

**Northern Eurasia Earth Science Partnership:
An emerging integrated regional study**

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What is NEESPI?

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.



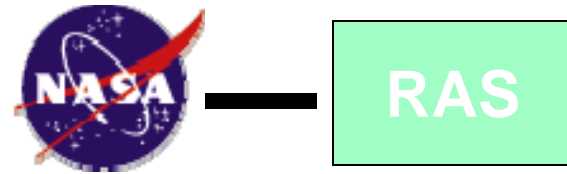
NEESPI Study Area includes: Former Soviet Union, Northern China, Mongolia, Fennoscandia, & Eastern Europe

Global, Interdisciplinary, and Active.

- **Global** - Priorities were assigned to projects and topics that address regional changes that affect (or may affect) Global Earth System
- **Interdisciplinary** –It was early recognized and shown in examples, that strong interactions within the system terrestrial ecosystem, hydrosphere, cryosphere, atmosphere, and human society in the region require interdisciplinary studies
- **Active** - Preparation of the NEESPI Science plan (2003-2004) occurred simultaneously with pilot projects initiation and the writing of proposals (some of them have been already funded).

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).

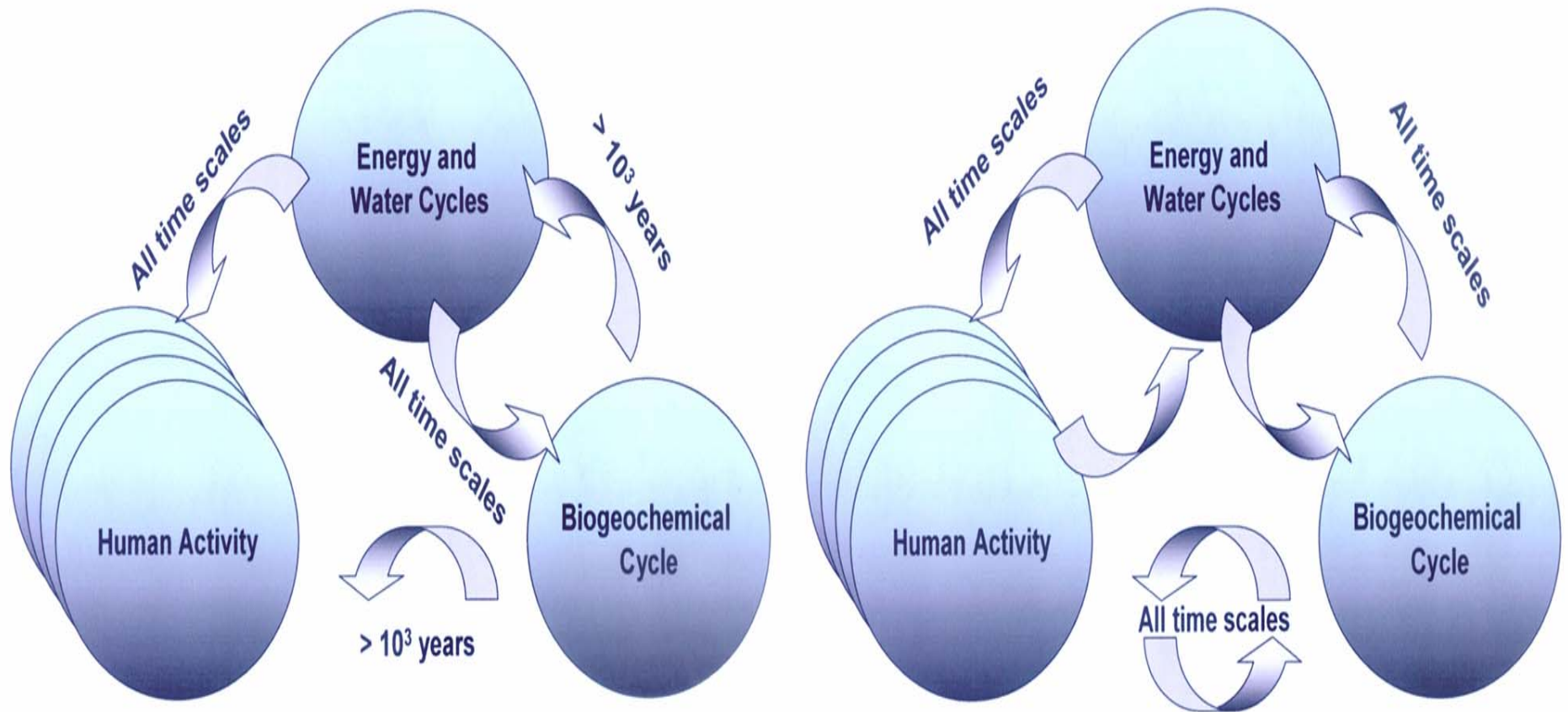


Since early 2005, the NEESPI community has worked to make NEESPI inter-agency (in the U.S.) and international.

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

The NEESPI Science Plan has elements that address concerns of WCRP, IGBP, IHDP, and DIVERSITAS Programs

Pre-industrial and present interactions in the Earth Global System



- Studying any one of these cycles or activities often requires analyses of its interaction with the other two and of the transitional (non-equilibrium) character of these interactions.

NEESPI Science Plan Structure

1. INTRODUCTION

2. SCIENTIFIC QUESTIONS AND MOTIVATION

3. MAJOR SCIENTIFIC TOPICS

3.1. Terrestrial ecosystem dynamics

3.2. Biogeochemical cycles

3.3. Surface energy and water cycles

