STATE OF THE ARCTIC

16 - 19 March 2010 • Hyatt Regency Miami

MASAMI FUKADA

Hokkaido University
International Arctic Research Center

International Arctic Research Center was established in 1999 jointly supported by US Government and Japanese Government

Joint IARC/JAXA Research Program on Arctic Wild Fire using Multi Satellite Sensors

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Frostfire: A Successful Experimental Burn in the Boreal Forest in 1999

FROSTFIRE: An experimental approach to predicting the climate feedbacks from the changing boreal fire regime *J. Geophys. Res.*, 108(D1), 8153

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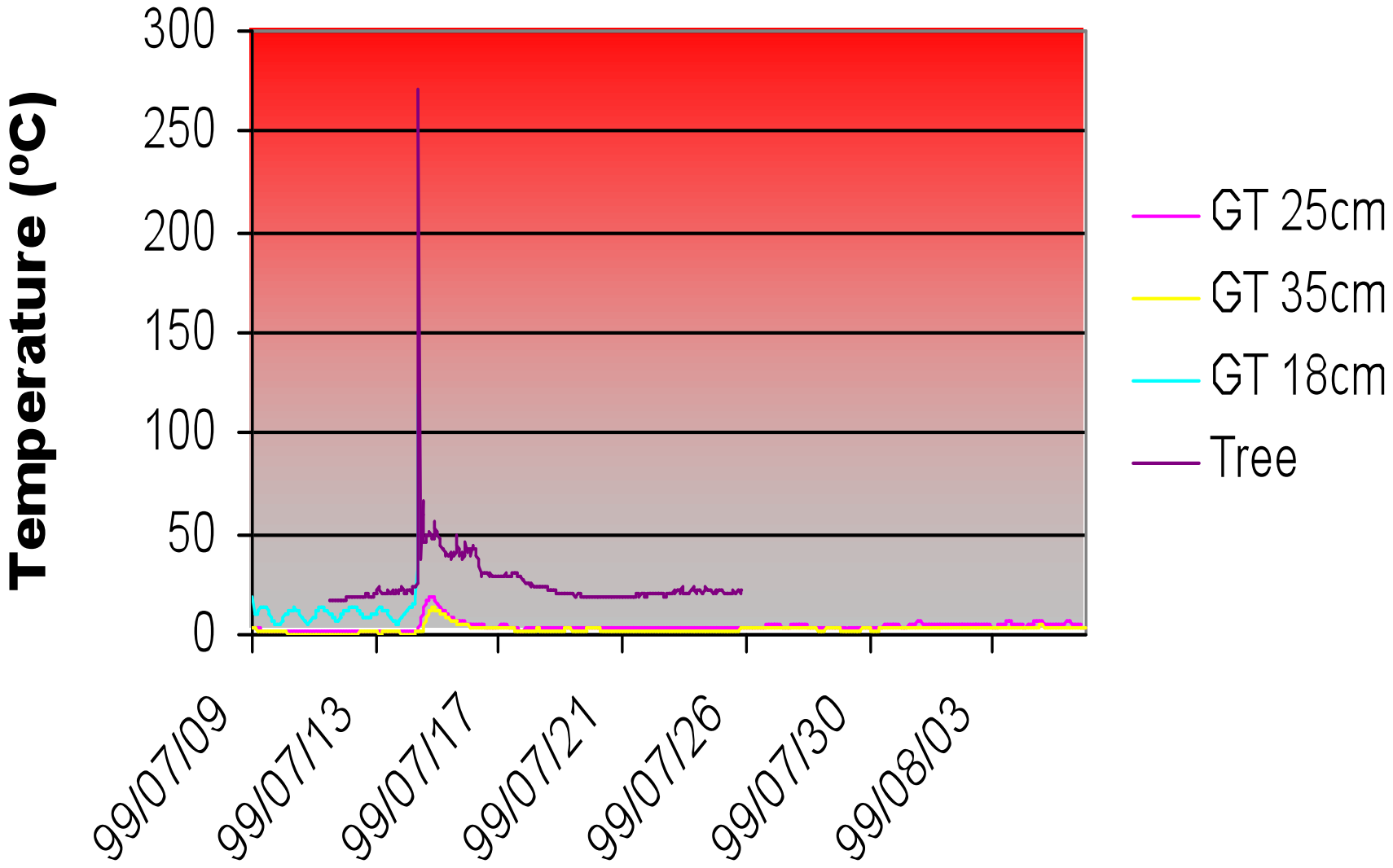
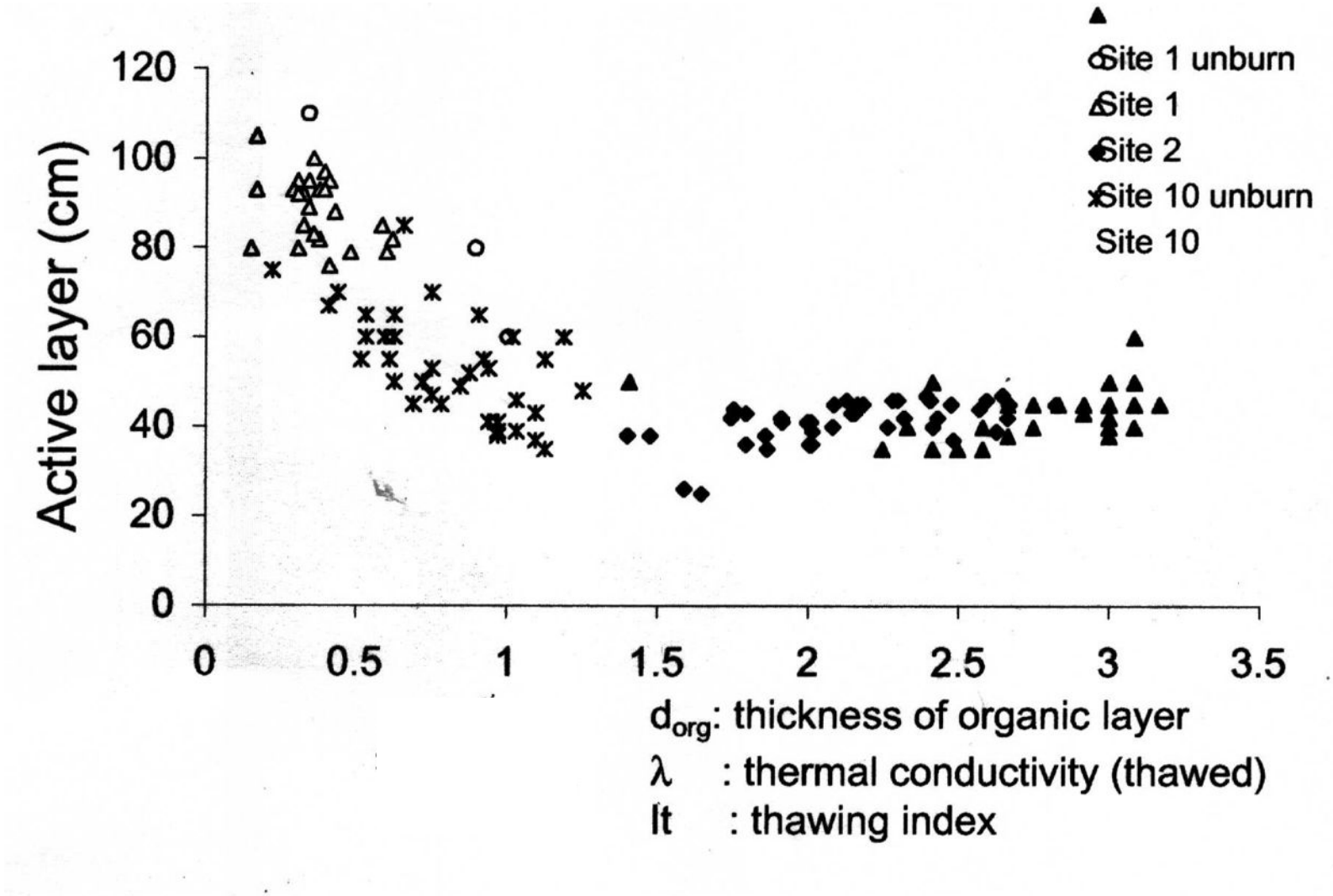
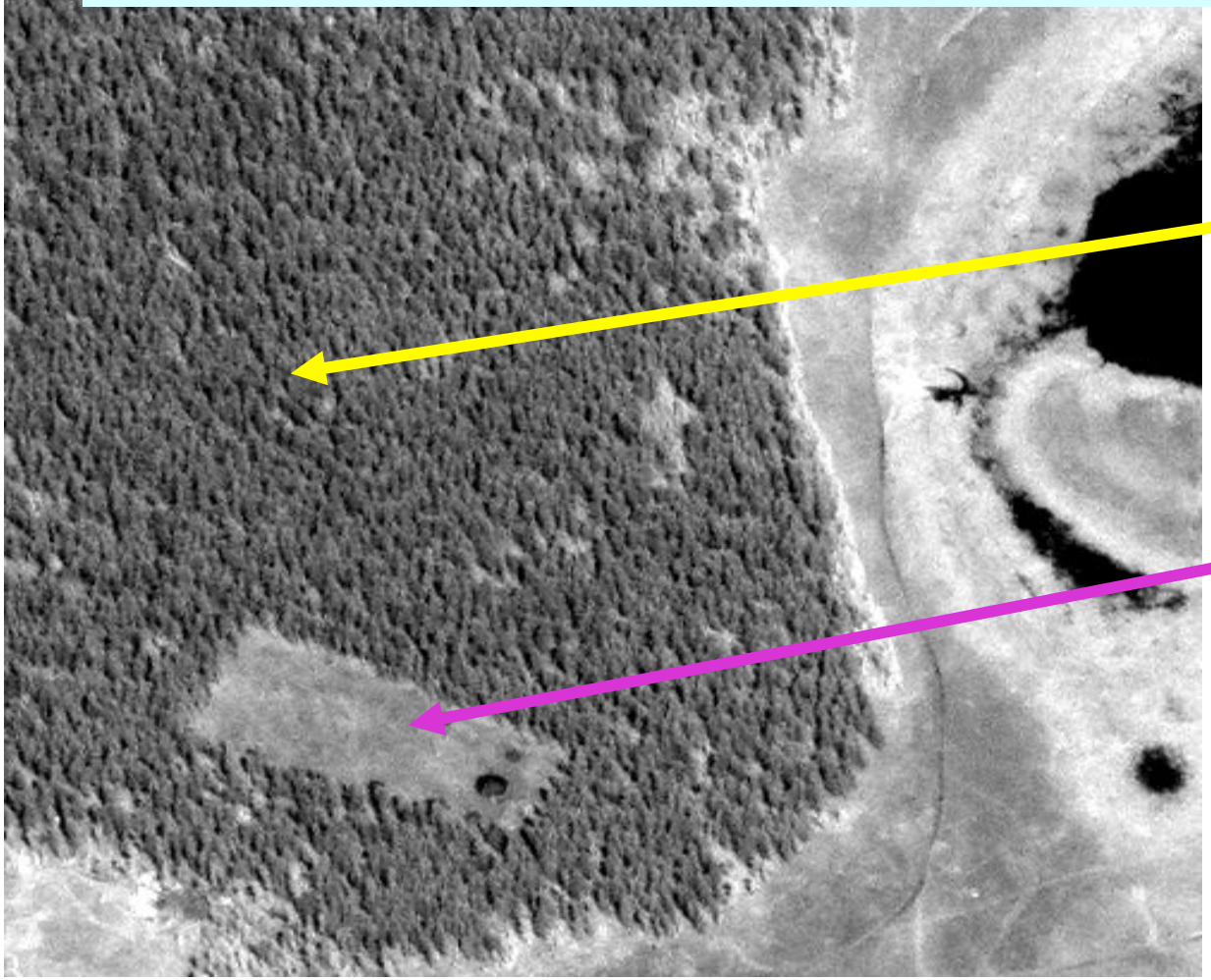
FROSTFIRE 1999 Experiment



