Belmont Forum Arctic
C budget of ecosystems and cities and villages on permafrost in eastern Russian Arctic (COPERA)

Main investigators: Japan (Sugimoto, Tabata), Russia (Prisyazhny, Maximov), USA (Yoshikawa)

Task 1 observation

Regional budget estimation by satellite data and modeling

C budget estimate for Sakha (Yakutia)
Sinario on permafrost and ecosystem chantes

State of Data

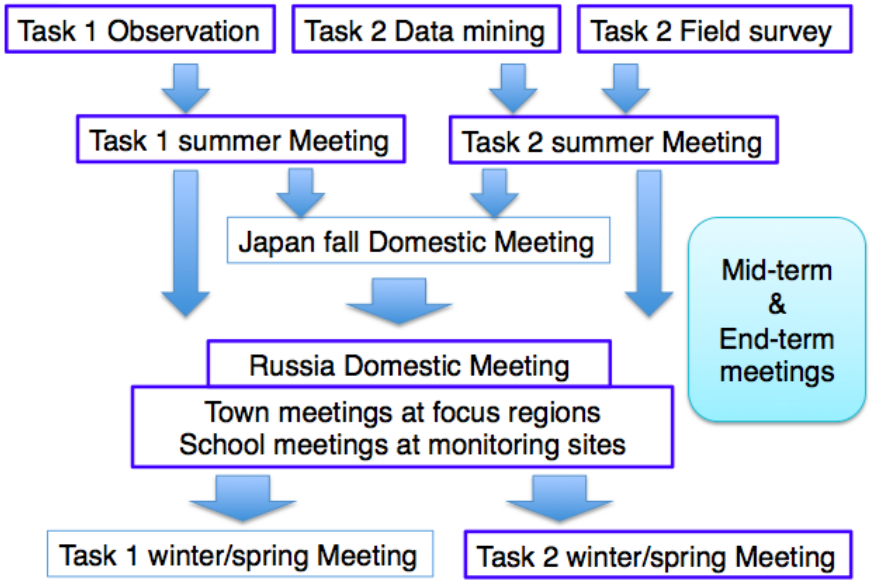
Raw data

Processed data for scientists

Processed for public

Useful information for public

Meetings to engage people in COPERA



Task 2

Statistical data analysis on fuel use and price, population, field survey, and analysis of economy

Estimations of fuel use, energy cost and population, and proposing of optimum use of energy

Future scenario

Background: Problems in Arctic and subarctic regions

impact on global climate ← decrease in CO2 uptake

- Climate
  - rapid warming
  - severe drought & heavy rainfall
  - flooding, over-wetting
- Permafrost ecosystem
  - degradation of permafrost
  - forest decline
  - vegetation change

impact on society

- Society
  - rapid growth of large cities
  - increase in consumption
  - increase in CO2 emission
  - shrink of small settlements
  - increase in energy cost
  - increase in financial burden on government & people

economic growth & crisis

Background: Problems in Arctic and subarctic regions

impact on permafrost ecosystem

- Society
  - rapid growth of large cities
  - increase in consumption
  - increase in CO2 emission

economic growth & crisis

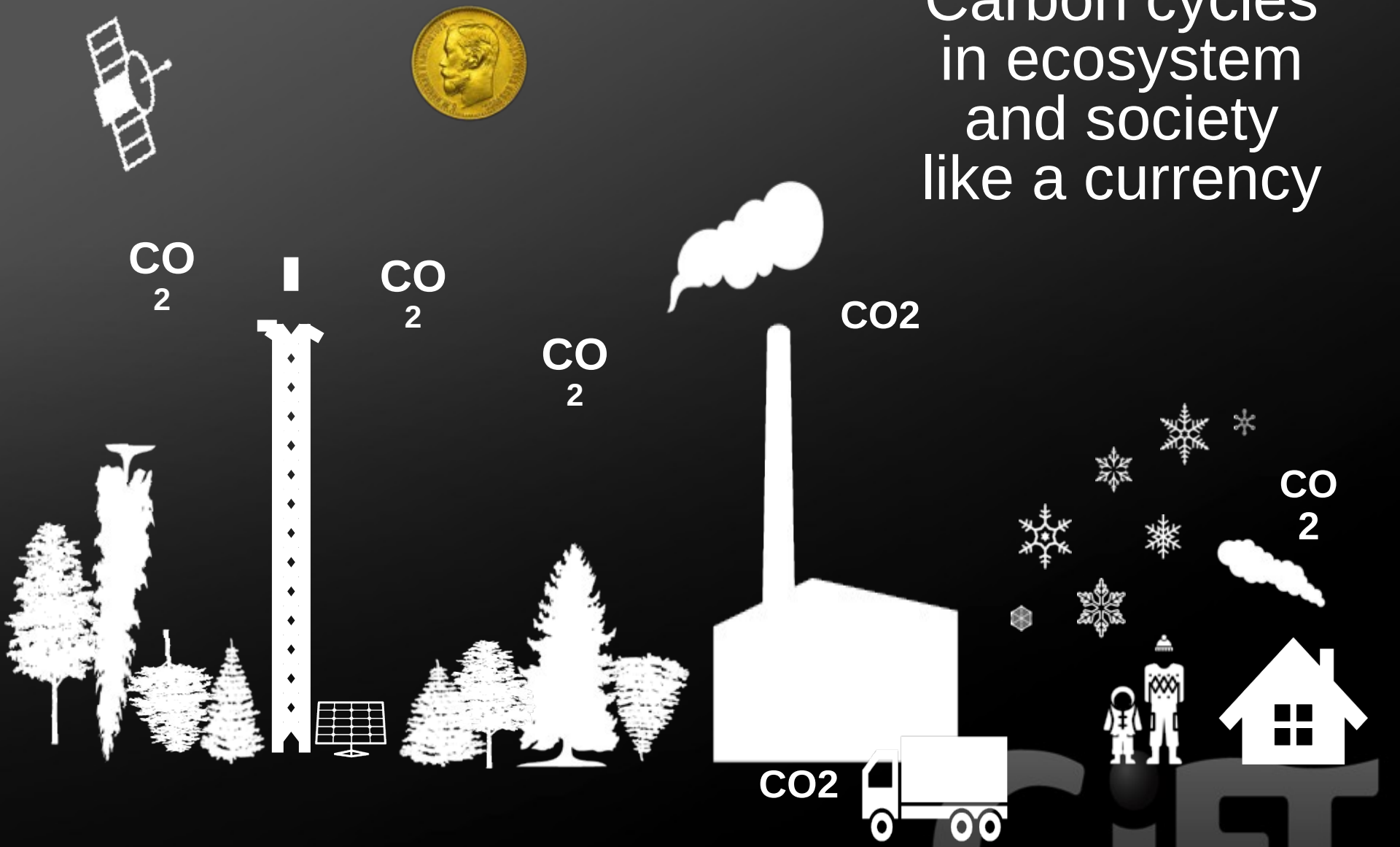
- shrink of small settlements
- increase in energy cost
- increase in financial burden on government & people

