Overview of Japanese Projects on Hydro-Meteorological Field Experiment in Northern Eurasia

-WECNoF/CREST/JST and IORGC Programs –

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Hydro-Meteorological Researches in Siberia by Japanese - Russian co-operations
GAME-Siberia

- **Land surface Processes**
  - Tikisi area (1998 -)
    - Tundra region
  - Yakutsk area
    - Plane taiga region
    - Spasskaya Pad (1998 -)
    - Ulakhan Sykkhan (1998-2000)
  - Tynda area (2000-2001)
    - Mountain taiga region

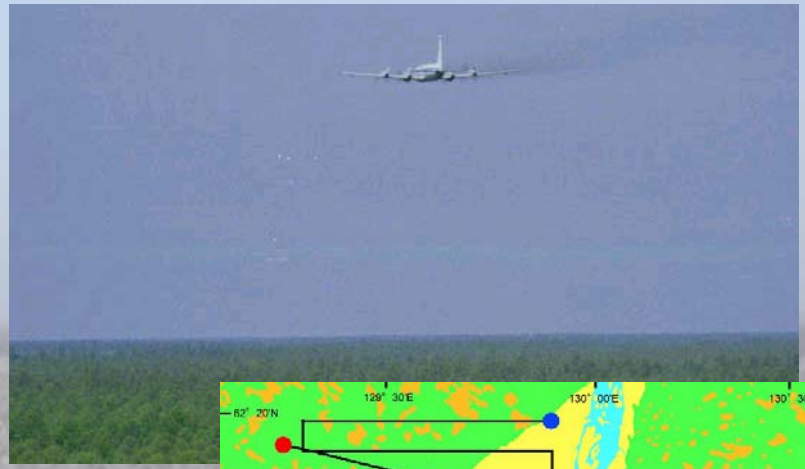
Hydro-Meteorological Researches in Siberia by Japanese - Russian co-operations

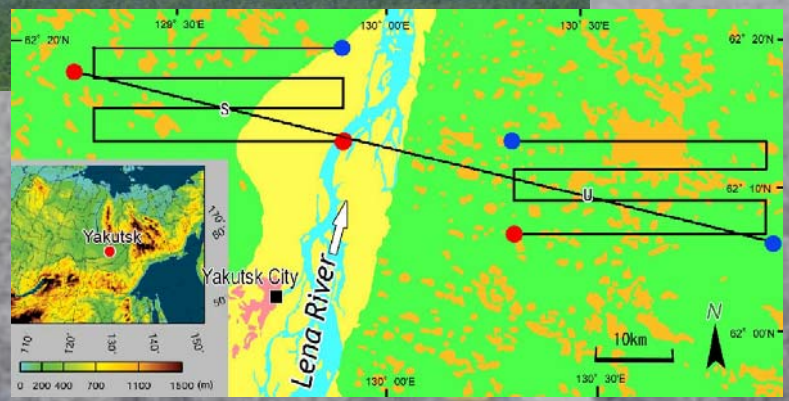
GAME-Siberia

- **Interaction between land surface and atmosphere**

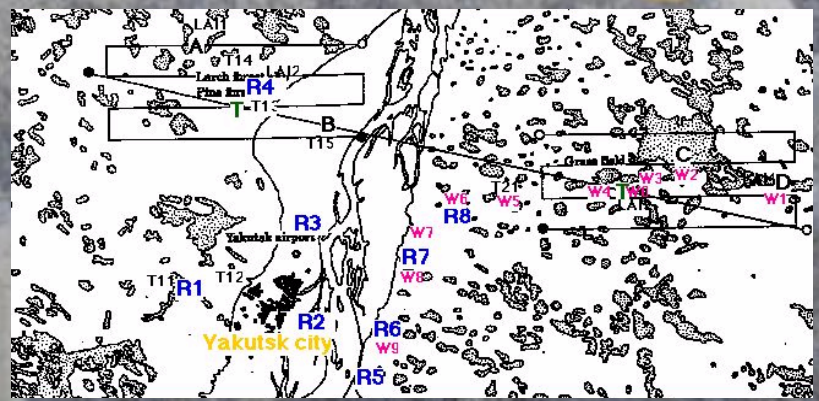
  Yakutsk Area

  – Airplane observations (2000)





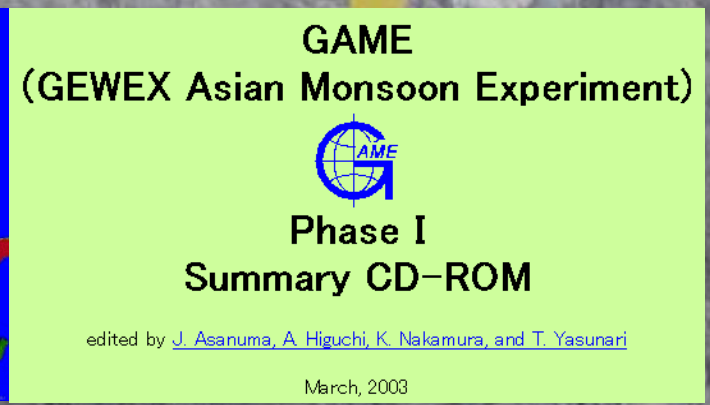
  – Regional observations (2000)



Hydro-Meteorological Researches in Siberia by Japanese - Russian co-operations

GAME-Siberia

- Results and dataset
  - They have been already opened by CD-ROMs.
  - The dataset obtained until 2000 is published in GAME-Siberia CD-ROM.
  - The papers published until 2003 are listed in GAME Summary CD-ROM.



Follow-on Projects of GAME-Siberia

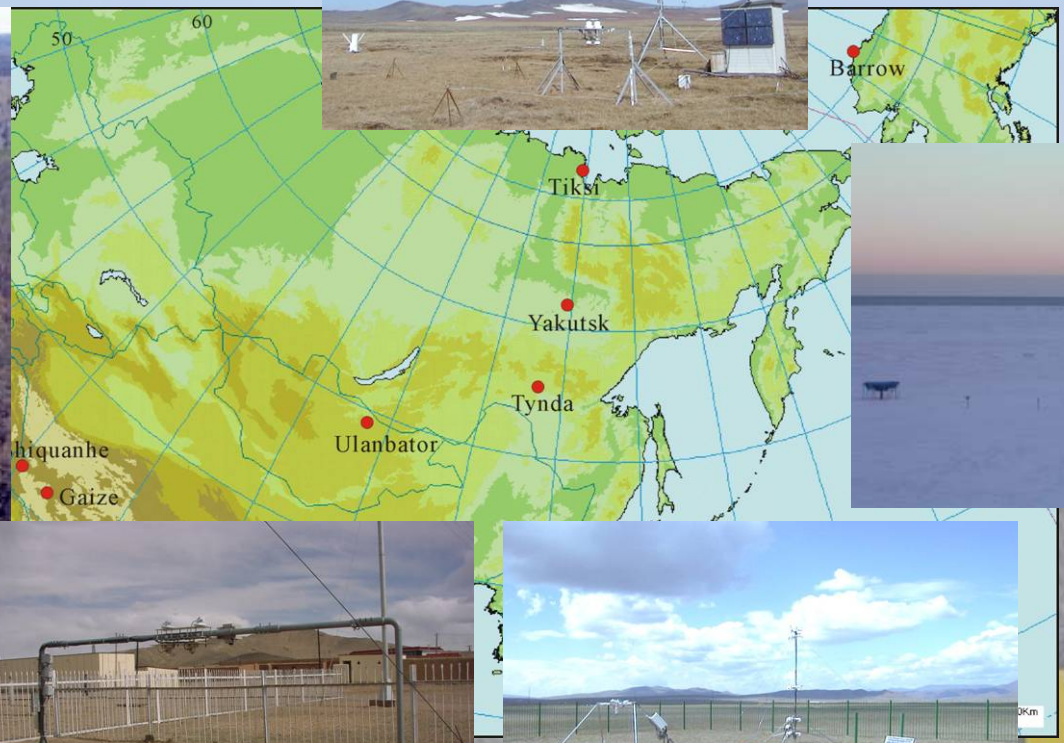
- **Institute of Observational Research for Global Change (IORGC/JAMSTEC)**
  - **To understand the water cycle systems in Eurasian cold region.**

