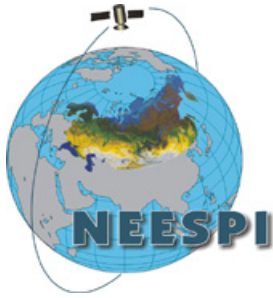


# Northern Eurasia Earth Science Partnership



**NEESPI /LCLUC Science Team**  
**Meeting, Urumqi, China, 16-21 Sept.,**  
**2007**

**Pavel Groisman and Jianguo Qi**

## **The NEESPI Program Component: Dry Land Studies**

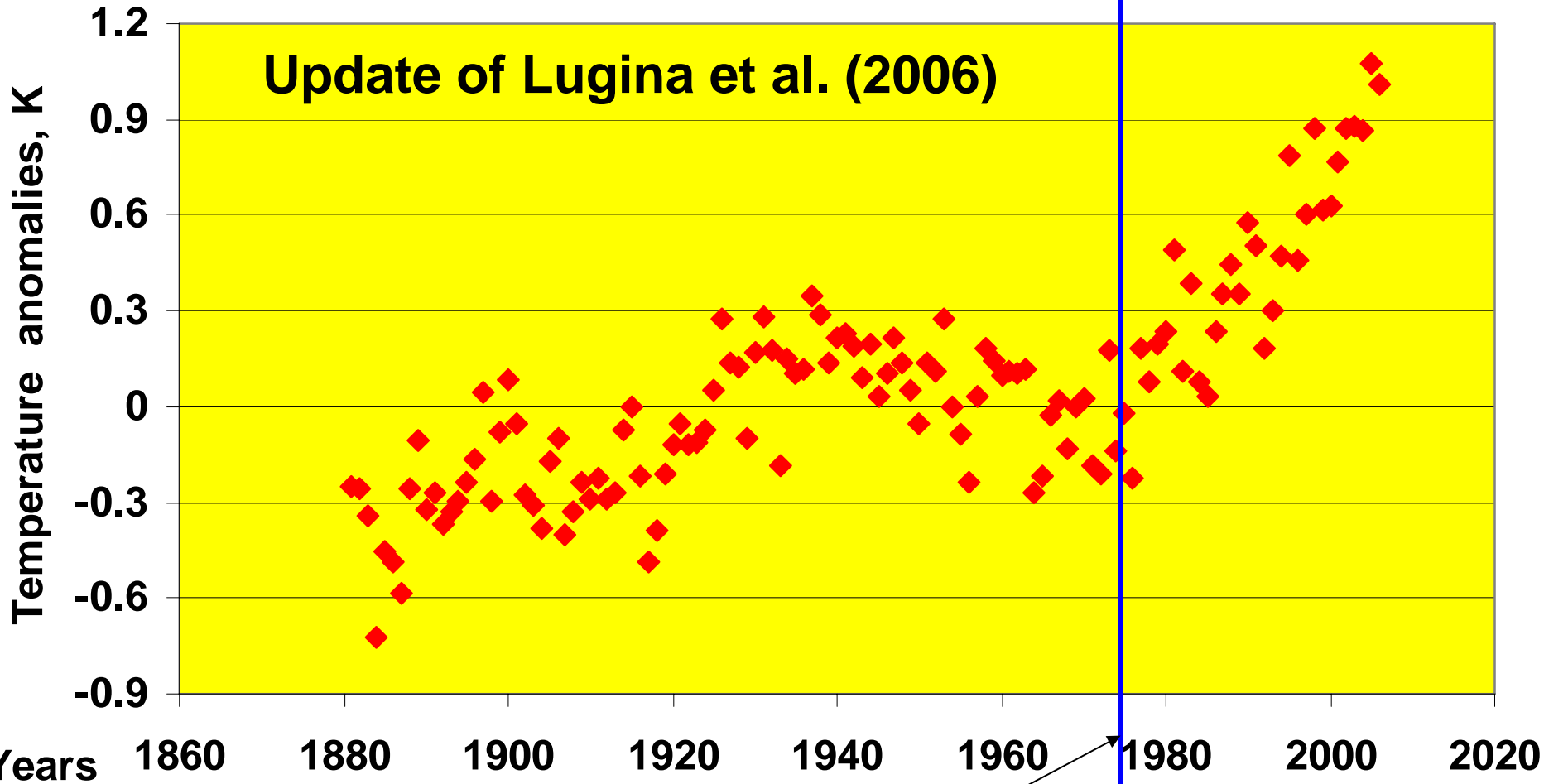
Recognition



**Small but relevant introduction from  
presentations at the Second International  
Symposium on Arid Climate Change and  
Sustainable Development,  
Lanzhou, China, 11-13 Sept., 2007**

