Northern Eurasia Earth Science Partnership (NEESPI): An overview of the current status

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Recognition

NEESPI is an interdisciplinary program of internationally-supported Earth systems and science research that addresses large-scale and long-term manifestations of climate and environmental change.

NEESPI Study Area includes: Former Soviet Union, Northern China, Mongolia, Fennoscandia, & Eastern Europe

NEESPI duration ~ 10 years

Life on the edge: "Most of Northern Eurasia does not receive a sufficient amount of heat and in the regions where there is enough heat there is a significant deficit of water".

Rationale for NEESPI

1. **Strong climatic and environmental changes**
2. **Strong interactions in the system terrestrial ecosystem - atmosphere hydrosphere - cryosphere - human society** and feedbacks to **global energy, water, and carbon cycles in the region and beyond**
3. **Strong societal impacts and feedbacks**
4. **Lack of tools to address science questions**

NEESPI Science plan major focuses

- **Focus on transient zones that are most vulnerable in the future changes**
  - **Coastal zone**
  - **Tundra-forest**
  - **Forest-steppe**
  - **Steppe-desert**
  - **Mountains**

Cold Lands

Dry lands

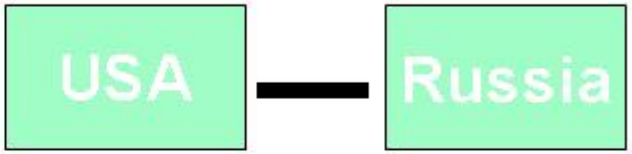
- **Focus on feedbacks that make the projection of the future changes uncertain**
  - **Biogeochemical feedbacks**
  - **Biogeophysical feedbacks**
  - **Human activity**
- *NEESPI Research Priorities:*

(a) the processes that directly feed back to the global Earth system and

(b) the processes of major societal importance

NEESPI AND ITS PAST

NEESPI and the actions to develop its Science Plan were initially promoted by Russian and US scientists (2003-2004).



Since early 2005, the NEESPI community has worked to make NEESPI inter-agency and international.

A central Science question:
"How do terrestrial ecosystems dynamics in Northern Eurasia interact with and alter the biosphere, atmosphere, cryosphere, and hydrosphere of the Earth?"

The NEESPI Science Plan (available on http://neespi.org) has elements that address concerns of WCRP, IGBP, IHDP, and DIVERSITAS Programs

Dynamics of the NEESPI statistics

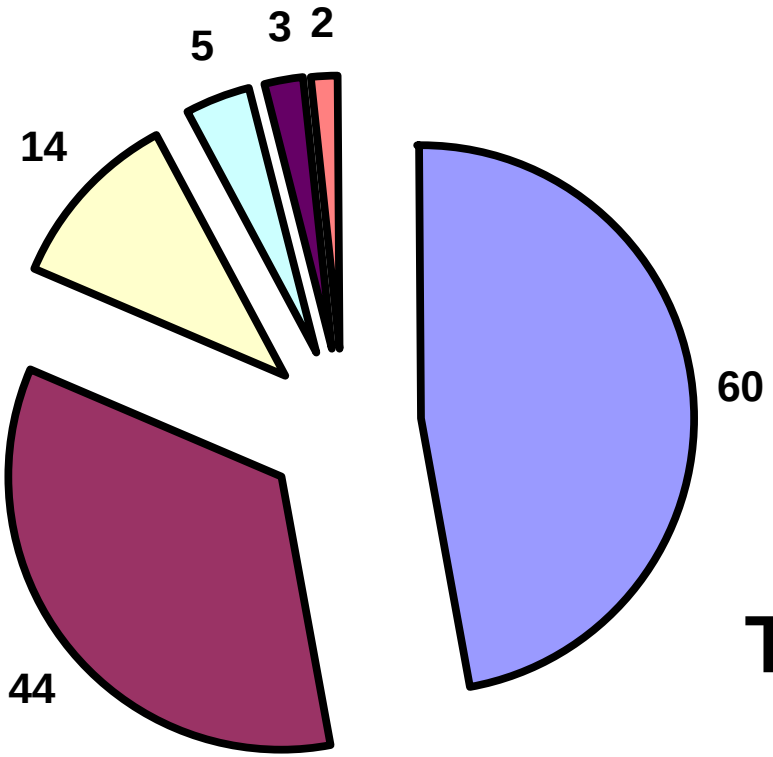
In December 2004, the NEESPI Science Plan was released after a successful peer review process.

In July 2006, 364 scientists of 195 institutions from 31 countries participated in the first 54 funded projects.

Current numbers (July 2008): More than 560 scientists from more than 200 institutions are working on 128 individual funded projects under the Initiative umbrella (with annual budget ~$15M) and several more projects are in the process of joining NEESPI.

Additionally, NEESPI receives in kind assistance from EU, US, Russian, Chinese, Japanese, and International Agencies and Institutions.

NEESPI Projects by country; July 1, 2008



Total 128 Projects

- All US Agencies
- All Russian Agencies
- All EU Agencies
- All Japanese Agencies
- All Chinese Agencies
- Canada

About half of the NEESPI projects can be assigned an "**Integrative, Large scale, Modeling**" category

Other categories are:

Biogeochemical Cycles,

Hydrology,

Cryosphere,

Atmospheric Aerosols/Pollution,

Land cover,

Land Use,

Human dimension, and Biodiversity

=> NEESPI contributes to all ESSP Programs & Projects

NEESPI Focus Research Centers

- ***Center for Cold Land Processes and Arctic Coastal Zone Studies***
- ***Center for Water System Studies***
- ***Center for Atmospheric Aerosol and Air Pollution Studies***
- ***Center for Land Use Studies***
- ***Center for Biogeochemical Cycle Studies***
- ***Center for Land Cover Studies***
- ***Regional Centers***
  - ***Regional Center for Dry Land Processes Studies***
  - ***Regional Center for NEESPI Studies in Eastern Europe***
  - ***Regional Center for NEESPI Studies in Siberia***

Five NEESPI Science Support Centers in USA, Russia, and China

NEESPI Outreach

http://neespi.org

During the past 3 years, 22 dedicated NEESPI Workshops and 5 NEESPI Open Science Sessions at the International Meetings were convened.

In 2005-2006: Approximately **200** papers and books were published

The publication statistics **for 2007** has not yet been completed but the count of refereed publications has already exceeded **150**.

In April 2007: 1st Special NEESPI issue (13 papers) in *Global and Planetary Change*

In December 2007: 2nd NEESPI Special issue in *Environmental Research Letters* (15 papers)

An overview paper for *Bull. Amer. Meteorol. Soc.* is in review and **three books** are in preparation.

During the past 6 months there were four NEESPI gatherings

- **March 17-19, 2008, Jena, Germany. Workshop of the NEESPI Focus Research Center for Biogeochemical Cycles. Max-Planck Institute for Biogeochemistry** (52 presentations, 28 oral and 24 posters)
- **April 13-18, 2008, Vienna, Austria. NEESPI Session at the European Geosciences Union General Assembly 2008.** Session **BG2.8: "Land-atmosphere interactions in Northern Eurasia"** (61 presentations, 24 oral and 37 posters)
- **June 2-6, 2008, Helsinki, Finland. Regional NEESPI Science Team Workshop "Environmental and Climate Change in High Latitudes of Northern Eurasia** (51 presentations, 39 oral and 12 posters)
- **August 23-28, 2008, Odessa, Ukraine. Regional NEESPI Science Team Workshop "Regional aspects of climate-terrestrial-hydrologic interactions in non-boreal Eastern Europe"** (49 presentations, 39 oral and 10 posters)

Projected: December 15-19, 2008, San-Francisco, USA. NEESPI Session at the Annual American Geophysical Union Fall Meeting. Session **GC2: "Land-atmosphere-cryosphere interactions in Northern Eurasia"** (47 abstracts submitted).