impact on global climate

impacts on ecosystem, society

- Industry
  - low energy efficiency → more CO2 emission
  - high energy cost for mining industry
  - unbalance of fuel export and import → financial burden
  - small business → inefficient energy use = more CO2 emission

Carbon cycles in ecosystem and society like a currency



Carbon cycles in ecosystem and society like a currency

using the amount of carbon like a currency

- Energy ---> CO2

  gas, coal, diesel, wood can be converted to the amount of CO2

- Easy to communicate between natural and social scientists

- Possible to compare CO2

  uptake or emission by ecosystem

  emission from household per

  emission by car

  emission fro y

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Meetings to engage people in COPERA

Task 1 Observation | Task 2 Data mining | Task 2 Field survey

Task 1 summer Meeting

Task 2 summer Meeting

Japan fall Domestic Meeting

Russia Domestic Meeting

Town meetings at focus regions
School meetings at monitoring sites

Mid-term & End-term meetings

Task 1 winter/spring Meeting

Task 2 winter/spring Meeting

Task 2

Statistical data analysis on fuel use and price, population, field survey, and analysis of economy

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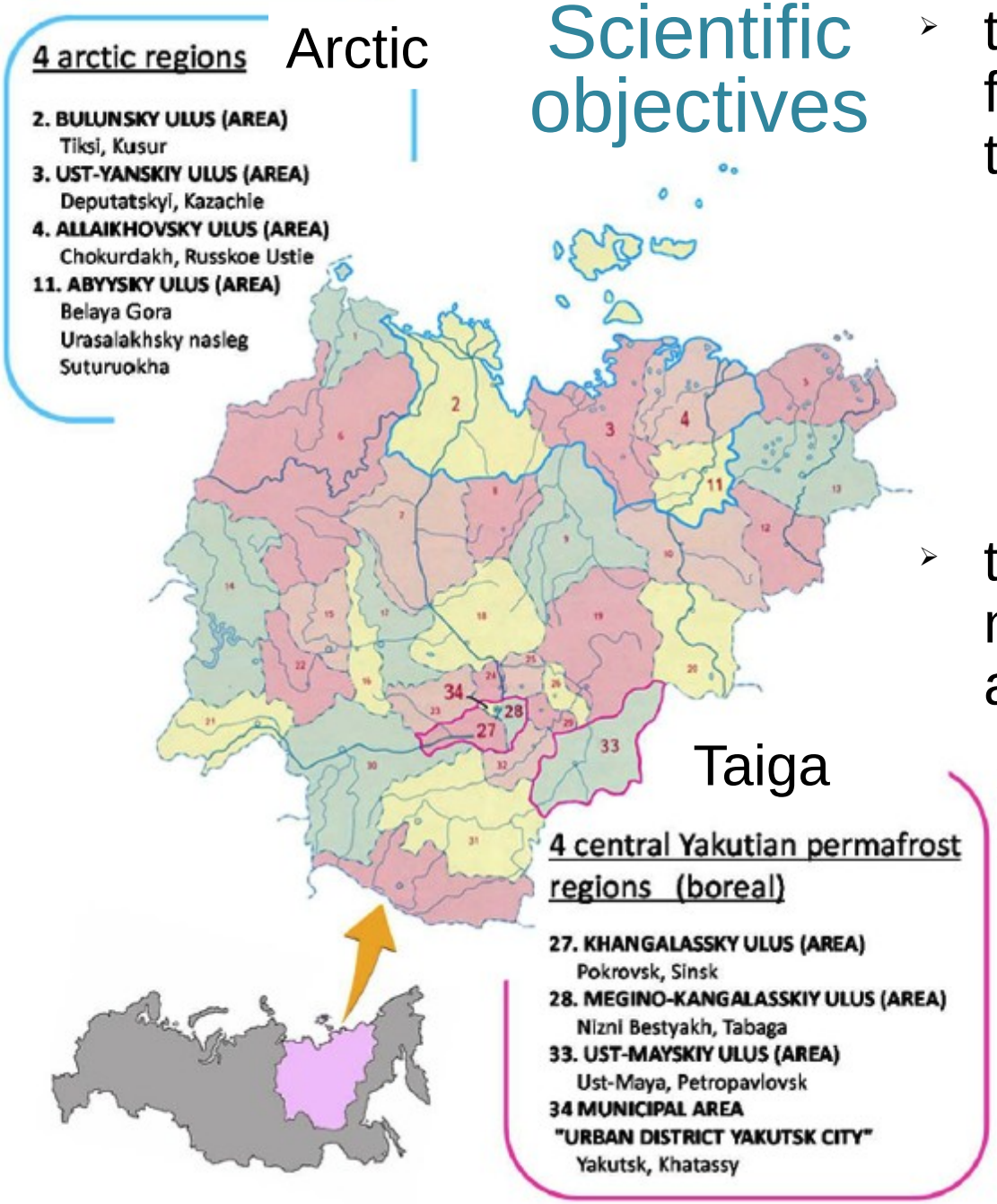
Future scenario

