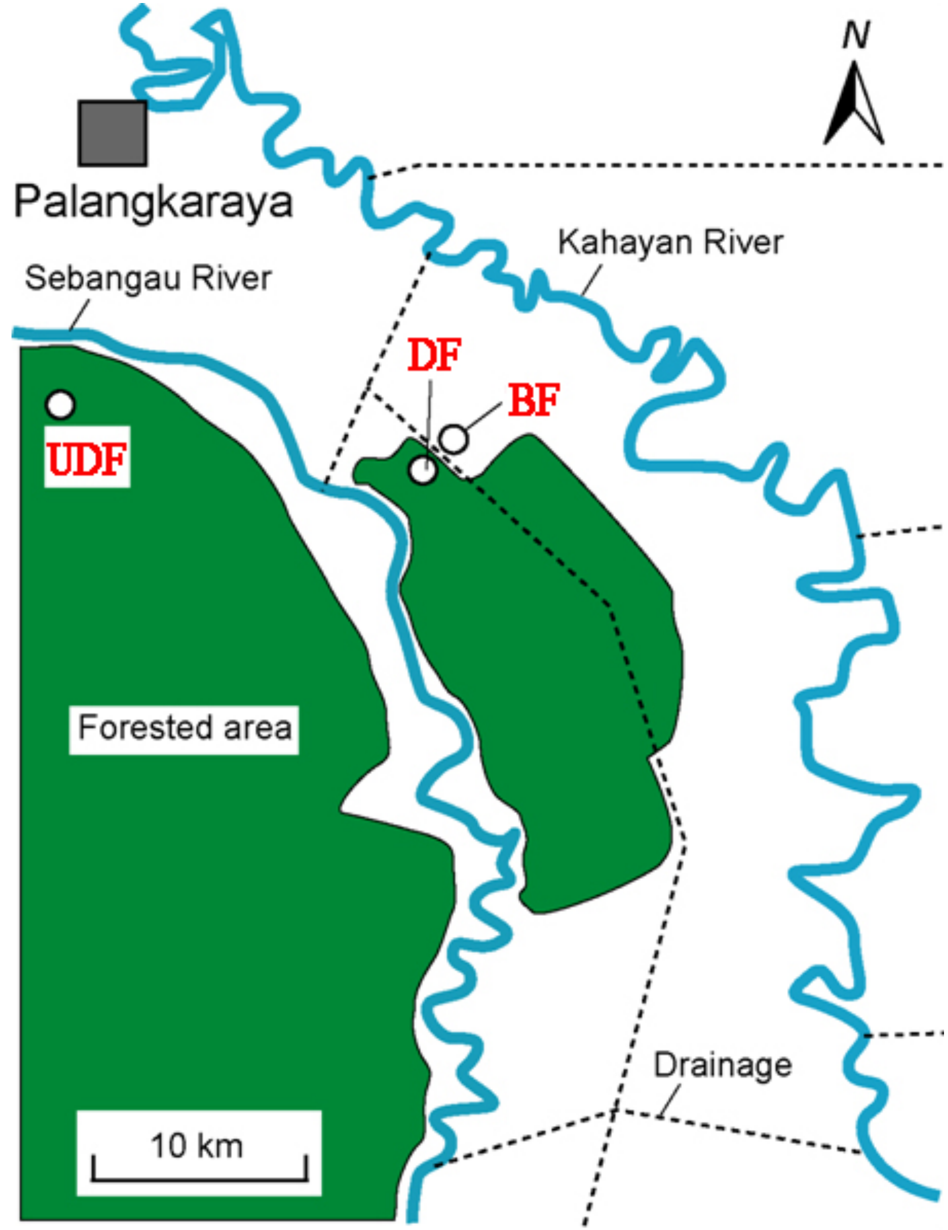


(1) Project Introduction

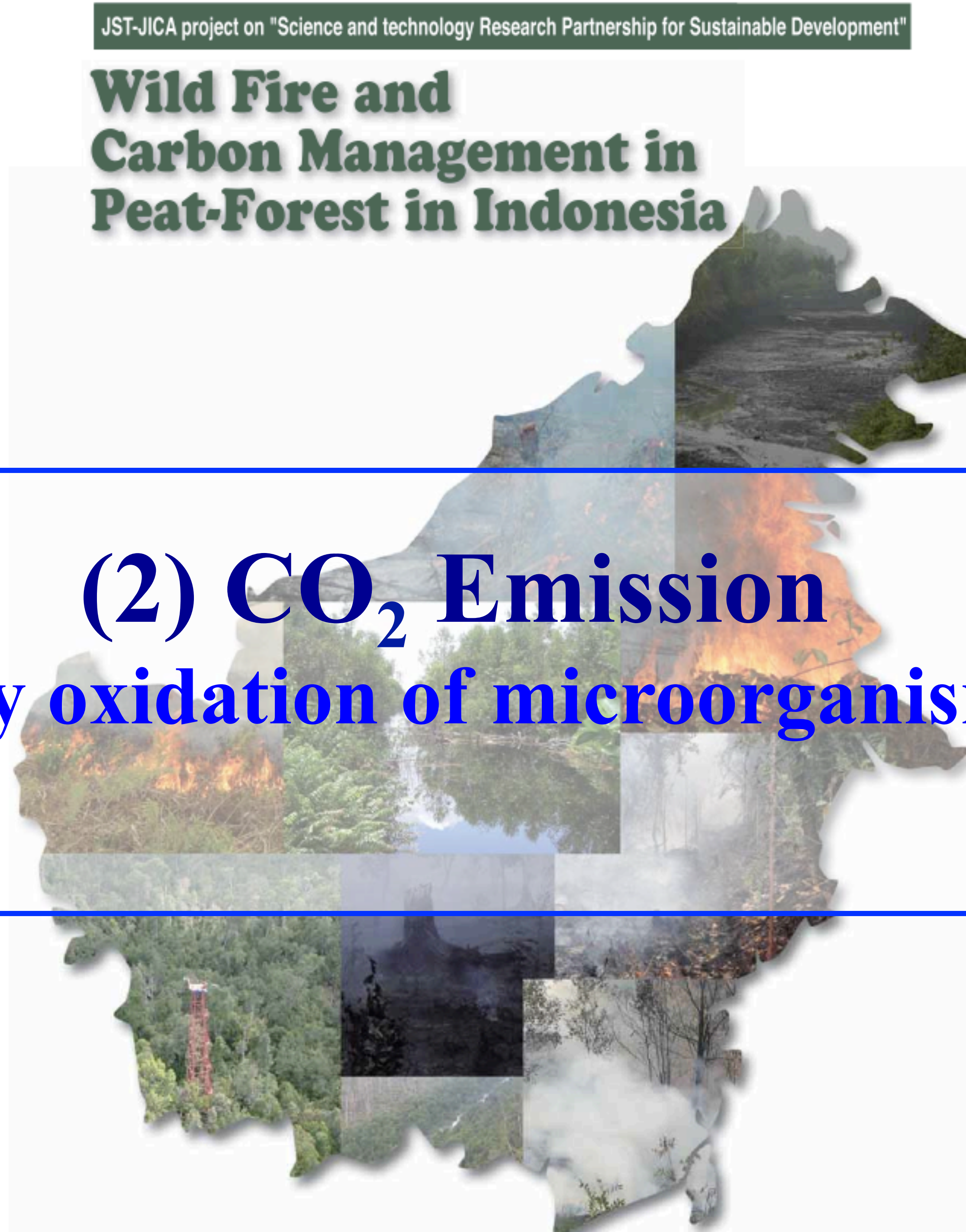
Study Site from 1997

- Central Kalimantan, Indonesia
- Peatland
- Mega Rice Project

Palangkaraya



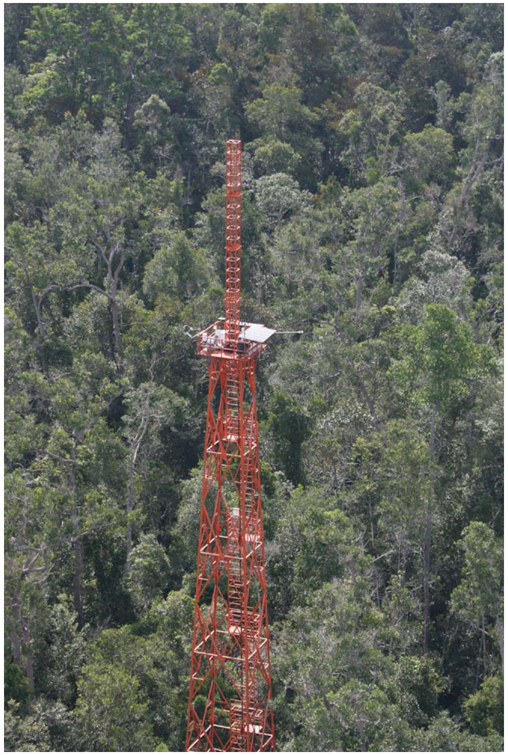
Study Topics:
- Green House Gasses Flux (CO_2, CH_4, N_2O)
- Fire Detection and Protection
- Water Table Monitoring and Management
- Peatland Ecology
- Integrated Farming