In 2009, we are planning 2 Regional Workshops (**High Elevation and Siberia**)

Goals of each Workshop

Discuss current knowledge on past, present and future changes (in the region of Northern Eurasia in question or the topic in question) and their linkages with the global change problem

Assess regional field studies, data availability, and modeling capabilities

Identify problems and needs

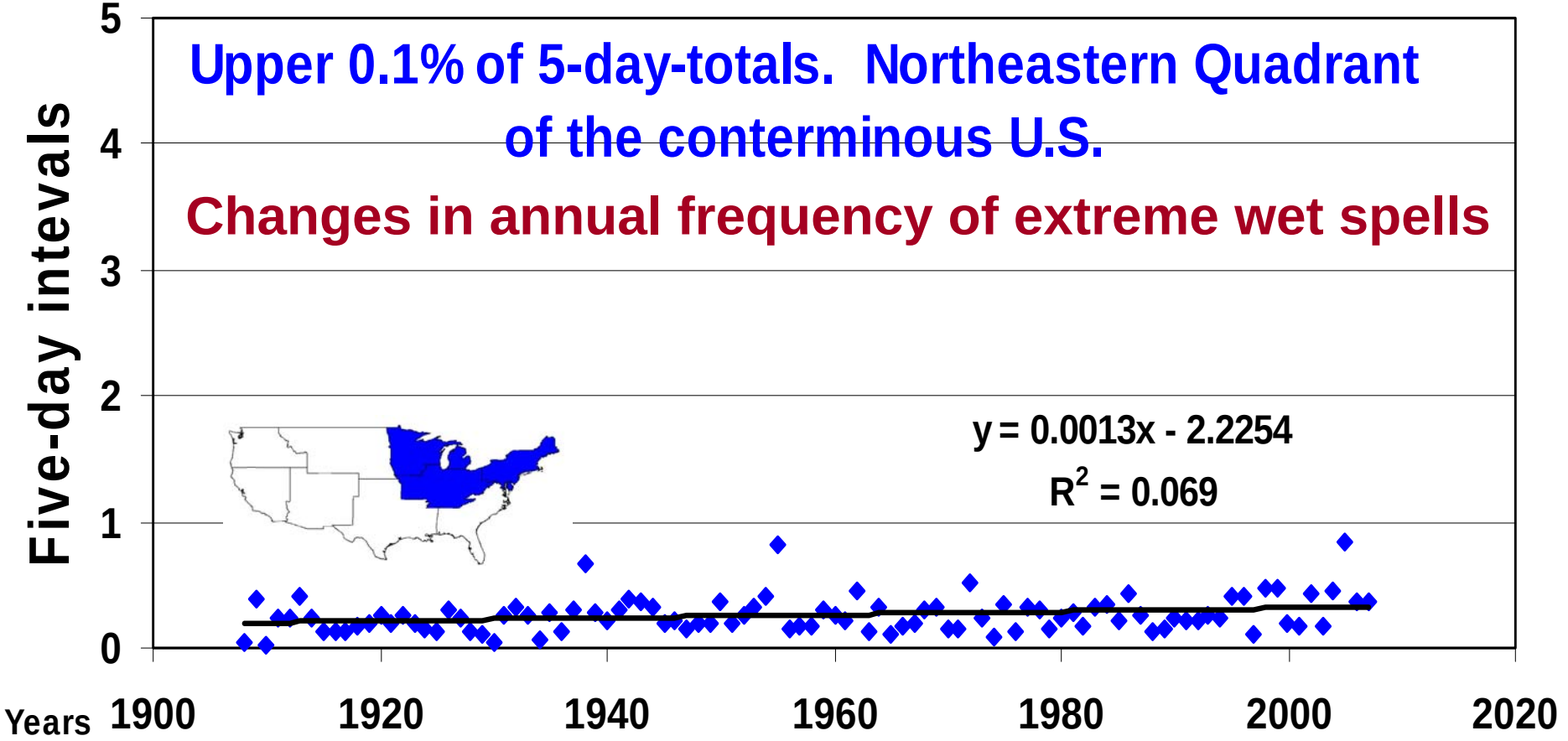
Bring researchers together to encourage coordination and synergies

We need to strengthen the NEESPI research focus to more effectively address projections
➔ We charge the Workshop participants with a question: What is the best road towards this goal?

The meeting is considered a success if we make progress towards

- **Synthesis of current state of knowledge of changes, field and modeling capabilities**
- **Recommendations for integration of NEESPI regional and topical studies**
- **Identification of missing research topics critical for achievement of the NEESPI objectives**
- **Collection and dissemination of the Meeting presentations**
- **Bringing in new NEESPI members**
- **Conceiving a summary article, book, or proceedings**

Going to (and out) the Western Hemisphere



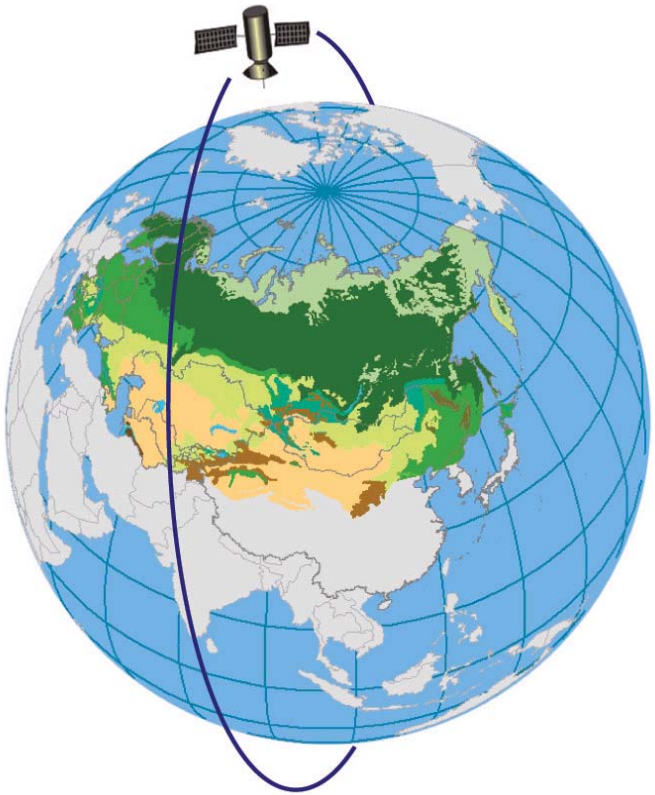
These events (>135-140 mm in 5-day-rainfall totals) occurred on average once in 5 years in the 1900s; once in 4 years (during the 1961-1990 period), and ~once in 3 years in the last decade.

Governmental backing

- **In April 2008, The NEESPI research foci on regional modeling and studies of climate impacts and adaptation capacity** became a part of **The Memorandum of Understanding for Collaboration in the Fields of Meteorology, Hydrology, and Oceanography** between the U.S. National Oceanic and Atmospheric Administration (**NOAA**) and the Russian Federal Service for Hydrometeorology and Environmental Monitoring (**Roshydromet**).