Scientific objectives



- to Estimate C budget for focus areas, and then territory of Sakha (Yakutia)
  - -Ecosystem
  - -Human activities
    - field survey and statistical data analyses on energy consumption in urban and rural settlements
- to Establish monitoring network on permafrost and temperature
- Analysis of energy cost
- Analyses of economic growth and development

Future scenarios

Cooperative Research Action Objectives

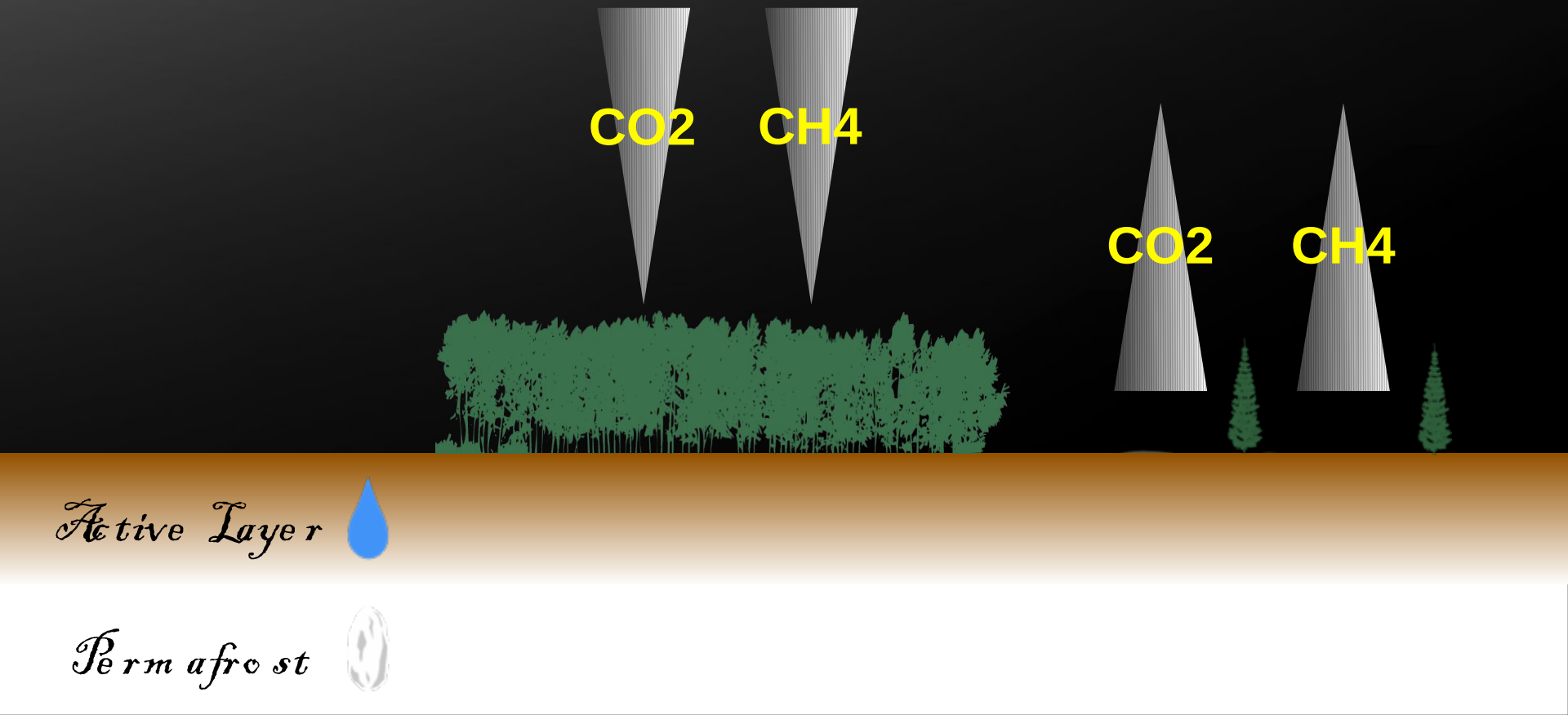
- to Inspire people (& government) and change their way of thinking by showing scientific data
  - -importance of permafrost ecosystem
  - -saving energy makes money, and saves ecosystem
  - -importance of their own action for saving energy & ecosystem
  - -anything else???
- to Foster future leaders
- to Find what we can do together for our future by understanding each other through communication

examples what natural scientists may be able to
-future land surface condition (vegeta
-future permafrost condi

GiFT

Permafrost Ecosystem

Important for the Global Carbon Cycle



6-8 slides on how to estimate C budget
by Japanese team

Measurement of CO2 fluxes

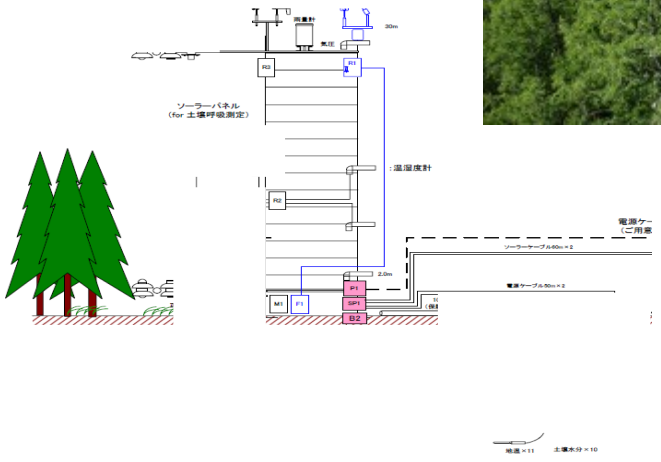
Observation tower at Ust'Maya

Yakutsk (Spasskaya Pad)