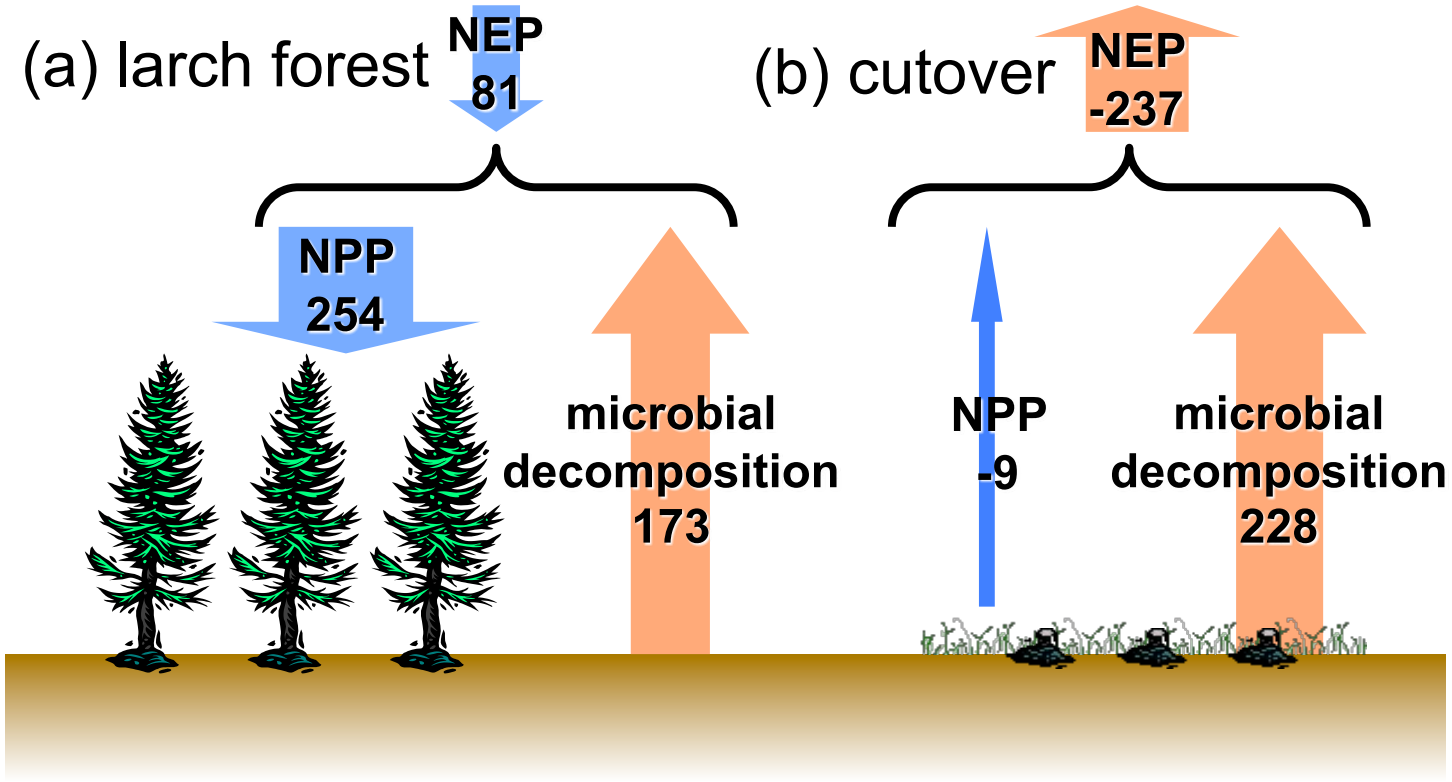

Active layer (cm)
120
100
80
60
40
20
0
0
0.5
1
1.5
2
2.5
3
3.5
Site 1 unburn
Site 1
Site 2
Site 10 unburn
Site 10
d_{org}: thickness of organic layer
λ : thermal conductivity (thawed)
It : thawing index

Field Experiment in east Siberia after FrostFire experiment 2000-2004

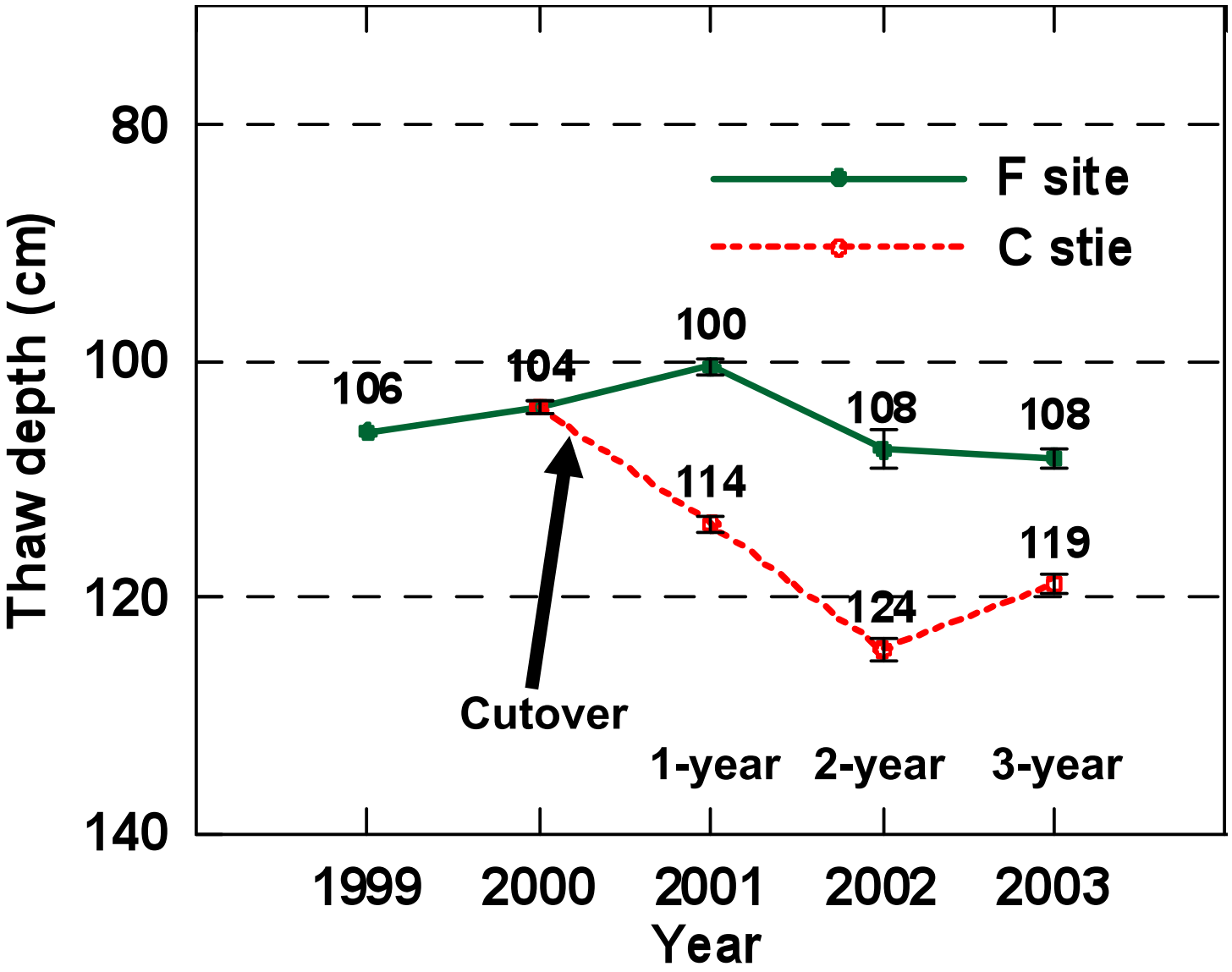
Joint Research Program between RAS and Hokkaido Univ.



5-month total budget in 2002 ($gC\ m^{-2}$)



Changes in Active Layer Thickness



Changes in soil moisture profiles (00'—02')