FOR MORE INFORMATION SEE THE NEESPI WEB SITE:

http://neespi.org



Side Note:

"NEESPI" is pronounced approximately like the Russian phrase for

"Don't sleep"

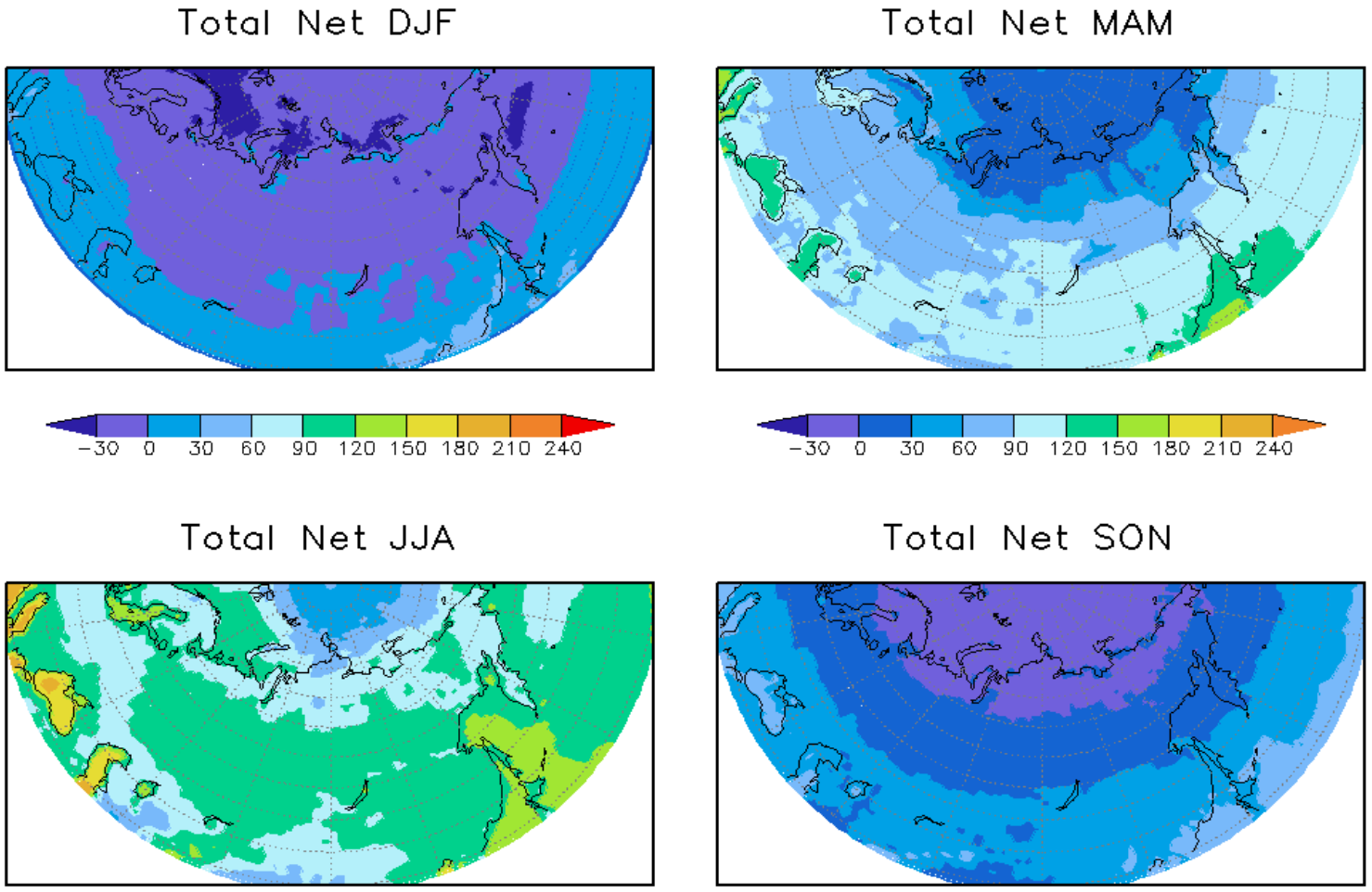
Northern Eurasia Earth Science Partnership Initiative

First phase foci of NEESPI: Monitoring and analyses

- Monitoring the energy & water cycles
- Monitoring the cryosphere
- Monitoring the surface water cycle
- Monitoring the biogeochemical cycles, land use, and land cover
- Monitoring and projection of dust storms and air pollution