- **CREST, Japan Science and Technology Agency (WECNoF/CREST/JST)**
  - **To evaluate the plant effects on water/energy/carbon cycles in cold regions**

Present observation network of Water Cycle Program IORGC/JAMSTEC

Position of IORGC observation sites

Tiksi, Russia (tundra)

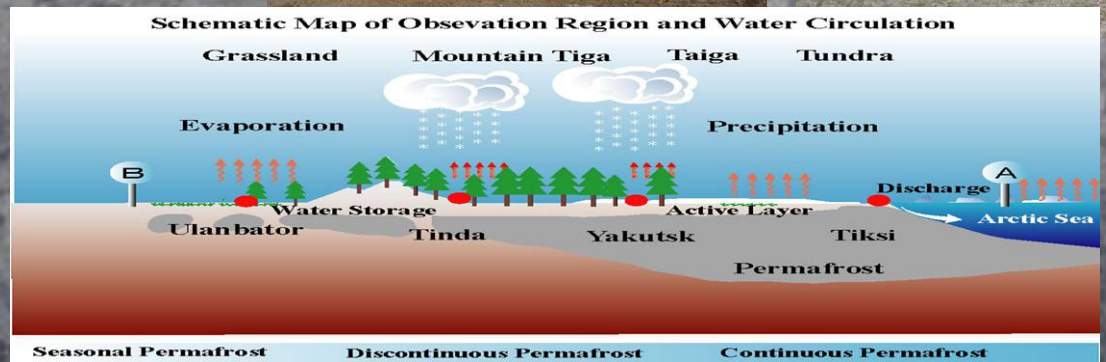


Barrow, Alaska (tundra)

Yakutsk, Russia, taiga

Gerze, Tibet, China Plateau

Ulanbaataar, Mongolia



Schematic figure of the cross section from Tiksi to Ulanbaatar

The activity of IORGC at Spasskaya Pad and in other Eurasian cold regions

- **Goal of IORGC**
  - Understanding the land hydrological process and atmosphere/land interaction
  - Monitoring the changes which are occurring the ongoing global change

Especially on cold northern regions on the Eurasian continent.

northern vegetation, snow cover, frozen ground …

The outline of WECNoF/CREST project

- Water & Energy Cycles in Northern Forests-

Parameterization of the relationships between the water cycle system and plant eco-physiological properties in boreal forest areas

- **The GOAL of CREST**
  - The exact parameterization of forest physiological and ecological effects in the land surface processes associated with the water/energy/CO2 cycles
  - We will provide the spatial-temporal distribution map of forest physiological and ecological parameters on a water/energy/CO2 cycle model in the boreal zone.

  - **Evaluation of forest effects on these three cycles**
  - **Present of current status of water budget in the boreal zone**
  - **Prediction of the variation of water budget under the global change issues**

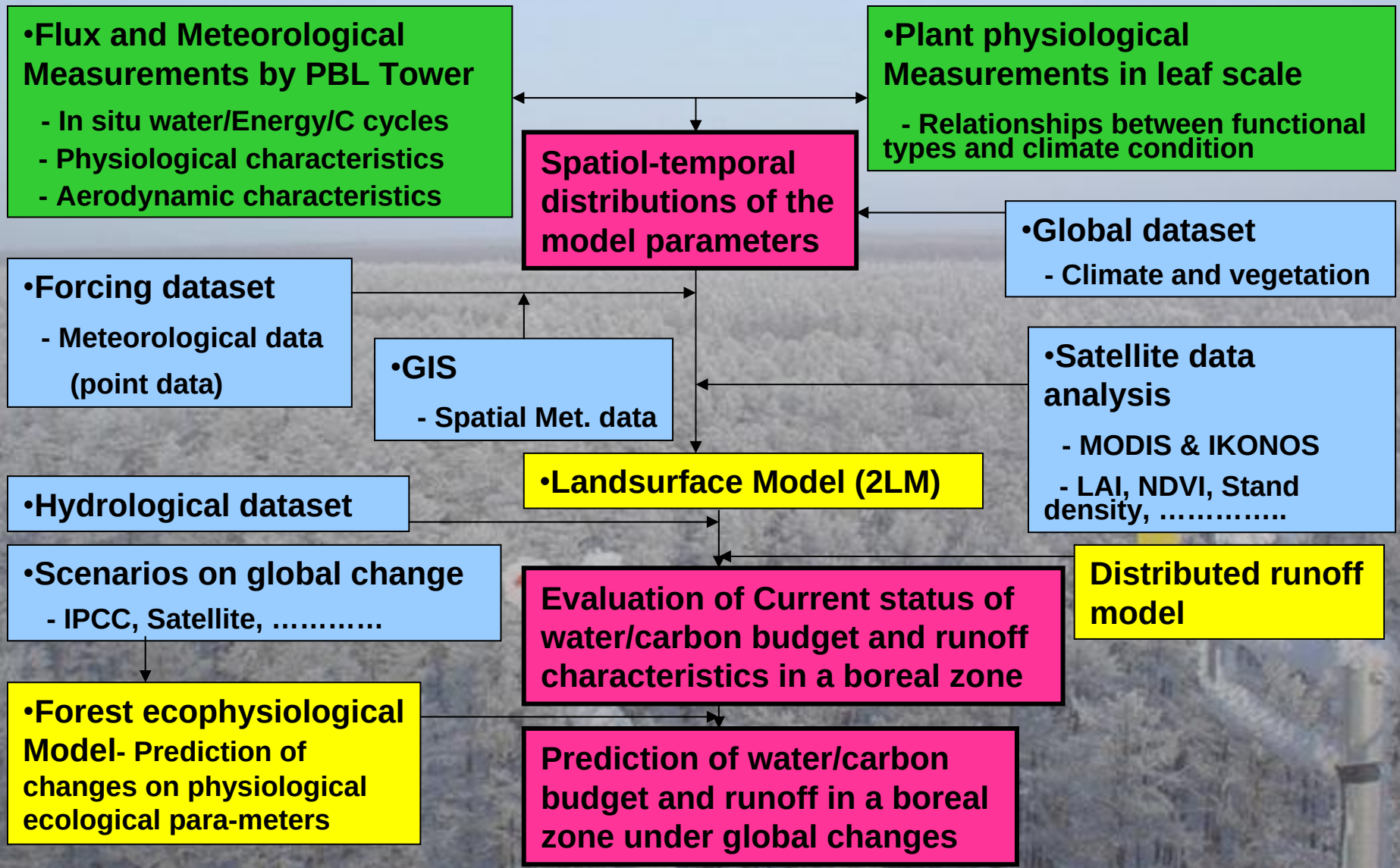
The Study sites of WECNoF/CREST

Yakutsk site (YKS):
co-operation with IORGC(JPN), IBPC(RUS), VUA(NL)