2000 **Wet**

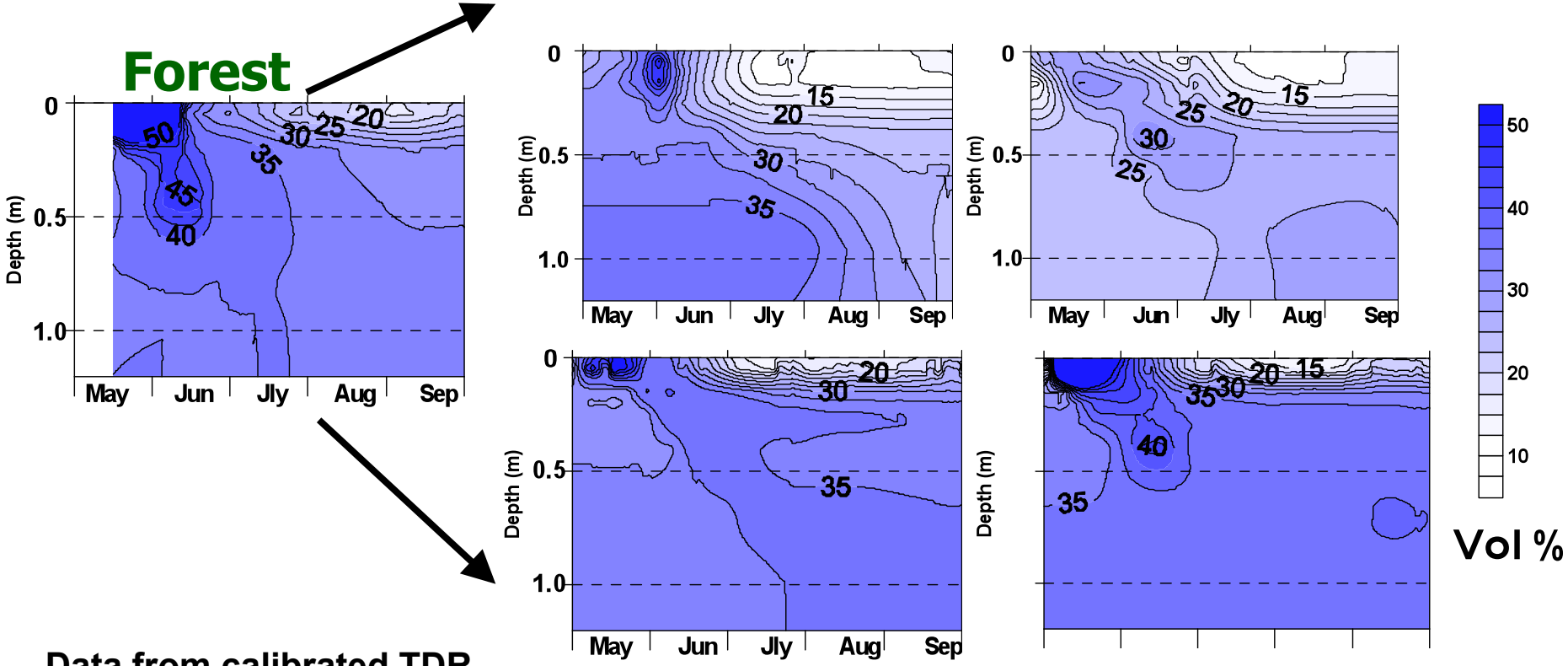
2001

2002

Forest

Forest

Forest



Data from calibrated TDR probes at 6 depths

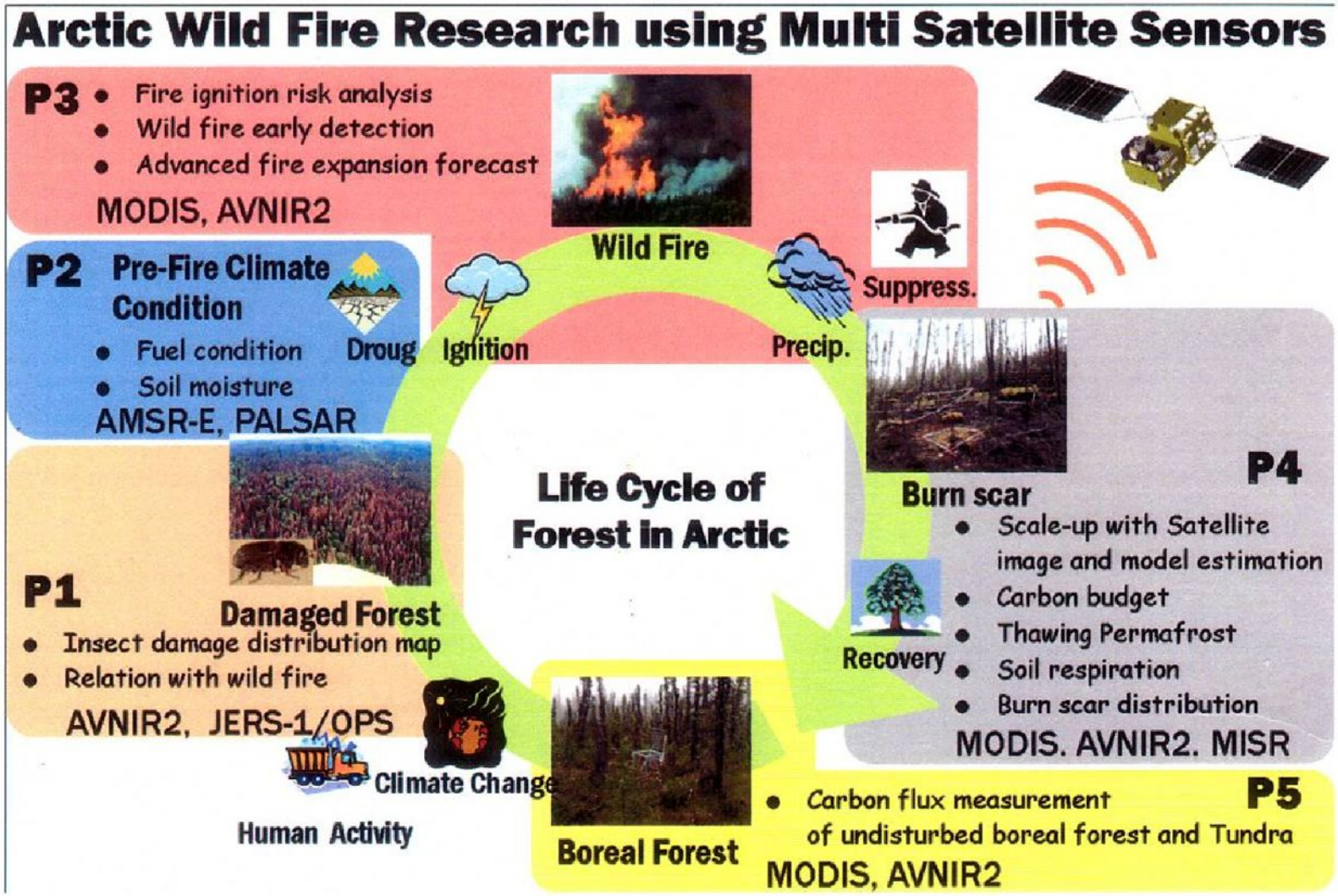
Cutover 1-year

Cutover 2-year

Boundary Fire July 30, 2004
Severely burned Experiment

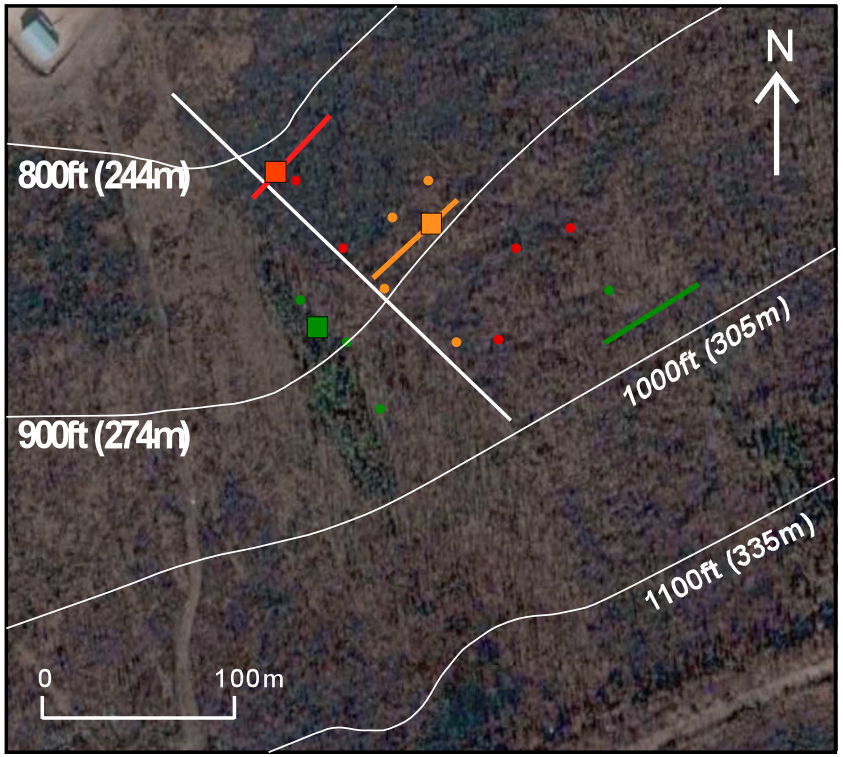
On going joint research programs

2005-2009



Poker Flat Research Range (PF)

Method



- Three transects on Heavily, Moderately, and Lightly burned sites

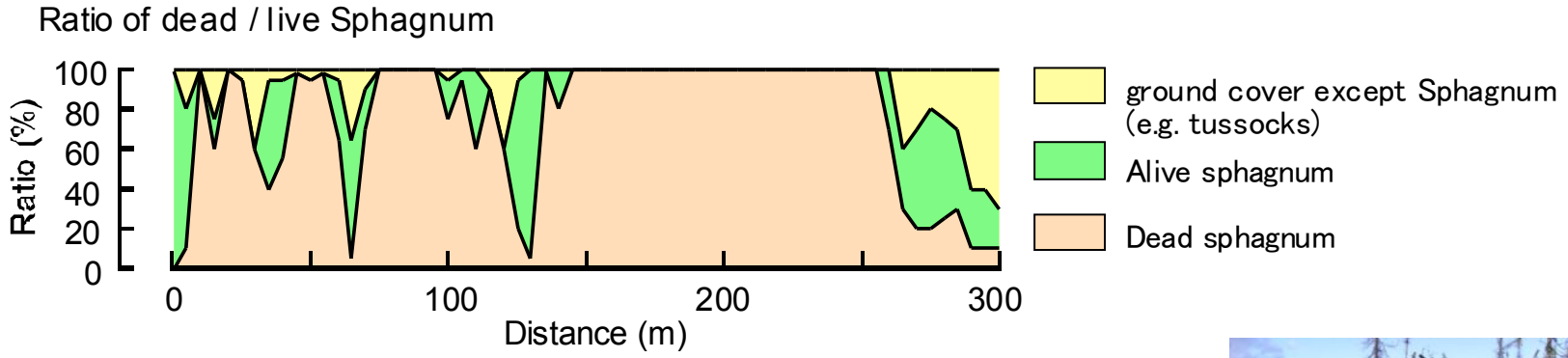
Heavily Moderately Lightly

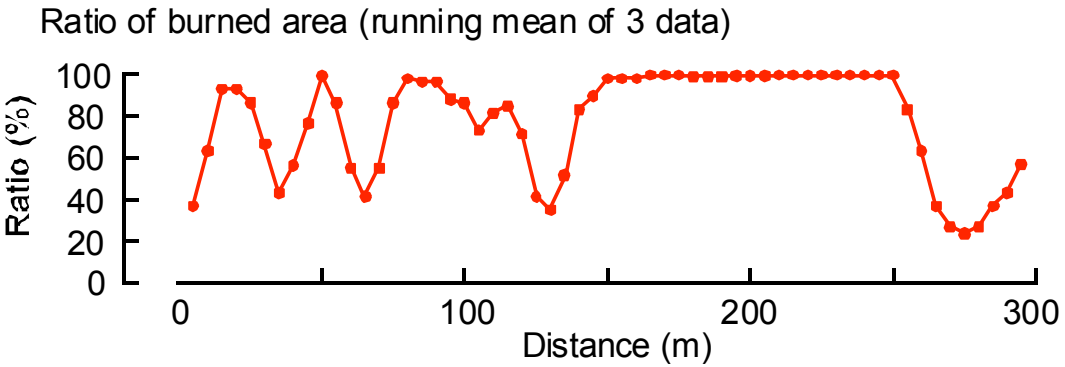
- Ground temperature monitoring

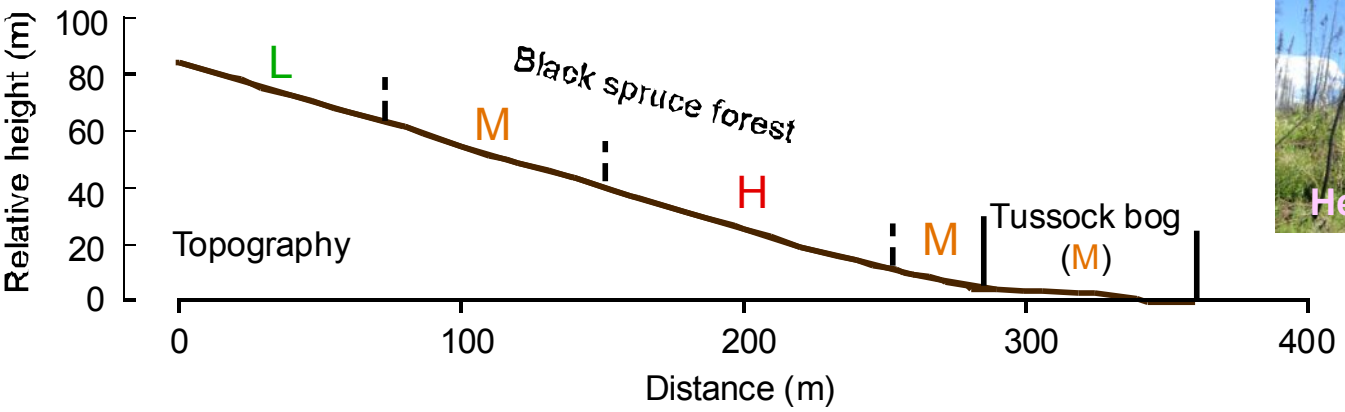
(2,50,100,150cm at H, M)
(2, 10, 20, 30, 40, 50cm at L)
Duration: 2006.8 – 2009.8