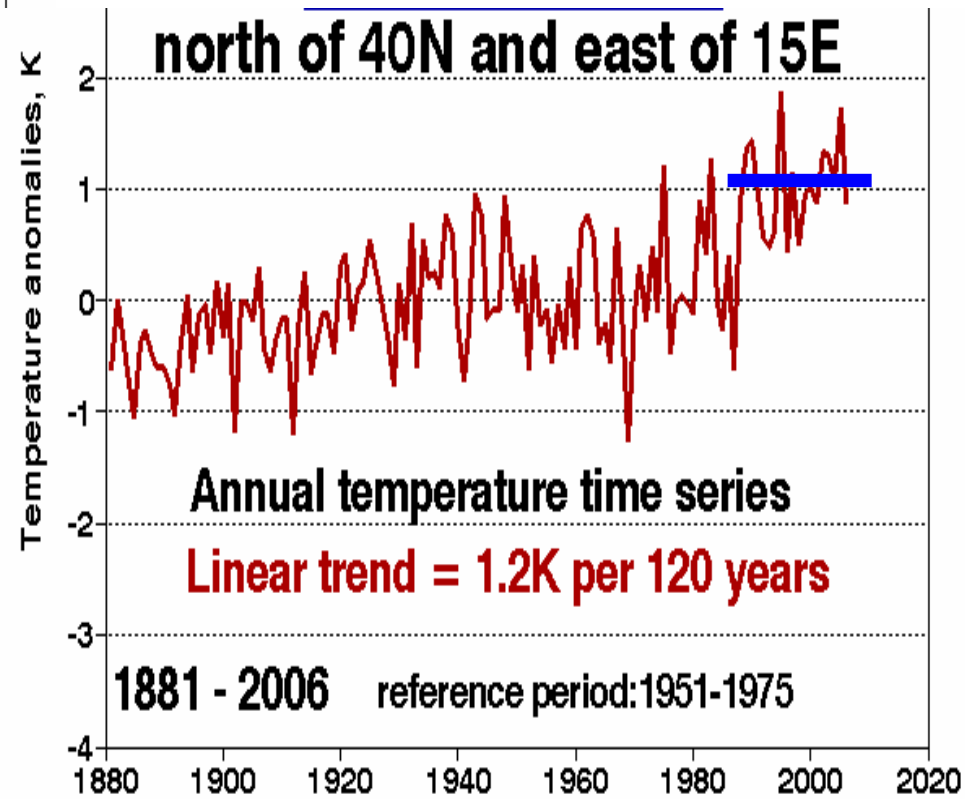
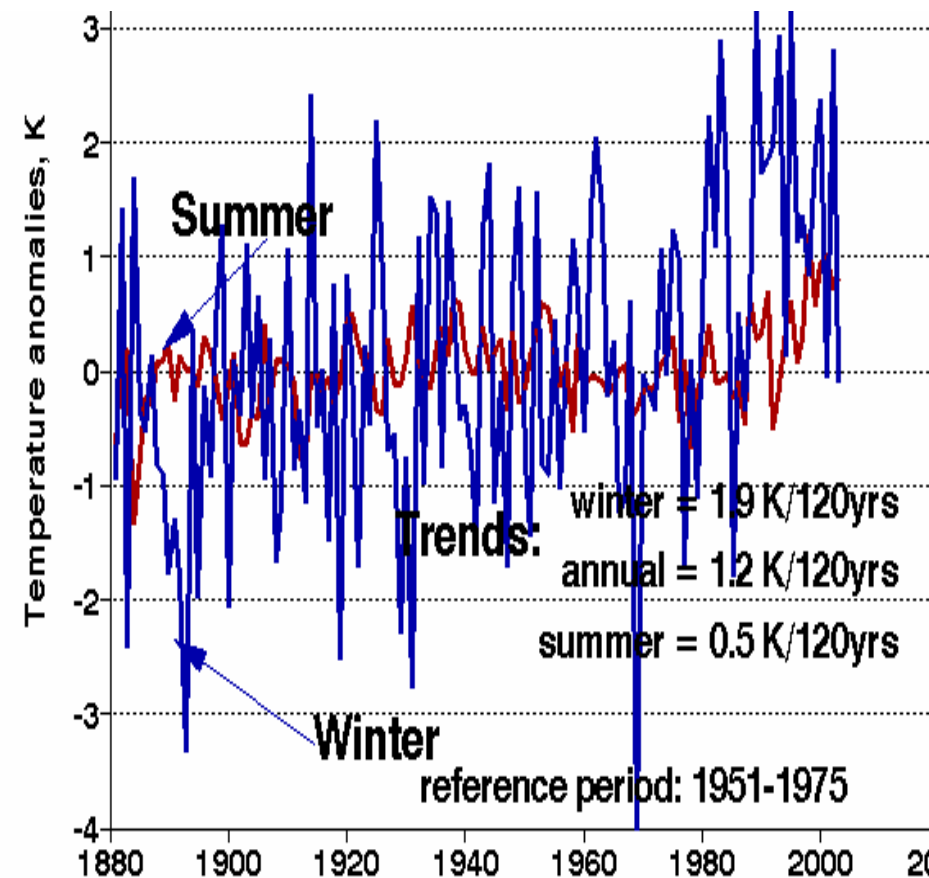
# Northern Hemisphere temperature anomalies, 1881-2006

Update of Lugina et al. (2006)



[Budyko&Vinnikov, 1976 "Global warming"]

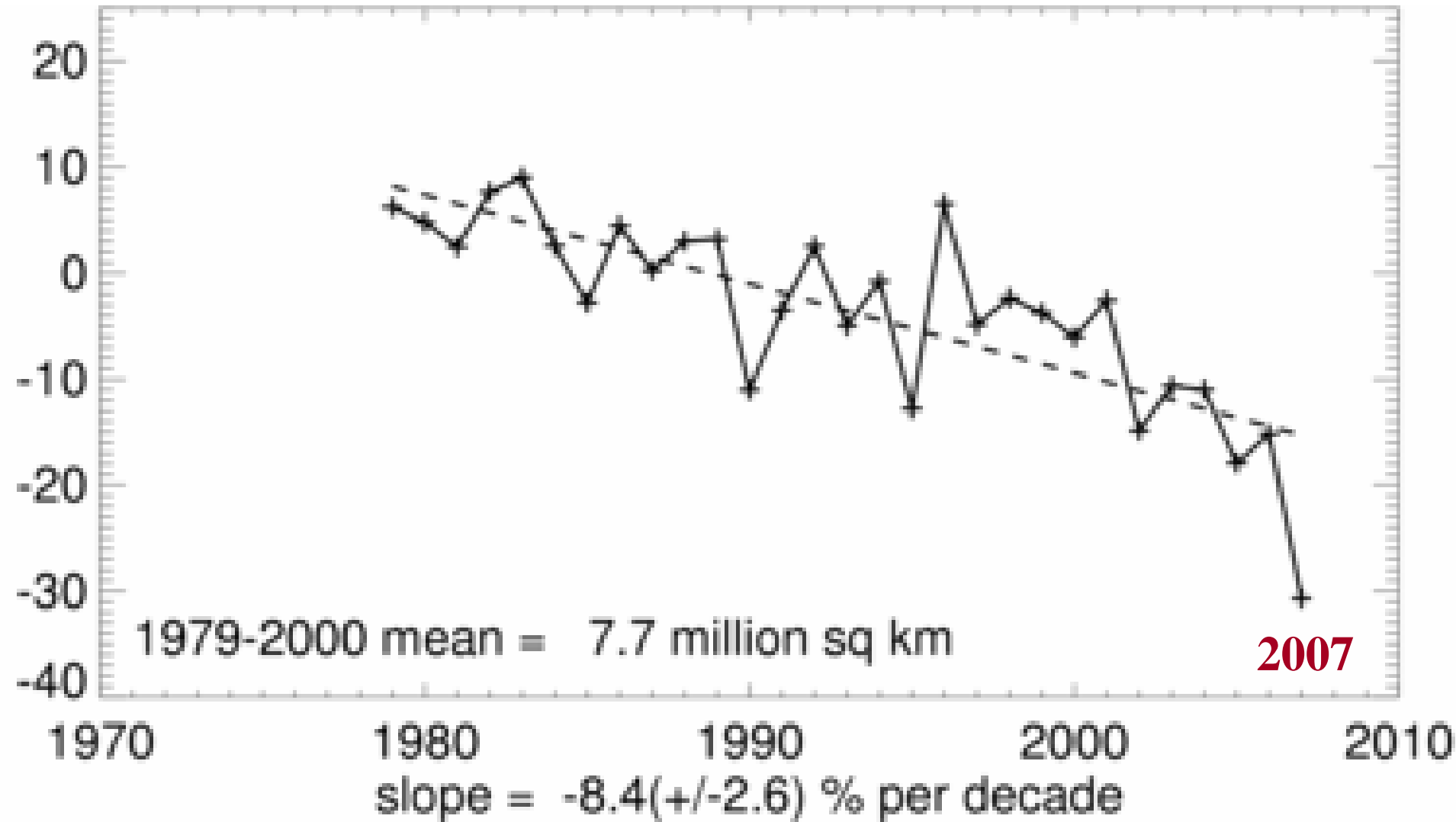
# North Eurasian surface air temperature changes during the past 126 years