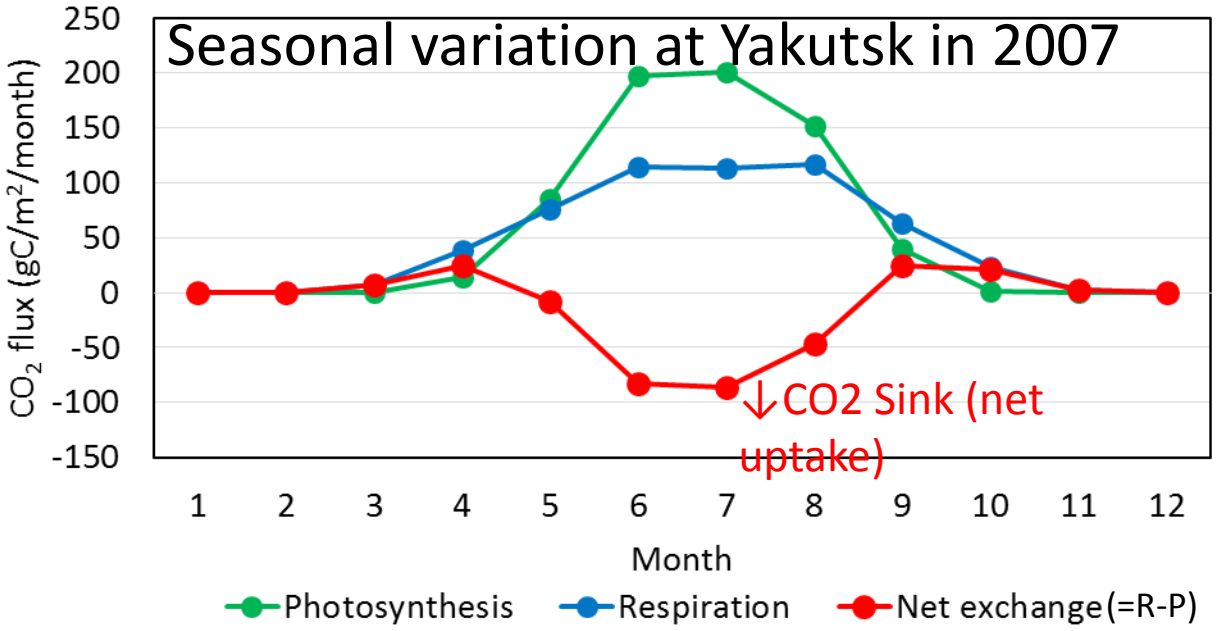
Meteorology sensors above and inside forest

Ust'Maya (Elgeeii)

Observation system at Chokurdakh

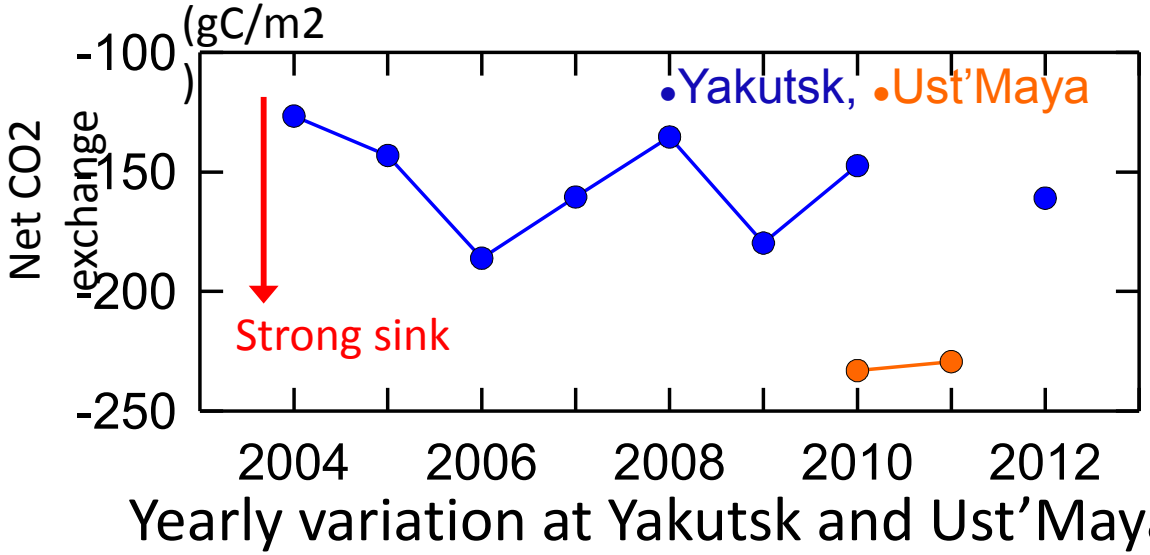


Variation of CO2 exchange over forest by Kotani



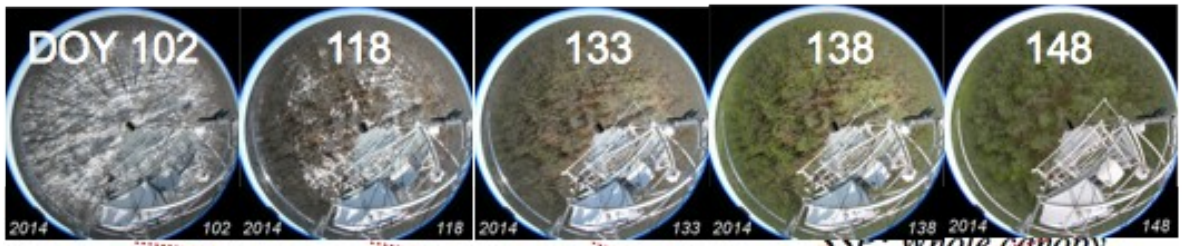
During summer, forest absorbs CO2

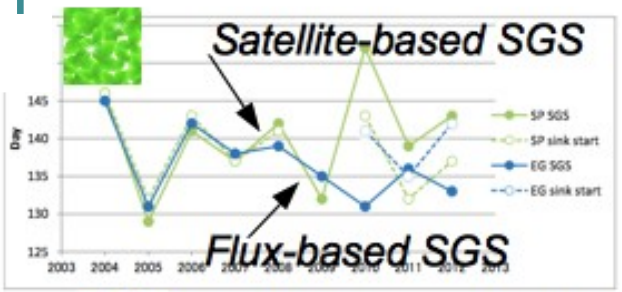
from atmosphere.