- Pit survey and 1D DC resistivity soundings along the survey line

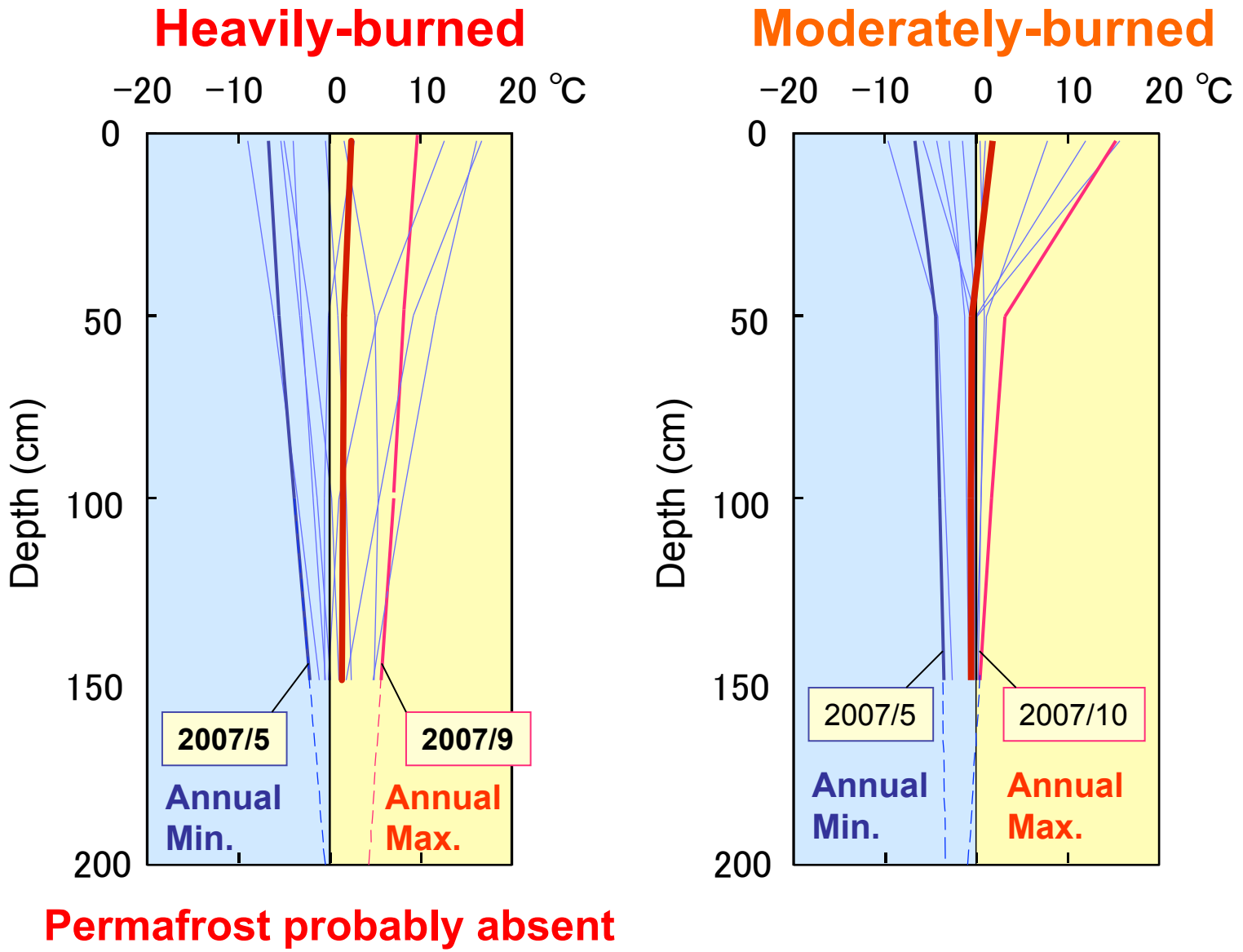
Vegetation along the survey line







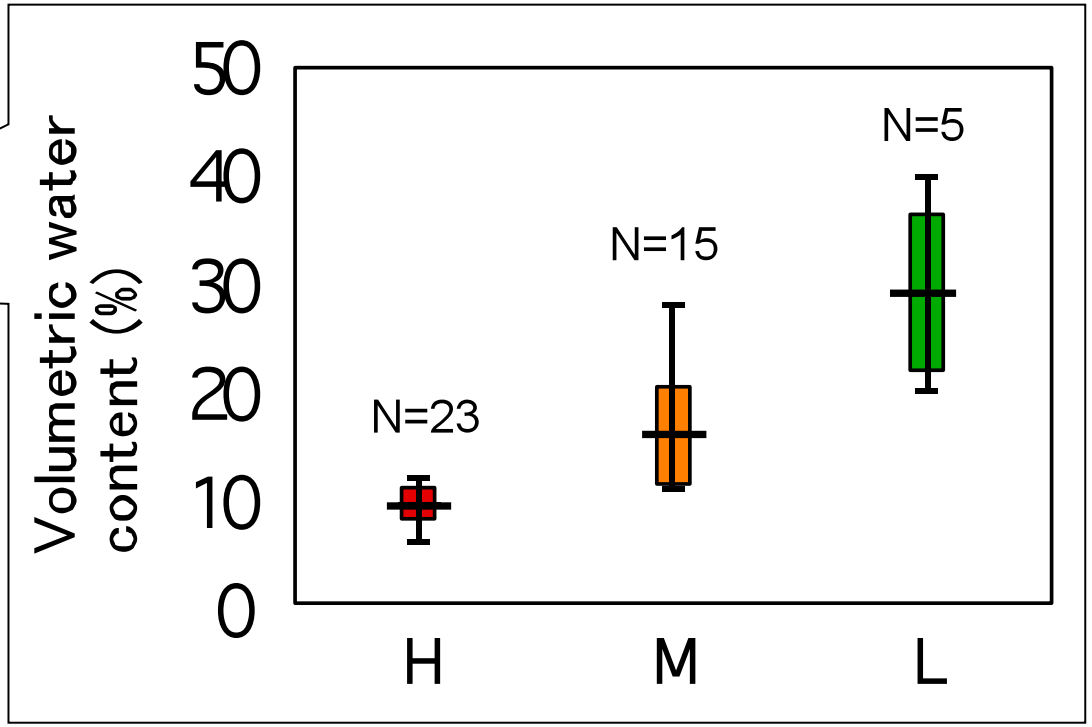
Annual range of ground temperature



Permafrost probably absent

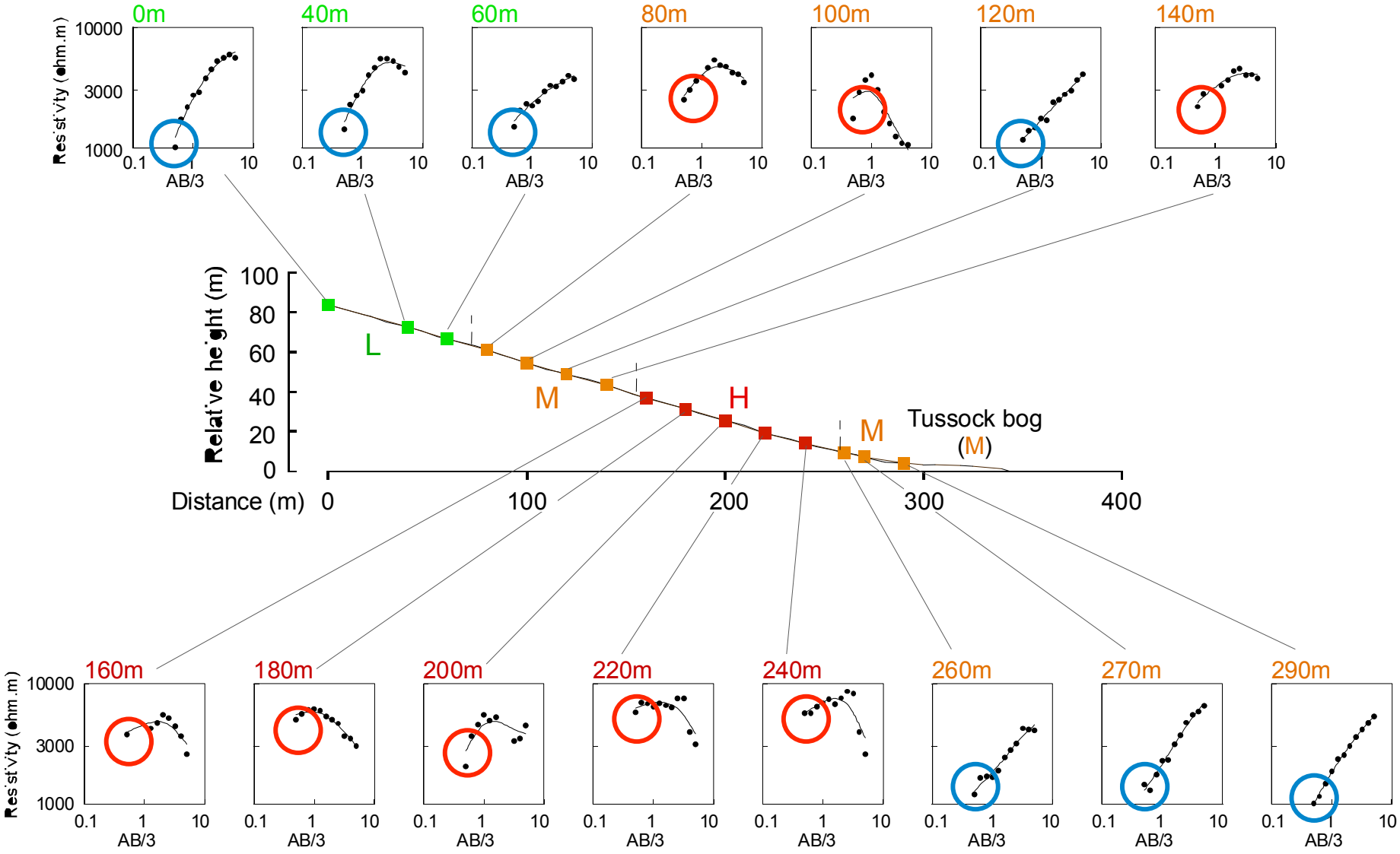
Soil water content

Volumetric soil water content of Sand-Gravel layer by TDR method

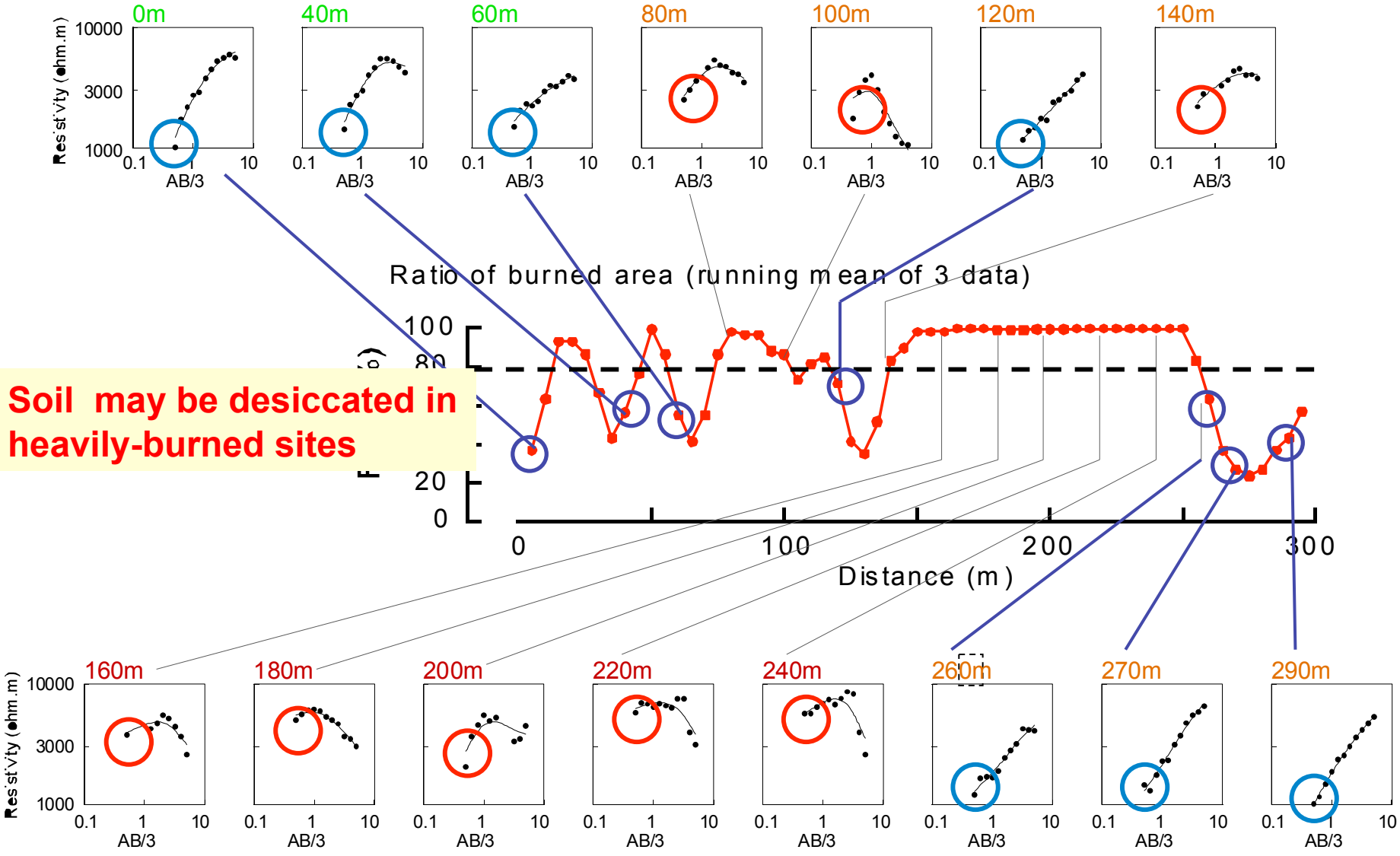


(August 2007)

1D DC resistivity soundings



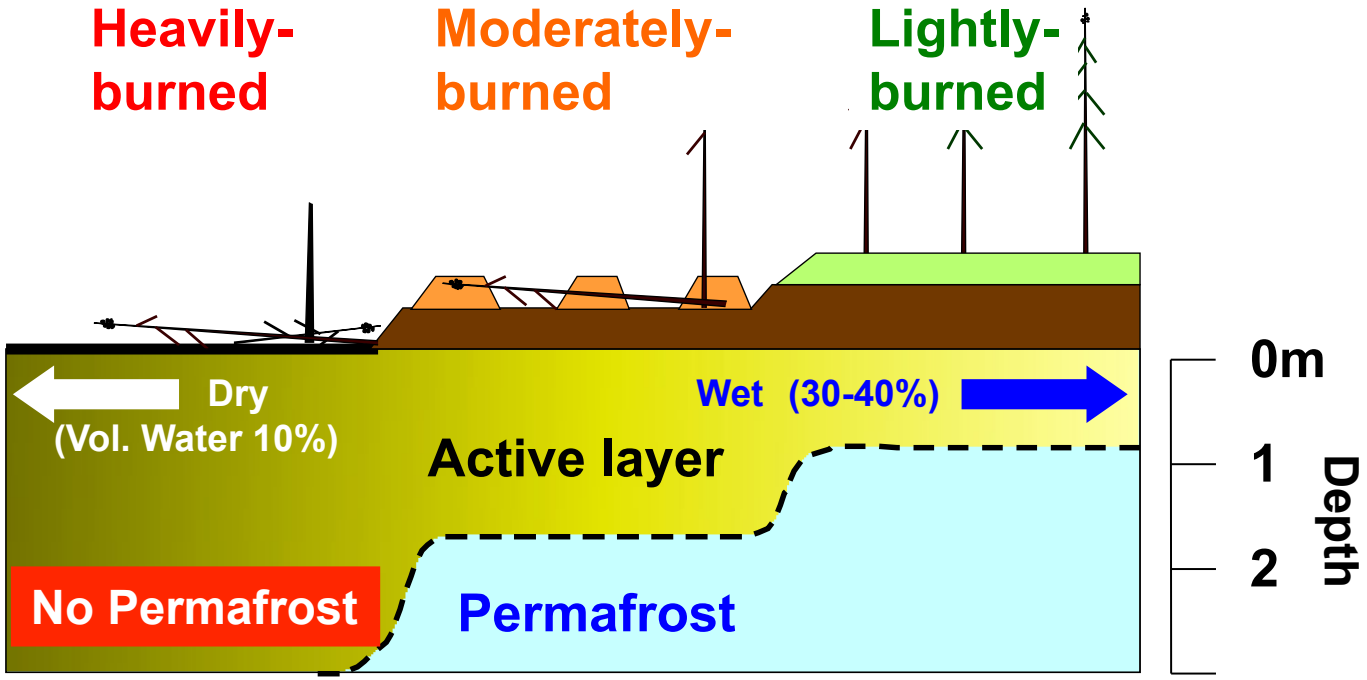