Continent north of 40°N and east of 15°E

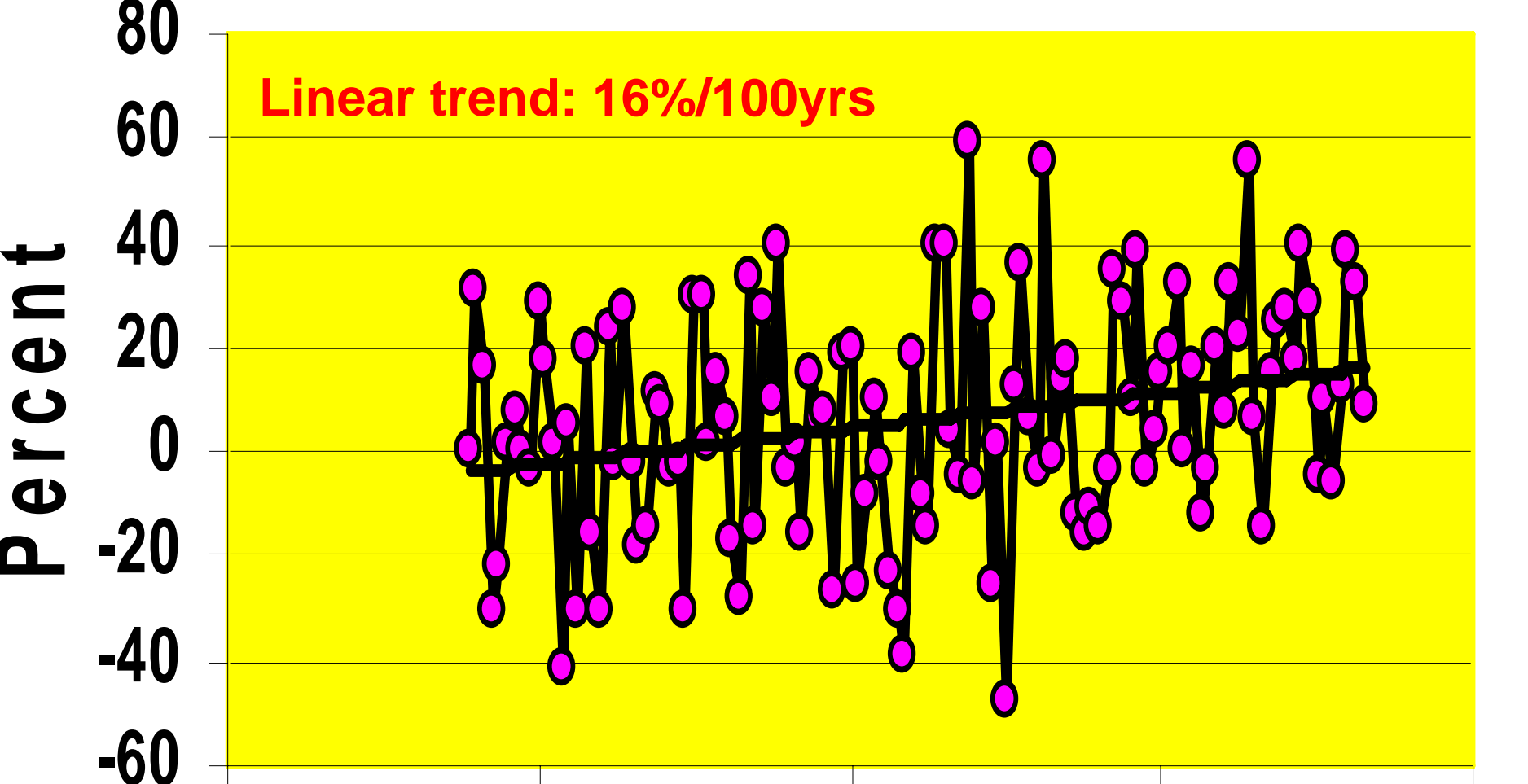
Data source: Archive of work of Lugina et al. 2005.

# Arctic Sea Ice Extent Anomalies, August, %



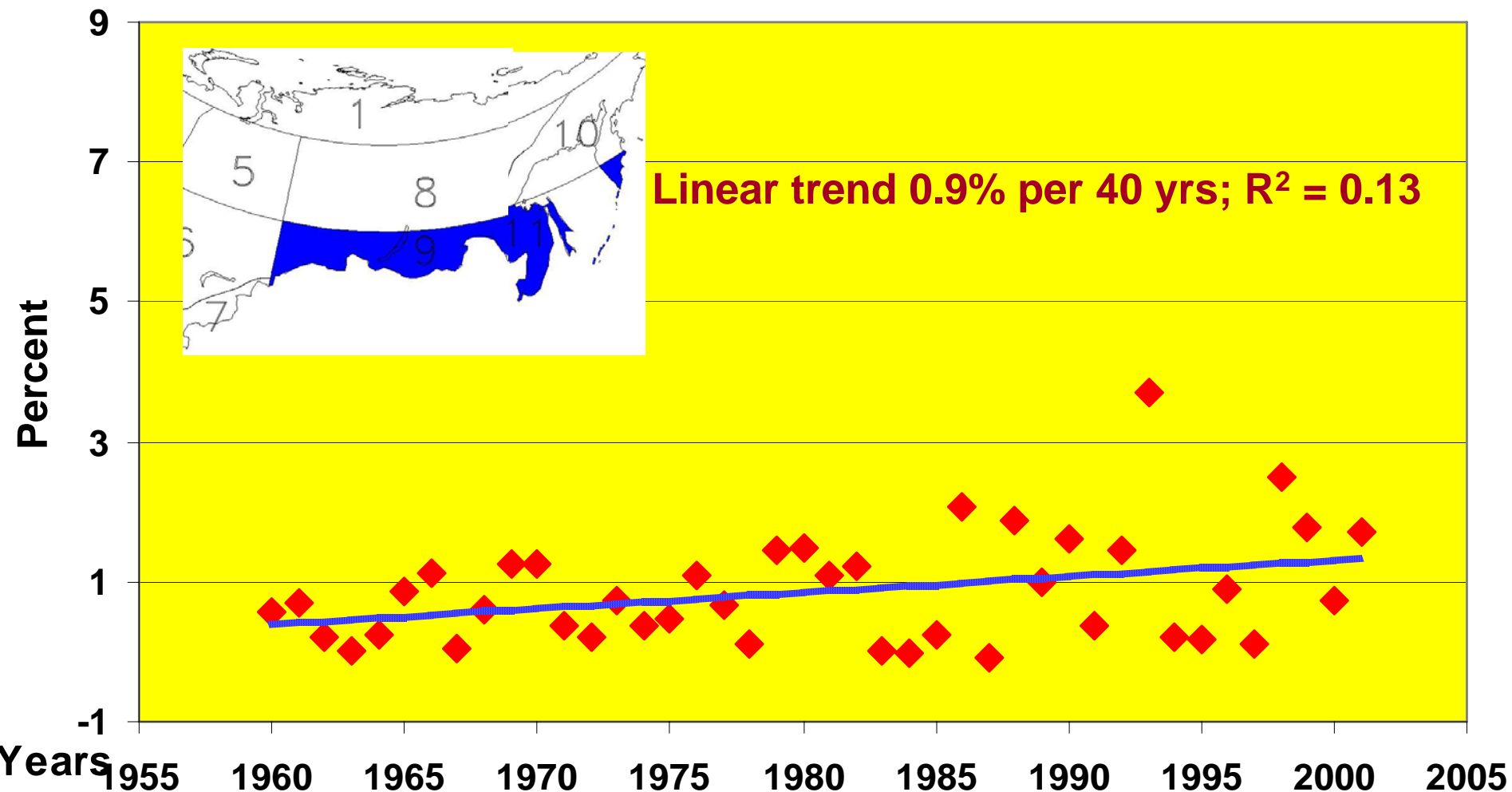
[http://nsidc.org/data/seaice\\_index/n\\_plot.html](http://nsidc.org/data/seaice_index/n_plot.html)