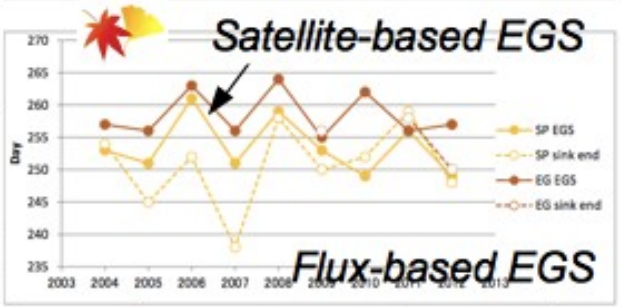


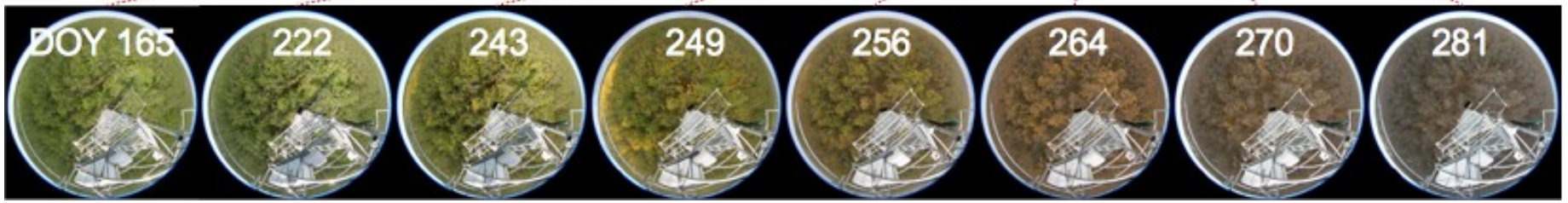
Forest at Ust'Maya uptakes more CO2 than that at Yakutsk

Observation on growing season length





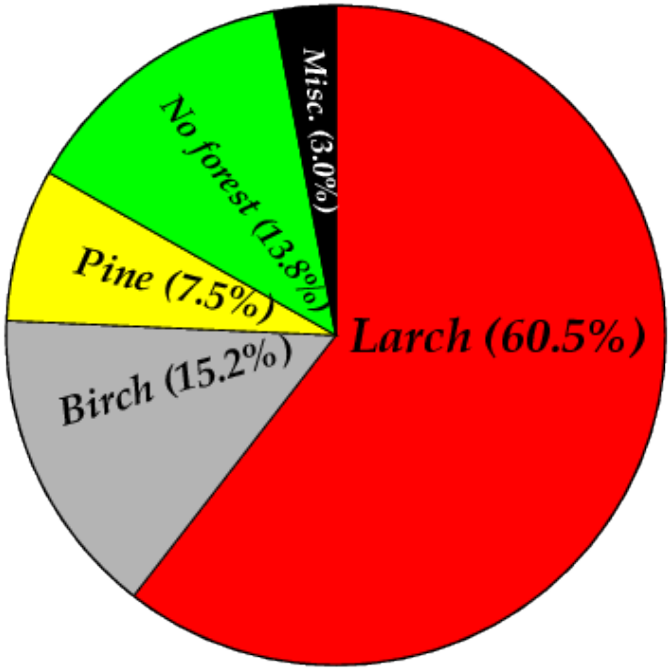




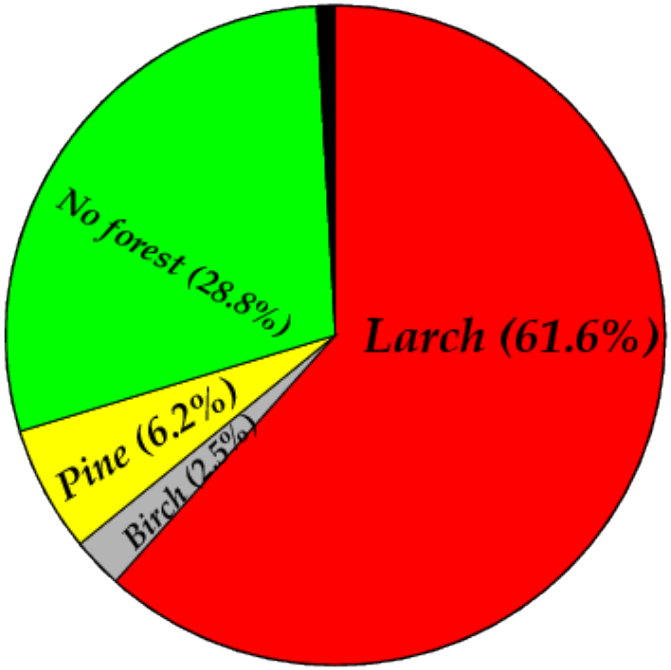
Land cover classification by airborne remote sensing in 2000