(2) CO_2 Emission

a) by oxidation of microorganisms

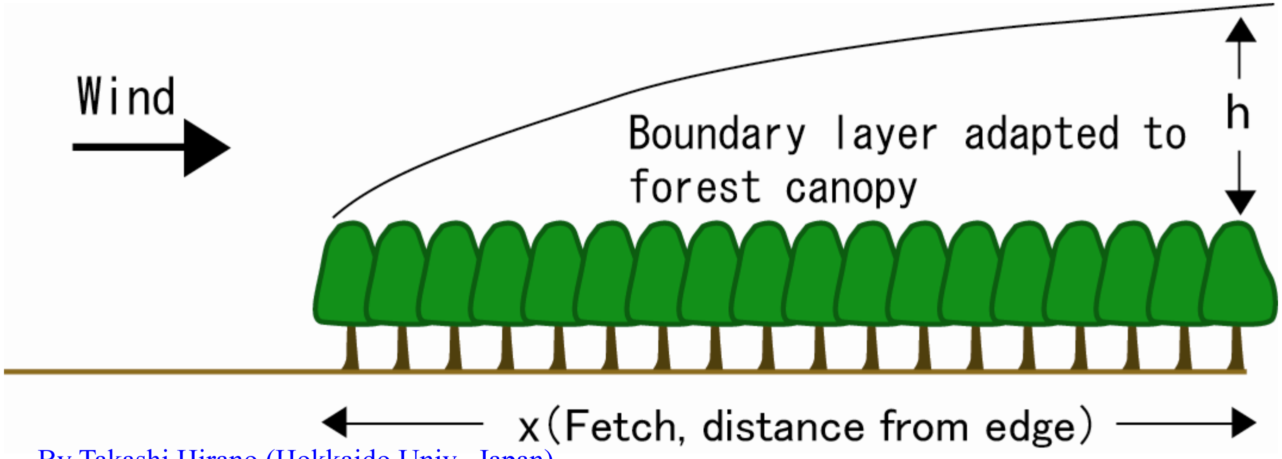
Eddy covariance technique



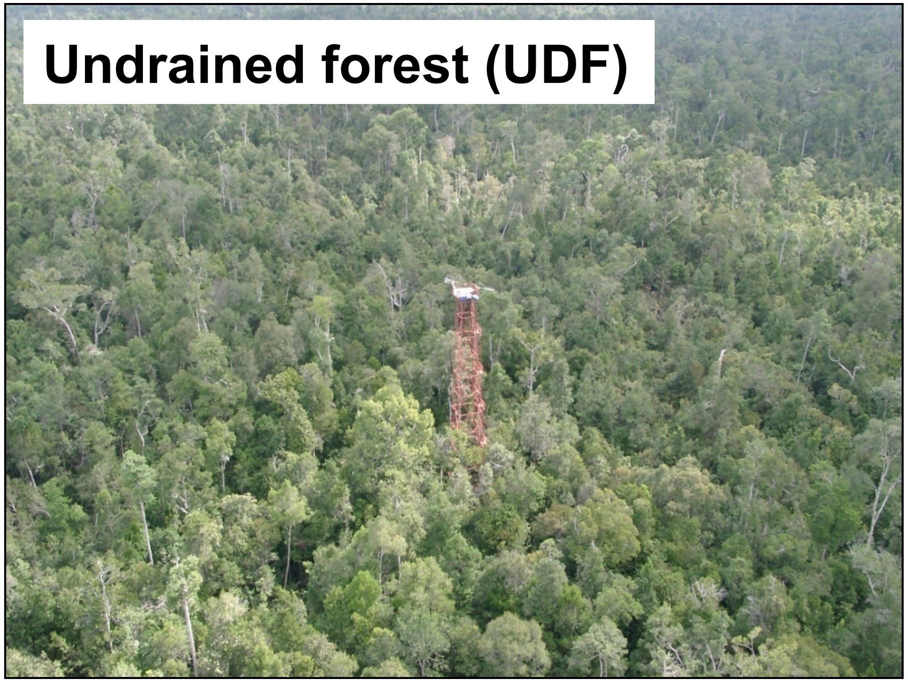
CO_2 flux (Net ecosystem CO_2 exchange) is calculated as the covariance of vertical wind speed and CO_2 density.

Within the boundary layer, vertical flux is almost constant.

If flux is measured at an appropriate height within the boundary layer, we can obtain flux averaged spatially over the fetch.

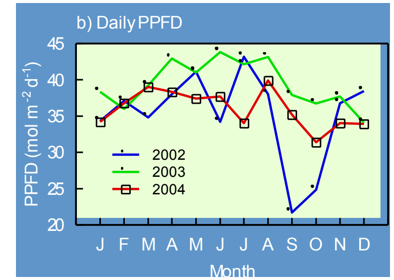


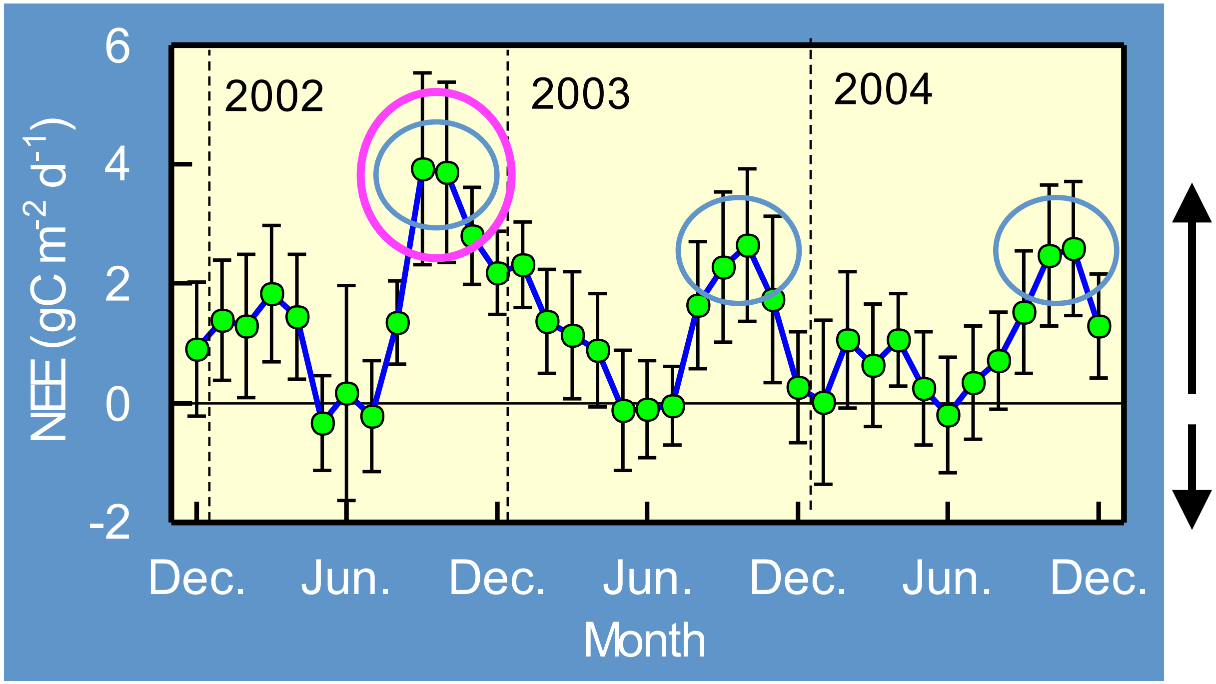
By Takashi Hirano (Hokkaido Univ., Japan)



By Takashi Hirano (Hokkaido Univ., Japan) (Unpublished)

Seasonal variation in NEE (net ecosystem CO_2 exchange) in DF site





- NEE was positive or neutral throughout 3 years (CO_2 source).
- CO_2 emission was the largest in the late dry season, partly due to the shading effect by smoke from farmland fires.
- CO_2 emission was the largest in 2002, an El Nino year, because of dense smoke from large-scale fires.

By Takashi Hirano (Hokkaido Univ., Japan)
(Unpublished)

Inter-site comparison of annual CO_2 balance

May 2004 to May 2005, Unit: gC m^{-2} yr^{-1}

Site	GPP	RE	NEE
UDF (undrained)	4000	4103	103
DF (drained)	3287	3724	437
BC (burnt & drained)	1075	1899	824

Peat decomposition

→ -1.4 mm yr^{-1}

→ -6.1 mm yr^{-1}

→ -11.6 mm yr^{-1}

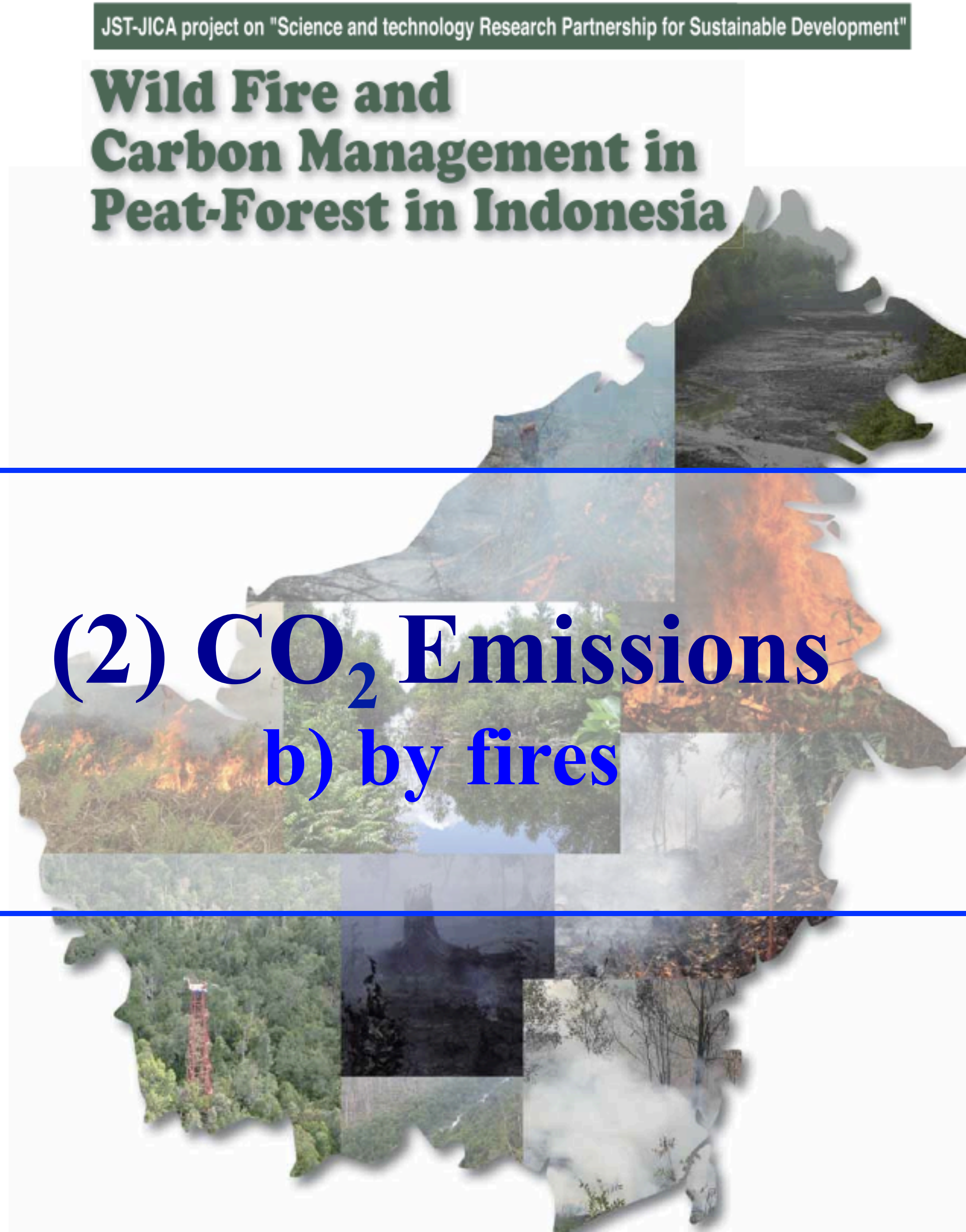
Positive NEE (CO_2 source strength): BC > DF > UDF

UDF also functioned as a CO_2 source to the atmosphere.