Moshi site (SET):
co-operation with Hokkaido University

Seto Site (SET):
co-operation with Nagoya University

Strategy for GOAL



Data policy

- **IORGC**
  - Does not have a clear Data Policy at the present.
  - Data are supplied to foreign Institutes which we have agreements, domestic Institute which we have cooperative works and certain individual researchers.
  - A part of the data are supplied to GAME-AAN, CEOP, IAEA and WECNoF/CREST from there, data are accesible.
  - A part of the data have been distributed in the form of CD-ROM in relation to the participation to GAME Project.

  <Future>
  - The non-opened period will be specified (probably 2 years) , and after that all obtained data will be available at web site of IORGC, excluding some special data. This will be settled during the 2005 fiscal year.
  - Quality check of data will be made periodically.

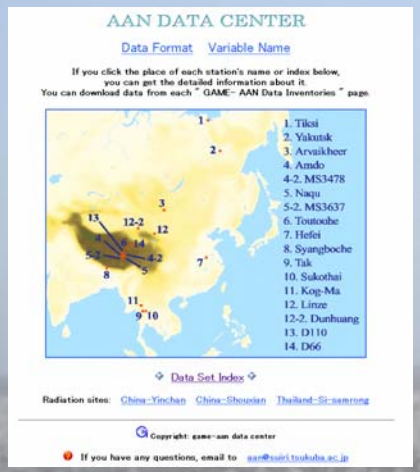
- **WECNoF/CREST/JST**
  - All of flux & meteorological dataset will be opened through the project WEB site after two years of data collection.
  - Additional dataset will not be opened in the WEB site. Please contact with me, if you are interested in the additional dataset.

    - PROJECT URL: http://www.agr.nagoya-.ac.jp/~wecnof/index.html
    - E-mail: takeshi@agr.nagoya-u.ac.jp

Current Data Center

- GAME-AAN data center :

http://www.suiri.tsukuba.ac.jp/Project/aan/aan.html-



GAME AAN Data Set Index

- Siberia_Tiksi
- Siberia_Yakutsk
- Mongolia_Arvaikheer
- Tibet_Amdo
- Tibet_MS3478
- Tibet_Naqu_MS3608
- Tibet_MS3637
- Tibet_Toutouhe
- China_Hefei
- Nepal_Syangboche
- Thailand_Tak_Egat
- Thailand_Sukothai
- Thailand_KogMa
- Tibet_Linze
- Tibet_Dunhuang
- Tibet_D110
- Tibet_D66

- The data obtained in northern Eurasia until 2002 is opened in GAME-AAN Web page.
- The 2 follow on project will open the data from 2005 according to their data policy.

Siberia_Tiksi

Station													
Data set													
Inventory	index												
	1996								8	9	10	11	12
	1997	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	1998	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	1999	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	2000	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	2001	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	2002	yearly	1	2	3	4	5	6	7	8	9	10	11	12
Photo														
Map														

- Meteorological data: 5 levels
- Soil Temp.: 5 depths
- Soil Mois.: 6 depths

Siberia_Yakutsk

Station													
Data set (Larch , Pine)													
Inventory	index												
	Larch 1996								8	9	10	11	12
	1997	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	1998	yearly(1~6)	1	2	3	4	5	6	7	8	9	10	11	12
		yearly(7~12)												
		WindDirection/5min	1	2	3	4	5	6	7	8	9	10	11	12
	1999	yearly	1	2	3	4	5	6	7	8	9	10	11	12
		WindDirection/5min	1	2	3	4	5	6	7	8	9	10	11	12
	2000	yearly	1	2	3	4	5	6	7	8	9	10	11	12
		WindDirection/5min	1	2	3	4	5	6	7	8	9	10	11	12
	2001	yearly	1	2	3	4	5	6	7	8	9	10	11	12
		WindDirection/5min	1	2	3	4	5	6	7	8	9	10	11	12
	2002	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	Pine 2000	yearly	1	2	3	4	5	6	7	8	9	10	11	12
		WindDirection/5min	1	2	3	4	5	6	7	8	9	10	11	12
Soil	Soil physical parameters													
	Soil weight													
	Volumeric water content - pressure head													
Photo														
Map														

- Meteorological data: 4 levels
- Fluxes: above the canopy
- Soil Temp.: 7 depths
- Soil Mois.: 5 depths

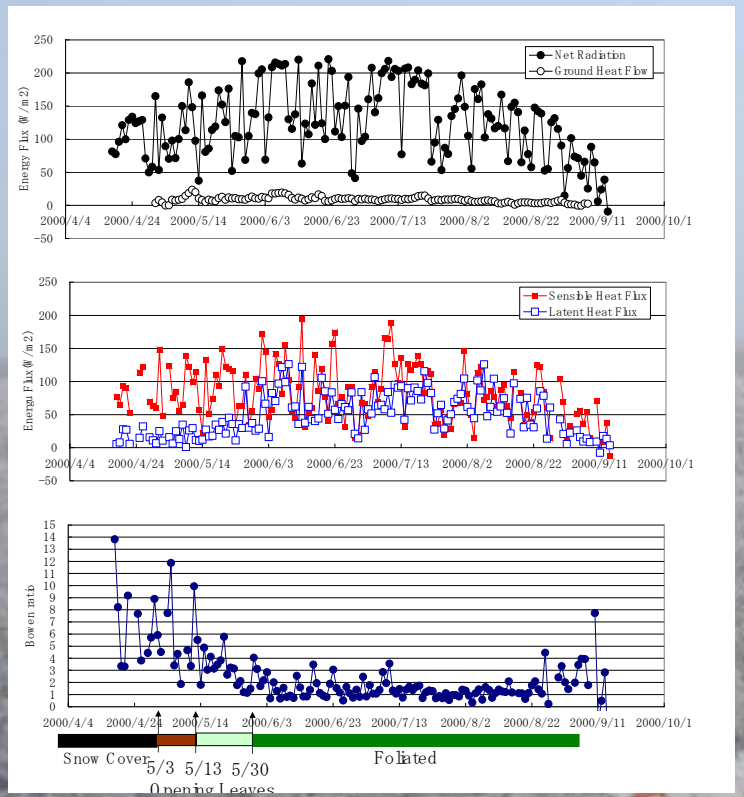
Mongolia_Arvaikheer

Station													
Data set													
Inventory	index												
	1997									9	10	11	12
	1998	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	1999	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	2000	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	2001	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	2002	yearly	1	2	3	4	5	6	7	8	9	10	11	12
	2003	yearly	1	2	3	4	5	6	7	8	9	10	11	12
Soil	Soil physical parameters													
	Soil weight													
	Volumeric water content - pressure head													
Photo														
Map														