Airborne remote sensing around Yakutsk in 2000

Left bank terrace
# of samples = 661

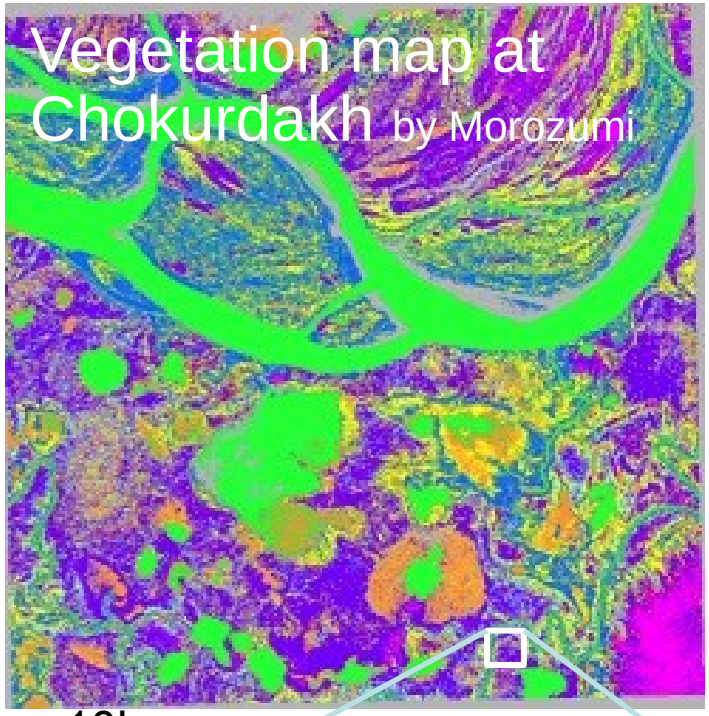


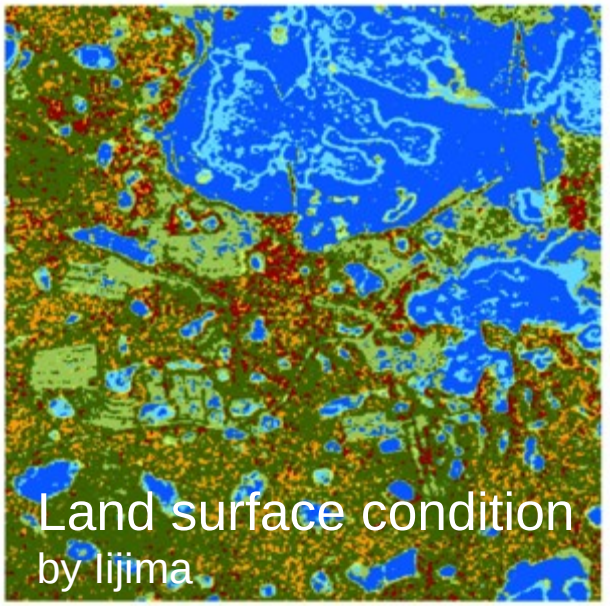
Right bank terrace
# of samples=1007

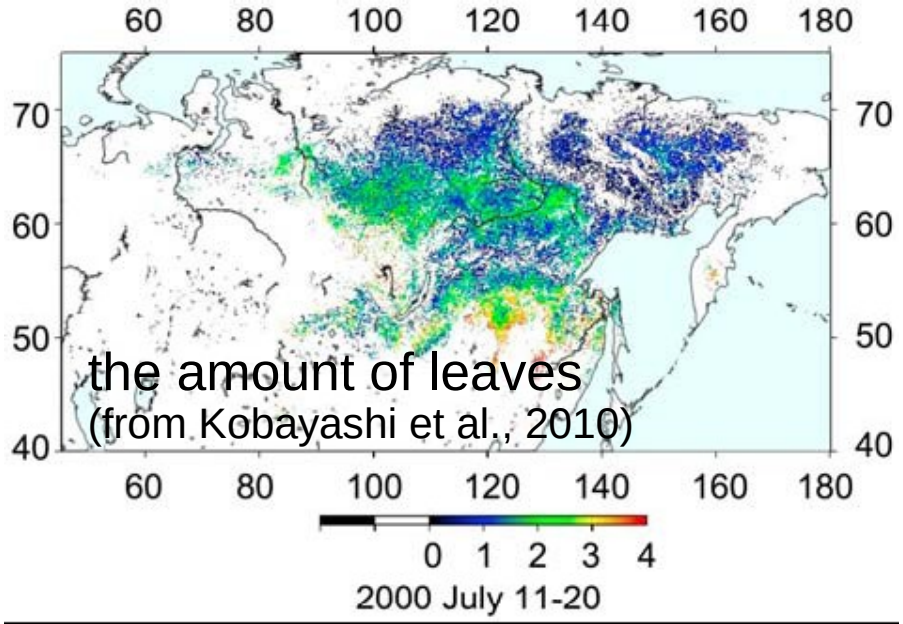


Suzuki et al. (2004), IJRS

<regional scale observation> Satellite remote sensing