Results of peat sampling

- Peat growth rate in Indonesia : 1 - 2 mm yr^{-1} (Sorensen 1993)
- Carbon accumulation rate in Palangkaraya: 56 gC m^{-2} yr^{-1} (0.8 mm y^{-1}) (Page et al. 2004)

By Takashi Hirano (Hokkaido Univ., Japan)
(Unpublished)

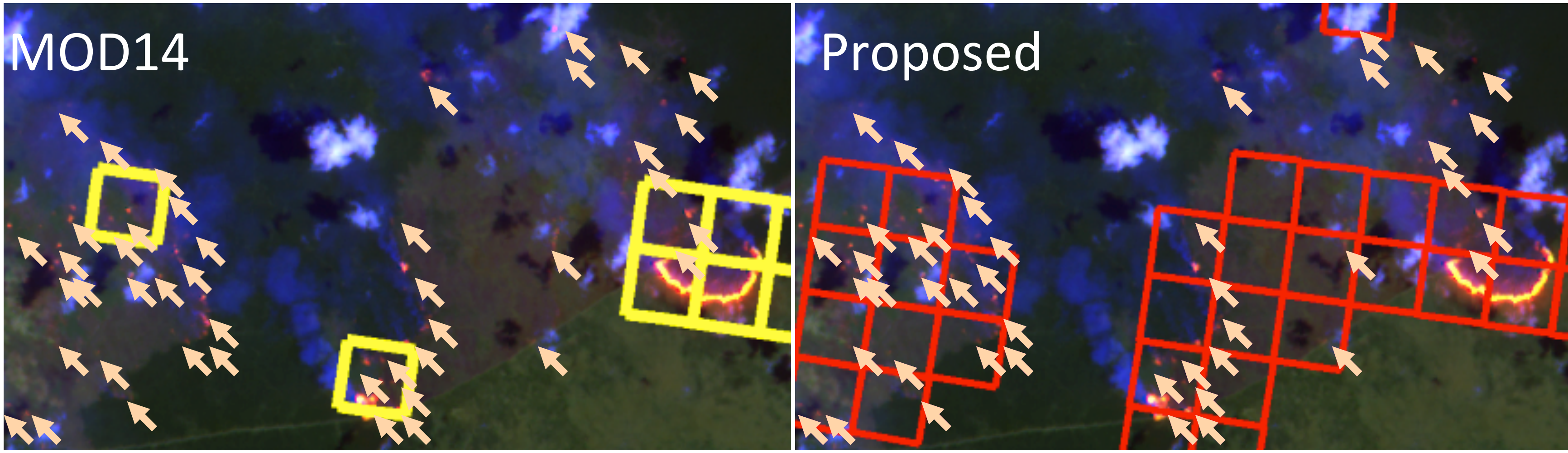


(2) CO_2 Emissions

b) by fires

Fire Detection

New Generation Fire Detection

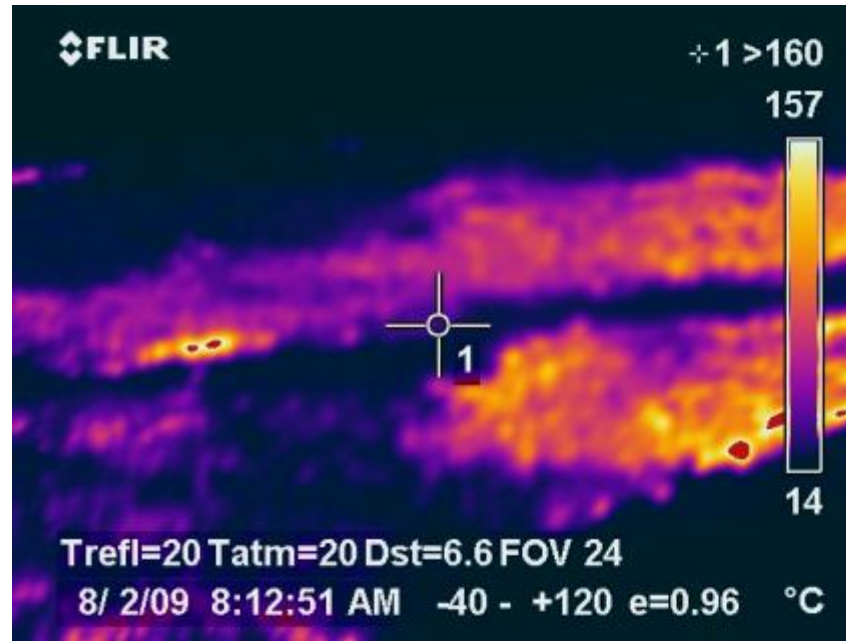


- Doubled S/N ratio (ASTER comparing to MOD14, and Algorism Improvement)
  - 80% more HS and & 10% less False Alarm
  - Smoldering, small fire or slush and burn
  - Geographical distribution is completely different
  - Suitable to decide firefighting strategy and confirm

Example of Thermograph Image of flight observation

RGB

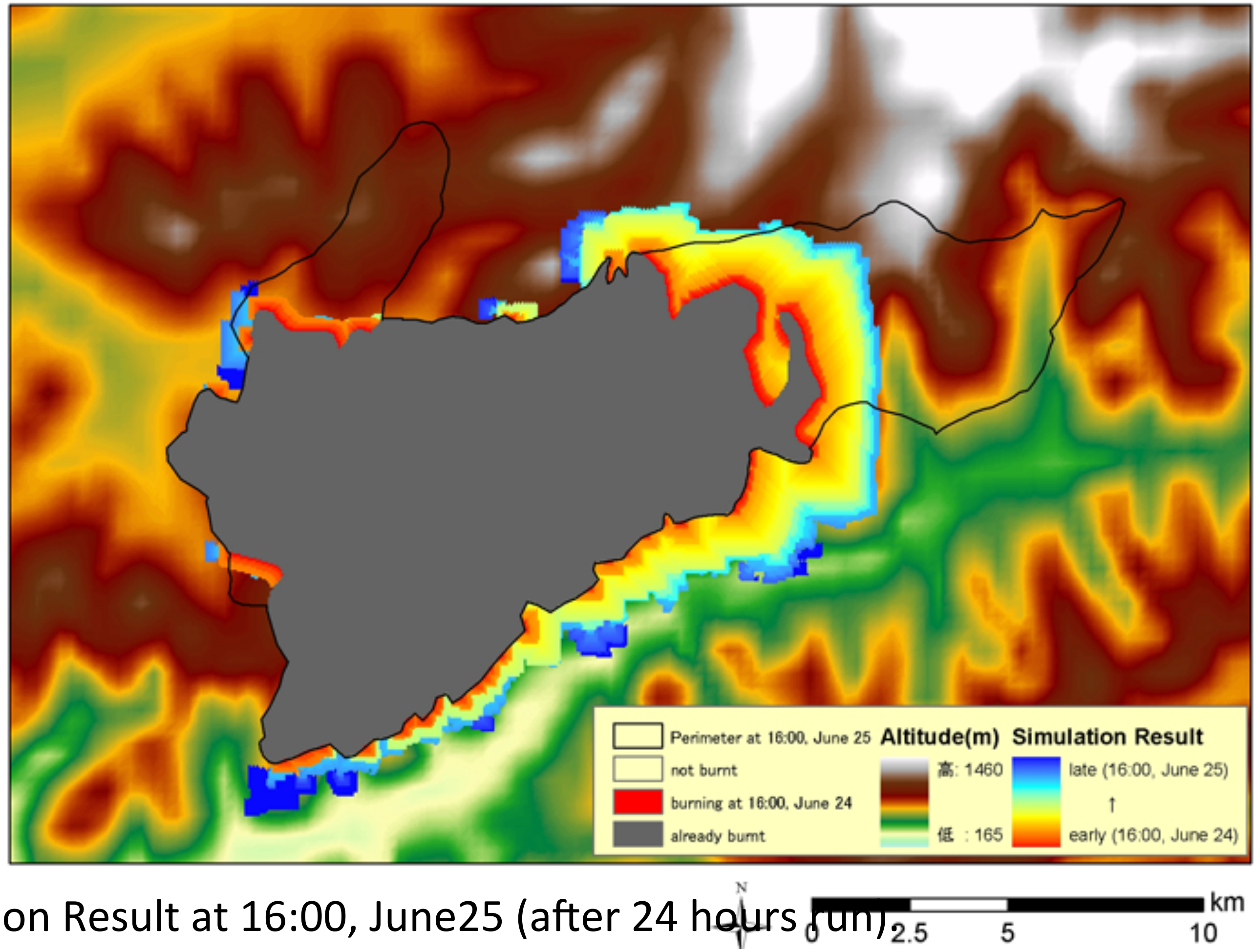
IR



UAV (Unmanned aerial vehicle) flight observation and Wireless Sensor Network are indispensable as well as ground observations.