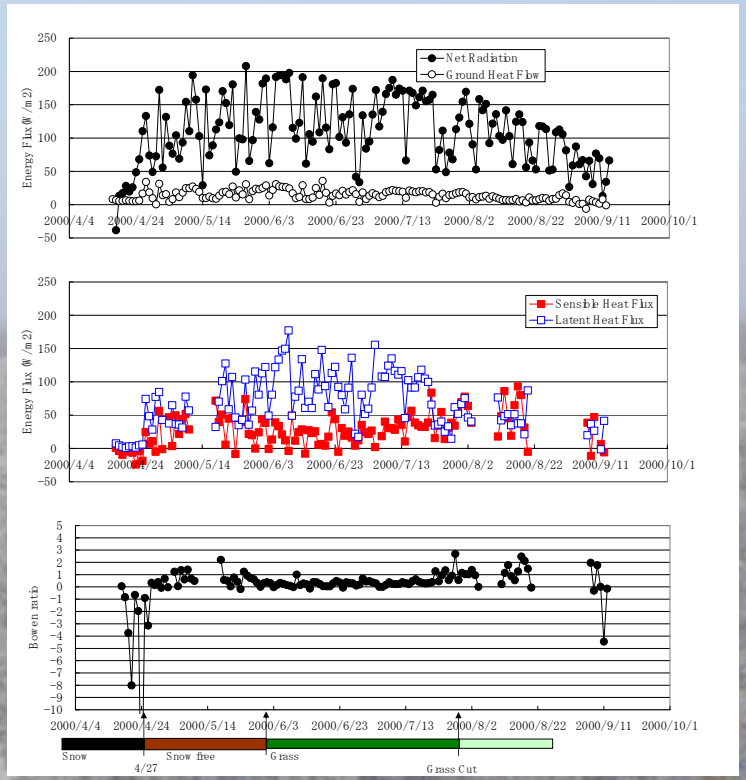
- Meteorological data:3 levels
- Fluxes: above the canopy
- Soil Temp.: 2 depths
- Soil Mois.: 6 depths

Energy balance on the typical land cover

Larch Forest



Grass Land

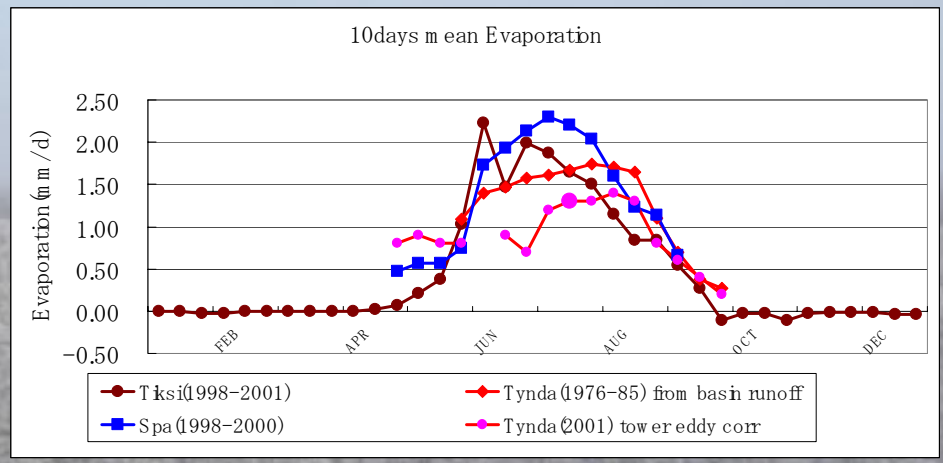


Yabuki et al., 2004

- Energy balance above the larch forest was strongly affected by the tree phenology. On the other hand, the effects of grass cutting was remarkable on the grass land.
- The latent heat flux was larger on the grass land than the larch forest. The Bowen ratio, consequently, was large on the larch forest.

Comparative study of three local sites in Lena Basin

- Peak evaporation period delays from north to south
- The peak value is rather similar at three sites.
- Spring evaporation in forested sites is higher at Tynda than Yakutsk.
- Seasonal variation show very flat curve at Tynda.

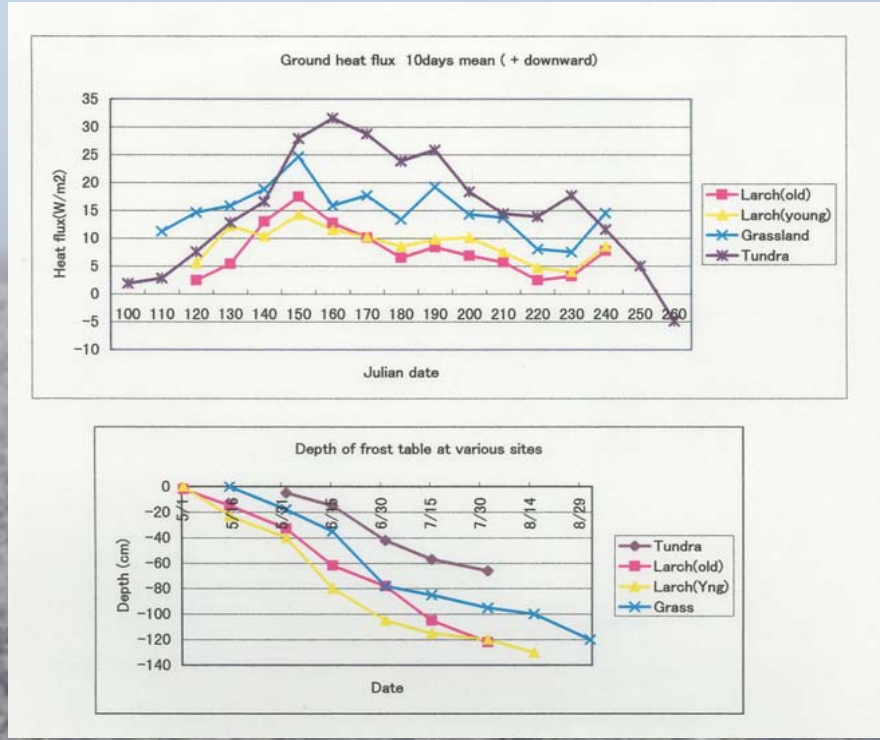


(Ohta et al., 2001, Yamazaki et al., 2005, Ohata et al., in preparation)

Difference of seasonal variation of ground heat flux and thaw depth during the warm period