# May-July drought index for the major cereal-producing region Southwestern Siberia & Northern Kazakhstan



(Mescherskaya & Blazhevich, 1997, updated to 2006)

# Prolonged Dry Episodes Over North America and Northern Eurasia: New Tendencies Emerging during the Last 40 Years. Example: Russia east of 85°E, south of 55°N



**Dry episodes above 30 days during the warm season**

Plus several droughts (severe fire weather conditions in the 2000s)

# It is difficult yet to summarize the ISACS results but for northwestern China the following key findings were reported:

- Increase of temperature and precipitation across the region during the past 50 years [[numerous presentations](#)]
- water availability for runoff, lakes, wetlands, ecosystems and human consumption across most of NW China is decreasing [[numerous presentations](#)]
  - in particular, the Yellow River Source Region is endangered [[Li Fengxia](#)]
- The rainy season in the western half of NW China (west of the Gansu province) has a non-monsoon origin [[Ding Yihui](#)]



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.

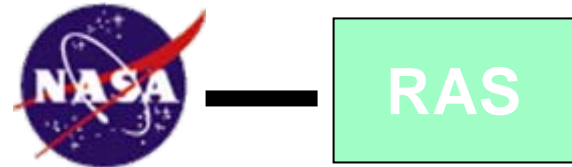


**NEESPI Study Area includes: Former Soviet Union, Northern China, Mongolia, Fennoscandia, & Eastern Europe**

**NEESPI duration ~ 10 years**

# NEESPI AND ITS PAST

**NEESPI and the actions to develop its Science Plan were initially promoted by NASA and Russian Academy of Sciences (2003-2004).**



**Since early 2005, the NEESPI community has worked to make NEESPI inter-agency (in the U.S.) 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**

Expansion

# Two modes of NEESPI expansion

- **Dedicated Calls** (recent NASA and RAS and perspective in the NIS, EU, and China)
- **Freely joined projects**
- **Benefits of the NEESPI membership**
  - **Improved links** to collaborators in Northern Eurasia and to US and EU scientists working on similar problems
  - **Exchange** of ideas, datasets, and knowledge with other team members working on similar problems
  - **Synergistic approach in working on complex problems**
  - **Priority access** to remote sensing and in situ **data** collected over Northern Eurasia
  - **Education**: student exchange, doctoral and post-doc positions sharing among the Team Institutions

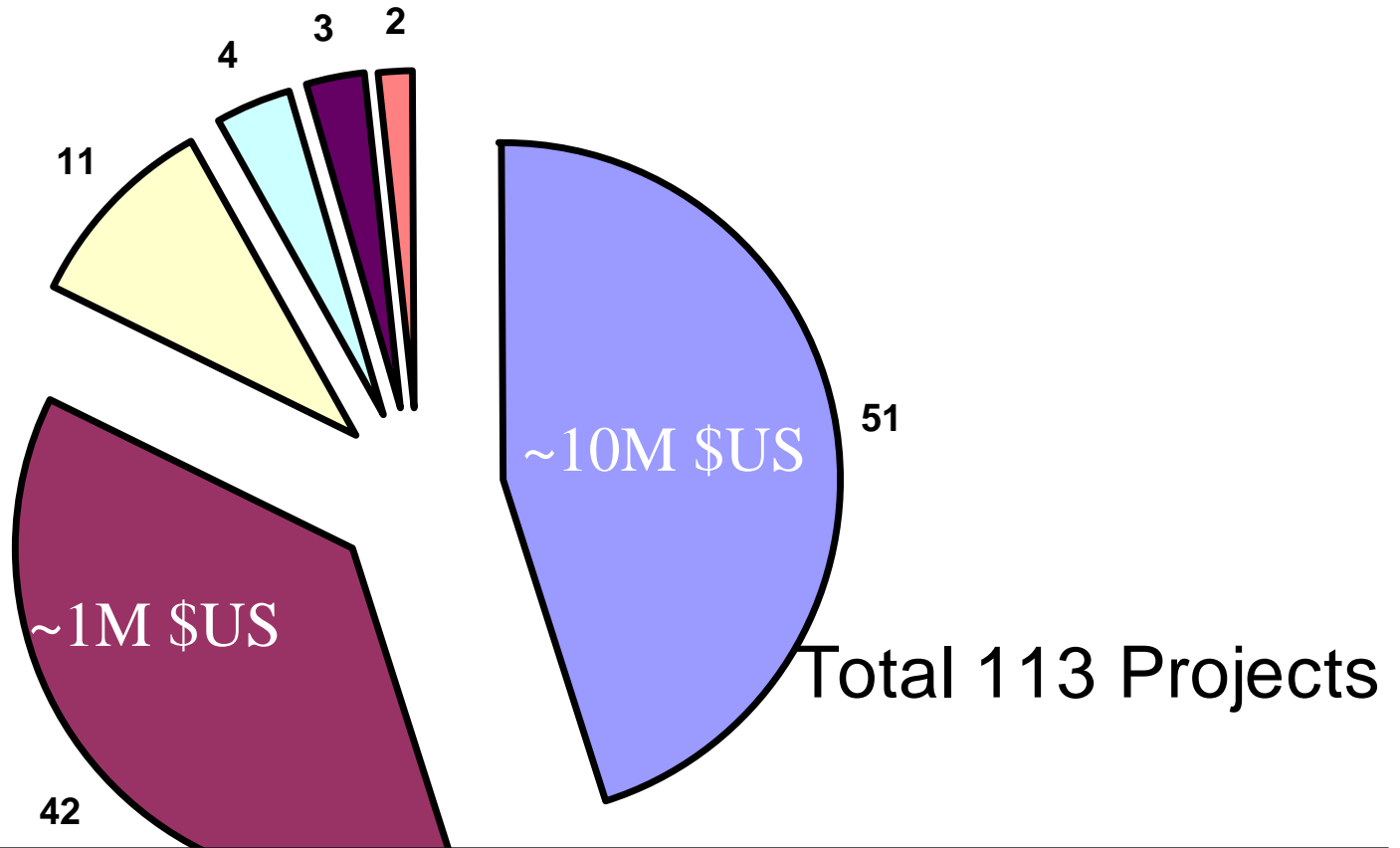
# Dynamics of the NEESPI statistics

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

**In January 2007, 70 individual research projects (always with the international participation) were funded and approximately 30 funded projects were in process of recognition/joining NEESPI.**