3.4. Land use interactions: societal-ecosystem linkages

3.5. Ecosystems and climate interactions

3.6. Topics of special interest

3.6.1. Cold land region processes

3.6.2. Coastal zone processes

3.6.3. Atmospheric aerosols and pollution

<http://neespi.org>

4. REMOTE SENSING

5. MODELING

6. DATA AND INFORMATION TECHNOLOGY

7. EDUCATION

8. RESEARCH STRATEGY

Scientific Background Appendix

TOOLS

NEESPI Science plan major focuses

- **Focus on transient zones that are most vulnerable in the future changes**

<ul style="list-style-type: none">– Coastal zone– Tundra-forest	Cold Lands
<ul style="list-style-type: none">– Forest-steppe	
<ul style="list-style-type: none">– Steppe-desert– Mountains	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 Deliverables:

to have in ~10 years

- **A suite of process –oriented models for each major terrestrial process in all its interactions**
- **A suite of global and regional models that seamlessly incorporate all regionally specific feedbacks associated with terrestrial processes**
- **An integrated observational knowledge data base for environmental studies**
- **A system in place that can serve the emergency needs of the society**

Current NEESPI statistics

NEESPI Science Plan Preparation Team includes more than 90 scientists (representing mostly academia) from 11 countries with the majority of them are from the United States and Russia.

364 scientists of 195 institutions from 31 countries are participating in the first 54 funded projects as of July 2006.

Now, more than 70 individual research projects (always with the international participation) are funded and approximately 30 funded projects are in process of recognition/joining NEESPI

NEESPI Senior Scientists by country (July 2006; 364 scientists from 195 institutions; 54 projects)