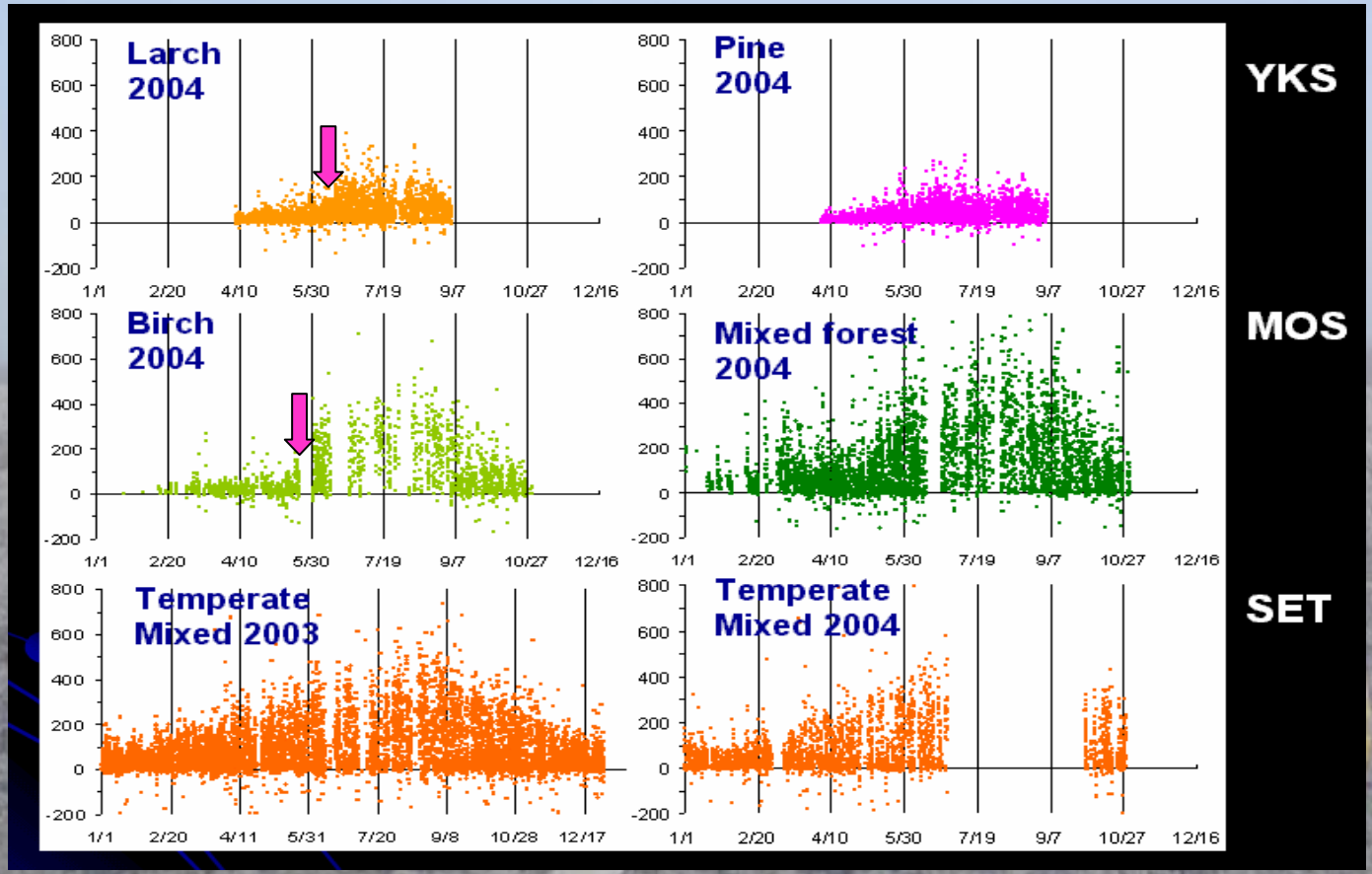
(Tiksi and Yakutsk)

- Ground heat flux is largest at Tiksi and smallest at larch forest.
- Active layer depth is deepest at larch forest and shallowest at tundra.
- The result seem to be controversial. The main reason for this is due to the difference in the soil moisture. If soil moisture is high value, strong heat conduction and large heat capacity. In case of Tiksi ,large heat capacity limits the taw depth.



(Ohata, personal communication)

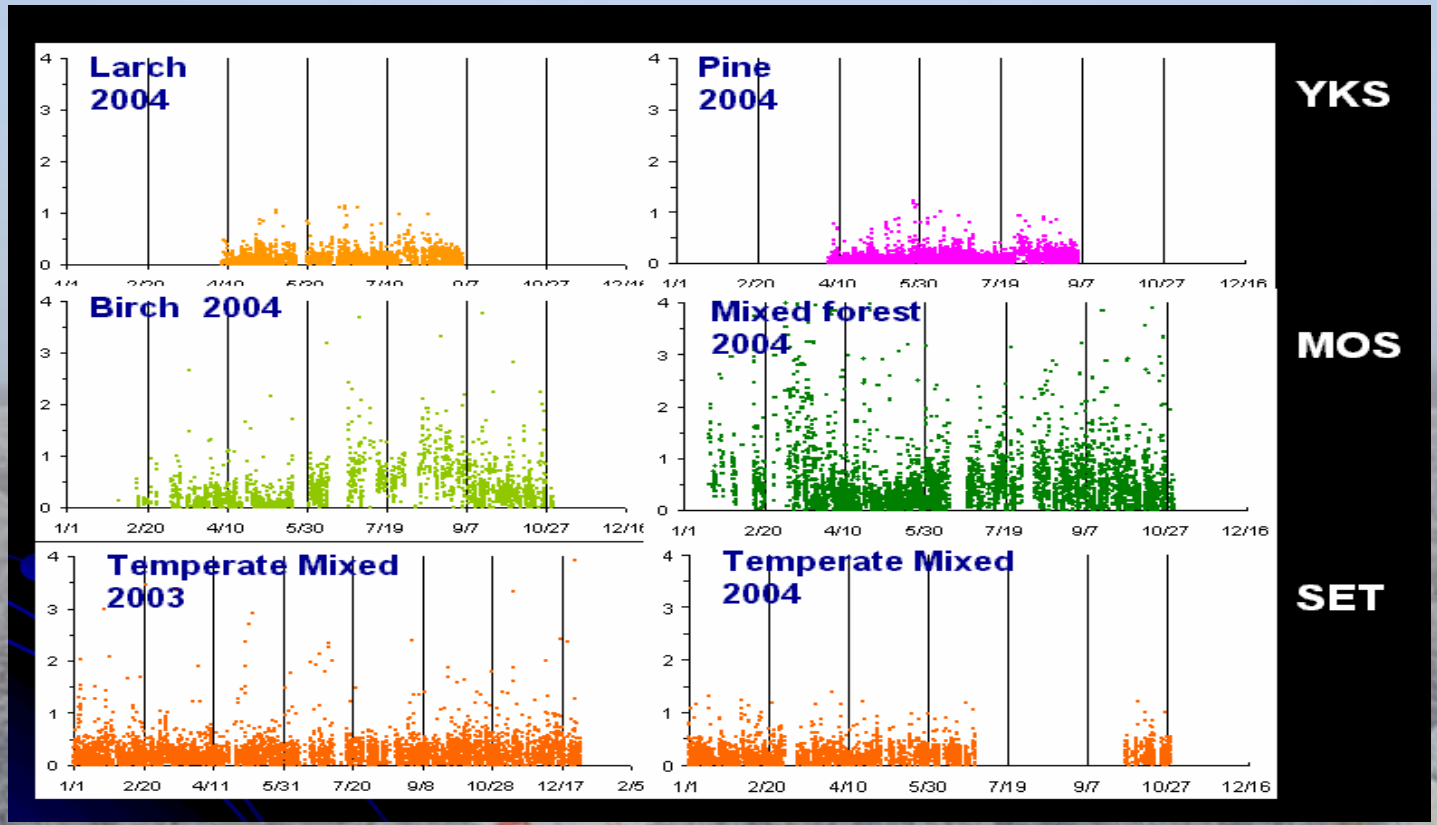
Latent heat fluxes above forests located in the different climate zone



Kuwada et al., submitted

- The latent heat flux is limited at YKS although there is no difference of solar radiation and air temperature during a growing season. → drier atmpsphere.
- There is no significant differences of LH between the different forest types in the same region.