**Current numbers: More than 400 scientists from more than 200 institutions are working on 113 individual funded projects under the Initiative umbrella and several more projects are in the process of joining NEESPI (+ in kind assistance from EU, US, Russian, Chinese, Japanese, and International Agencies and Institutions)**

# NEESPI Projects by country



■ All US Agencies

■ All Russian Agencies

■ All EU Agencies+NATO

■ All Japanese Agencies

■ All Chinese Agencies

■ Canada

# Example of in-kind assistance

To support a Summer Workshop-School in Fedorovskoe (Russia, July 2007) on Boreal Forest Environmental Studies, sponsors from

- Japan (National Institute of Environmental Sciences),
- China (Beijing Normal University),
- Russia (Severtsov Institute for Ecology, Russian Foundation for Basic Research, and private companies),
- Germany (Friedrich-Schiller-University), and
- USA (NASA, Maryland University, **The International Arctic Research Center, Fairbanks, Alaska**, and private companies)

swiftly came together with a 6-digit sum of money.

# Distribution of projects by major research themes in January 31, 2007. One project could be included in several groups

- Biogeochemical Cycles 19
- Hydrology 25
- Cryosphere 22
- Land Use 27
- Land cover 12
- Atmospheric Aerosols/Pollution 13
- Human dimension 18
- Biodiversity 9
- Large scale, integrative 39
- **Total 73**

Since that time, more than 30 individual projects joined NEESPI



From 84 currently listed at the  
NEESPI web site projects

about half can be assigned  
**Integrative, Large scale, Modeling**  
Category

# Coping with Growing Pains

**While the NEESPI Science Plan is balanced, a quick growth and non-proportionate funding caused different paces of development of different NEESPI components. To mitigate this disproportionality in implementation, we:**

- structure the Initiative by Topical and Regional Focus Research Centers**
- move the NEESPI data support to Permanent Science Data and Services Centers, and**
- promote clustering (integration) among the NEESPI Projects into virtual Mega-Projects and/or inception of interdisciplinary internally-integrated projects**

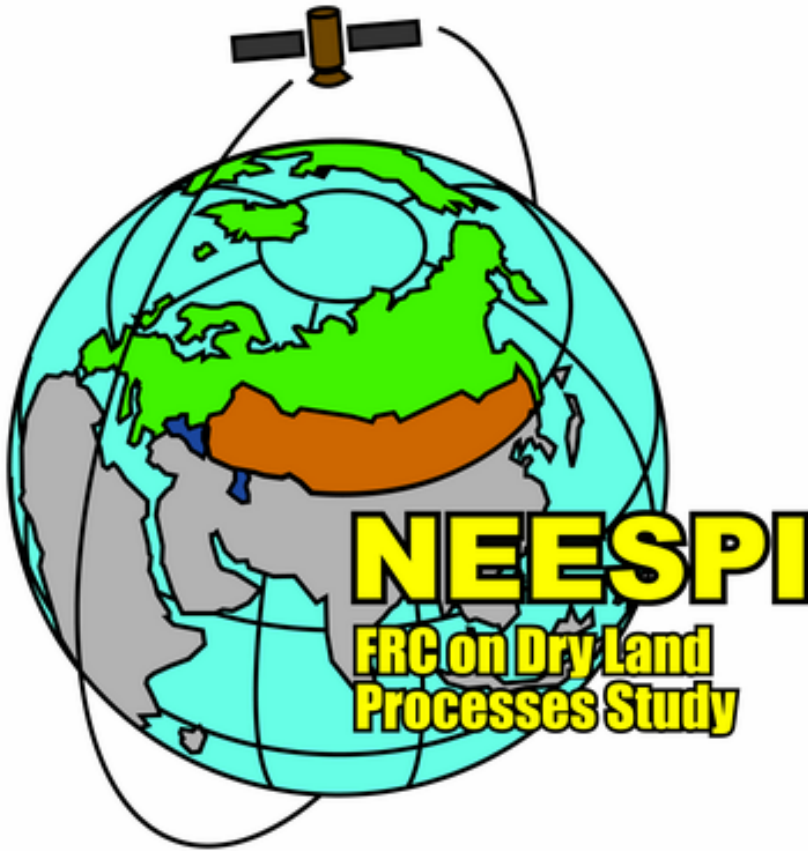
**These steps will: (a) secure the continuity of the research within the cluster (or FRC) when individual projects (usually 3 year-long) expire; (b) allow the data preservation; and (c) will gradually balance advances in different research directions**

# Currently, there are the following NEESPI Focus Research Centers

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

Additionally, we envision (project): *Center for Integration of the NEESPI Results and Modeling Studies, and three more Regional FRCs (in Moscow, Helsinki, and Vladivostok)*

# **Regional NEESPI Focus Research Center on Dry Land Processes Studies** established during the First FRC Workshop, Beijing, China, 7-8 November 2006)



- Ecosystem Monitoring and Assessment
- Water issues in arid regions
- LCLUC ecological impact
- Aeolian Desertification
- Socio-economic responses to climatic and environmental changes
- Regional environmental modeling

# Example of the NEESPI integrative project

## *Understanding the role of changes in land use/land cover and atmospheric dust loading and their coupling on climate change in the NEESPI study domain drylands*

