

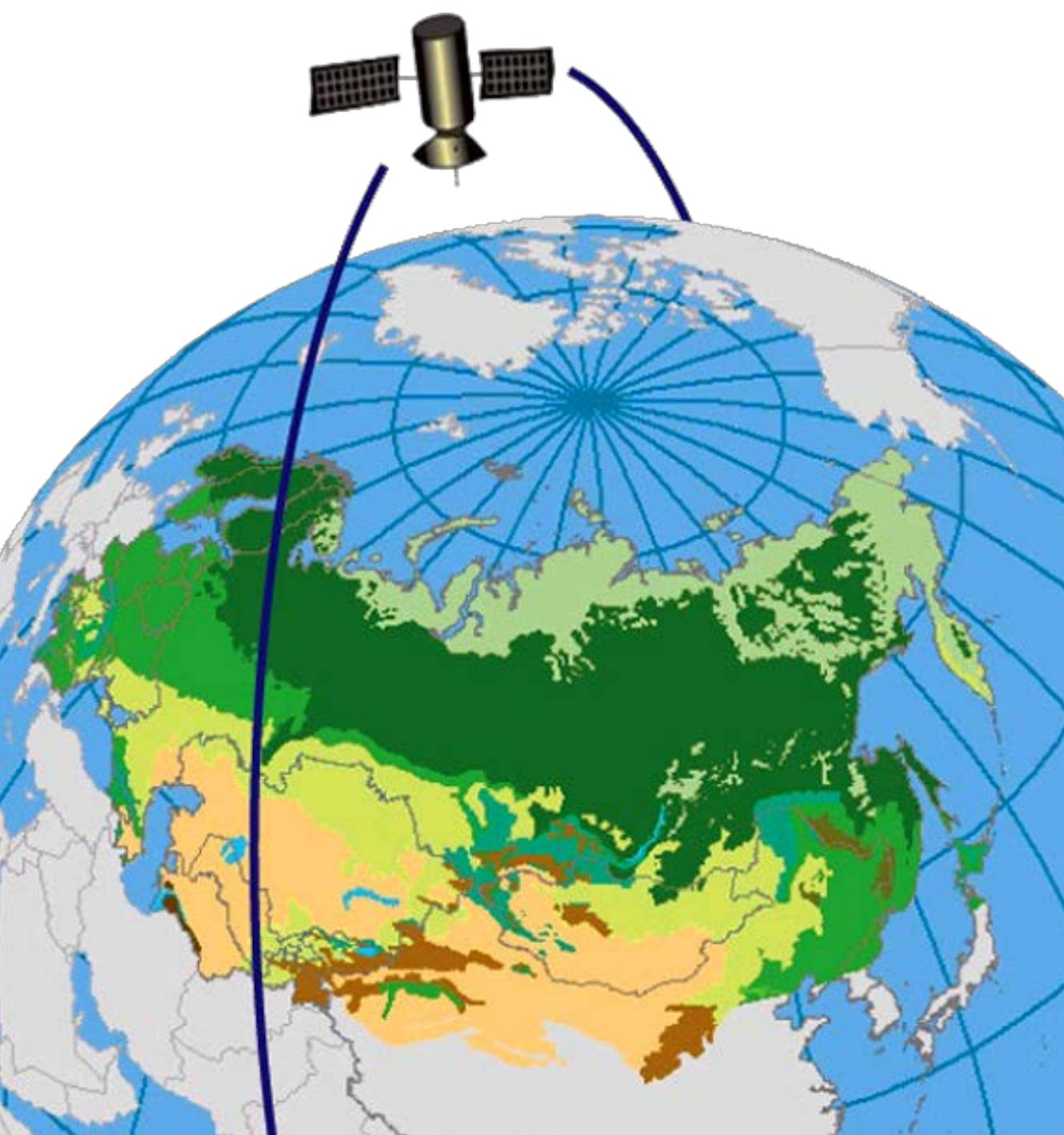


NASA – NEESPI RESEARCH UPDATE

**Transition from *Northern Eurasia
Earth Science Partnership
Initiative (NEESPI) to Future
Northern Eurasia***

Pavel Groisman

UCAR at NOAA National Climatic Data Center, Asheville, North Carolina



The NEESPI Study Area

<http://neespi.org>

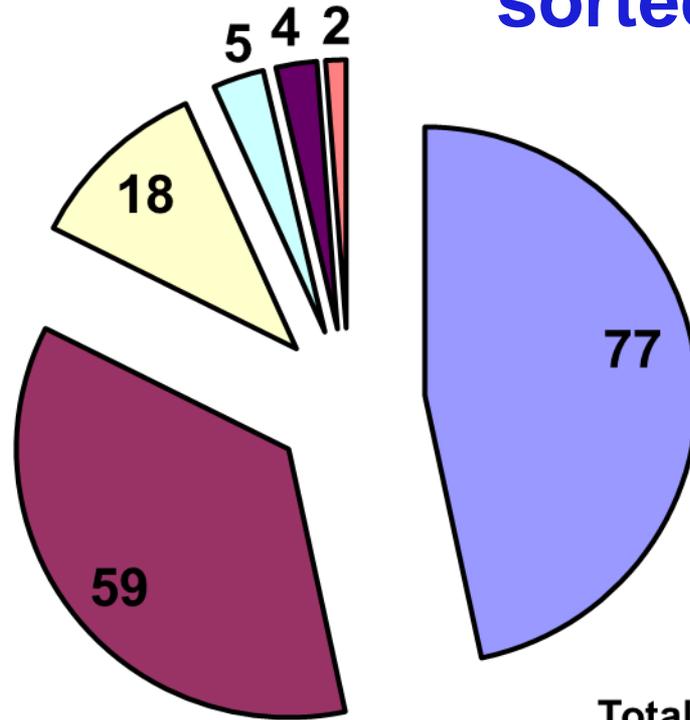
During the past 10 years, NEESPI has been an interdisciplinary program of internationally-supported Earth systems and science research that addresses large-scale and long-term manifestations of climate and environmental change.

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

NEESPI duration ~ 10-12 years (started in 2004)

Completed and ongoing NEESPI Projects by country (or group of countries), March 2014