Toshihisa Honma, Hokkaido University, Japan

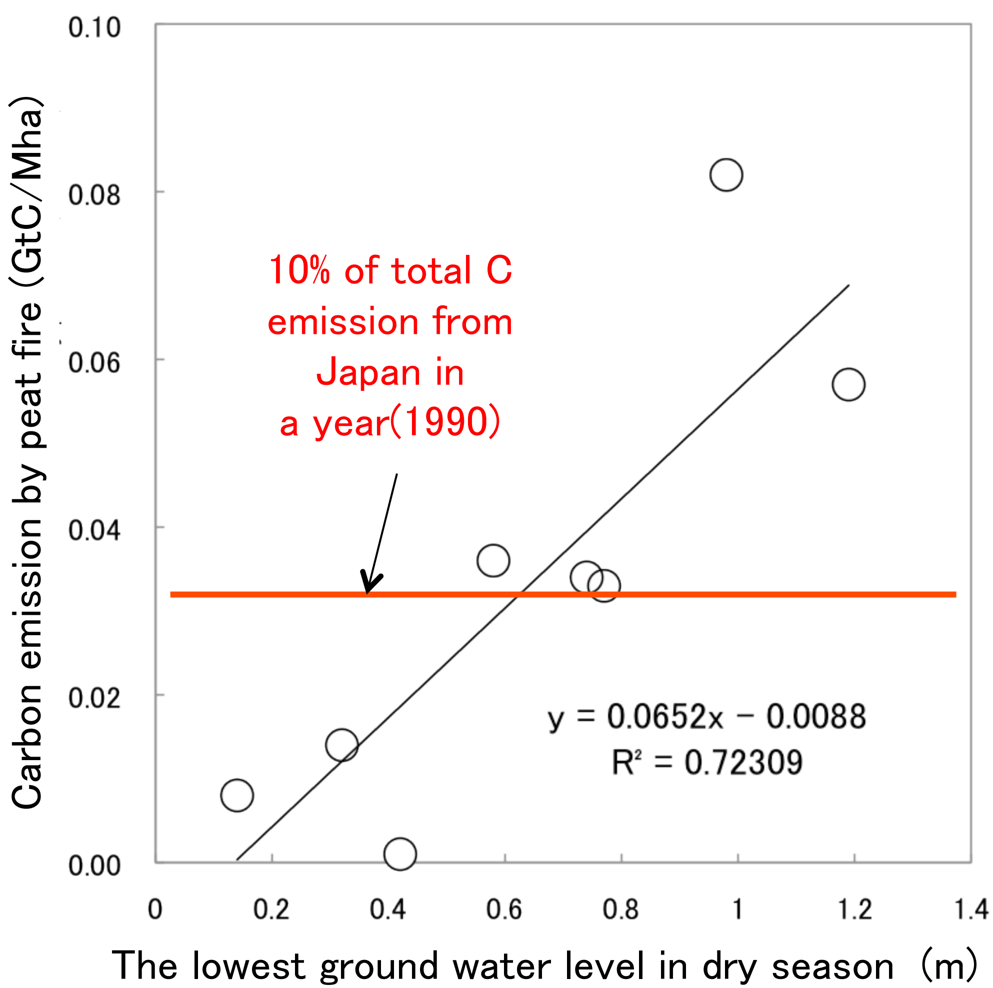
Fire Expan. Simulation

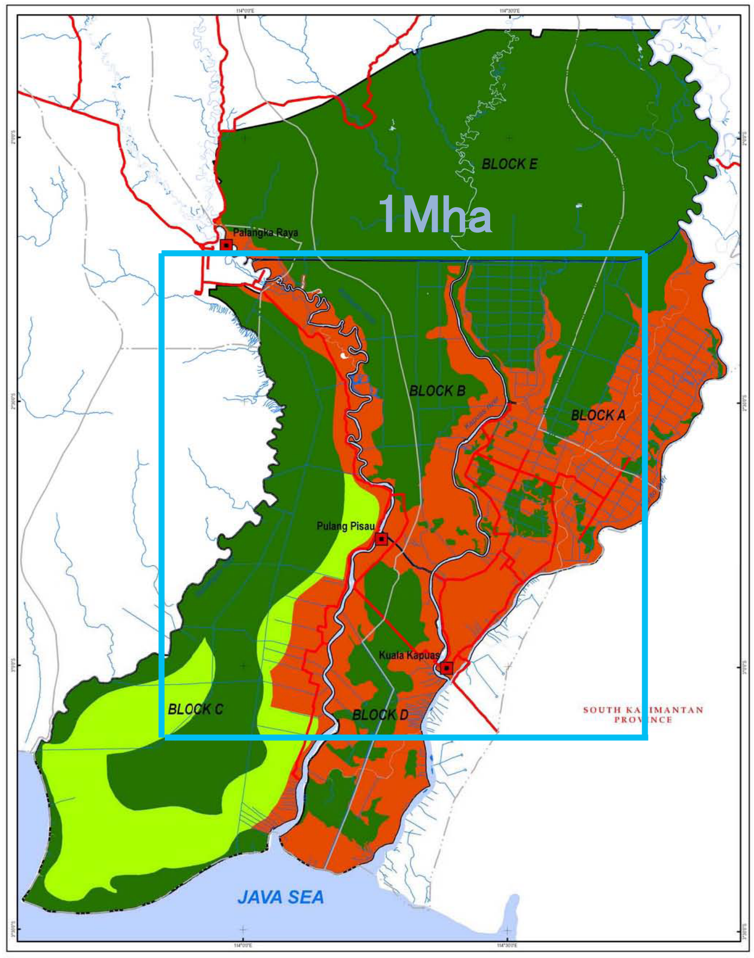


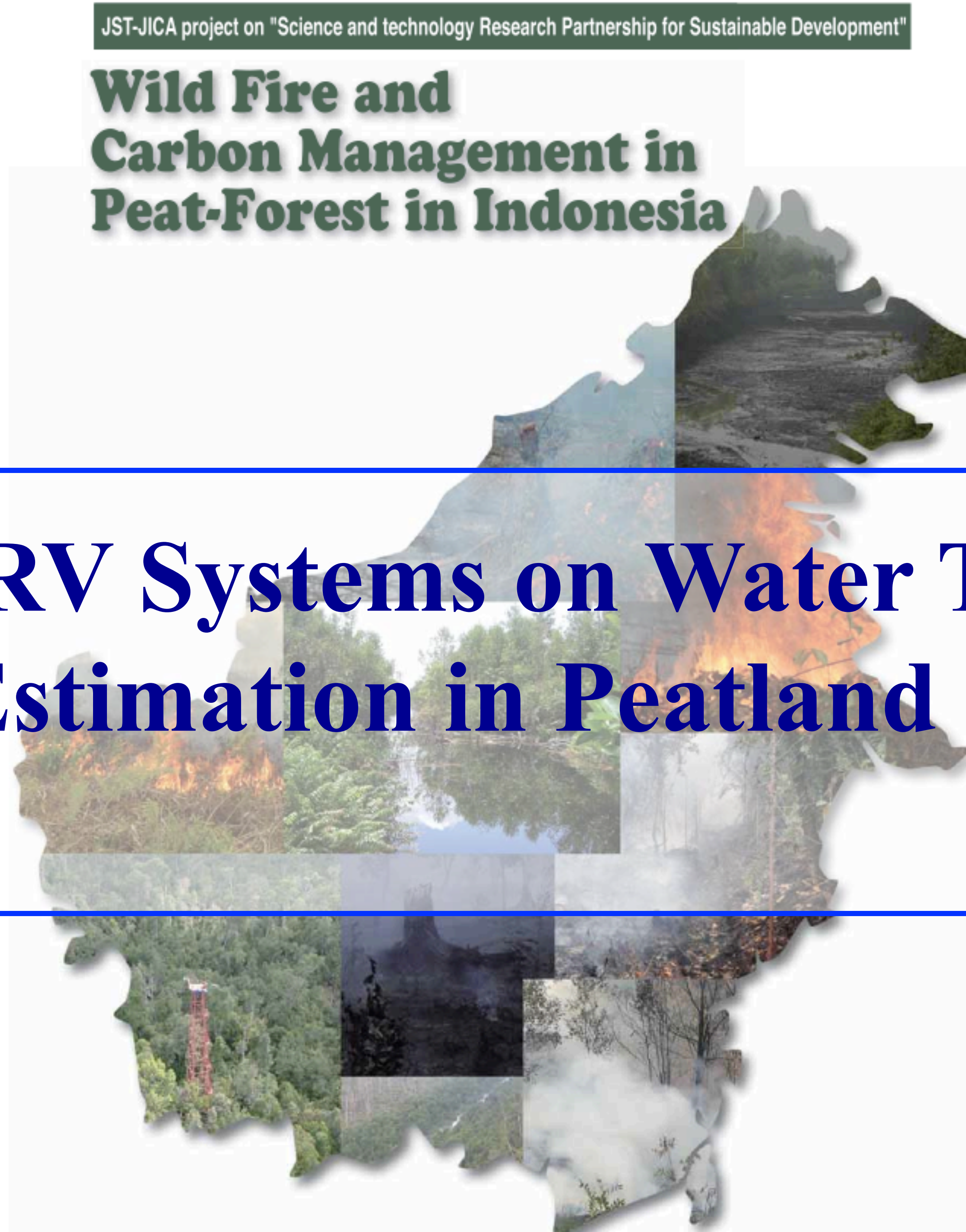
- Simulation Result at 16:00, June25 (after 24 hours run).
- The expansion for the very slow expansion mainly to southward is overestimated.
- The rapid expansion toward eastward is underestimated because of the limit of time step.

Toshihisa Honma, Hokkaido University, Japan

Relation ship between the lowest ground water level in peatland and total amount of carbon emission in Mega rice project area (Data of carbon emission is offered by Dr. Erianto Indra Putra)