**PI: Irina Sokolik** Georgia Institute of Technology, Atlanta, Georgia, USA

### Co-PIs:

**Robert Dickinson** Georgia Institute of Technology, Atlanta, Georgia, USA

**Yongjiu Dai** Beijing Normal University, Beijing, China

**George Golitsyn** Obukhov Institute of Atmospheric Physics, Russian Academy of Sciences, Moscow, Russia

### Collaborators:

**R. Bektursunova** Eurasian National University, Akmolla, Kazakhstan

**B. Marticorena and G. Bergametti**, Laboratoire Interuniversitaire des Systèmes Atmosphériques, Paris, France

**D. Jugder** Institute of Meteorology and Hydrology, Ulaan Baatar, Mongolia

**Y. Shao** City University of Hong Kong, China

**I. Uno** Institute Applied Mechanics, Kyushu University, Japan

**M. Mikami** Meteorological Research Institute, JMA, Tsukuba, Japan

**Y. Chun** Meteorological Research Institute, Seoul, Korea.

# *NEESPI activity in dry regions*

- *Integrated regional NEESPI activity* is focused at the NEESPI Focus Research Center for Dry Land Processes Studies (Institute of Geographic Information and Natural Resources Research, Chinese Academy of Sciences, Beijing, China)
  - ***International NEESPI Projects that cover only China***
    - ***Land Use and Land Cover Dynamics of China in Support of GOF/GOLD and NEESPI Sciences (10 Chinese Universities and Labs+9 US and 1 Canadian Universities); PI: Jianguo Qi***
    - ***Effects of Land Use Change on the Energy and Water Balance of the Semi-Arid Region of Inner Mongolia ( 7 US and 2 Chinese Institutions); PI Jiquan Chen.***
    - ***Climate Change impacts and adaptation research - Retrospective Analysis and climate scenarios (Canadian & Chinese Meteor. Adm.)PI: Paul Whitfield***

## *NEESPI activity in dry regions. Part 2*

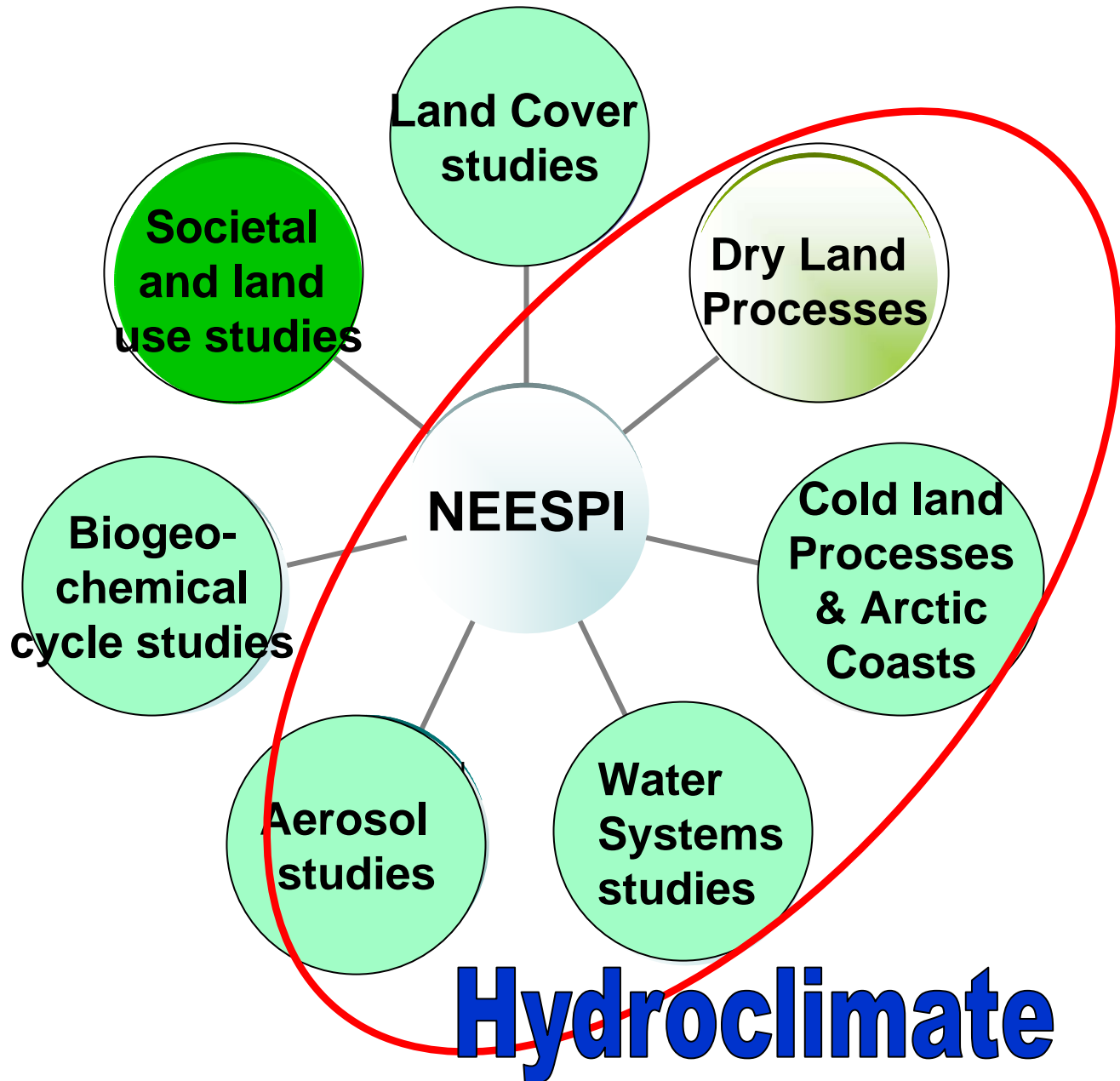
- Near-Global International NEESPI Projects
  - ***Integrated Study for Terrestrial Carbon Management of Asia in the 21st Century (1 Japanese and 6 Russian Institutes); PI Toshinobu Machida***
  - ***Thermal State of Permafrost (TSP): The U.S. contribution to the International Permafrost Observatory Network (4 US, 1 Canadian, 1 Norwegian, and 6 Russian Institutions); PI Vladimir Romanovsky***
  - ***Boreal zone forest type and structure from EOS data sets (2 US and 1 Russian Institution); PI Jon Ranson***
  - ***Northern Eurasia Landcover Dynamics Analysis: Monitoring and validating the distribution and change in land cover across Northern Eurasia (5 Russian, 4 US, and 1 Ukrainian Institutions); PI Olga Krankina***
  - ***and 12 more projects***

## ***NEESPI activity in dry regions. Part 3***

- International NEESPI Projects that cover only dry regions of Northern Eurasia
  - ***Contributions of Changes in Land Use/Land Cover, Water Use, and Climate to the Hydrological Cycle Across the Central Asian States ( US, Russian, Uzbek and Kazakh Institutions); PI: Charles Vorosmarty***
  - ***Understanding the role of changes in land use/land cover and atmospheric dust loading and their coupling on climate change in the NEESPI study domain drylands (9 Inst., 8 countries); PI Irina Sokolik***
  - ***Evaluating the effects of institutional change on regional hydrometeorology: Assessing the vulnerability of the Eurasian semi-arid grain belt (5 Institutions from 3 countries); PI Geoff Henebry***
  - ***Northern Eurasian C-land Use Climate Interaction in the Semi-Arid Regions (3 US and 6 Kazhakh, Mongolian, and Uzbek Institutions); Pi Dennis Oijma***
  - ***and 7 other projects***