sorted by funding source



Total 165 Projects

■ All US Agencies

■ All Russian Agencies

■ All EU Agencies

■ All Japanese Agencies

■ All Chinese Agencies

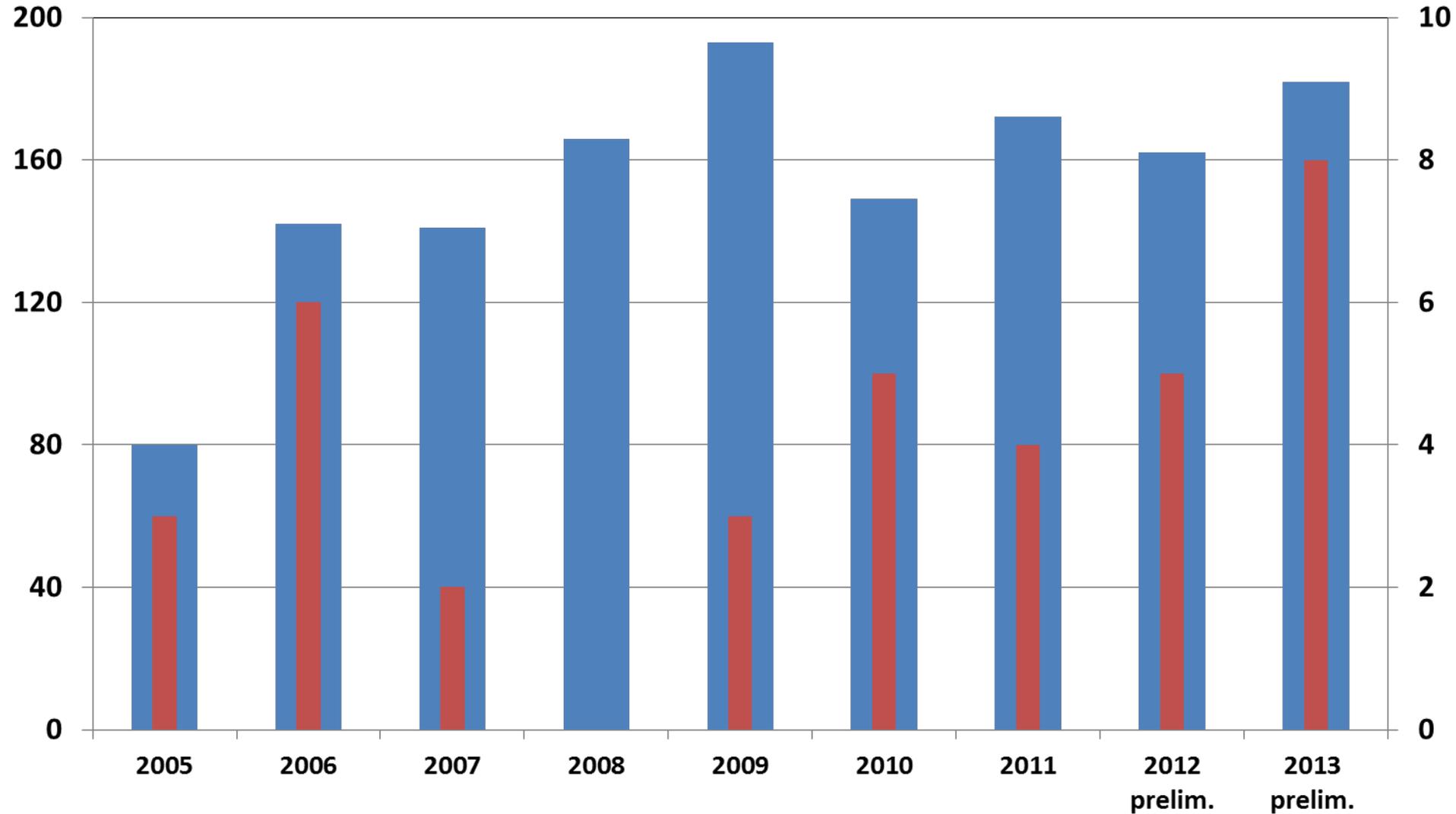
■ Canada

NEESPI publications by year

Papers

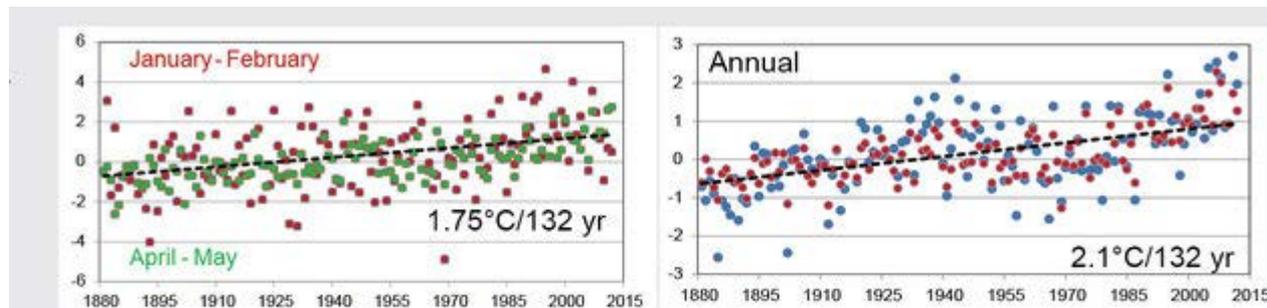
Peer-reviewed publications Books

Books

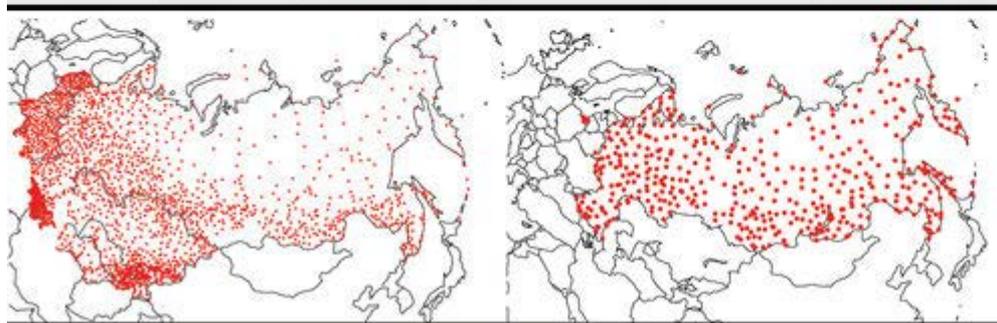


NEESPI's facilitating role has been in promoting international large-scale