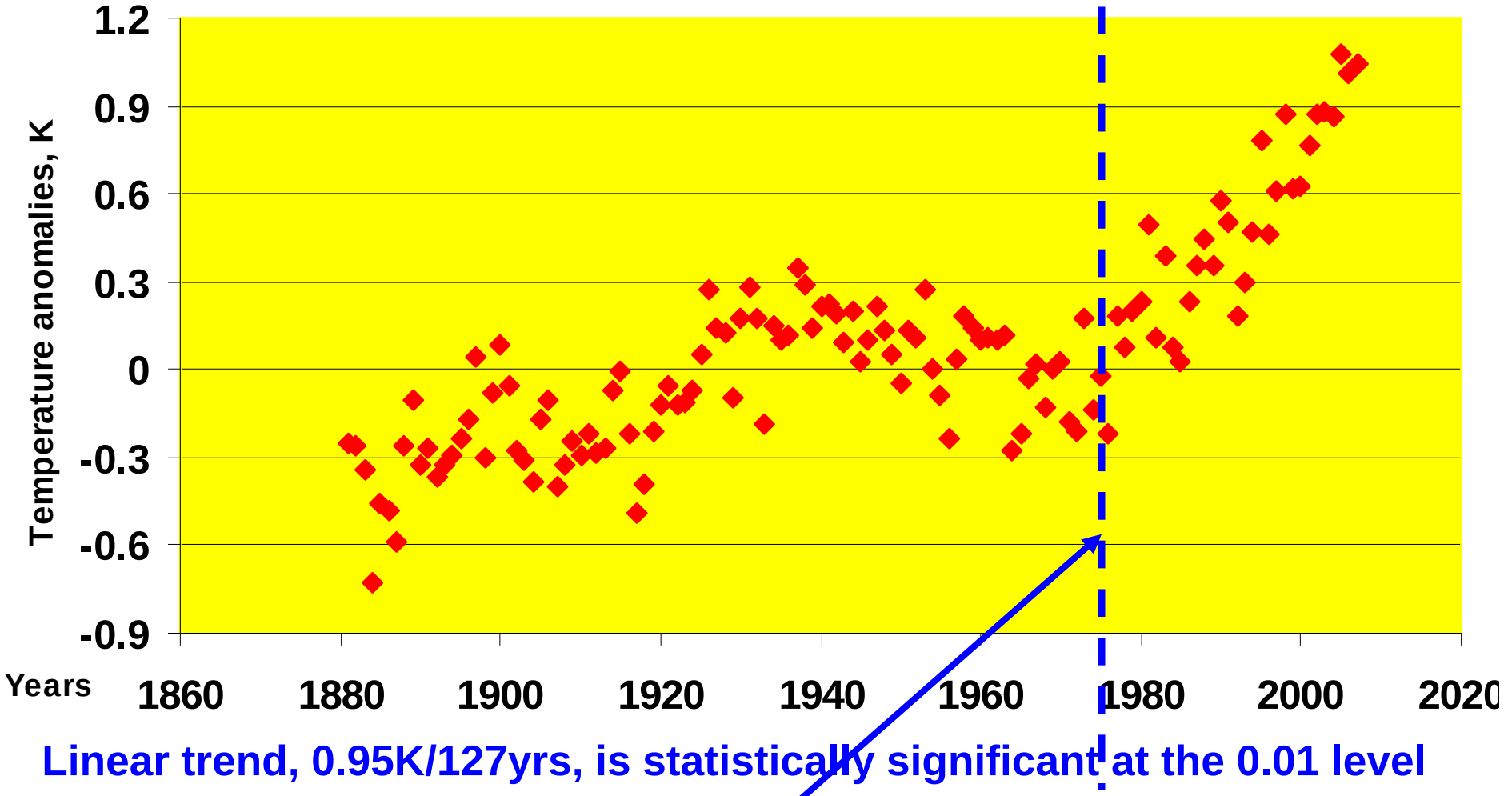
Monitoring of the energy & water cycles

The mean seasonal net surface radiation budget, W m^{-2}



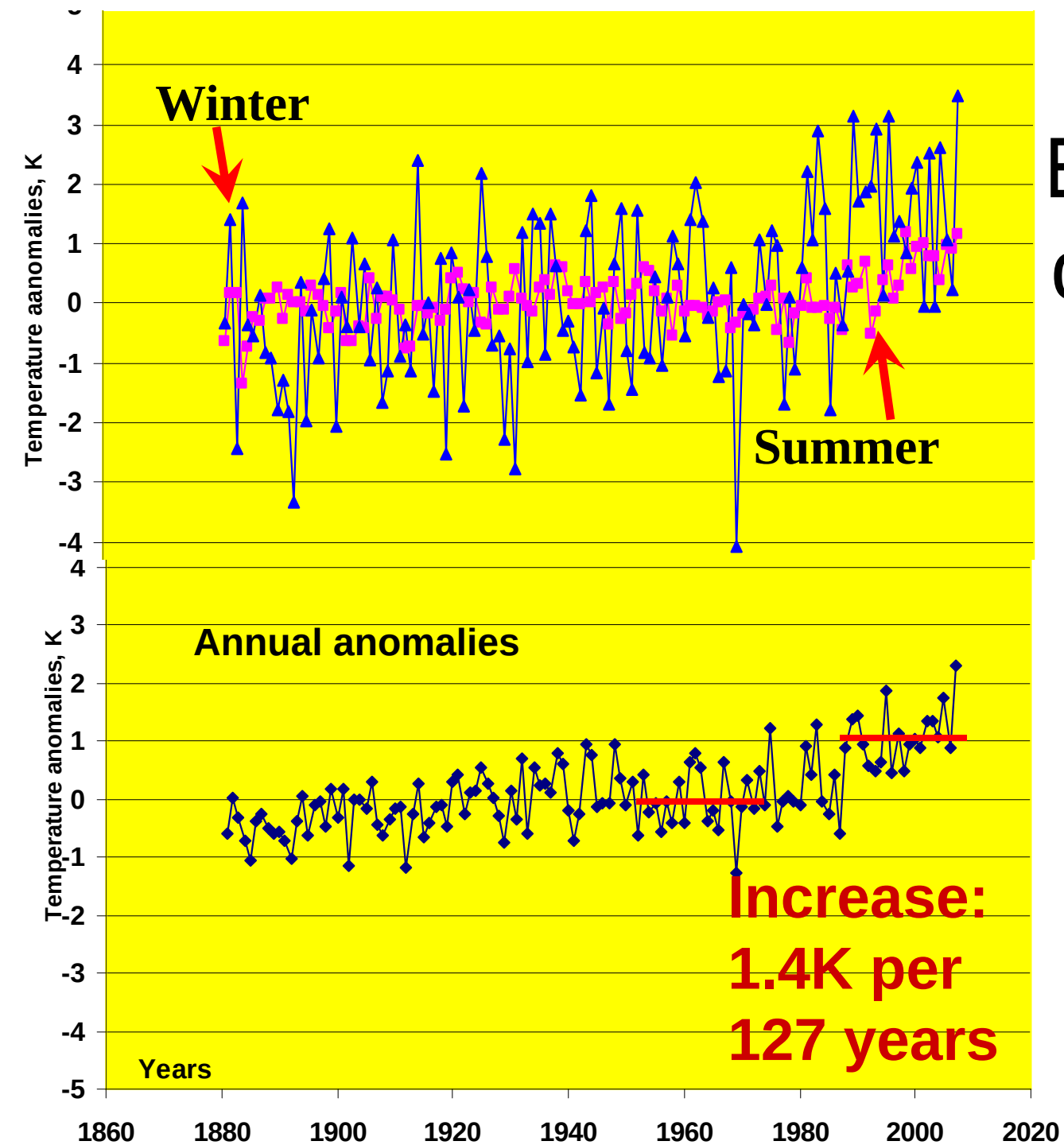
(Stackhouse 2004)

Northern Hemisphere temperature anomalies, 1881-2007 (Lugina et al. 2007)



Linear trend, 0.95K/127yrs, is statistically significant at the 0.01 level

[Budyko & Vinnikov, 1976 “Global warming”]

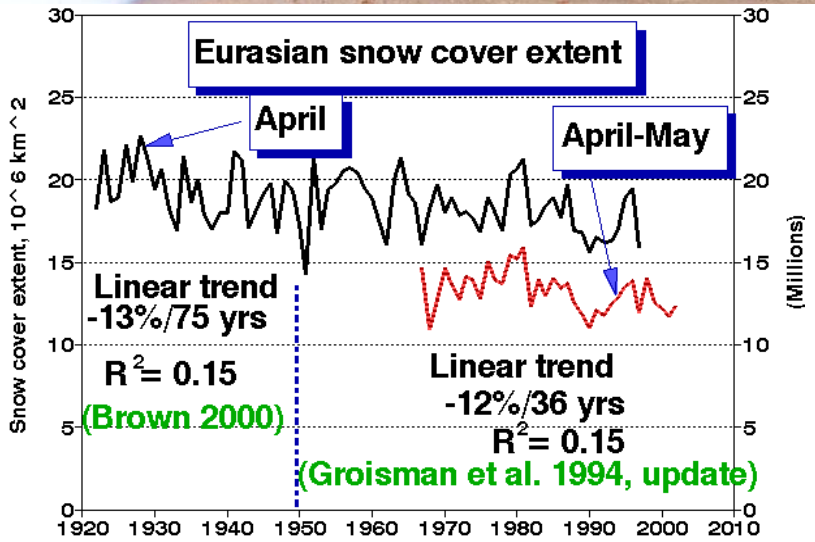


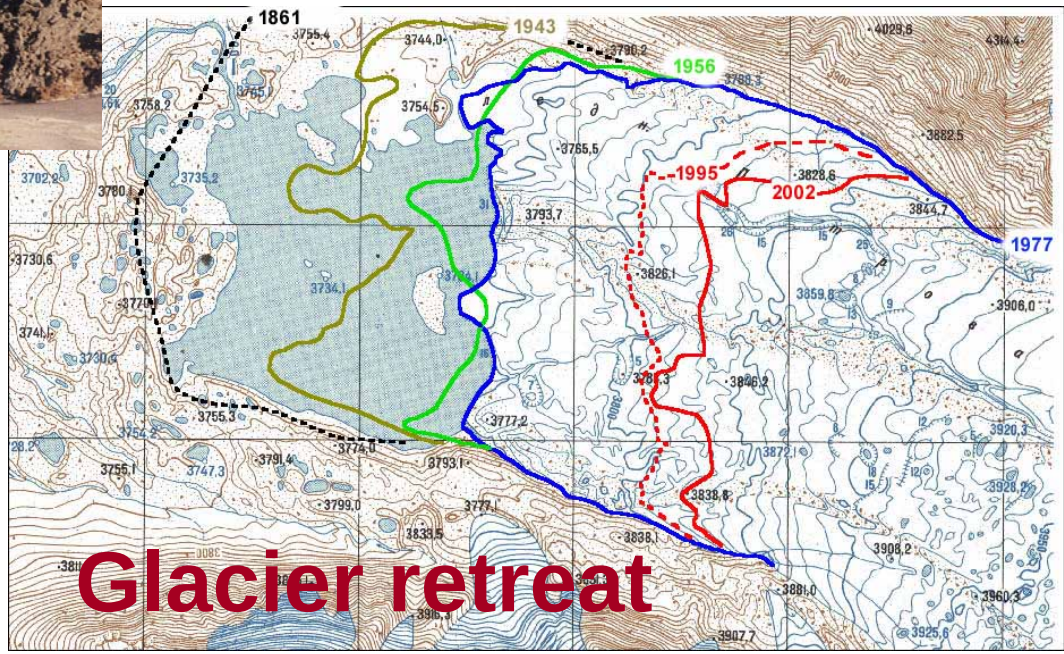
Northern Eurasia, north of 40N east of 15E. Surface air temperature anomalies. 1881-2007.