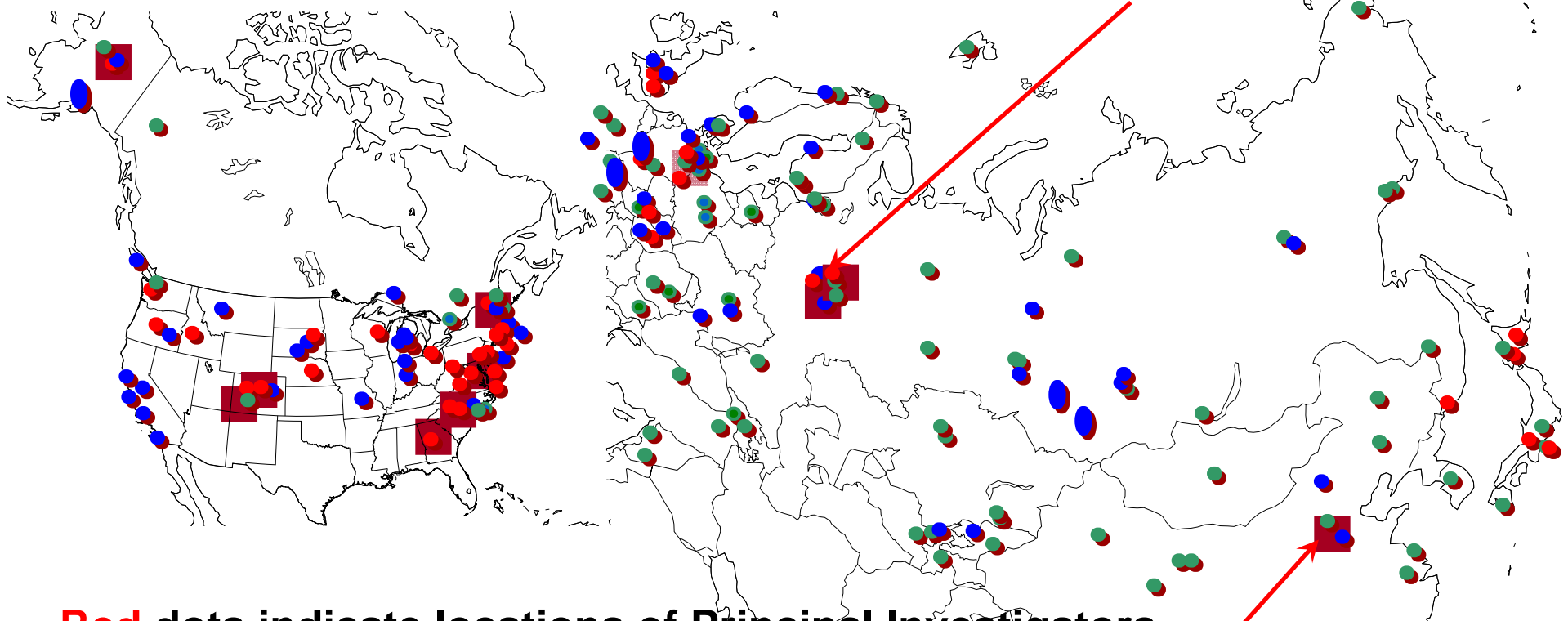
- **Russia** 106 scientists 42 institutions
 - including Moscow 58 scientists 19 institutions
 - most active Institution: RAS Sukachev Institute of Forest Research (8 sci. in 8 projects)
- **China** 26 scientists 15 institutions
 - most active Institution: Institute of Botany, Chinese Acad. Sci. (5 scientists)
- **United States** 113 scientists 50 institutions
 - most active institution: University of Maryland (10 scientists in 10 projects)
- **European Union (W)** 54 scientists 37 institutions 10 countries
 - including Finland 10 scientists 5 institutions
 - including Germany 16 scientists 10 institutions
- **Japan** 16 scientists Intern. Arctic Res. Ctr. + 8 institutions
- **Canada** 6 scientists 5 institutions
- **NIS countries, Mongolia, Korea, Syria, and Eastern Europe** 43 scientists 37 institutions 16 countries

Large fraction of hidden participation from the NEESPI domain, including institutional support from Russian and Chinese Academies of Sciences and CMA.

NEESPI Scientific Network

(On July, 2006: 364 scientists from 195 institutions; 54 projects)

19 institutions in Moscow participate in 26 projects



Red dots indicate locations of Principal Investigators

Blue dots – locations of Co-Investigators, and

Green dots - locations of Collaborators.

Squares show Focus Research and Science Support Centers.

6 institutions in Beijing participate in 5 projects

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

Two modes of NEESPI expansion

- **Dedicated Calls** (recent NASA and RAS and perspective in the NIS, EU, and China)
- **Freely joined projects**
- **Benefits of 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

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 two more Regional FRCs (Moscow and Vladivostok)*

Example of the NEESPI Focus Research Center

NEESPI Focus Research Center for Cold Land Processes and Arctic Coastal Studies (CLAC FRC)