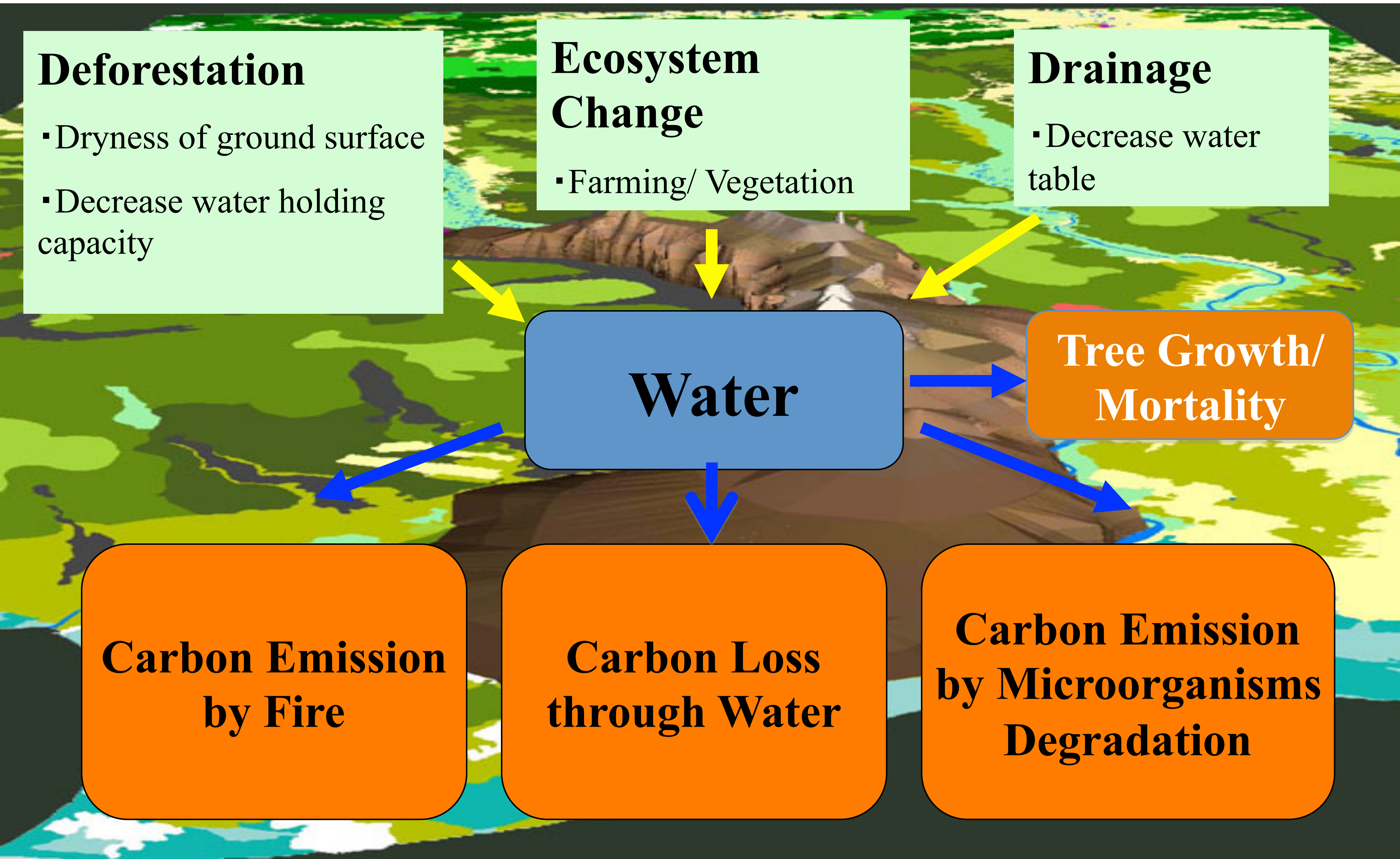




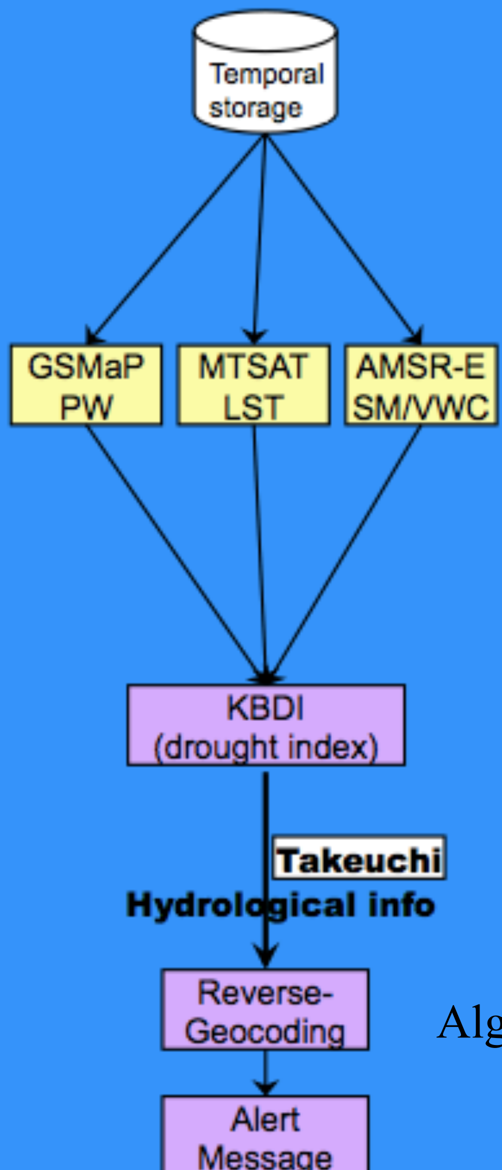


(3) MRV Systems on Water Table Estimation in Peatland

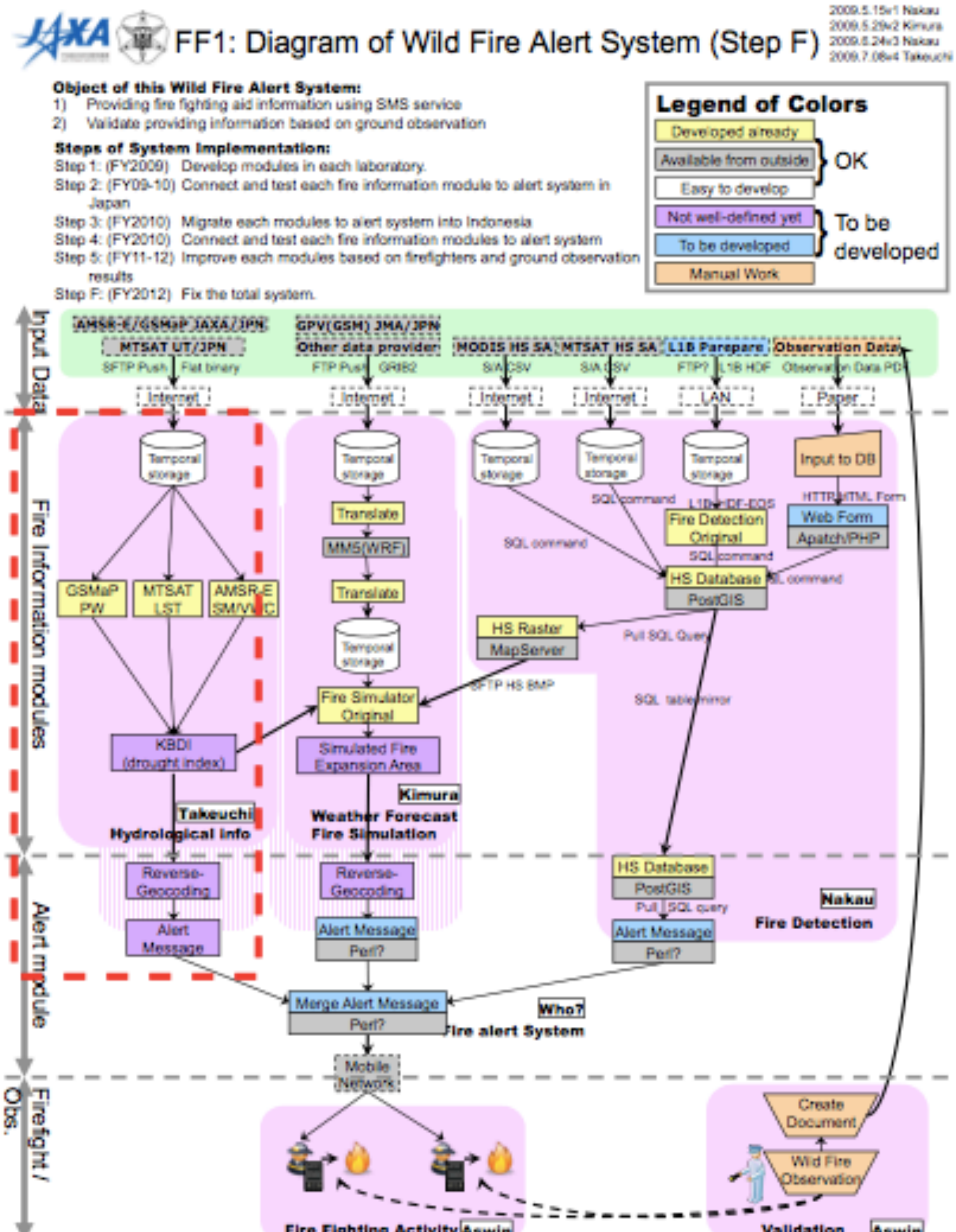
What Factors Regulate Carbon in Tropical Peat?



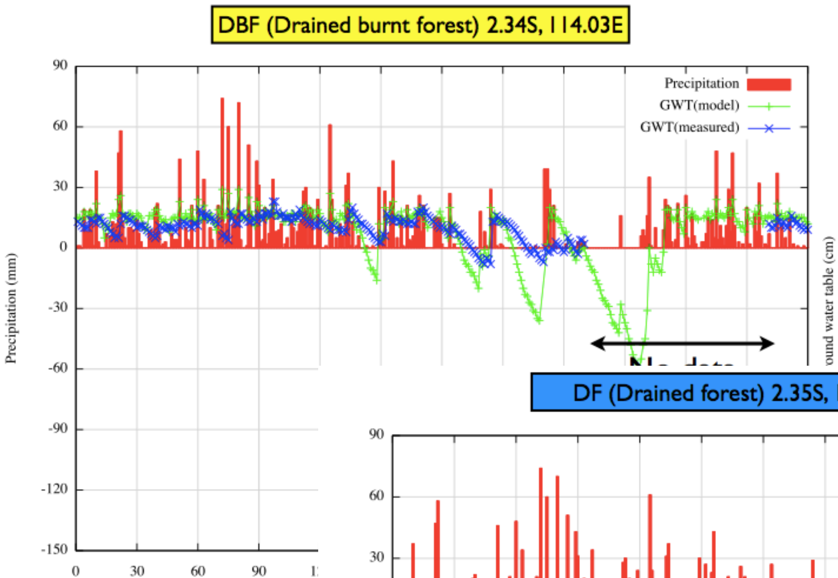
Peat moisture estimation (U-Tokyo)

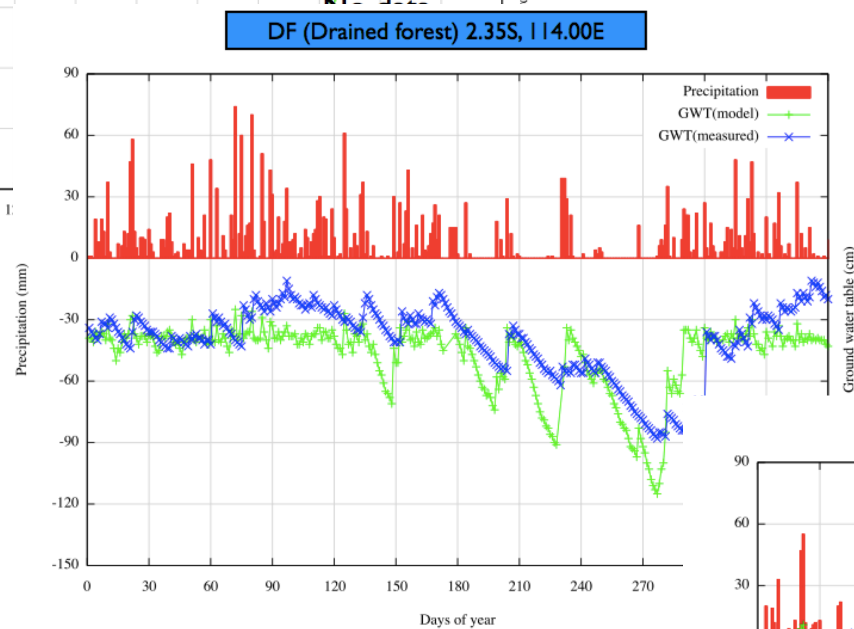


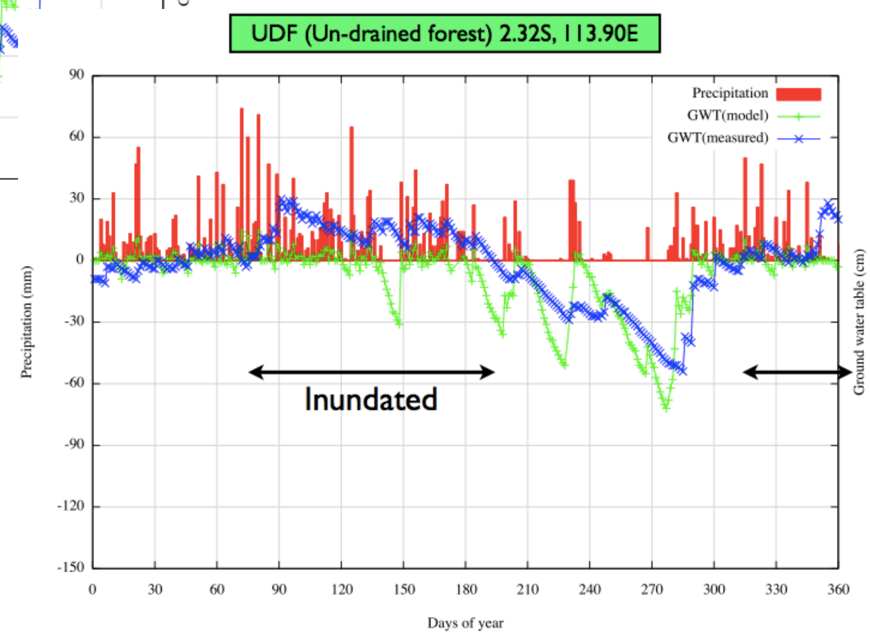
Algorism



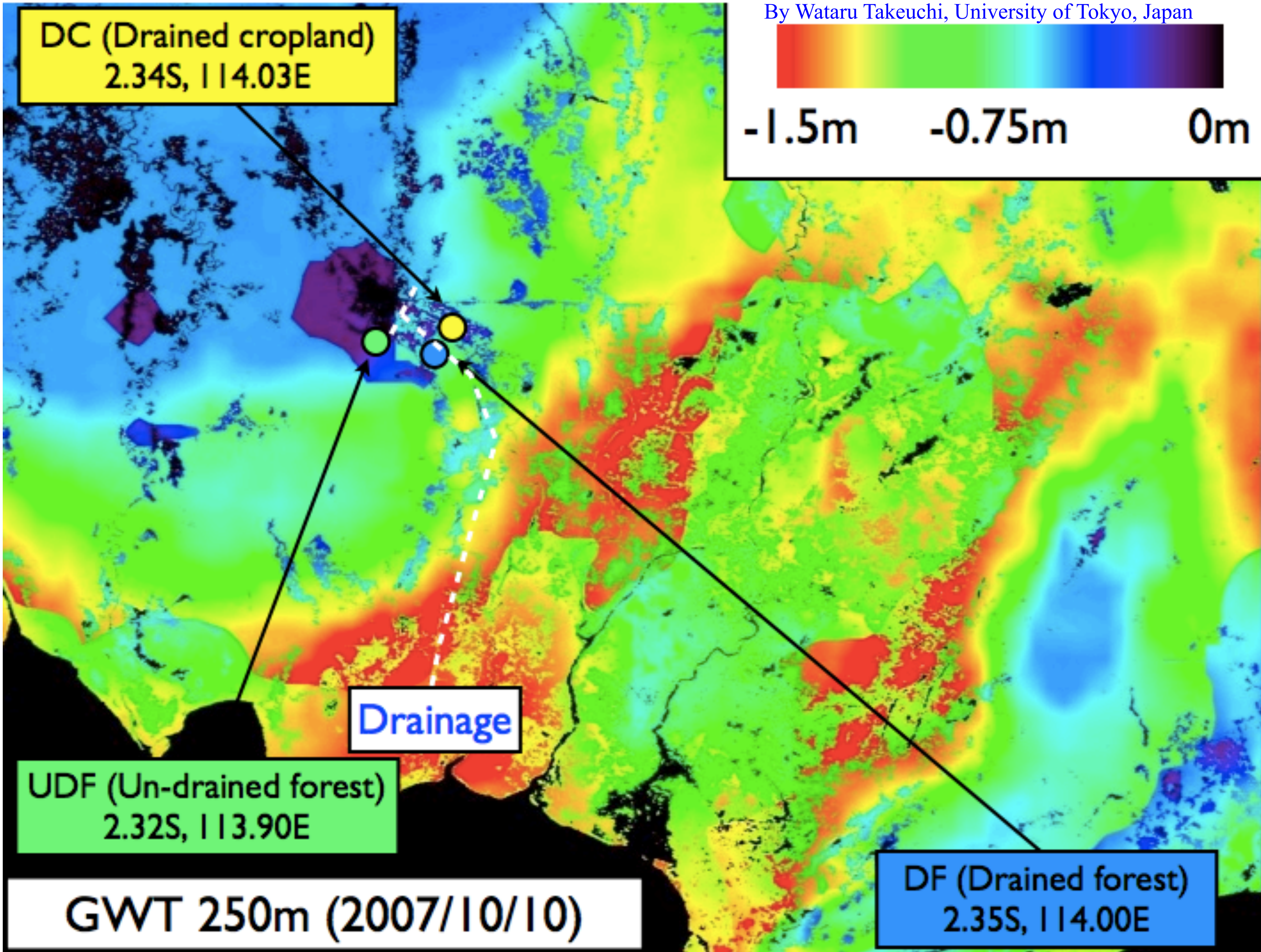
By Wataru Takeuchi, University of Tokyo, Japan