Data source: Archive of work of Lugina et al. 2007.

Monitoring of the cryosphere

Extremely ice-rich permafrost cliff (22 m high) retreats with an average rate of 11 m/year at this location on the Muostakh Island in the Arctic. Significant amount of organic-rich material is being supplied to the near-shore ocean





Glacier retreat

Cryosphere – Land cover feedback: Two possible scenarios of land cover change after the permafrost thaw **and it began thaw:**

Wetlands

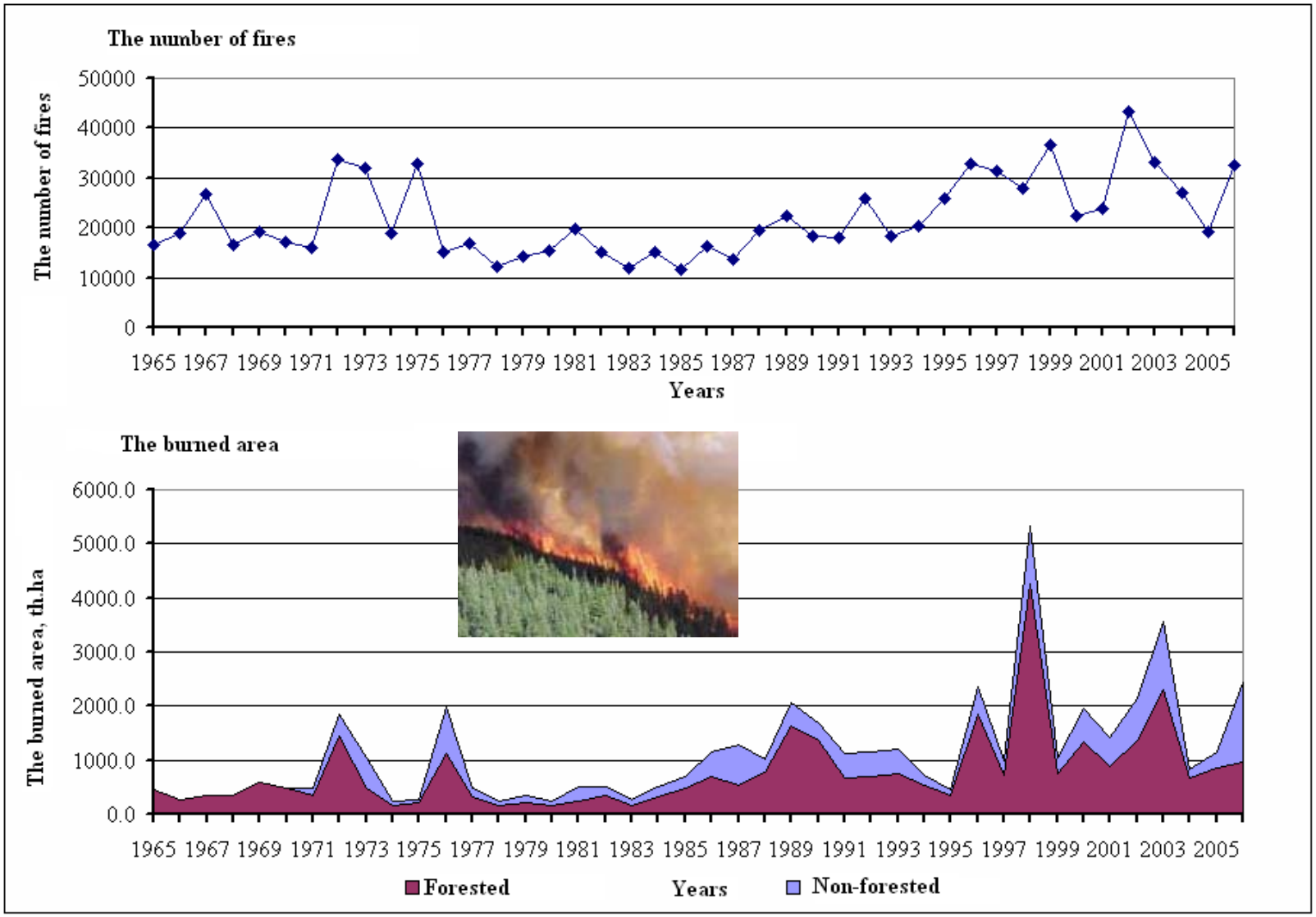
Steppe

Changes in the surface water cycle over Northern Eurasia that have been statistically significant in the 20th century

Regions with more humid conditions (blue), regions where potential forest fire danger has increased in the 20th century (red), the region where agricultural droughts have increased (circled), and the region where prolonged dry episodes have increased (rectangled).

Mescherskaya & Blazhevich (1997 updated), Dai et al. (2004), Zhai et al. (2005), Niu and Zhai (2008), Groisman et al. (2005, 2007), Groisman and Knight (2007).

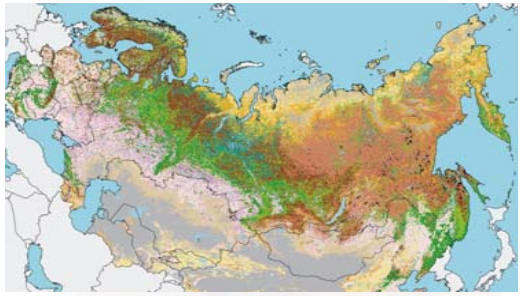
DYNAMICS OF FIRES NUMBERS AND BURNED AREA (PROTECTED TERRITORY OF RUSSIA)