- **Venue:** International Arctic Research Center, University of Alaska Fairbanks, Alaska
- **Objectives:** conduct, promote, and facilitate research aimed at improved understanding and modeling of the cold land processes in the Earth System focusing on Northern Eurasia and its coastal zone
- **Links to International Projects:** CliC
- **Leaders:** Romanovsky, Hinzman, Walsh, Walker, Sergienko, Zheleznyak, Makshtas, Fukuda, Atkinson, Kofinas, Semiletov, Forbes
- **Current Science foci:**
 - Permafrost
 - Cold land hydrology and global biogeochemical cycles
 - Cryosphere interactions with climate, biota, and environment
 - Humans in the Arctic
- Funded and pending proposals to NSF, NOAA, NASA, JAMSTEC, JAXA, Far Eastern Branch of Russian Academy of Sciences, DOE, and ONR; 4 recognized IPY activities
- **Other relevant activities:**
 - ✓ The Focus Research Center is going to serve as one of the base institutions for CliC studies in Northern Eurasia and Alaska

Example of the NASA-NSF funded cluster of 10 NEESPI projects

- **PI:** Dennis Lettenmaier. *Diagnosis and Prognosis of Changes in Lake and Wetland Extent on the Regional Carbon Balance of Northern Eurasia*
- **PI:** Eric Wood. *An integrated understanding of the terrestrial water and energy cycles across the NEESPI domain through observations and modeling*
- **PI:** Charles Vörösmarty. *Role of land cover and land use change in hydrology of Eurasian Pan-Arctic*
- **PI:** Vladimir Romanovsky. *Permafrost dynamics within the Northern Eurasia region and related impacts on surface and sub-surface hydrology*
- **PI:** Eric Wood. *Collaborative Research: Understanding Change in the Climate and Hydrology of the Arctic Land Region: Synthesizing the Results of the ARCSS Fresh Water Initiative Projects*
- **PI:** Larry Hinzman. *Current climate changes over Eastern Siberia and their impact on permafrost landscapes, ecosystem dynamics, and hydrological regime*
- **PI:** Vladimir Romanovsky. *Thermal State of Permafrost (TSP): The U.S. contribution to the International Permafrost Observatory Network*
- **PI:** Dennis Lettenmaier. *Use of International Polar Year data to improve attribution of long-term hydrologic changes in Arctic Eurasian land areas*
- **PI:** Alexander Shiklomanov. *Study of Dam/Reservoir-Induced Hydrologic Changes in Large Siberian Watersheds: Regional Analysis to Pan-Arctic Synthesis*
- **PI:** Vladimir Romanovsky. *Development of a Network of Permafrost Observatories in North America and Russia: The US Contribution to the IPY*

Example of the NEESPI funded 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 Science and Data Support Centers

- **Within the United States**
- *For hydrometeorological information:*
- *National Climatic Data Center, Asheville, NC*
- *For remote sensing information:*
- *Goddard Space Flight Center, Greenbelt, MD*

Within the Russian Federation

- *For hydrometeorological information:*
- *Research Institute For Hydrometeorological Information, Obninsk, Kaluga Area*
- *For remote sensing information:*
- *SCANEX Corp., Moscow*

Within China with focus on East Asia

- *Beijing Climate Center*

Education within the NEESPI Science Plan Structure

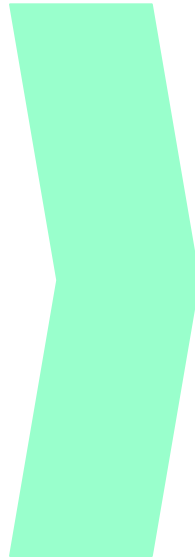
- The presence of an **education component has been and will be among the funding requirements** of *successful* NEESPI projects
- Additionally training will be implemented at all levels

Examples:

- GLOBE's International Plan
- Joint educational programs between Georgia Institute of Technology (USA) and Chinese Universities
- **Proposed international efforts to school a new generation of the Polar Researchers (in the framework of IPY)**
- AIMES plans to train young climate modelers

NEESPI TRANSITION FROM INDIVIDUAL STUDIES TO COORDINATED IMPLEMENTATION

Individual projects funded separately in response to research funding calls. They should reflect the needs listed in the science plan.



A coordinated set of research activities that are mutually supportive, receive centralized infrastructure support and are visible and effective as a “program.”

NEESPI HAS MANY ELEMENTS FOR COORDINATED IMPLEMENTATION.

[Center for Integration of the NEESPI Results and Modeling Studies](#)

(Planned)

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”.