By Wataru Takeuchi, University of Tokyo, Japan


By Wataru Takeuchi, University of Tokyo, Japan
-1.5m
-0.75m
0m
DC (Drained cropland)
2.34S, 114.03E
Drainage
UDF (Un-drained forest)
2.32S, 113.90E
DF (Drained forest)
2.35S, 114.00E
GWT 250m (2007/10/10)

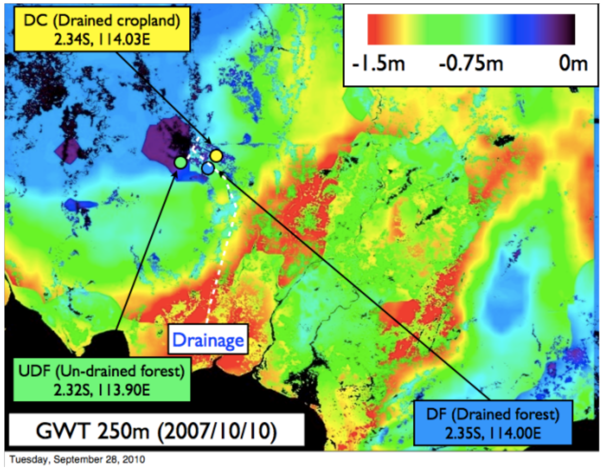
Water Table is Key for Peatland Ecosystem!!

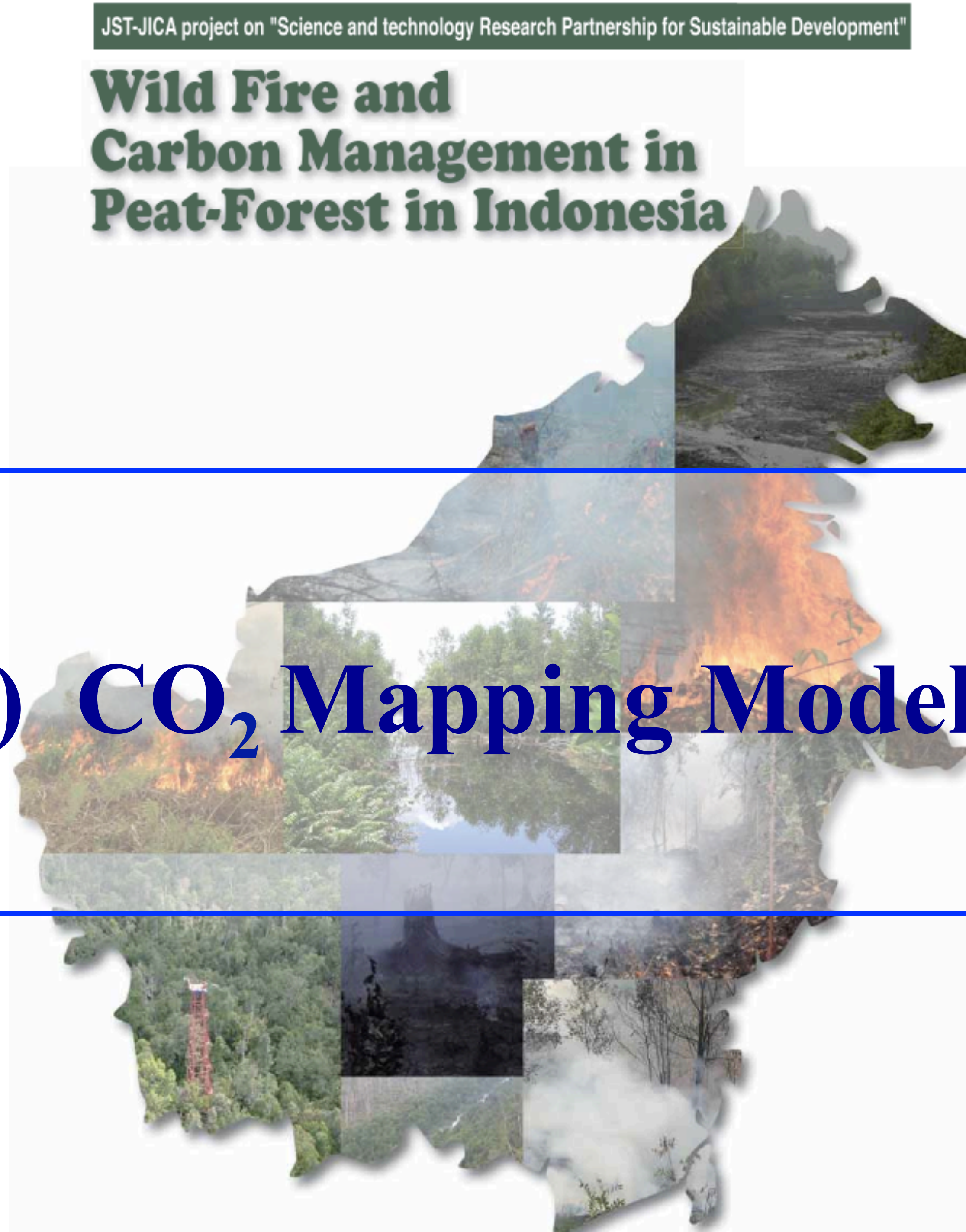
1) Oxidation

2) Fire Factors

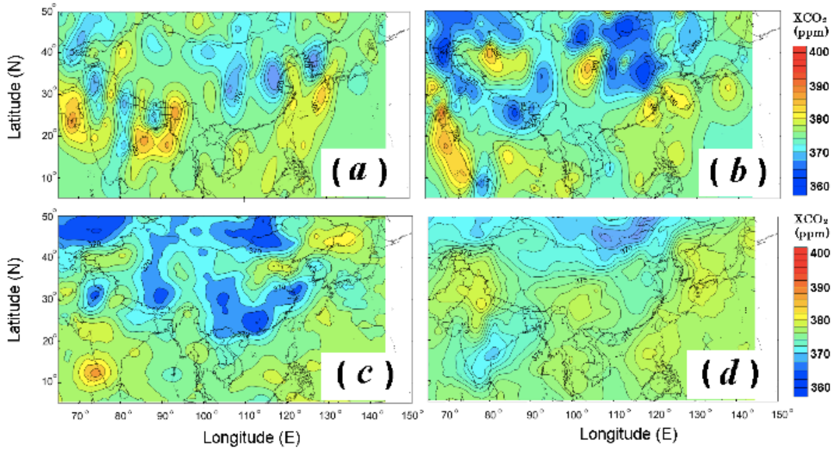
3) Tree growth and Mortality

4) DOC



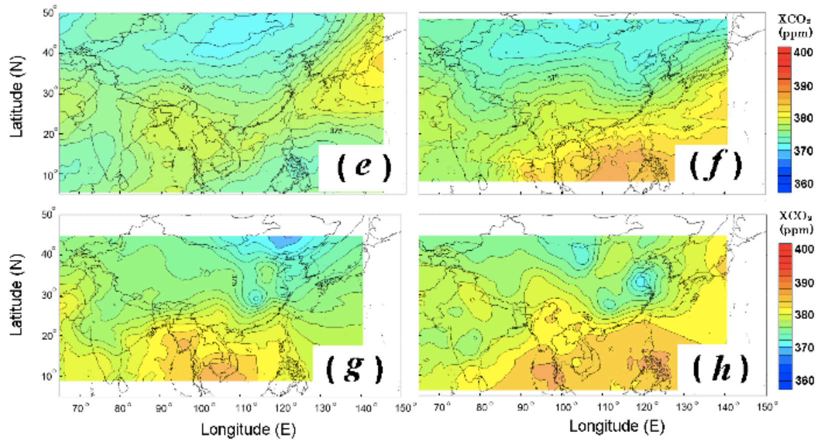


(4) CO_2 Mapping Model



CO2 mapping by GOSAT data

by Yang LIU and Wang Xiufeng
(unpublished)



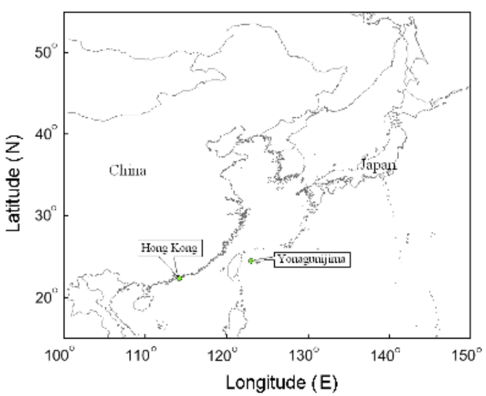


Fig. 4.2 Location of WMO WDCGG data in Hong Kong and Yonagunijima station.

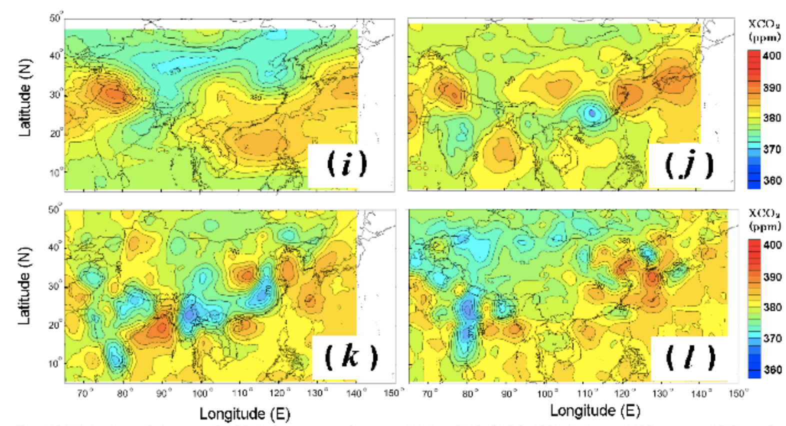


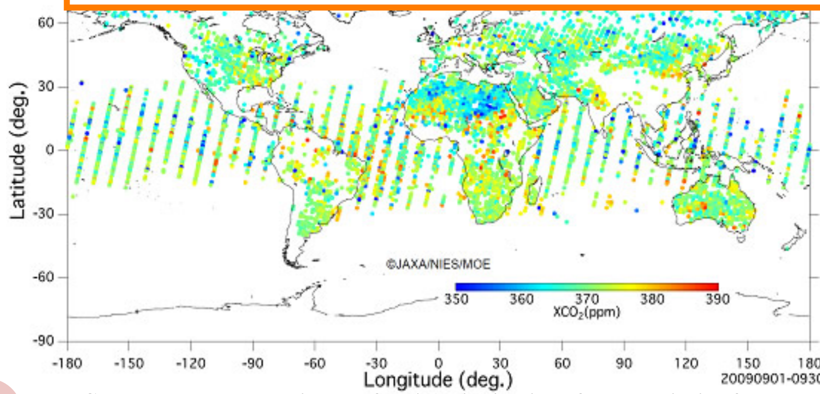
Fig. 4.10 Kriging interpolation map of XCO_2 in four seasons of: summer ((a) June 2009, (b) July 2009, (c) August 2009); autumn ((d) September 2009, (e) October 2009, (f) November 2009); winter ((g) December 2009, (h) January 2010, (i) February 2010) and spring ((j) March 2010, (k) April 2010, (l) May 2010).