# Relationships used for Coordination with NEESPI Focus Research Centers of the new GEWEX NEESPI RHP



# 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*

**Human impact in drylands has already  
lead to ecological disaster in Central Asia**

**E.g., most of the Aral Sea will disappear  
in the next ten years**



July - September, 1989

**1989**



August 12, 2003

**2003**



**... and put society wellbeing and human health in harm way**

**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.**



## Specific human dimension in Northern Eurasia

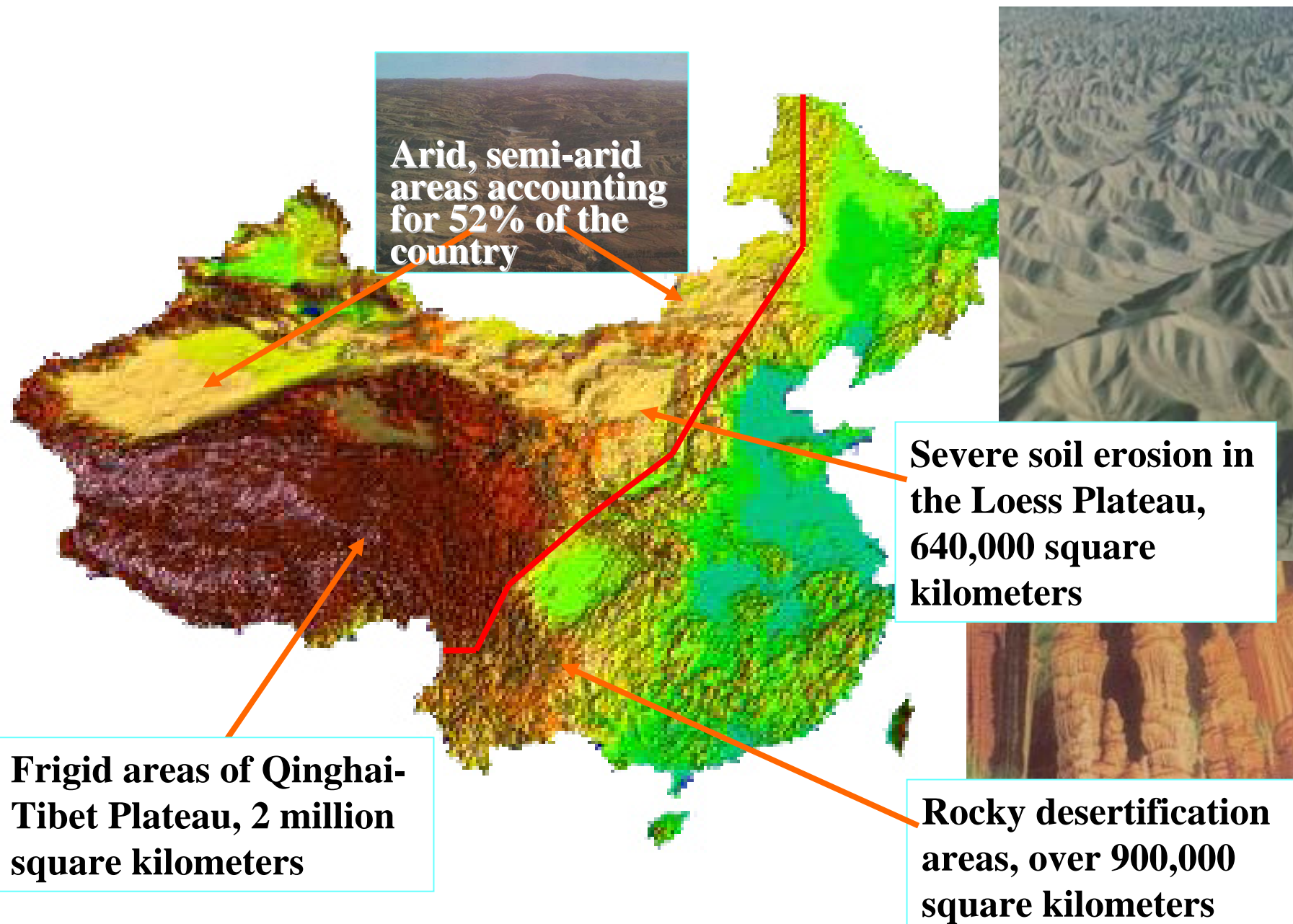
We had “managed” societies in Northern Eurasia and now *social shocks superimposed with environmental changes reduce the resilience of the societies of the region*

- Political system changed
- Land use rules changed
- Economics changed
- Infrastructure of social services unsupported