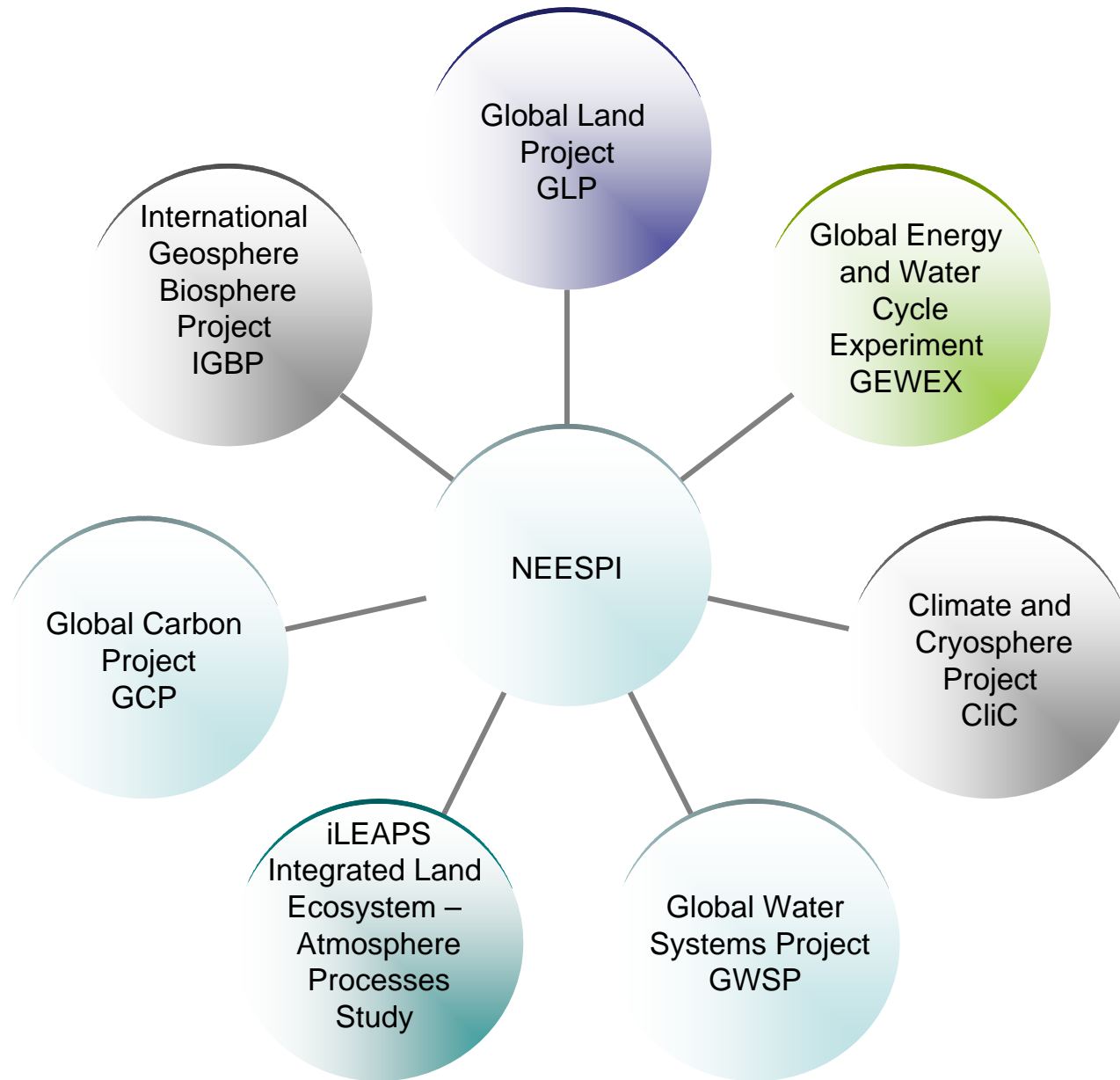
Rationale for NEESPI

- 1. Strong 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****
- 2. Strong climatic and environmental changes**
- 3. Strong societal impacts and feedbacks**
- 4. Lack of tools to address science questions**