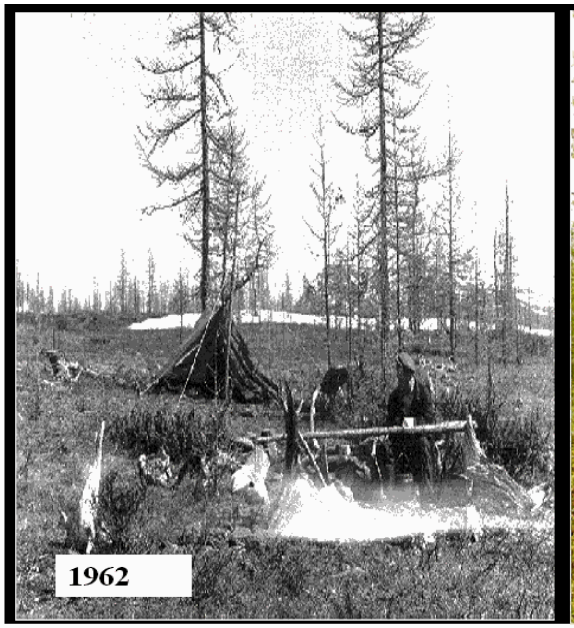


Korovin and Zukkert 2003, updated

Monitoring the biogeochemical cycles, land use, and land cover

300-m tall flux tower in Siberia



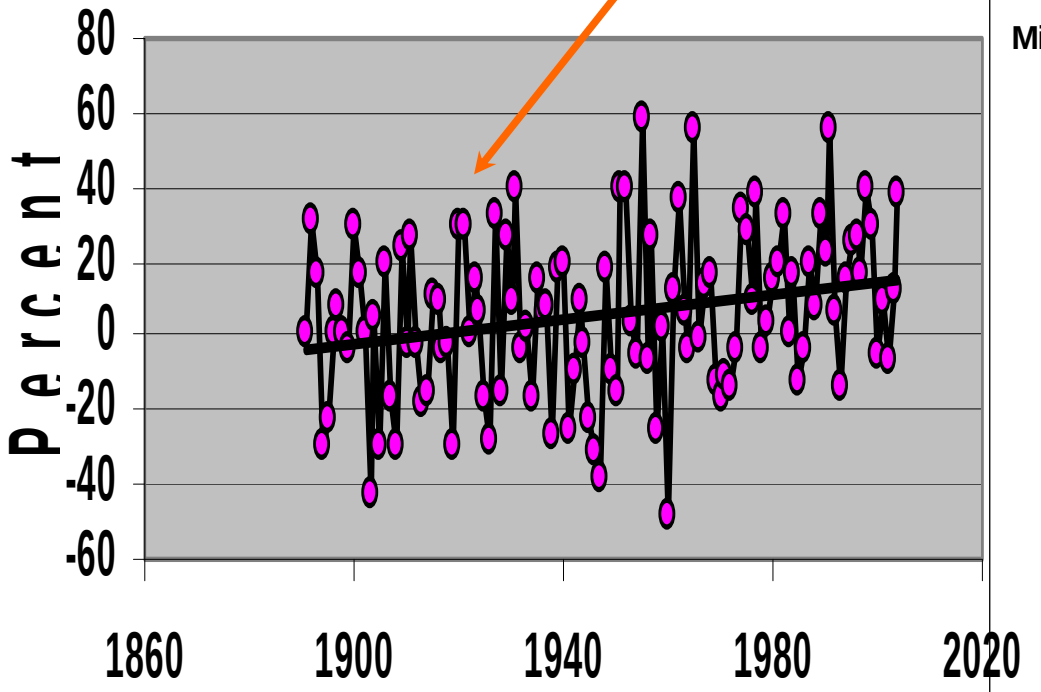


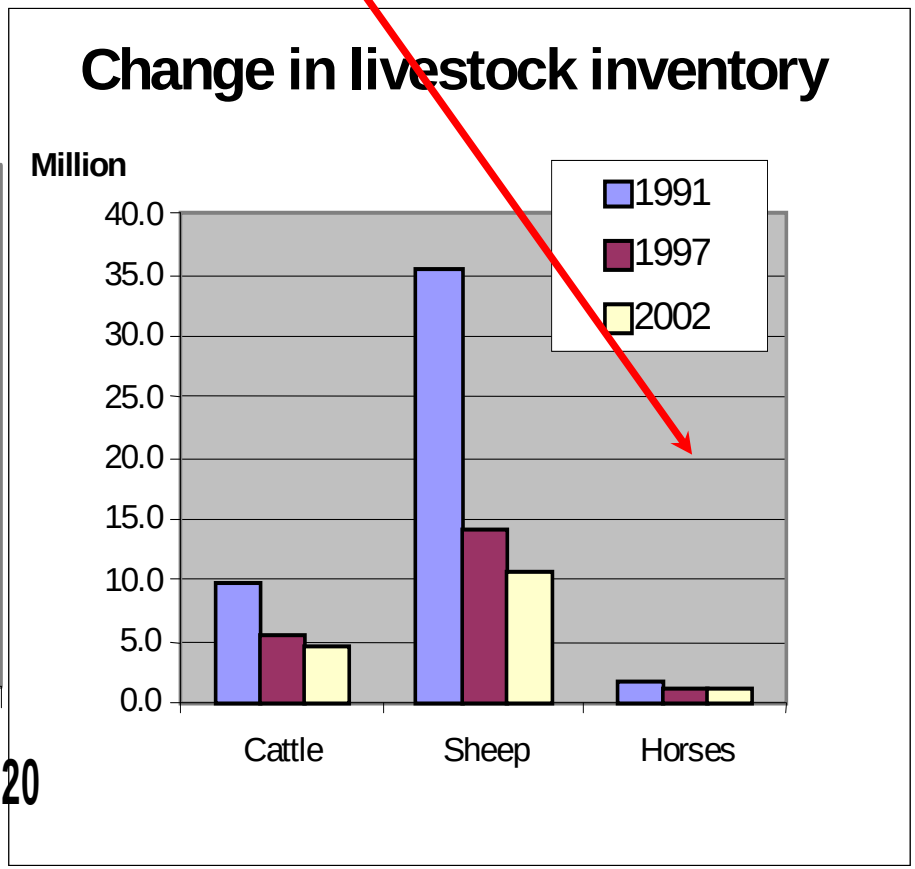
Aral Sea retreat

"Social Shocks" superimposed with environmental changes (example: Kazakhstan):

Satellite data show greening,
meteodata show drying, and
socio-economic data show decline.

Regional drought index (Meshcherskaya & Brazhevich, 1997, updated to 2004)





Monitoring and projection of dust storms and air pollution

Increasing frequency of dust storms and increasing rate of soil erosion.

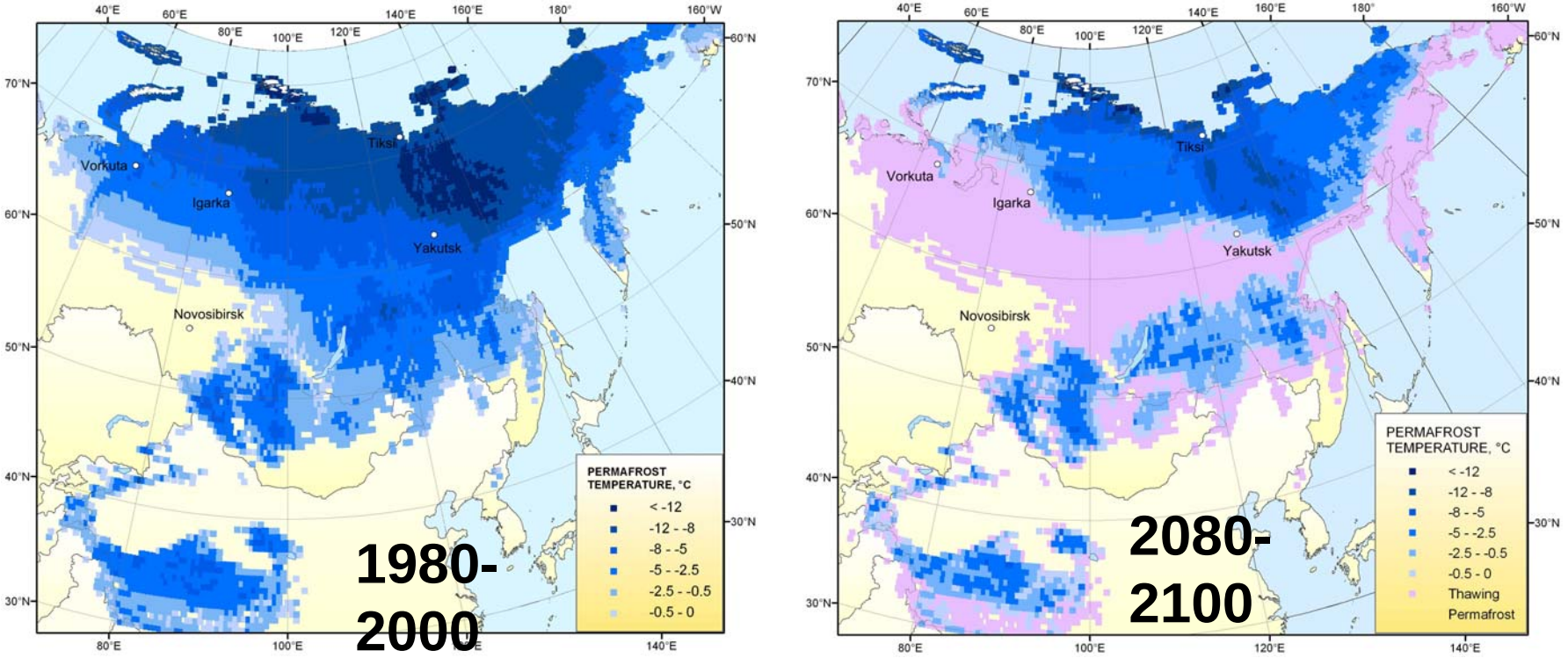
Air pollution. Fine aerosol particles are responsible for causing the greatest harm to human health.