Top-down
- satellite
- airplane
- inverse model

Integrated, practical carbon budget map

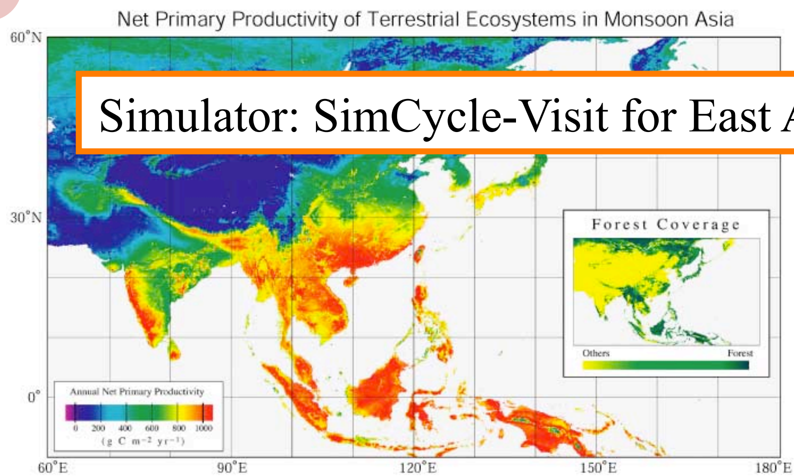
Bottom-up
- field survey
- flux obs.
- process model

Satellite GOSAT "IBUKI" Senescing: CO2

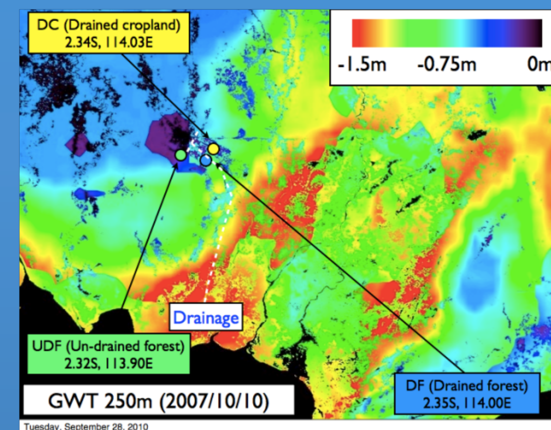


Column averaged dry air mole fraction distribution of carbon dioxide for the month of September, 2009, obtained from IBUKI observation data (unvalidated) By JAXA

Simulator: SimCycle-Visit for East Asia

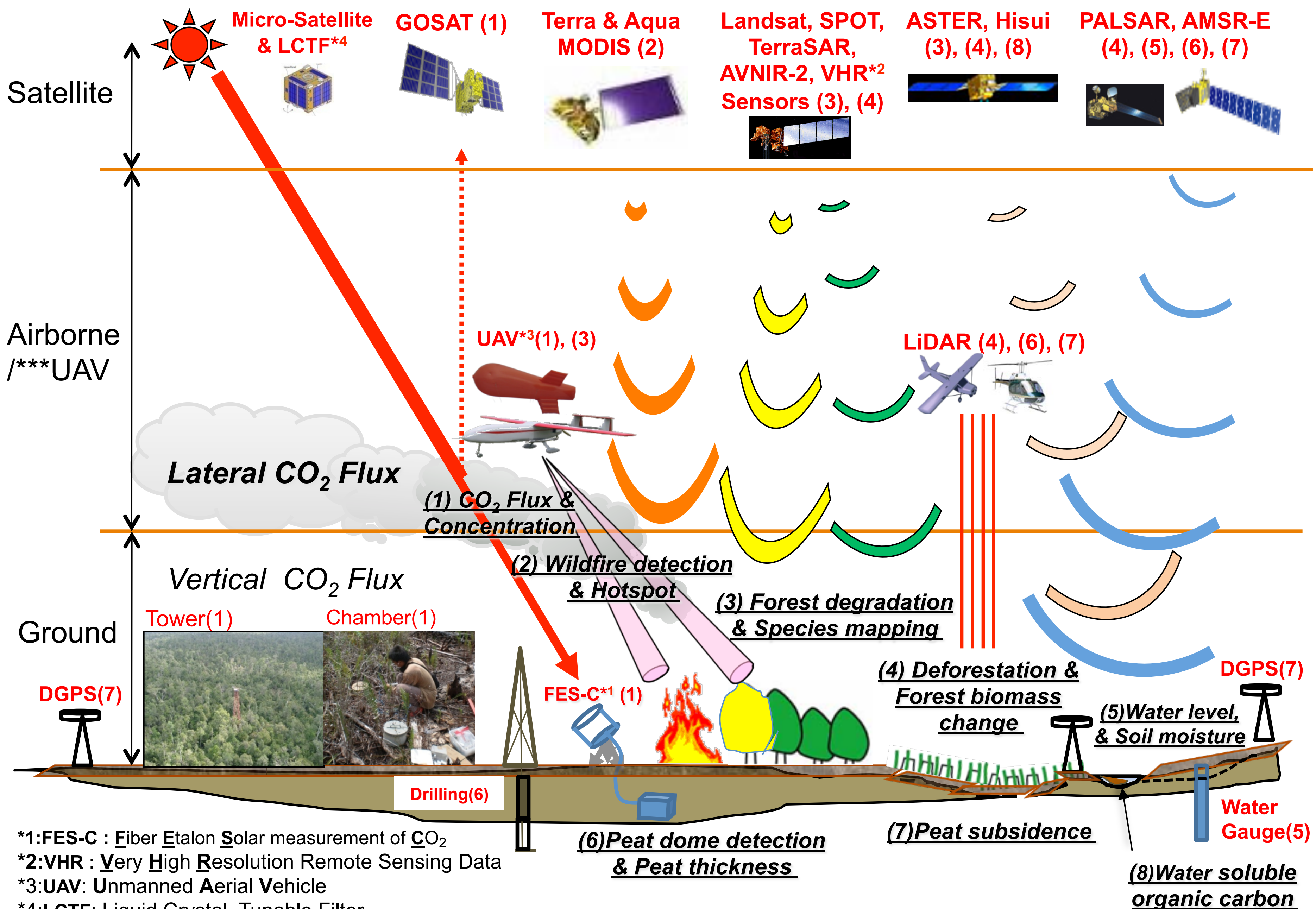


Carbon-Water Simulator



・Carbon Emission by Fire
・Carbon Loss through Water
・Carbon Emission by Microorganisms Degradation
・Tree Growth/Mortality

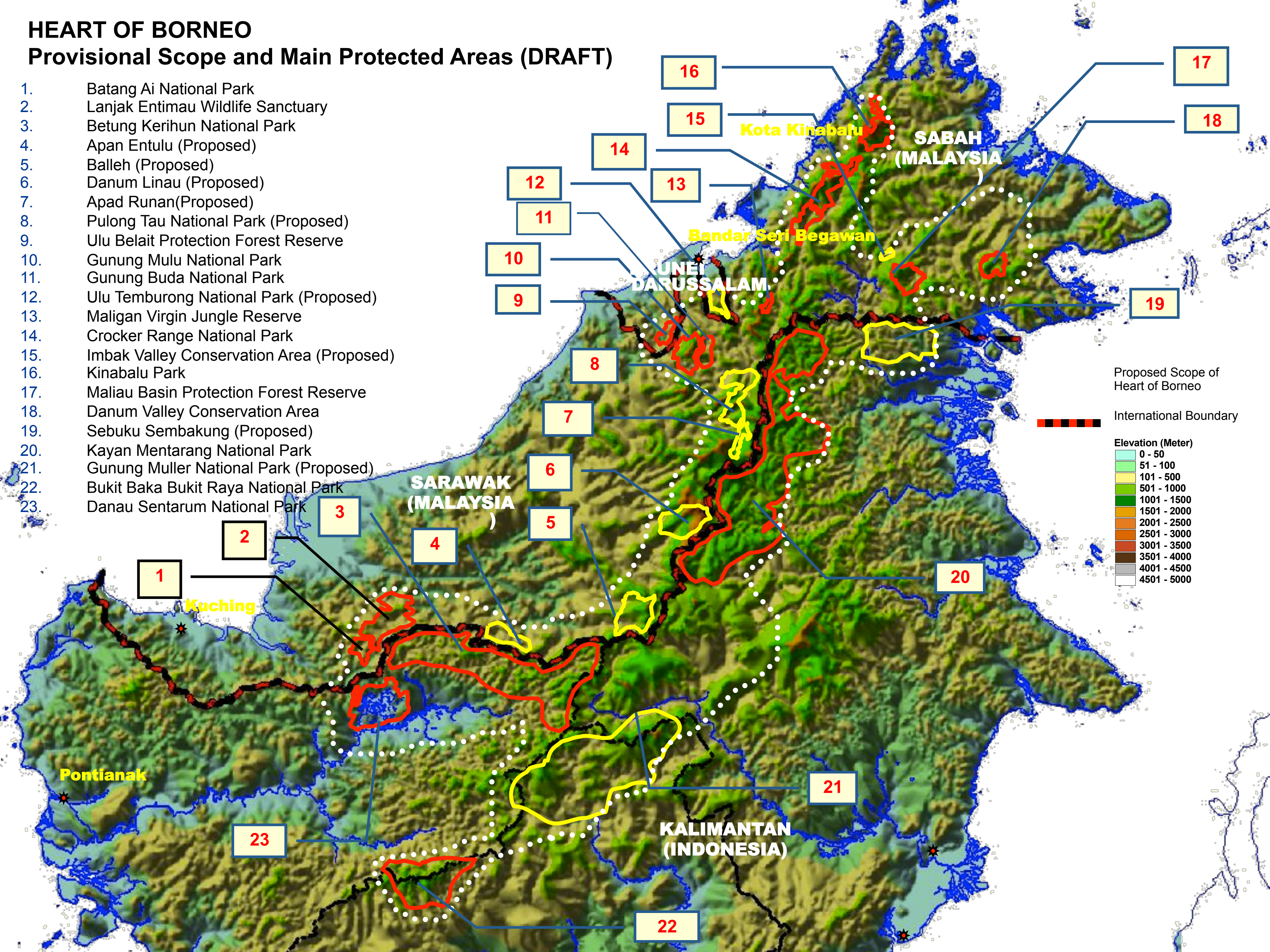
(5) Integrated MRV System on Large Scale Ecosystem



*1:FES-C : Fiber Etalon Solar measurement of CO_2
*2:VHR : Very High Resolution Remote Sensing Data
*3:UAV: Unmanned Aerial Vehicle
*4:LCTF: Liquid Crystal Tunable Filter