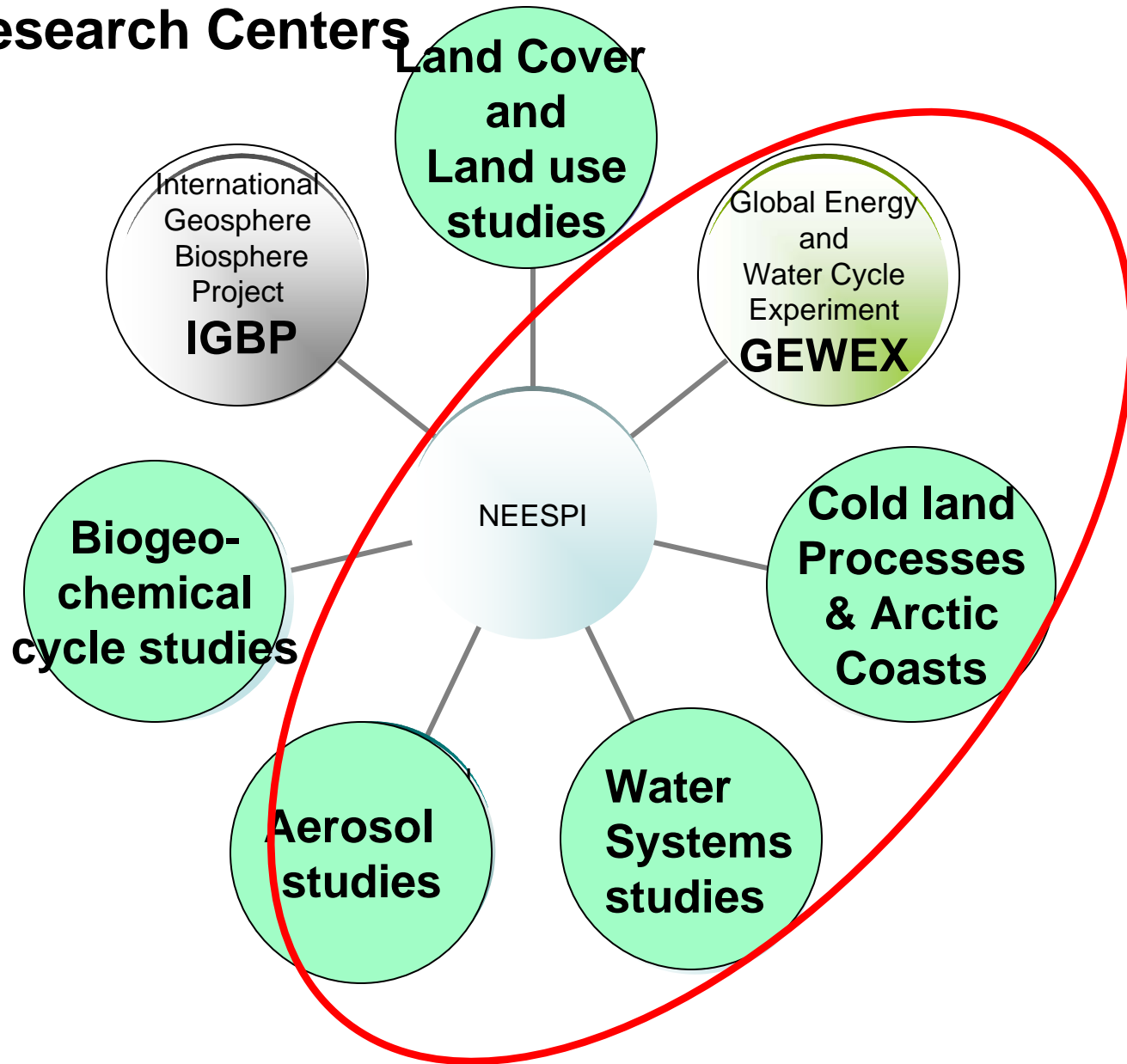
Overlaps of the NEESPI and GEWEX research topics. We just listed them. Going backwards:

- **Atmospheric aerosols**
- **Water cycle and its changes**
- **Surface energy cycle and its changes**
- **Other factors that strongly affect changes in energy and water cycles (human activity, changes in cryosphere and biosphere)**