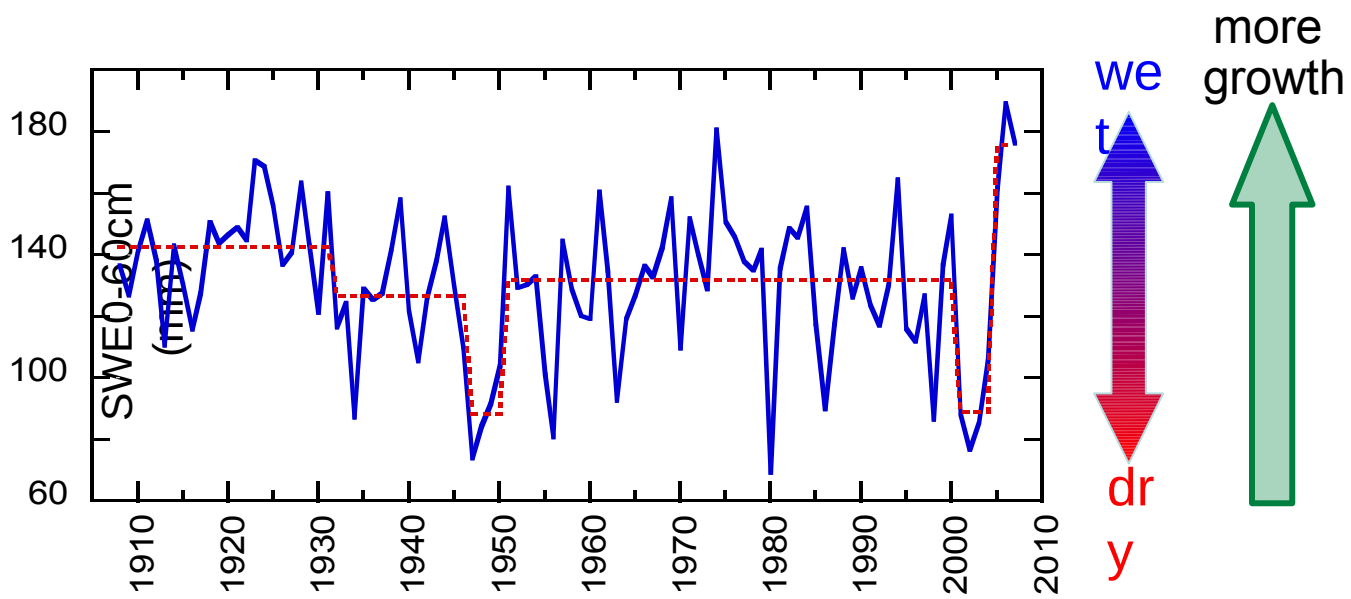




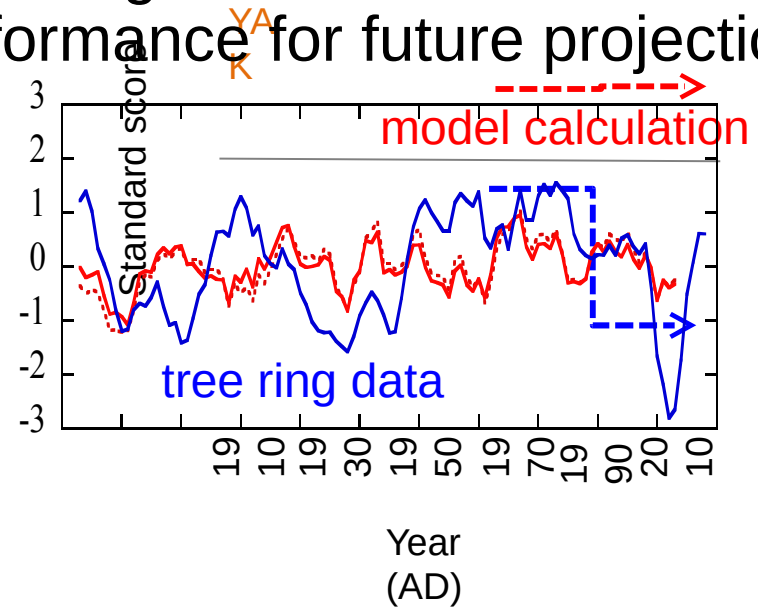


Learning the past to know the future

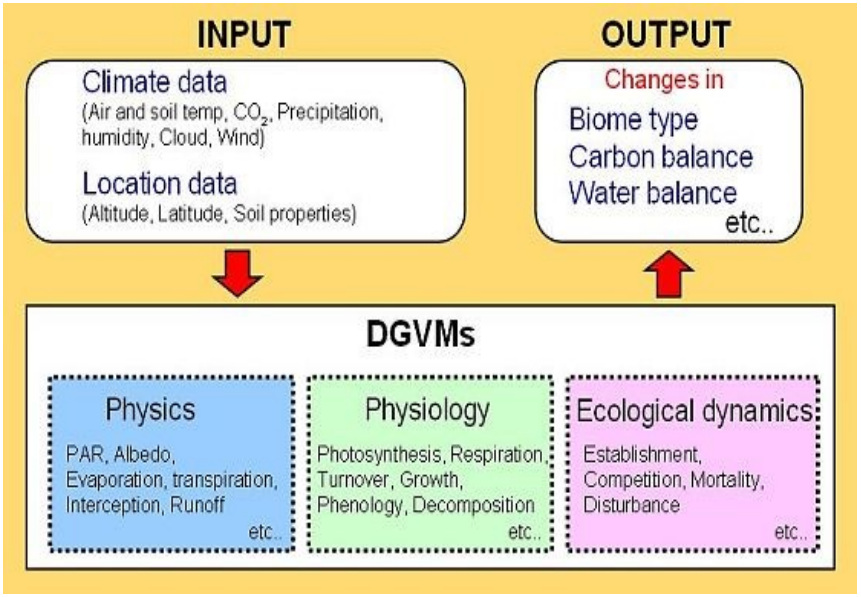
Dry-wet cycle revealed by tree ring data

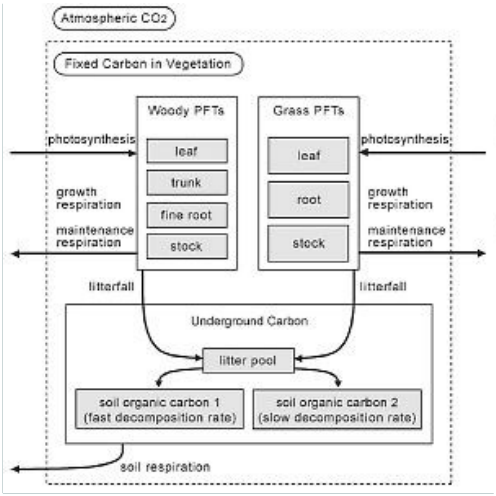


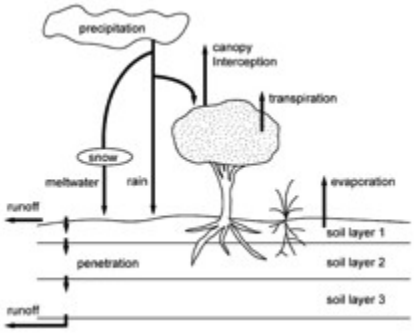
Checking simulation model performance for future projection