Aspen Global Change Institute Workshop in August 2007

New course towards strengthening of the NEESPI research focus on projections...

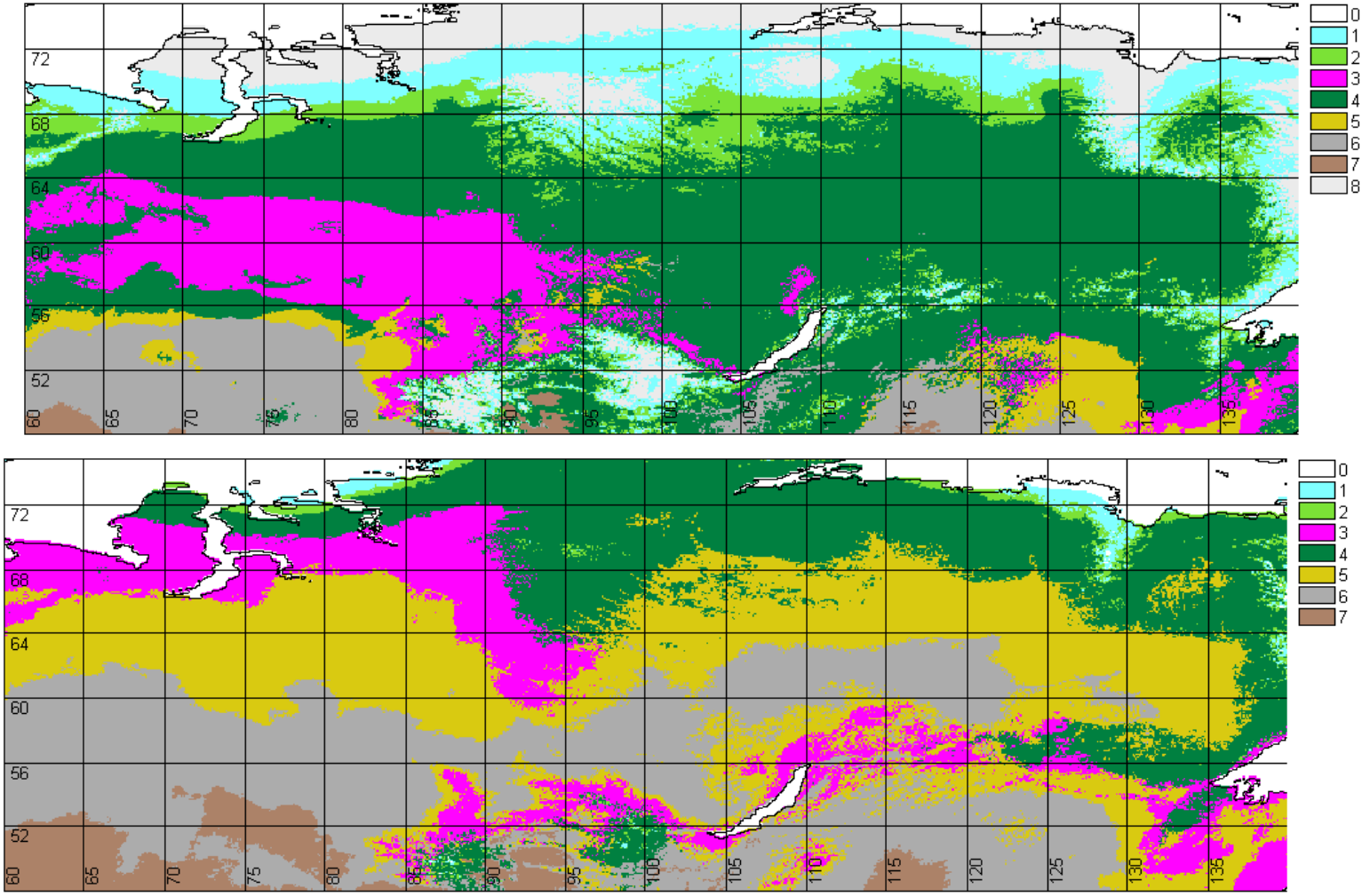
i.e., on modeling; and regional modeling will play a key role within this focus...

Projections of climate, cryosphere, and terrestrial ecosystems



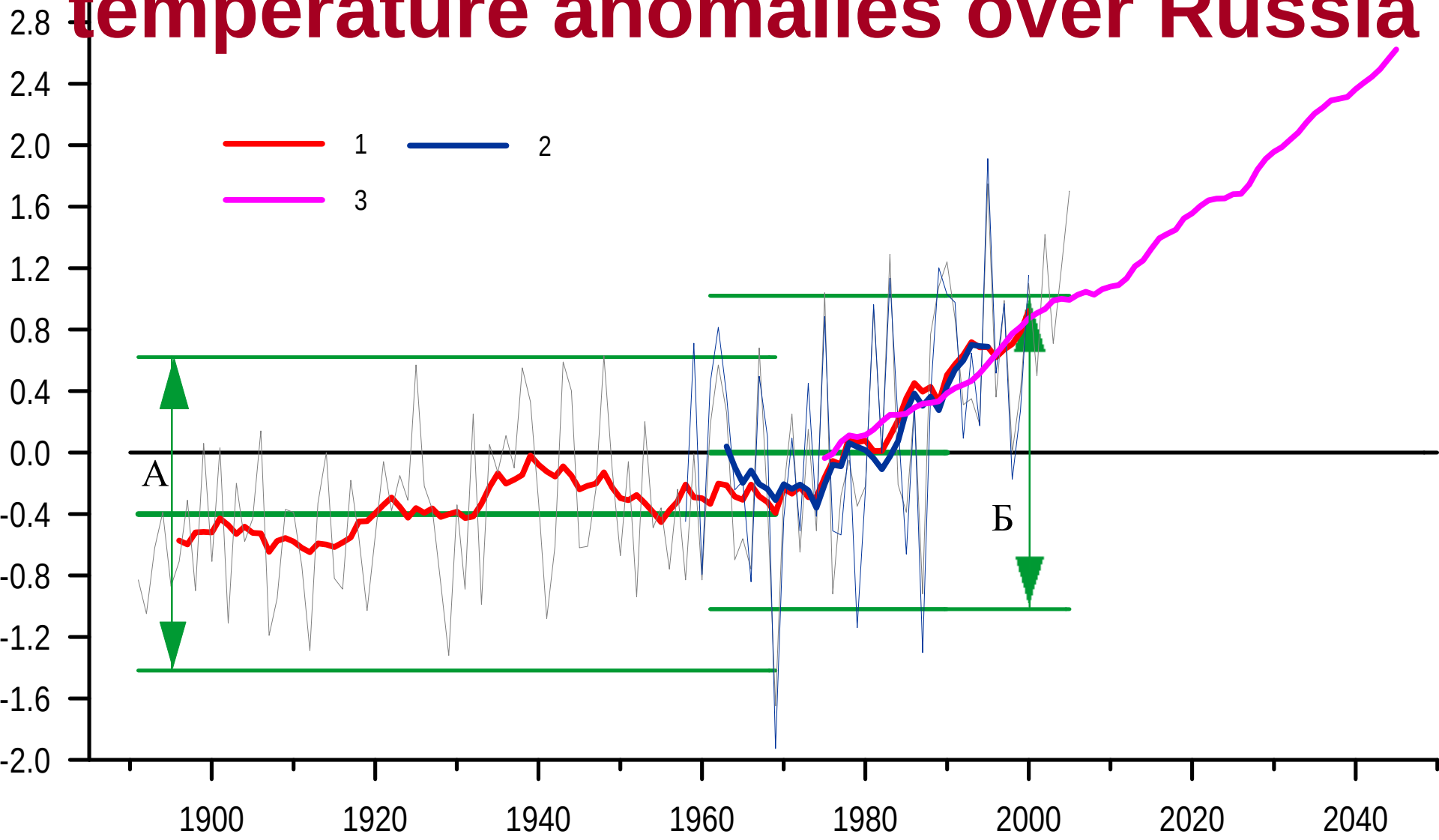
Modeled mean annual temperature at the permafrost surface in Northern Eurasia (Marchenko et al. 2008).