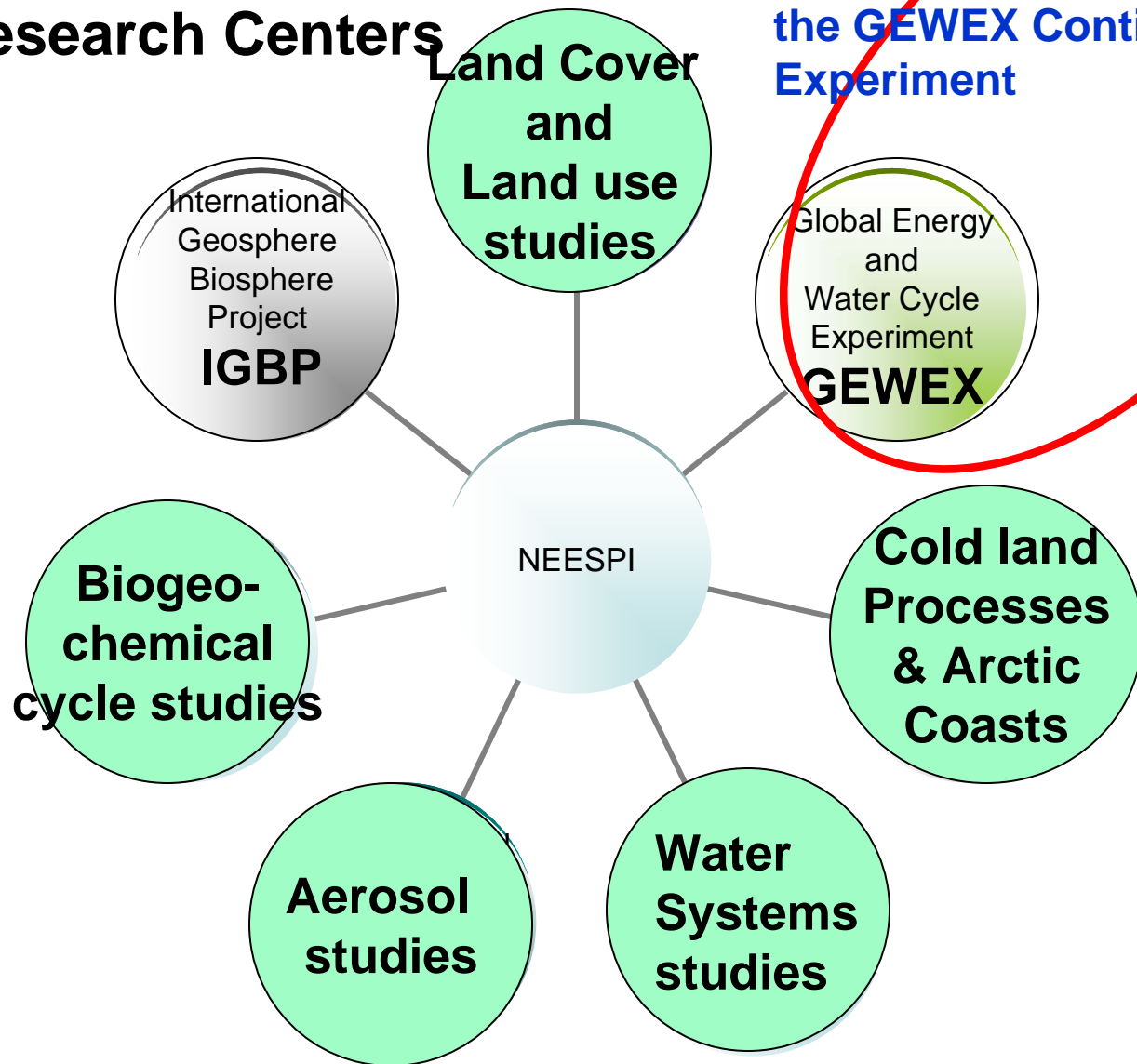
Links to ESSP Projects and Programs



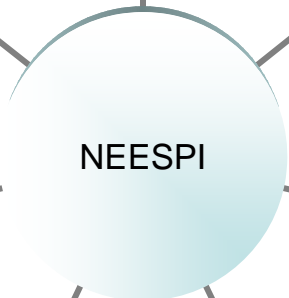
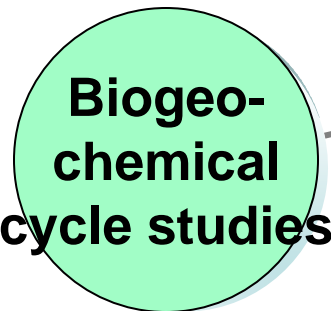
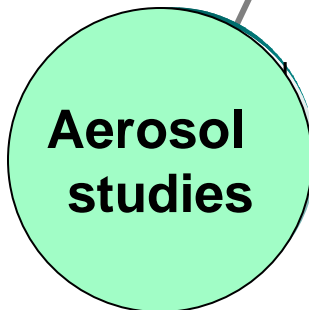
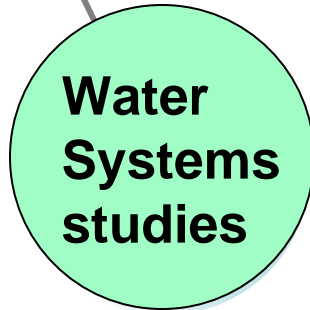
Relationships used for Coordination with NEESPI Focus Research Centers



Relationships used for Coordination with NEESPI Focus Research Centers



Proposal to GEWEX to become the GEWEX Continental-Scale Experiment



How GEWEX and NEESPI
activities can help each other?

Peculiarity of the region

- 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**

We expect that GEWEX Scientists may help...

GEWEX CSE Scientific Criteria:

- *Observe, simulate, and predict the diurnal, seasonal, annual and interannual cycles*
- *Determine climate system variability and critical feedbacks*
- *Demonstrate improvements in predictions of water-related climate parameters*
- *Demonstrate the applicability of techniques and models for other regions*
- *Assess the human impact on hydroclimate variations, including vulnerability to climate change*
- NEESPI research includes the same criteria. However, in order to “demonstrate” we have to develop something first. We intend to adapt and use seasoned models and techniques => we hope...

GEWEX CSE Technical Criteria:

- *Numerical Weather Prediction Center for provision of atmospheric and land surface data assimilation* [BCC, RCC-M]
- *Atmospheric-hydrological models for studying transferability and climate variability* [WRF, VIC, need regional reanalysis]
- *Mechanism for collecting and managing adequate hydrometeorological data sets* [5 NEESPI SDS Centers]
- *Participate in the open international exchange of scientific information and data* [NEESPI Data Policy]
- *Interaction with hydrological services and related groups*
- *Evaluation of GEWEX global data products* [mutually beneficial proposals should be written]