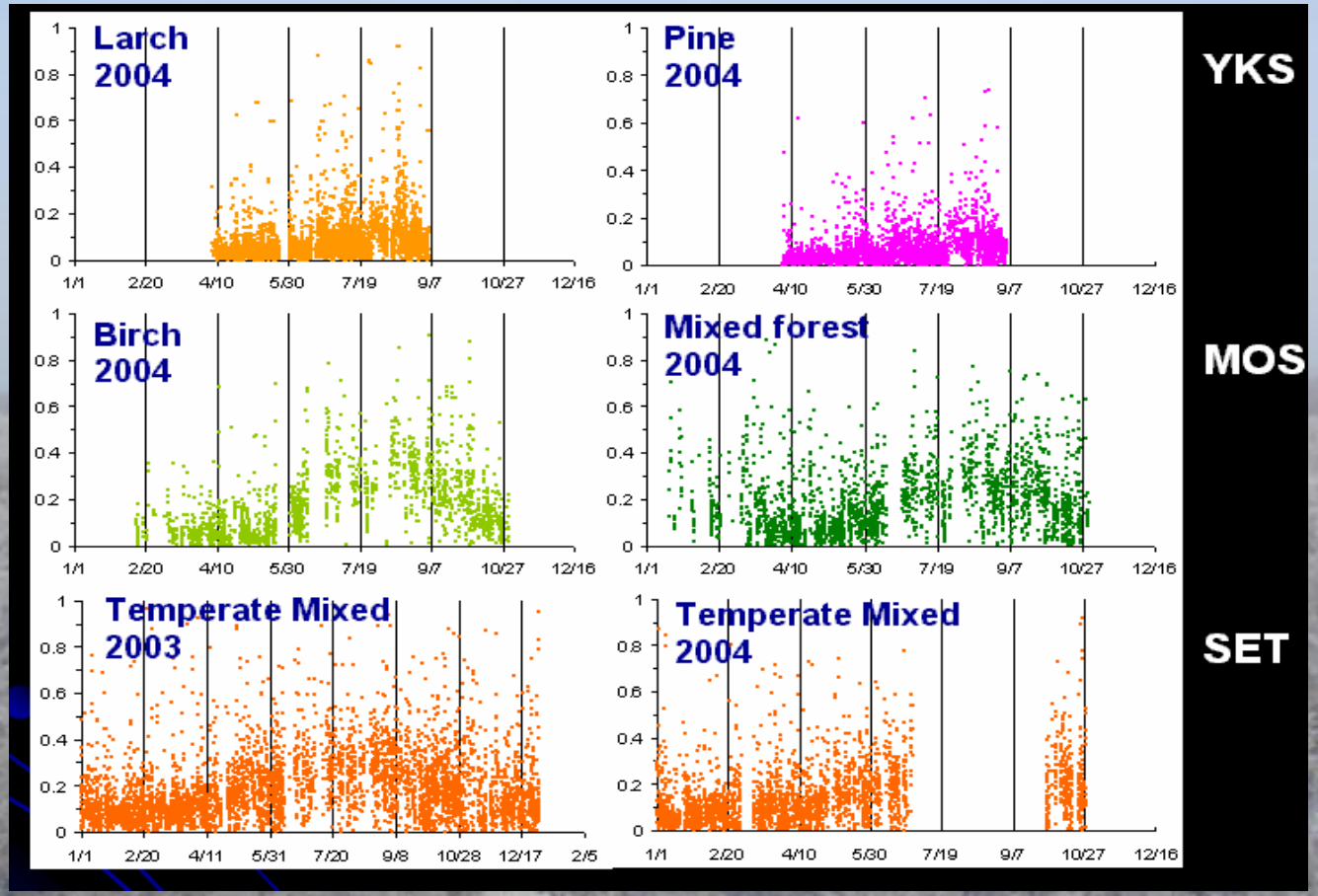
Canopy conductance in the different climate zone



Kuwada et al., submitted

- The canopy conductance is quite low at the both sites of YKS.

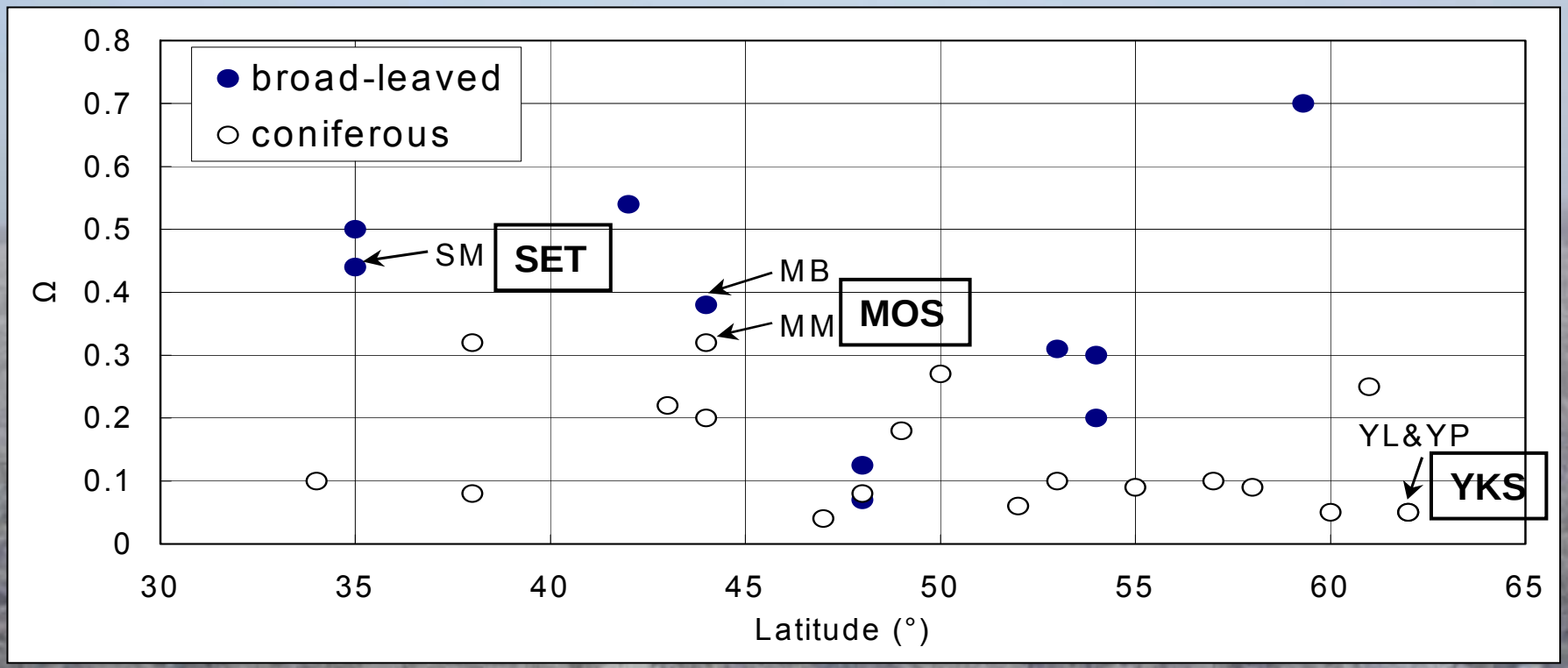
Decoupling coefficient in the different climate zone



Kuwada et al., submitted

- The decoupling coefficient is smaller in the higher latitude region. This tendency implies that the land surface effects on transpiration will be more significant in the high latitude regions.