1D DC resistivity soundings



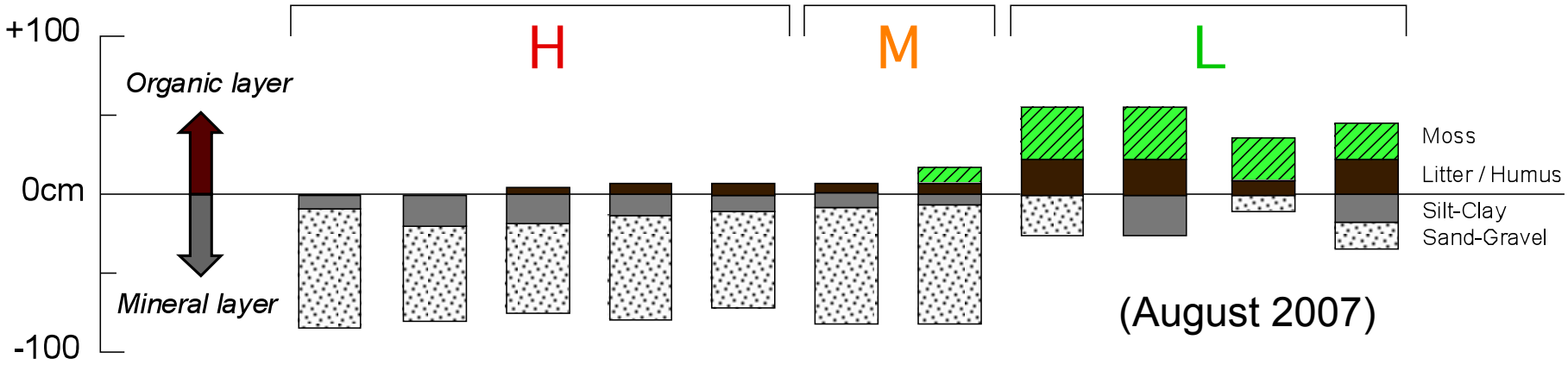
Soil may be desiccated in heavily-burned sites

Fire disturbance and active layer

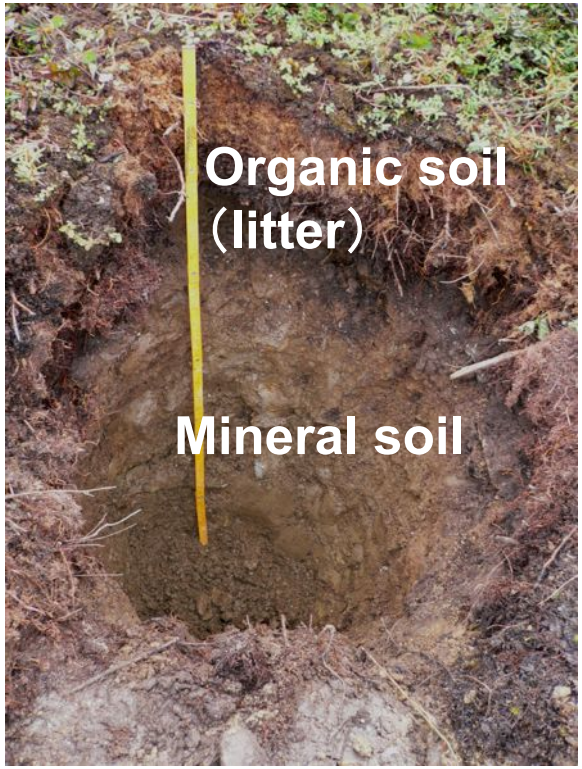
- Permafrost has disappeared in the Heavily-burned site.
- This deep-thaw can be triggered by combustion of organic soil and low heat capacity of soil due to small water content.
- According to the resistivity data, permafrost-disappeared area is restricted only in heavily-burned area in lower slope.