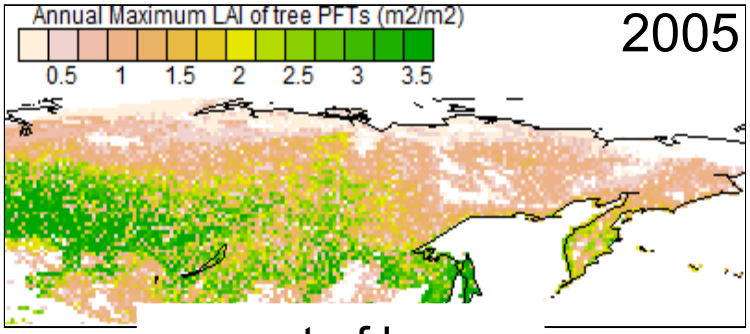


Computer simulation for prediction of future ecosystem

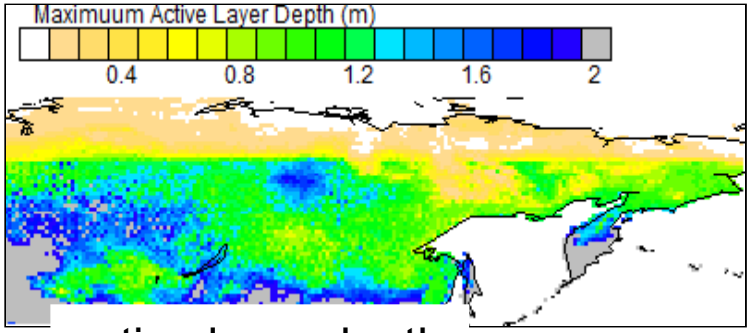




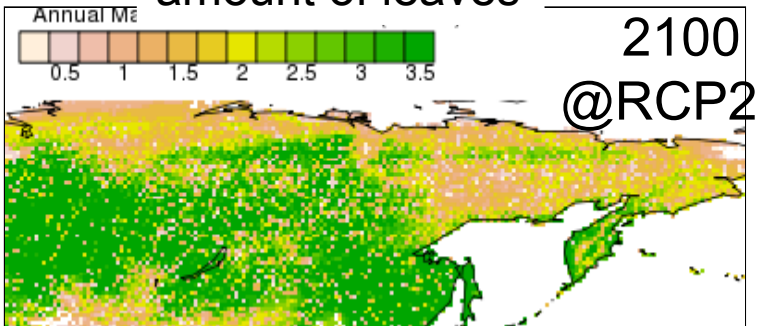


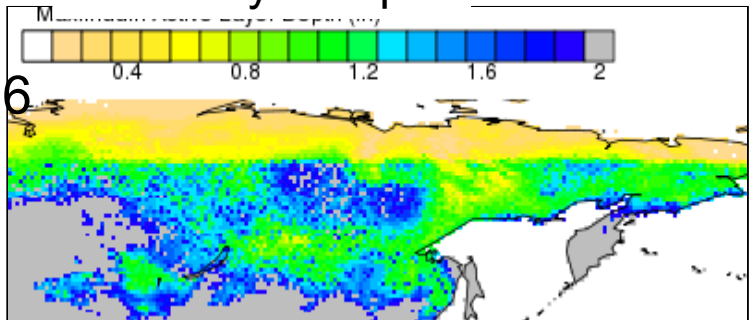


amount of leaves



active layer depth





Research Plan for COPERA

by Shinichiro Tabata with Nina Ksenofontova

- Aims to analyze influences:
  - of human activities on environment
  - of environment, including climate changes, on human activities
- Data analysis of economic development of Sakha as a whole: comparison with other Far Northern regions in Russia
  - GDP (GRP); Industry; Investment
- Policy analysis: federal and regional government strategy or plan of economic development
  - Some scenarios of economic development
- Demographic trends (past and future)
  - Natural increase (decrease) and migration
  - By regions: comparison of urban and rural areas
- Energy balance (past and future)
  - Production, consumption, exports and imports
  - By resources
  - By regions: comparison of urban and rural areas

Fostering future leaders

- Observations with school kids in COPERA
- Lectures and Summer school in RJE3 and other programs
- Education for graduate students in research activities

Observations on permafrost with school kids and school teachers

Already established network by Yoshikawa & NEFU

- 87 schools Sakha (Yakutia), Sakhalin, Kamchatka, Magadan, Chukotka and Yamal
- 5 schools in Yakutsk

Plan for COPERA

- More schools in focus areas, and temperature observations in several schools
- involvement of NEFU students

Community school in the North of Yakutia. Suturuokha, Abiysky region in 2013

monitoring sites near schools

Members

Japan

Atsuko SUGIMOTO (Leading PI) Hokkaido Univ, Faculty of Environmental Earth Science, Professor

Shinichiro TABATA, Hokkaido Univ, Slavic-Eurasian Research Center, Director, Professor

Mamoru ISHIKAWA, Hokkaido Univ, Faculty of Environmental Earth Science, Associate Professor

Masahiko FUJII, Hokkaido Univ, Faculty of Environmental Earth Science, Associate Professor

Tsuyoshi SETOGUCHI, Hokkaido Univ, Faculty of Engineering, Professor

Hiroshi HAYASAKA, NPO Hokkaido Institute of Hydro-climate, Researcher

Ryusuke HATANO, Hokkaido Univ, Faculty of Agriculture Science, Professor

Rikie SUZUKI, JAMSTEC (Japan Agency of Marine-Earth Science and Technology), Department of Environmental Geochemical Cycle Research, Director

Hisashi SATO, JAMSTEC, Department of Environmental Geochemical Cycle Research, Scientific Researcher

Yoshihiro IIJIMA, JAMSTEC, Institute of Arctic Climate and Environment Research, Senior Researcher

Shin NAGAI, JAMSTEC, Department of Environmental Geochemical Cycle Research, Senior Researcher

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Tuyara GAVRILYEVA, NEFU, Institute of Engineering & Technology, Research Professor

Trofim MAXIMOV, IBPC (Institute for Biological Problems of Cryolithozone), SBRAS, Head of laboratory / NEFU, BEST center, Director, Professor

Alexander KONONOV, IBPC, SBRAS, Senior Researcher / NEFU, BEST center, Leading Researcher

Yury ZHEGUSOV, Institute for Humanities Research and Indigenous Studies of the North, SBRAS, Researcher / NEFU, BEST center, Senior Researcher

Roman NOGOVITSIN, NEFU, Arctic Innovation Centre, Director, Professor

Nadezhda STEPANOVA, NEFU, Arctic Innovation Centre, Deputy Director

Nikita BOCHKAREV, Yakut Scientific Centre, SBRAS, Researcher

Alexander SAFRONOV, Deputy Chief of the Administration of the Head of the Republic of Sakha (Yakutia) and the Government of the Republic of Sakha (Yakutia)

Georgi MIKHAILOV, Deputy Head of Administration of the City District "Yakutsk"

Tatyana SIVTSEVA, Ministry of Industry of Republic of Sakha (Yakutia), Chief Specialist of the Department of Fuel Industry

USA

Kenji YOSHIKAWA (Partner PI) University of Alaska, Fairbanks, Water and Environment Research Center, Professor

And many other researchers and students from Japan, Russia, USA, and people from local government and schools in Russia