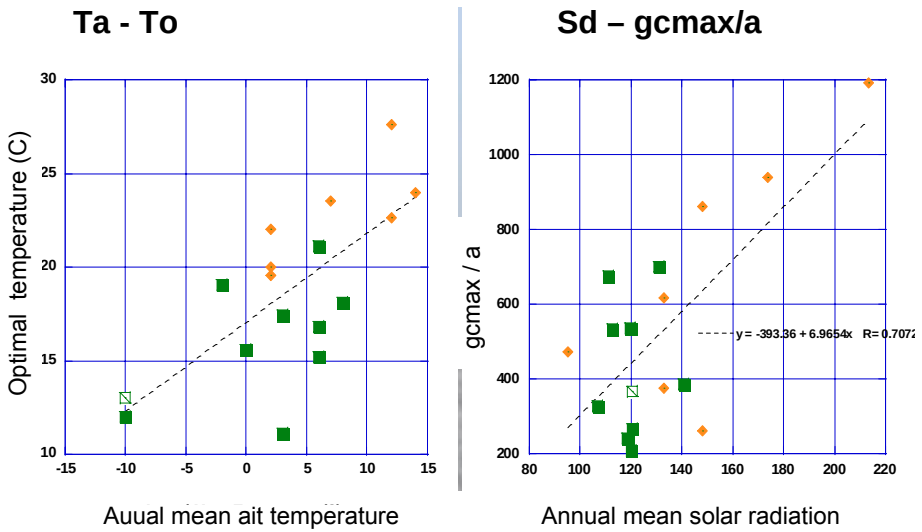
Decoupling coefficient in the different climate zone

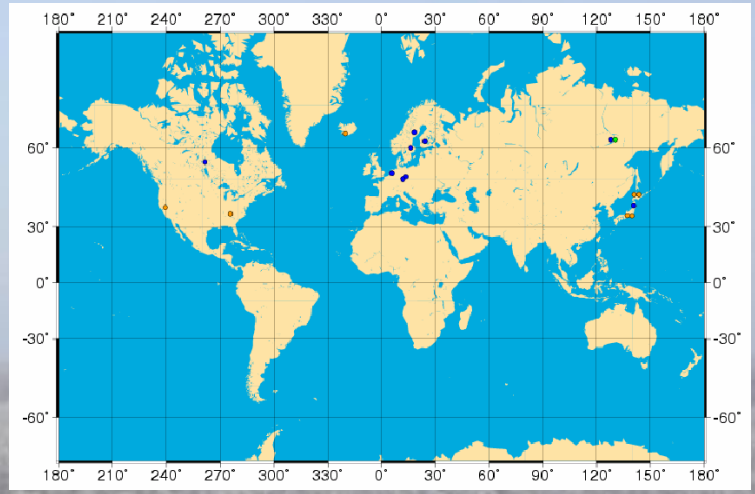


- Decoupling coefficient is smaller in the high latitude regions.
- The land surface effects are more significant in boreal forests.

(Kuwada et al., submitted)

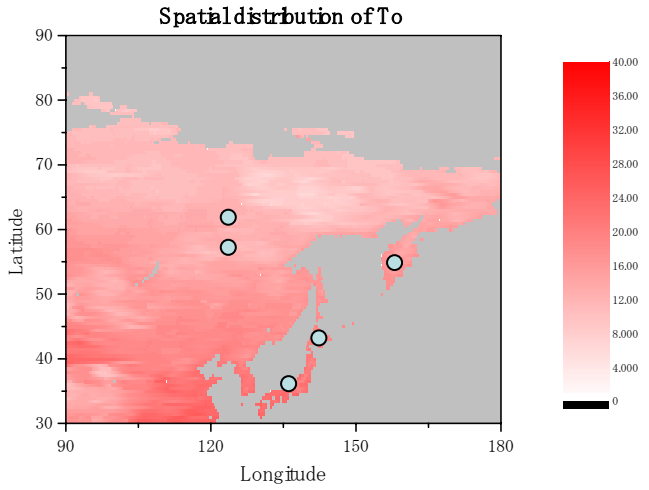
Spatial distribution of conductance model parameters

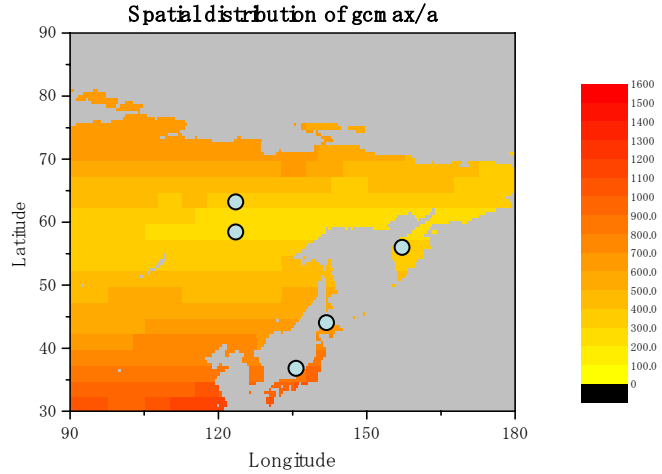


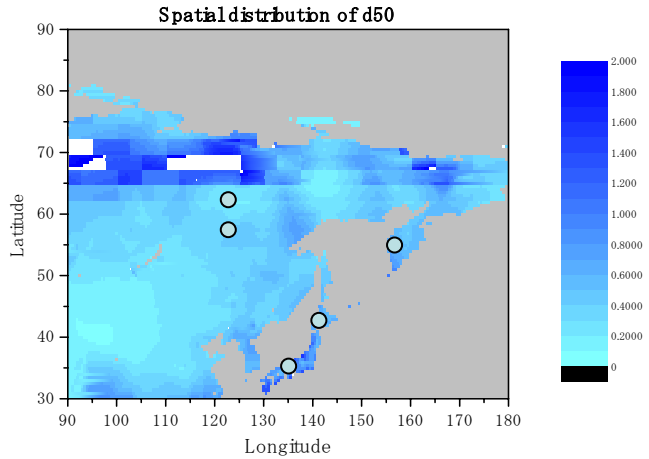


- Optimal temperature for transpiration is lower in the cooler regions.
- The response of forests to light at bright-fewer regions saturates under the low short-wave radiation.
- The conductance in drier areas responses more sensitively against air dryness comparing with that in humid areas. (Ohta et al., submitted)