Red: Instrument
Black: Target

Key Elements of Tropical Peatland MRV System


HEART OF BORNEO
Provisional Scope and Main Protected Areas (DRAFT)
1. Batang Ai National Park
2. Lanjak Entimau Wildlife Sanctuary
3. Betung Kerihun National Park
4. Apan Entulu (Proposed)
5. Balleh (Proposed)
6. Danum Linau (Proposed)
7. Apad Runan(Proposed)
8. Pulong Tau National Park (Proposed)
9. Ulu Belait Protection Forest Reserve
10. Gunung Mulu National Park
11. Gunung Buda National Park
12. Ulu Temburong National Park (Proposed)
13. Maligan Virgin Jungle Reserve
14. Crocker Range National Park
15. Imbak Valley Conservation Area (Proposed)
16. Kinabalu Park
17. Maliau Basin Protection Forest Reserve
18. Danum Valley Conservation Area
19. Sebuku Sembakung (Proposed)
20. Kayan Mentarang National Park
21. Gunung Muller National Park (Proposed)
22. Bukit Baka Bukit Raya National Park
23. Danau Sentarum National Park
Kota Kinabalu
SABAH (MALAYSIA)
Bandar Seri Begawan
BRUNEI DARUSSALAM
SARAWAK (MALAYSIA)
Kuching
Pontianak
KALIMANTAN (INDONESIA)
Proposed Scope of Heart of Borneo
International Boundary
Elevation (Meter)
0 - 50
51 - 100
101 - 500
501 - 1000
1001 - 1500
1501 - 2000
2001 - 2500
2501 - 3000
3001 - 3500
3501 - 4000
4001 - 4500
4501 - 5000
1
2
3
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22
23

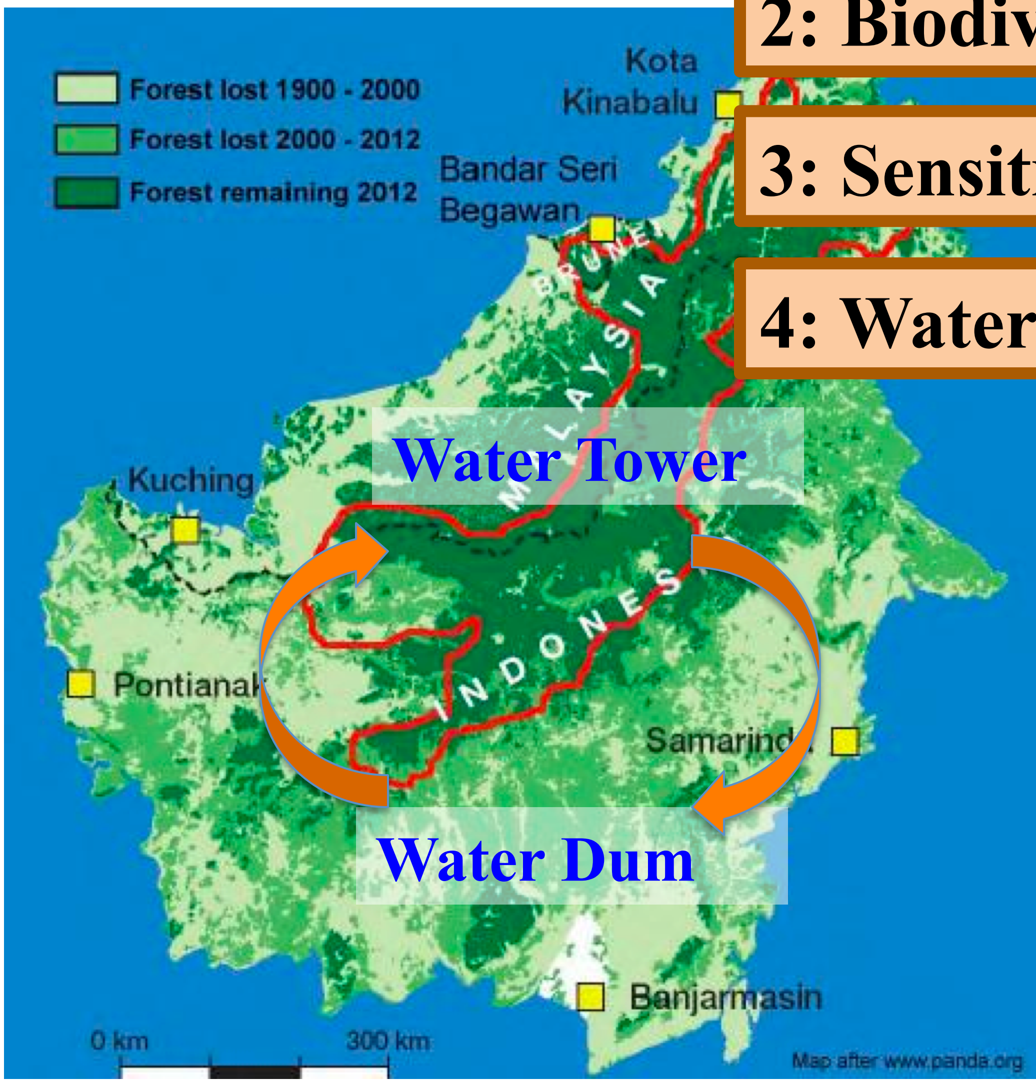
Water Tower in Heart of Borneo and Water Dum in Peatland

1: Carbon storage

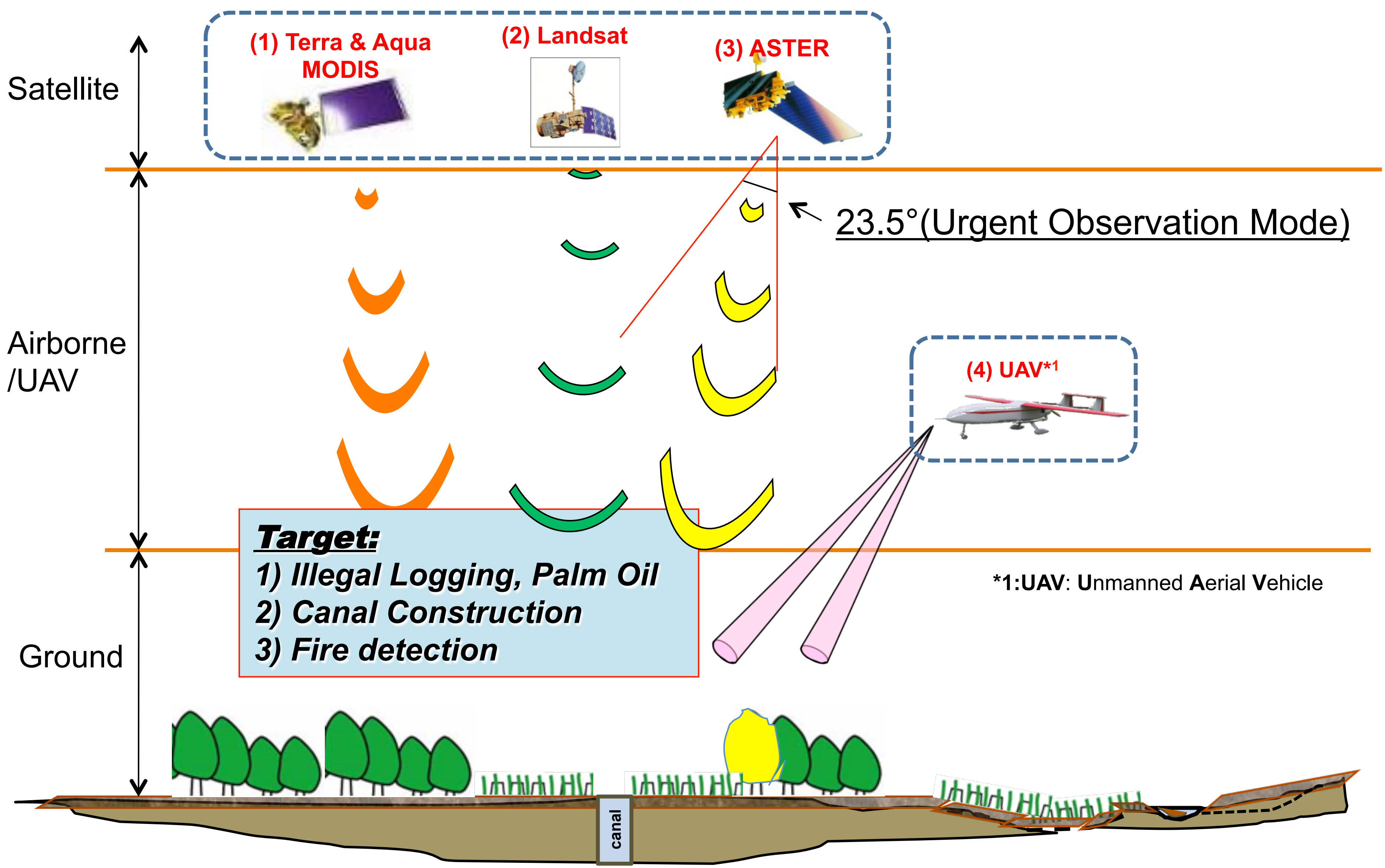
2: Biodiversity

3: Sensitive to climate changes

4: Water storage



Operational Sensors in Jan. 2012



Sub-national/District Level MRV proposed by BAPPEDA, DNPI, JST-JICA

Summary of Operation

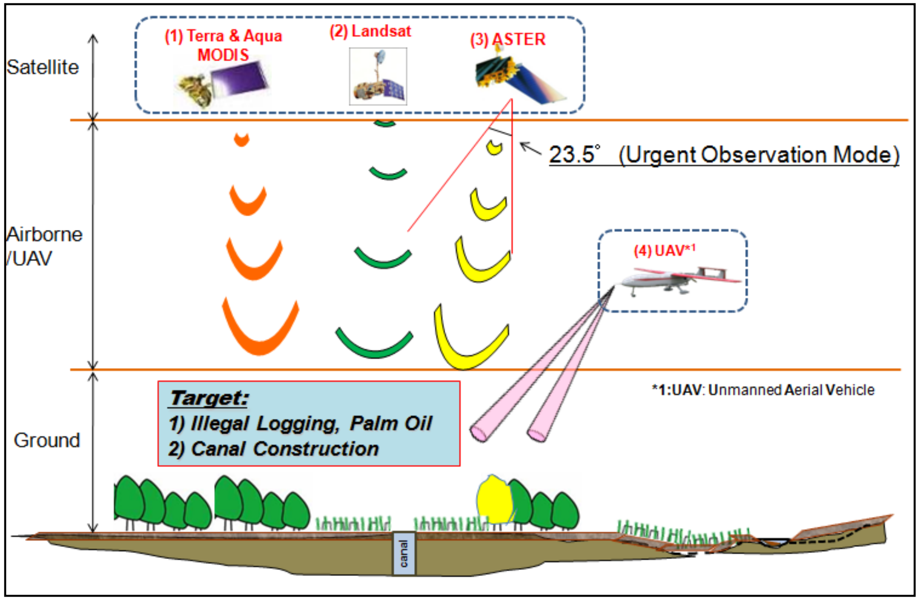
1. National Level → INCAS

2. Sub-national/District Level → Moratorium Map Assessment

Requirement

1) Frequent observation
   (Near real-time)
2) Simple system
   (managed by Indonesia)
3) Low-Cost

***MODIS-Landsat-ASTER-UAV**



3. Project Level → JST-JICA (Hokudai), METI F/S, *VCS, etc*

Thank you for your attention