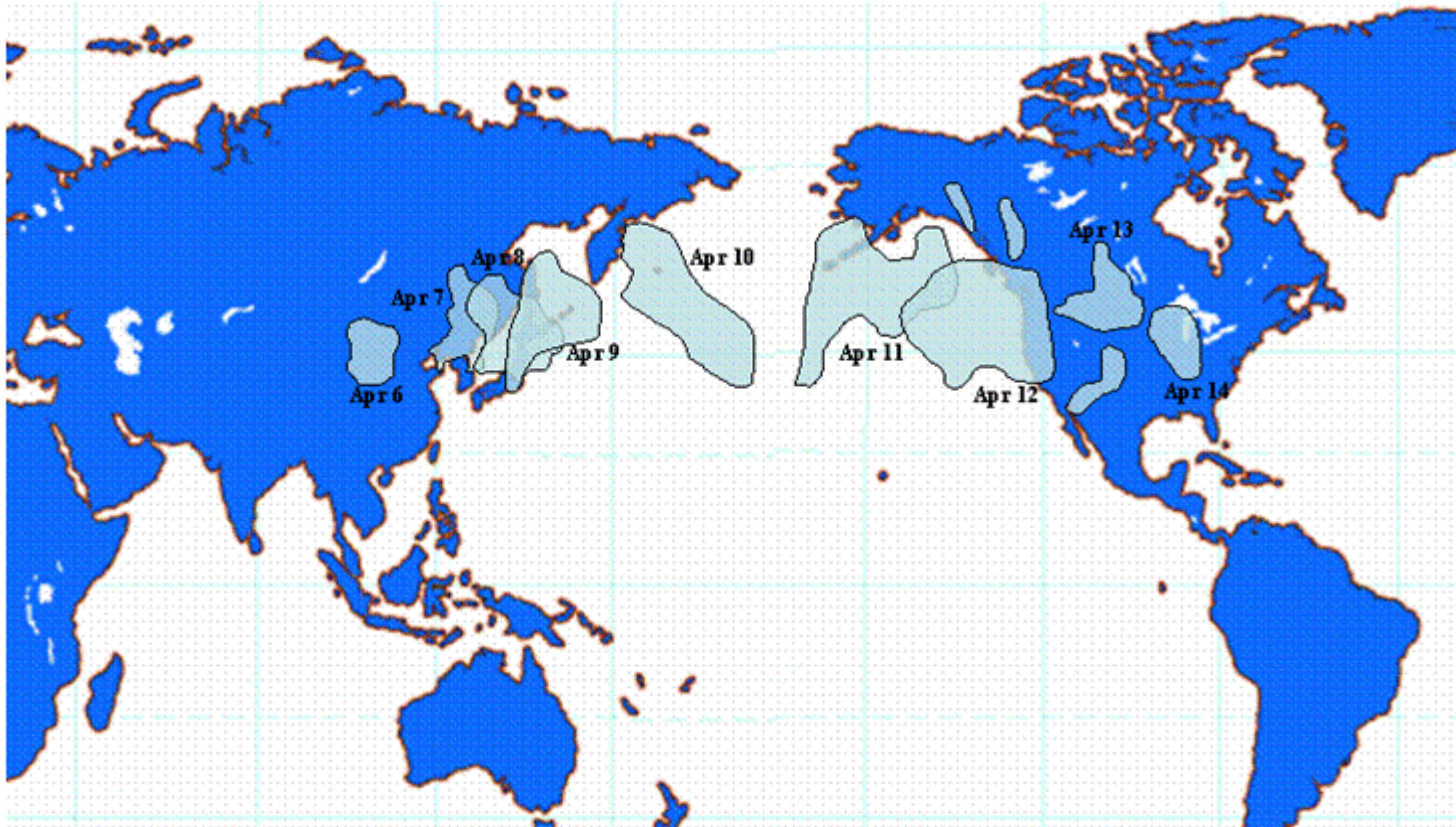
**Plus**

- “Hot spot” of climatic change
- Numerous feedbacks acting in uncertain ways





# The aeolian mineral dust transfer may have the global scale



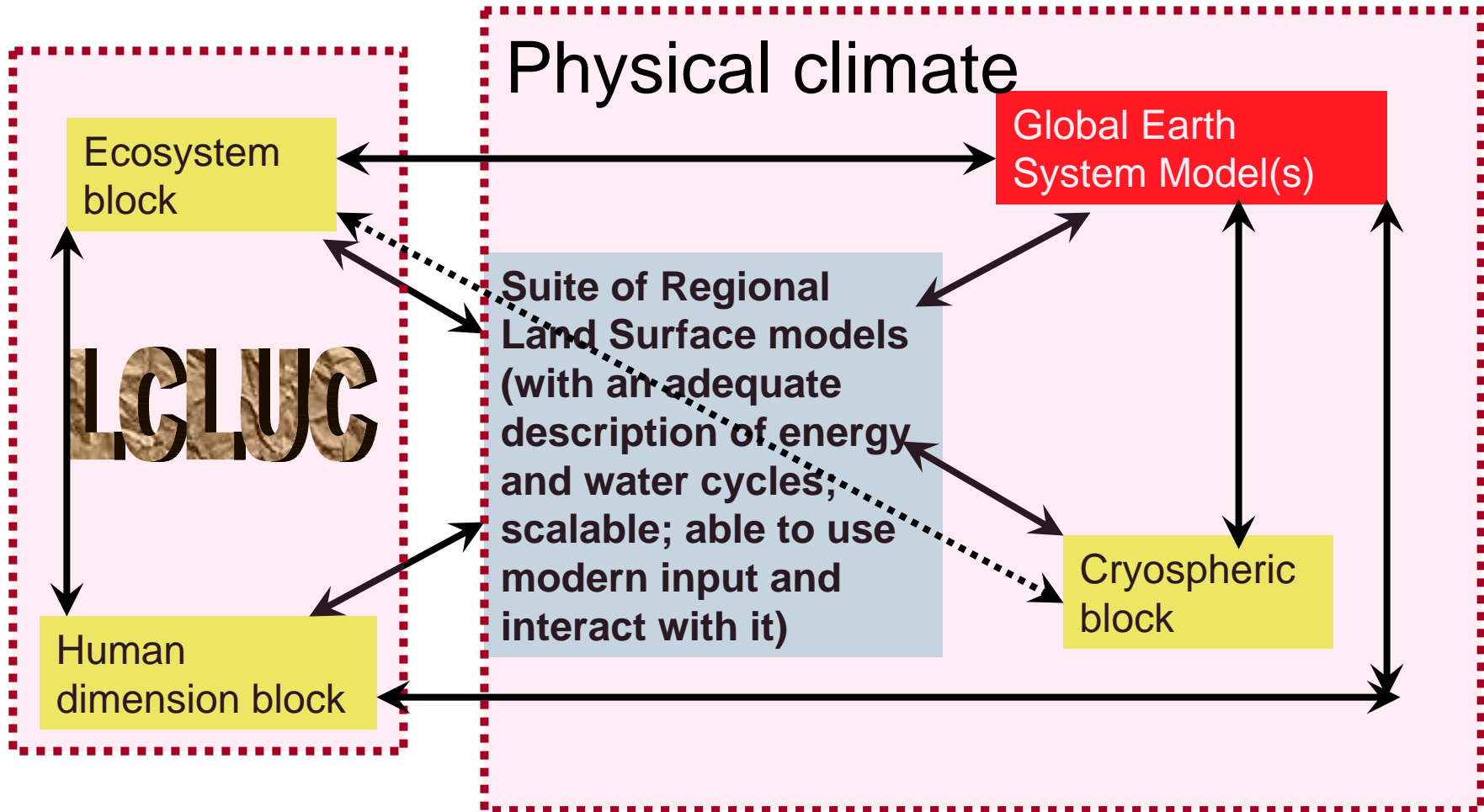
- Long-range transport of the dust storm originated over the Gobi desert on April 6th, 2001 (Darmenova and Sokolik, 2002)

# Peculiarity of the regional studies

- Opposite to North America, Europe, and several other parts of the Globe, we are still lacking many essential tools (e.g., well developed RCMs, hydrological models, and regional reanalyses) that are a prerequisite for answering the major NEESPI science questions =>
  - (a) An urgent need for modern models' development and
  - (b) Investments in Education



# Northern Eurasia modeling suite



# NEESPI Milestones for Year 2010

- To have in place:
  - a suite of tested land surface and regional climatic models that account for peculiarities of the energy and water cycles in Northern Eurasia
  - major components of the data support system (including near-real time dataflow) for these models
  - first version of the biospheric blocks for these models
- To complete all funded IPY activities in the region
- To organize during the next three-year-long period up to 20 summer schools and/or special courses for training of the Earth Science K-12 teachers and a new generation of the NEESPI domain Earth Science researchers.

Out-  
reach

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

**In April 2007:** 1st Special NEESPI issue (13 papers) in *GaPC*

**In 2007-2008:** 2 more NEESPI Special issues (~50 papers) in *ERL* and *J. Climate*

**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**