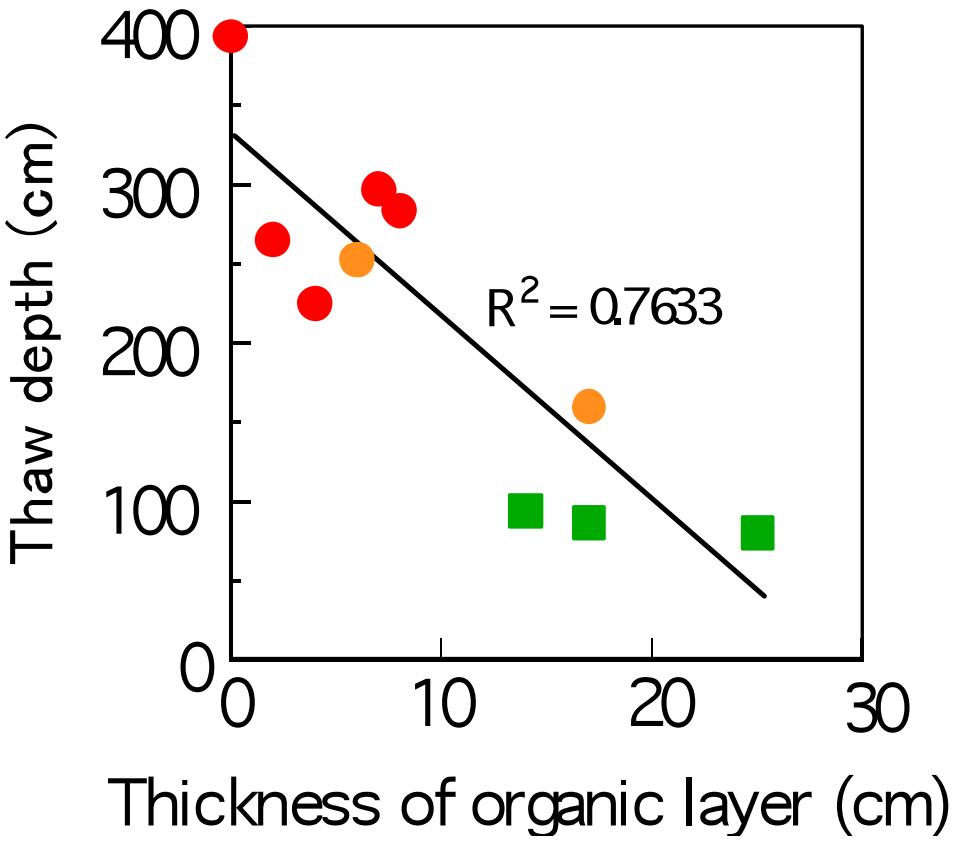


Soil profile and thaw depth



Organic soil thickness and thaw-depth

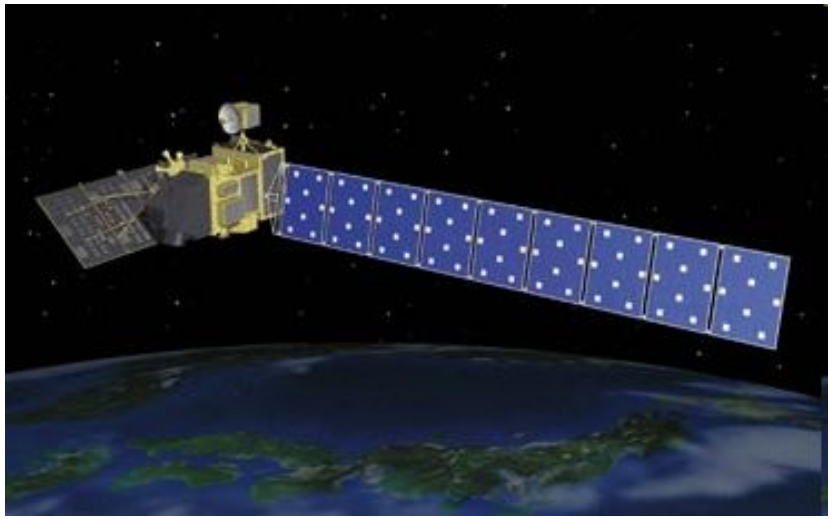




(August 2007)

Detection of Soil Moisture by Microwave L-band

PALSAR observation on permafrost

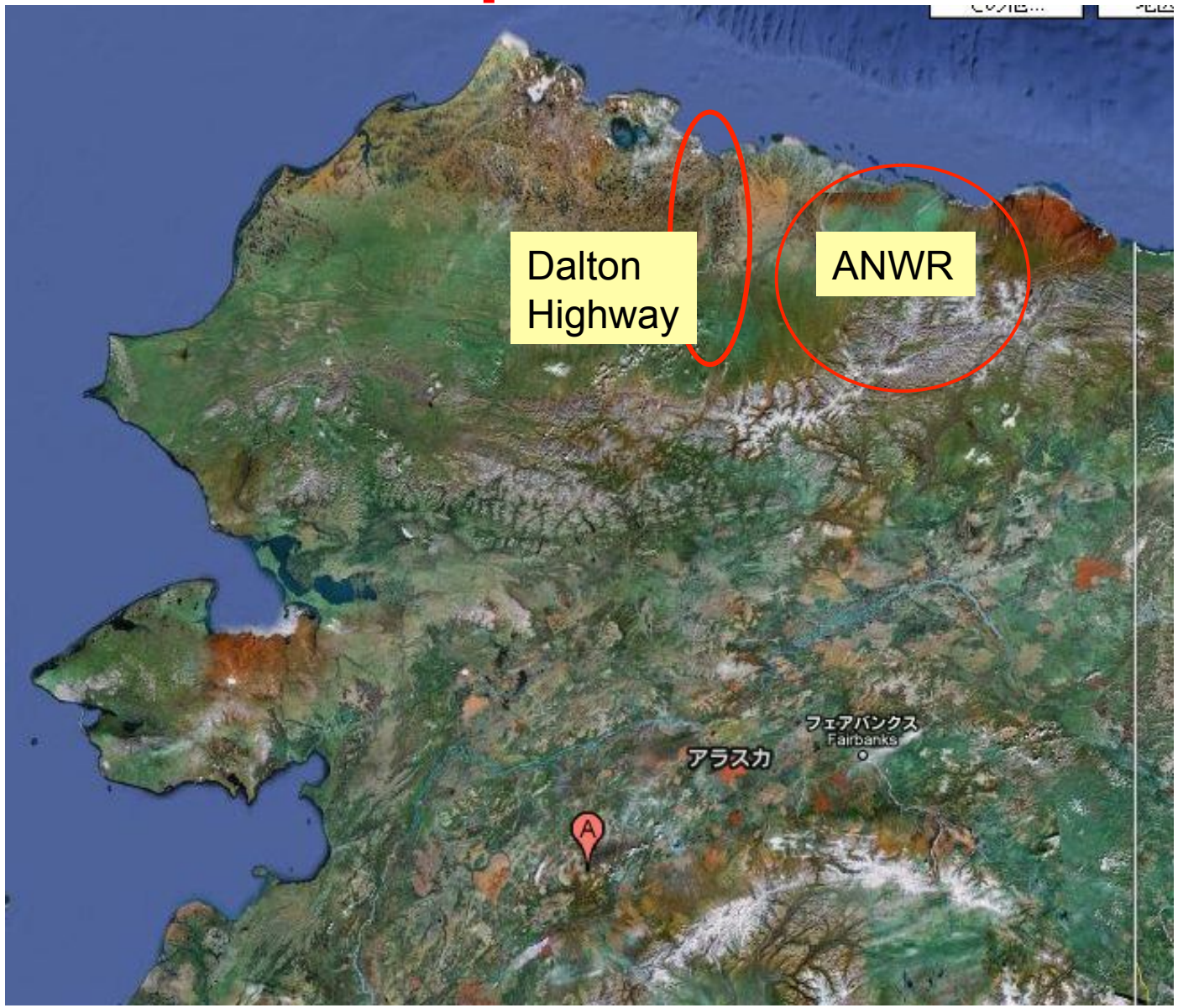


ALOS

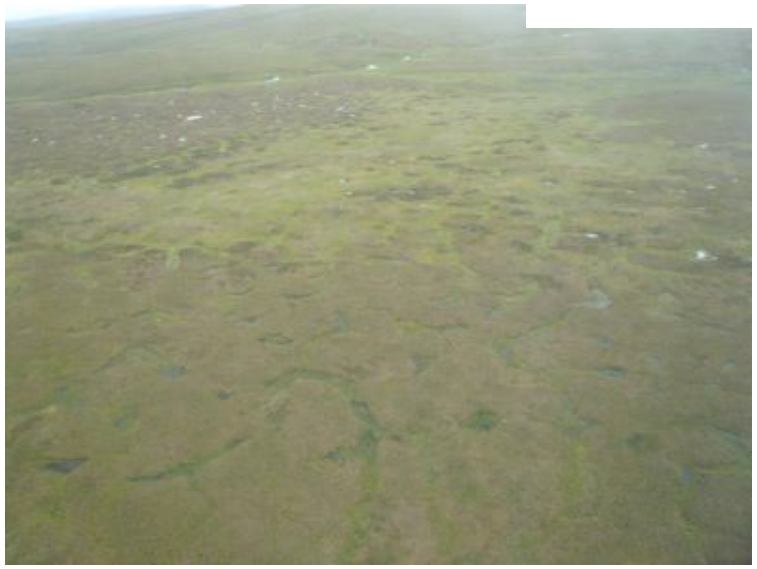
Advanced Land Observing Satellite 2006 Jan.

phased array type L-band synthetic aperture radar (PALSAR)

Field experiment



Field experiment



ANWR test site

Corner reflector deployment
for PALSAR observation

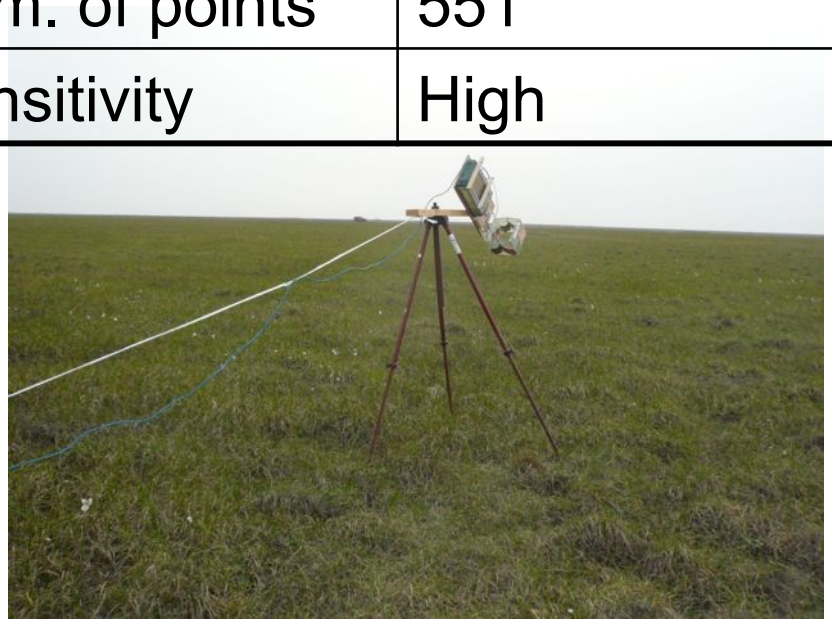
Surface roughness & TDR measurement

Data logger (August 2007 - July 2008)