Biome distribution over Siberia in current (a) and 2090 (b) climates (Vygodskaya et al. 2007)



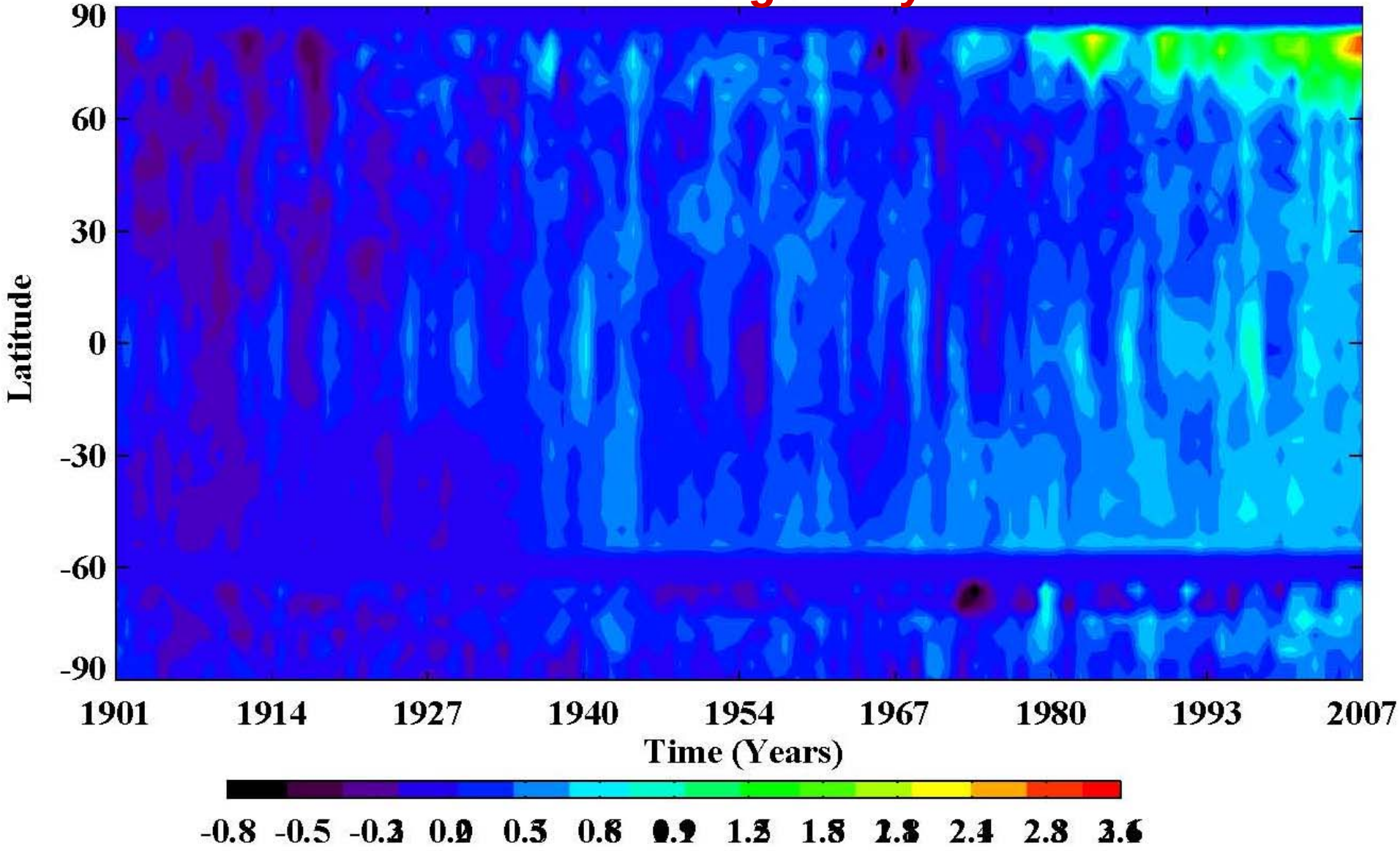
Water (0),Tundra (1), forest-tundra (2), darkleaf taiga (3) and lightleaf taiga (4), forest-steppe (5), steppe (6), semidesert (7), and polar desert (8).

Observed and projected surface air temperature anomalies over Russia



(1) station data, (2) reanalyzed (ERA-40) data, and (3) simulated /projected by 17-member ensemble of the latest IPCC Global Climate Models in a “business as usual” scenario (Meleshko et al. 2007) .

Annual land surface air temperature changes due to "forcing" by SST and sea ice changes (Sokolov 2008) => Northern Eurasia is "attacked" globally and from the Arctic



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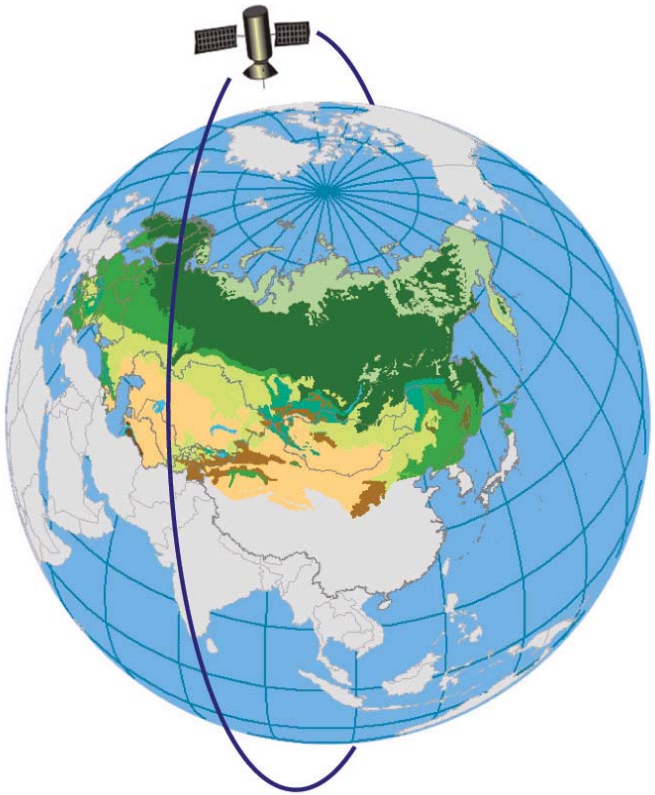

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