Spatial distribution of conductance model parameters

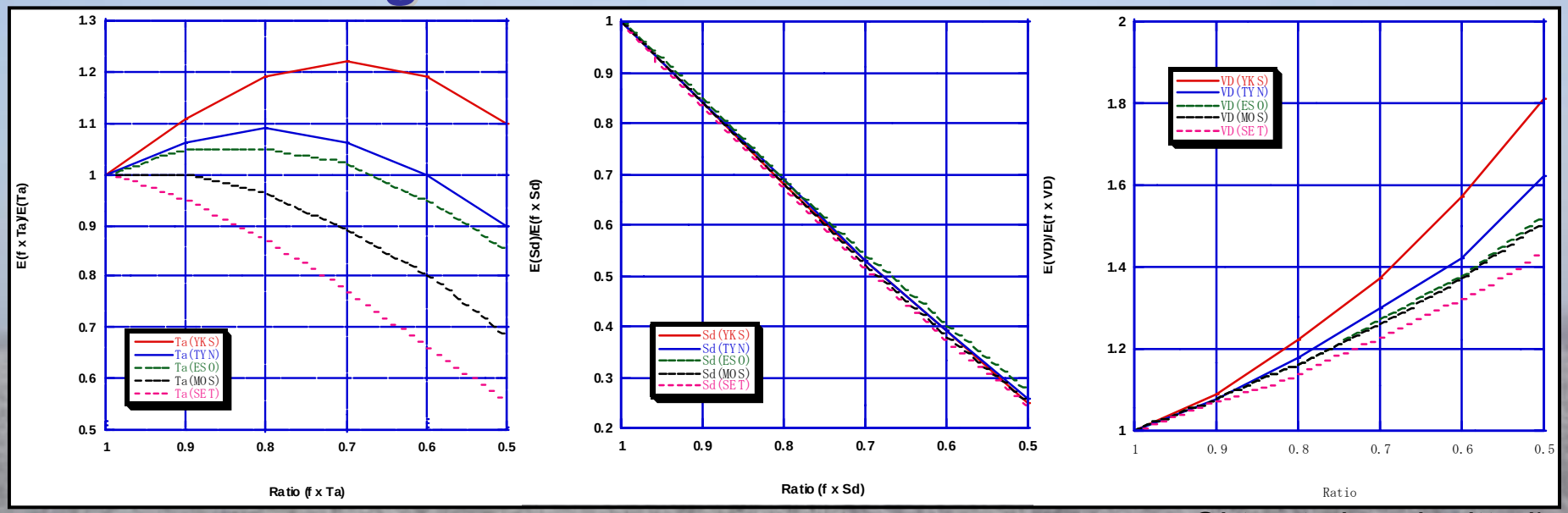






- The spatial distribution maps of model parameters are obtained from the relationships between the parameters and climate conditions.
- It is estimated that the conductance sensitivity to lighr and air dryness will be most sensitive in the middle reaches in R. Lena. (Ohta et al., submitted)

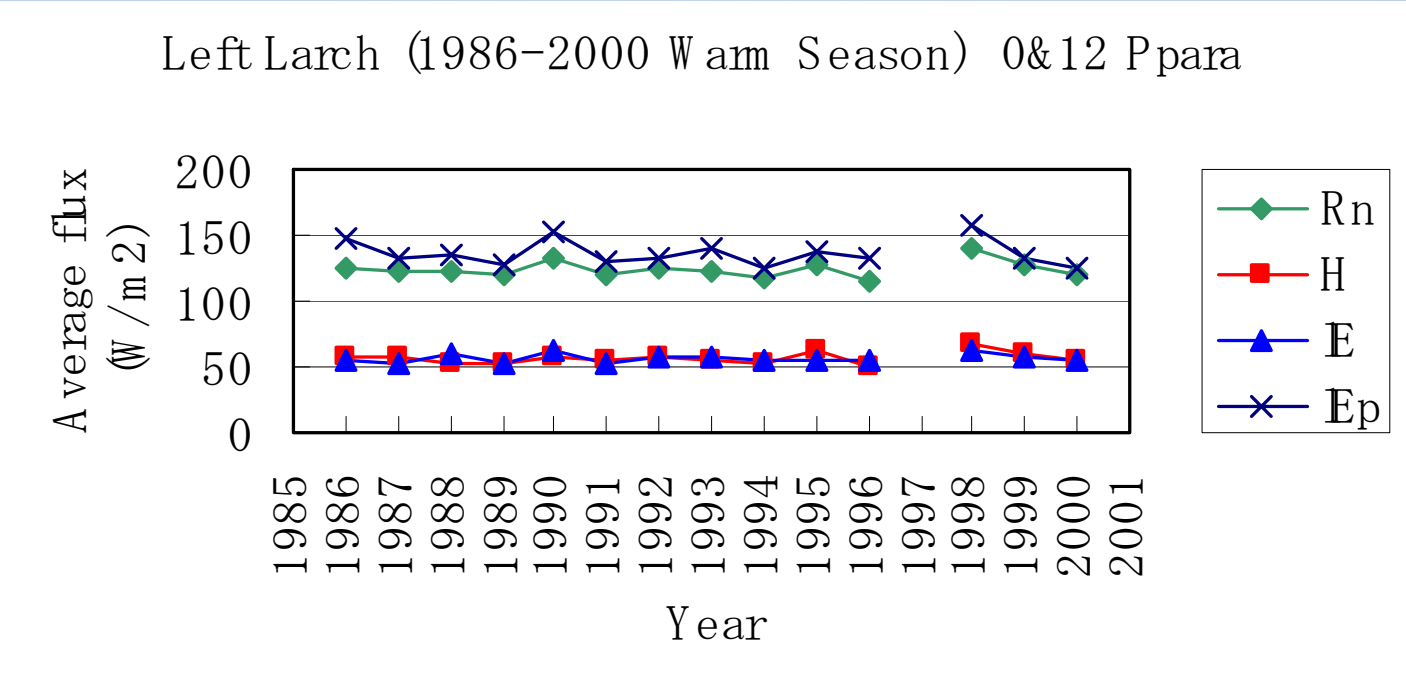
Sensitivity of evapotarsnpiration to meteorological variables in the different climate



Ohta et al., submitted)

- The sensitivity of evapotranspiration is examined at the five points. The three are Siberian site (YKS, TYN, ESO) and the other two are Japanese sites (MOS, SET), using the parameter distribution maps.
- to Air temperature: Evapotranspiration will respond significantly in the temperate forests. The spatial difference on sensitivity will be significant.
- to PAR: The sensitivity will be significant, but there will be no spatial differences.
- to VPD: The sensitivity will be more clear in boreal forests.

Estimation of long-term variation of energy balance above the larch forest



- The inter-annual variation of energy balance components will be stable, although there was a significant inter-annual variation on precipitation. This results results from the existence of permafrost. This tendency agrees well with the results obtained by Sugimoto et al., (2002). **(Yamazaki et al., 2004)**