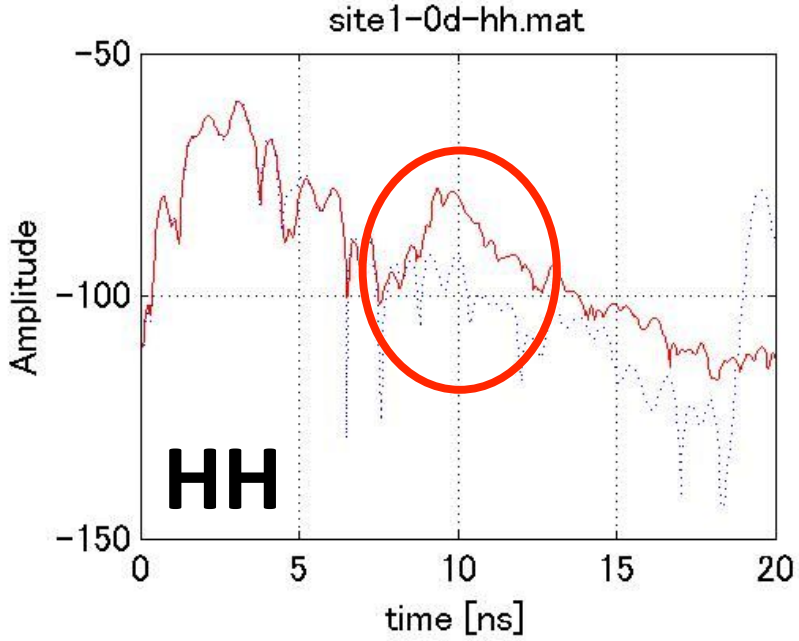
Develop a ground based portable full porarimetric scatterometor

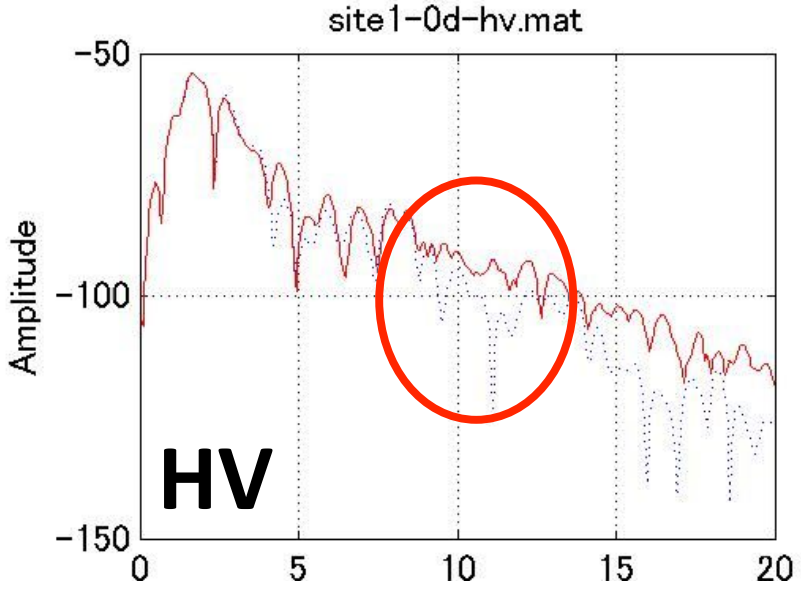
Radar measurement parameters

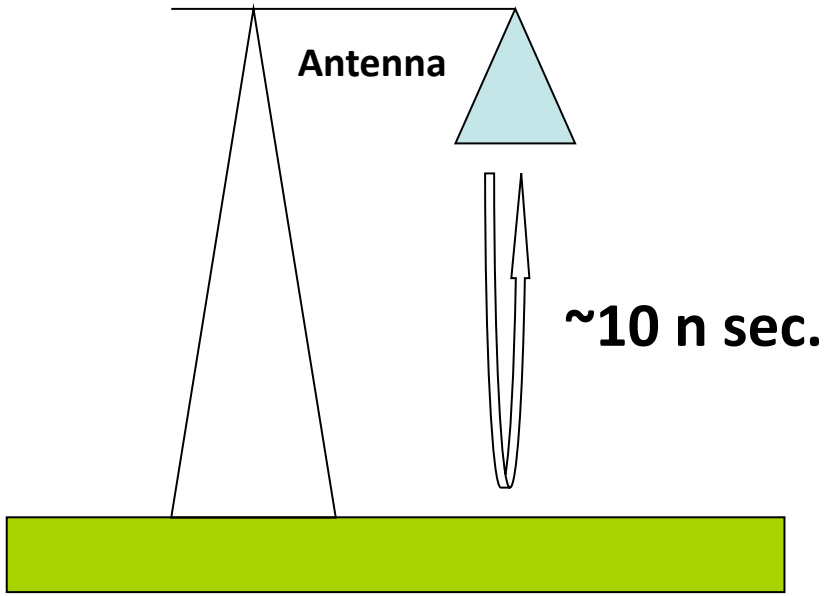
VNA	Anritsu
Antenna	Vivaldi antenna array
Frequency	**0.5-4GHz**
Polarization	**HH, HV, VH, VV**
Num. of points	551
Sensitivity	High

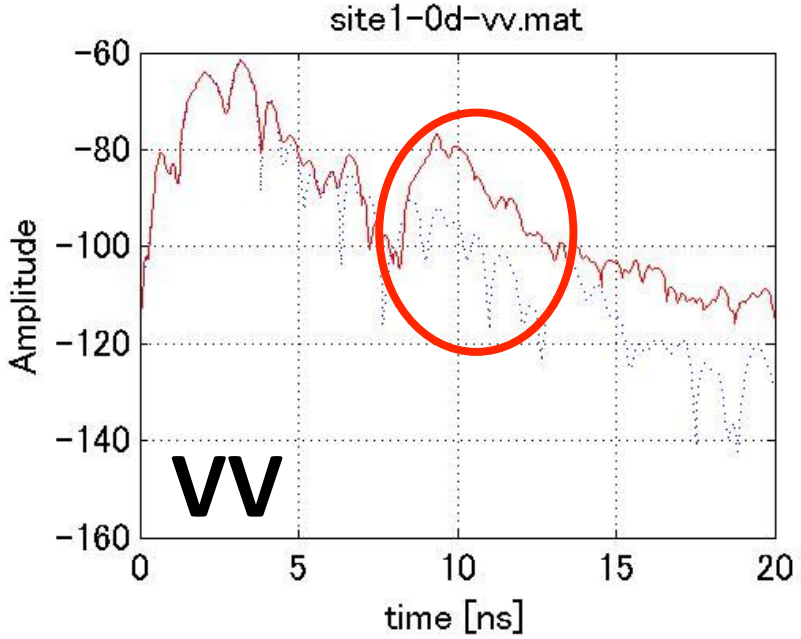


Radar signal from the permafrost









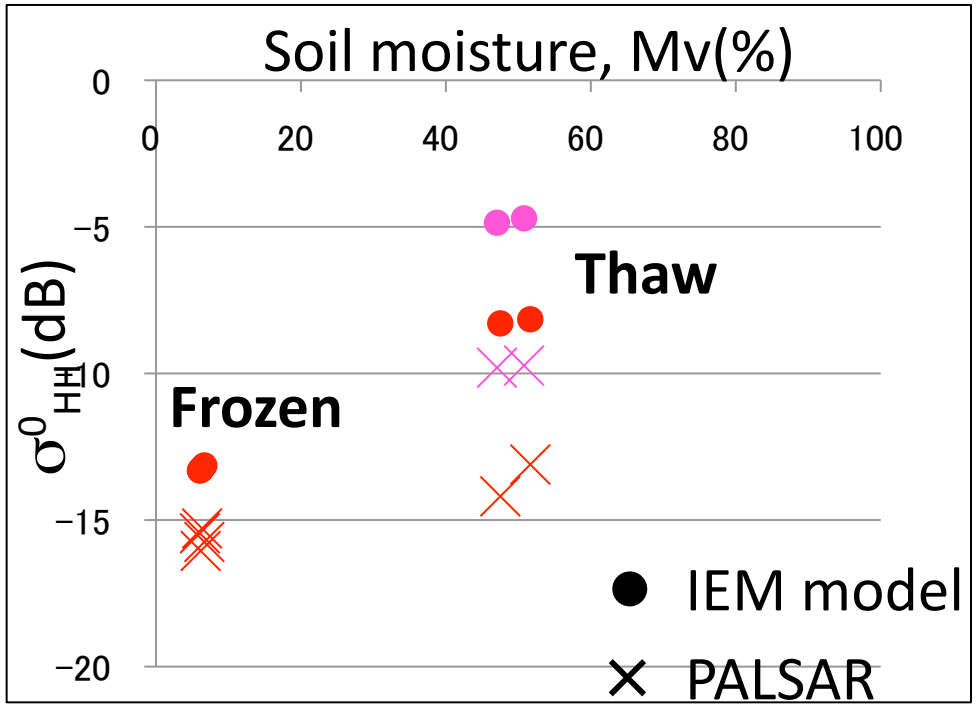
Compare satellite data with IEM model

(Single(HH) polarization data of Alaska)

Data logger in Alaska for 1 year

Red : Off-nair : 34.3°

Pink : Off-nair : 21.5 °



~5dB lower than IEM model (Thaw)

2~3dB lower than IEM model (Frozen)

Detection of forest decline and burned area using ALOS imagery in Kenai Peninsula

Collecting basic data

"Reflectance of Individual tree level"

1) healthy branch with green needle
2) fire damaged branch with brown needle
3) grey branch without needle
4) charred branch