- *Contribution to CEOP in situ, remote sensing and model output databases* [collaboration already started; 2 tiers]

Summary: NEESPI has the scope, breadth of scientific endeavor, and the broad international involvement to be an effective Regional Continental Scale study within GEWEX

- **NEESPI** has a completed Science Plan and a wide range of pilot funded projects. This will be supplemented with an Implementation Plan that (among other issues) will show how NEESPI addresses specific issues of relevance to GEWEX
- **NEESPI** has a handful of recently funded projects focused on integration; NEESPI scientists published ~120 refereed papers in the past year (including 5 books)
- **NEESPI** has established Science Advisory Panel (1st Meeting was held in Feb. 2006); NEESPI Coordinating and Steering Committee (NCSC; Reps. of Funding Institutions and Agencies) met at the same time and the second meeting is scheduled in Helsinki in May 3-4, 2007
- **NEESPI** International Coordination Office in Europe is under construction

NEESPI and GEWEX

- **PROPOSED ACTION:**

- We propose that GEWEX formally recognize NEESPI as either (a) **a GEWEX/CEOP CSE** , or (b) a collaborator which will jointly plan field campaigns in Eurasia, direct the current and potential NEESPI participants' research towards the GEWEX goals, and participate in GEWEX meetings.
- **There are many areas for mutually beneficial collaborative studies between GEWEX and NEESPI** at regional (e.g., BALTEX, MAGS) and global scales (e.g., How change in the Arctic relates to changes in the global water and energy cycles
- **NEESPI has been endorsed by IGBP, GWSP, CliC, iLEAPS, GCP, and GLP**, represents an integrated Earth Science activity and has a potential to bring these ESSP Projects and GEWEX closer together
- **GEWEX has many types of expertise and products that could benefit NEESPI.** NEESPI is very open to collaboration with GEWEX scientists and the share NEESPI data for GEWEX studies.

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