- **Distribution of each component**

scorched/ not scorched, foliage %, branch %, brown

Measurement of reflectance

Healthy-looking tree

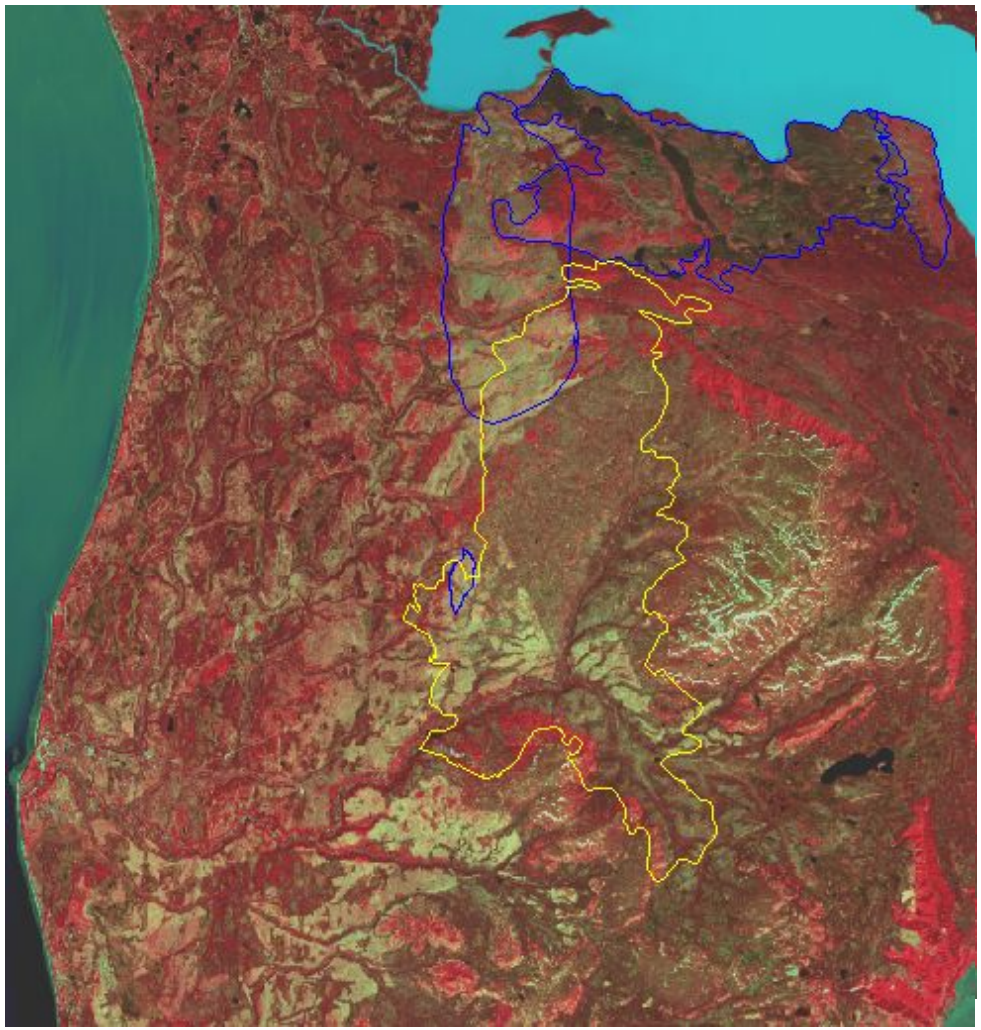
Partial defoliation by fire

Tree with brown needles

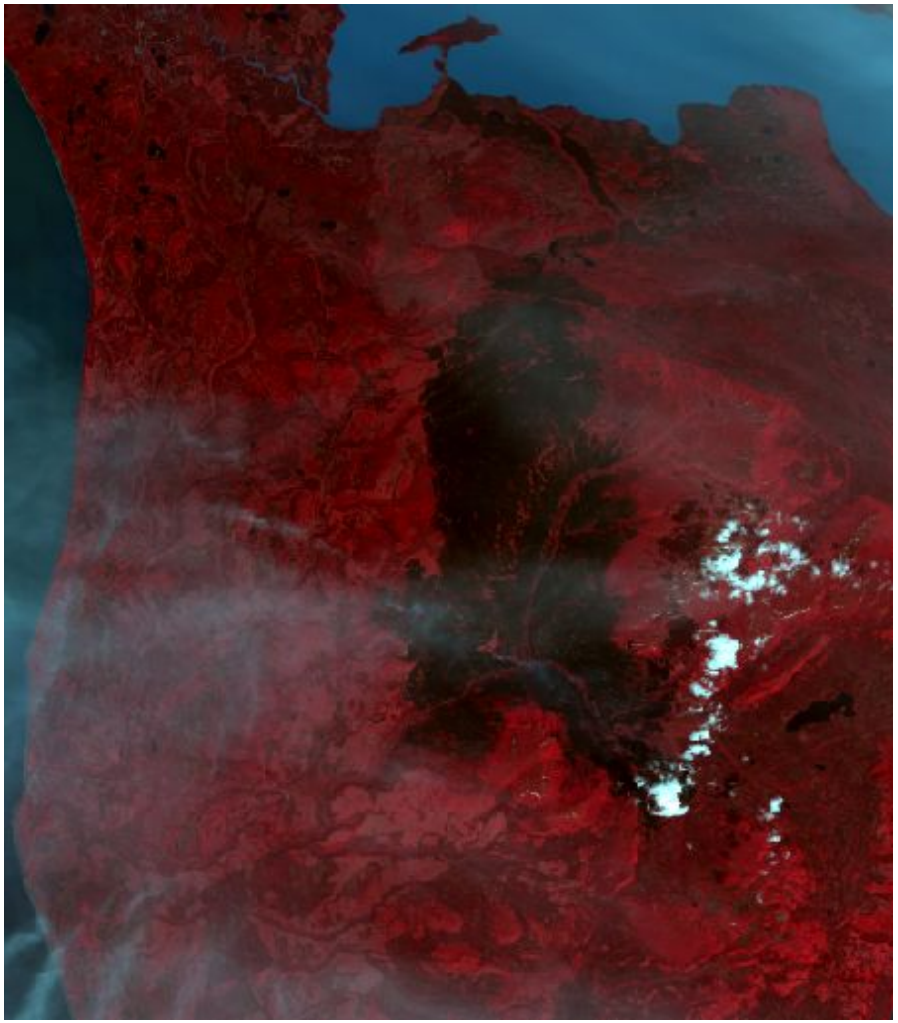
Trees without needles

From the observation in 2007

Two images were obtained before and after wildfire which burned trees withered by an attack of spruce bark beetle.



False color image observed by ALOS/AVNIR-2 on June 19, 2007 (before wildfire)



False color image observed by ALOS/AVNIR-2 on June 27, 2007 (after wildfire)

Summary

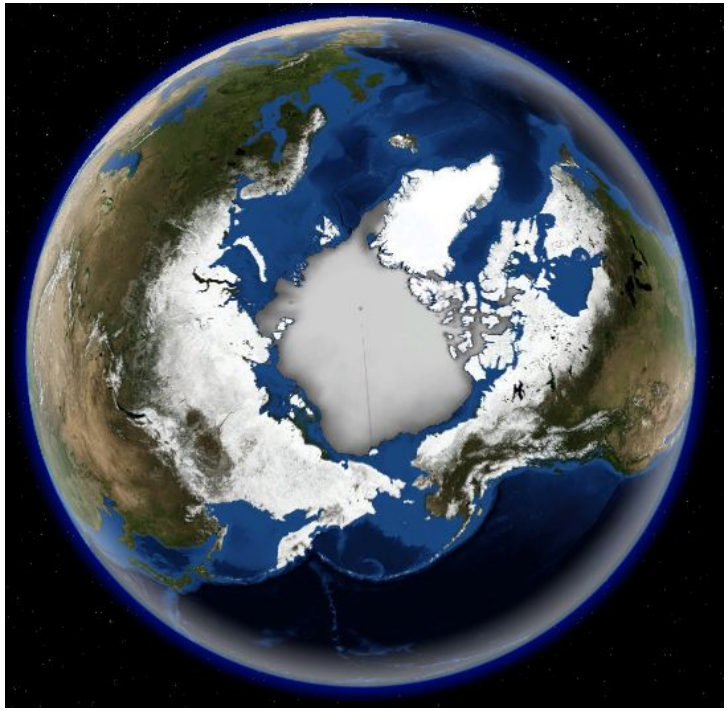
Wild Fire Impact to Physical and Biological Environment in Alaska

FrostFire Experiment → Siberian field Experiment → IARC/JAXA program

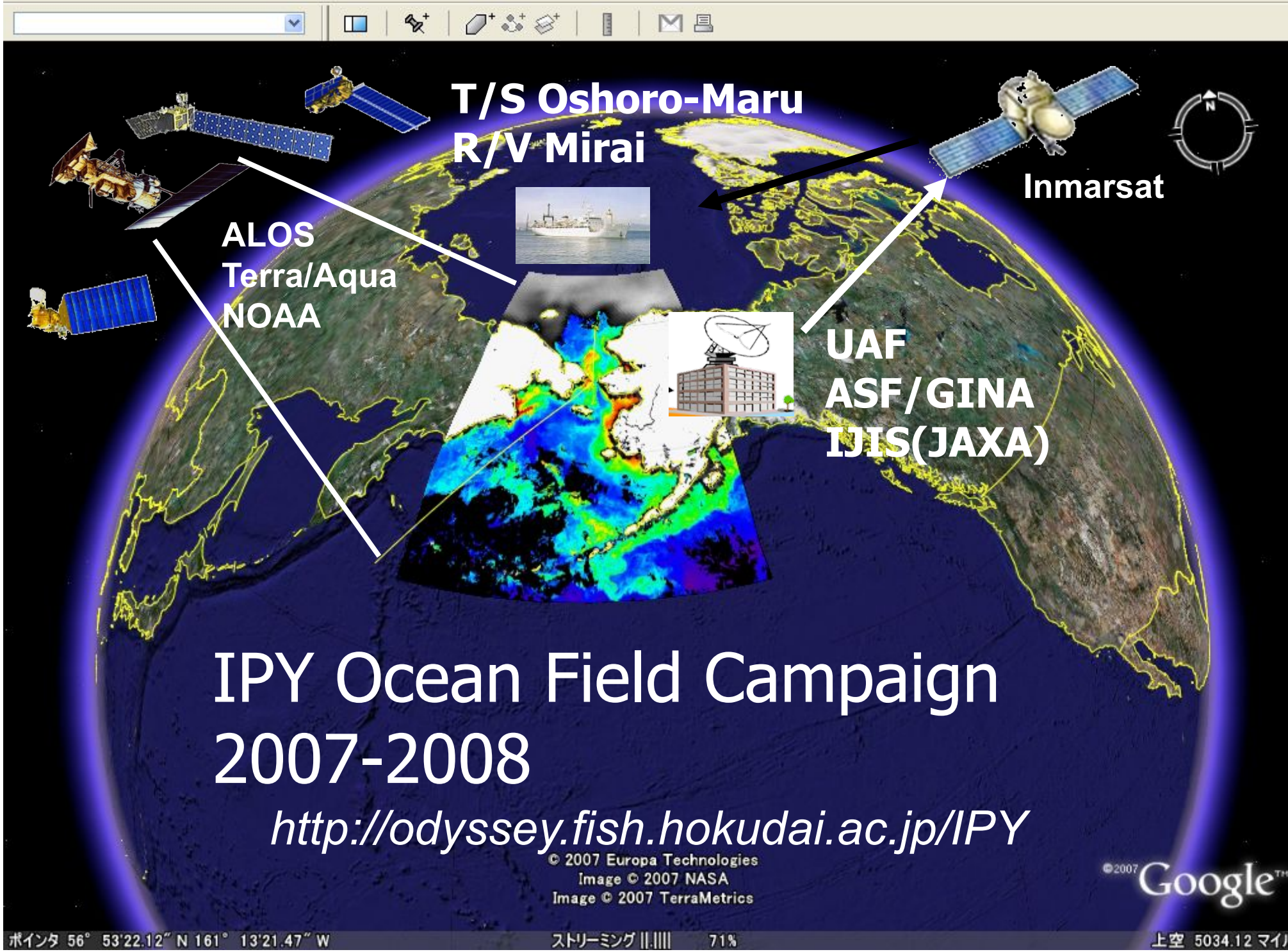
Field monitoring and Satellite remote sensing

25 members from Japan and 10 members from UAF join this program

Elucidation of the role of sea-ice cover change on the marine ecosystem using multi-sensor remote sensing approaches



Japan Aerospace Exploration Agency


T/S Oshoro-Maru
R/V Mirai
Inmarsat
ALOS
Terra/Aqua
NOAA
UAF
ASF/GINA
IJIS(JAXA)
IPY Ocean Field Campaign
2007-2008
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Second International Symposium on the Arctic Research ISAR-2

December 7-10 2010 Tokyo JAPAN

hosted by National Polar Research Institute

First Circular April 20,2010

Submission of Abstract Sept.30 2010

contact: isar2@nipr.ac.jp

First International Symposium on the Arctic Research was held Nov.4-6 2008 in Tokyo http://www.jamstec.go.jp/iorgc/sympo/isar1/.

"Drastic change in the recent global warming"

190 participants from 12 countries