regional studies and framing the diverse individual projects into a 3-phase balanced Programme

- The first phase of NEESPI projects has focus on documenting, monitoring and analyses of climatic changes, biogeochemical cycles, land use, and land cover changes over Northern Eurasia

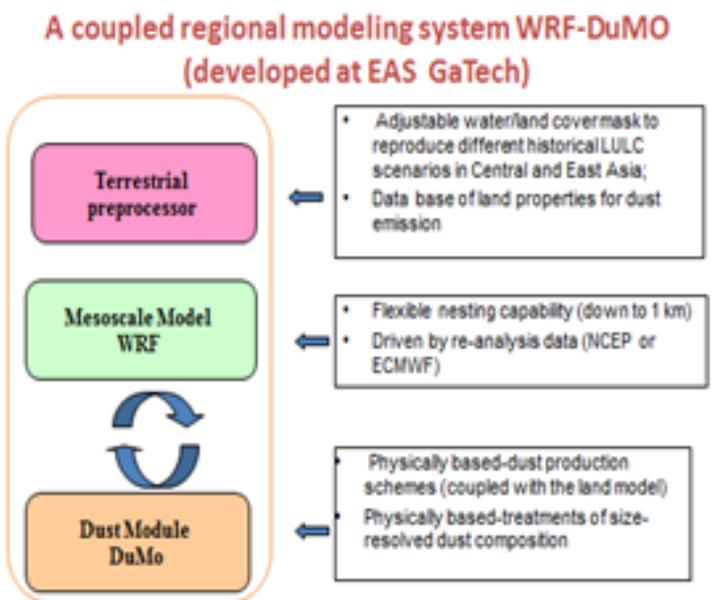


Surface air temperature anomalies area averaged over Eurasia north of 40°N (red and green dots) and north of 60°N (blue dots)

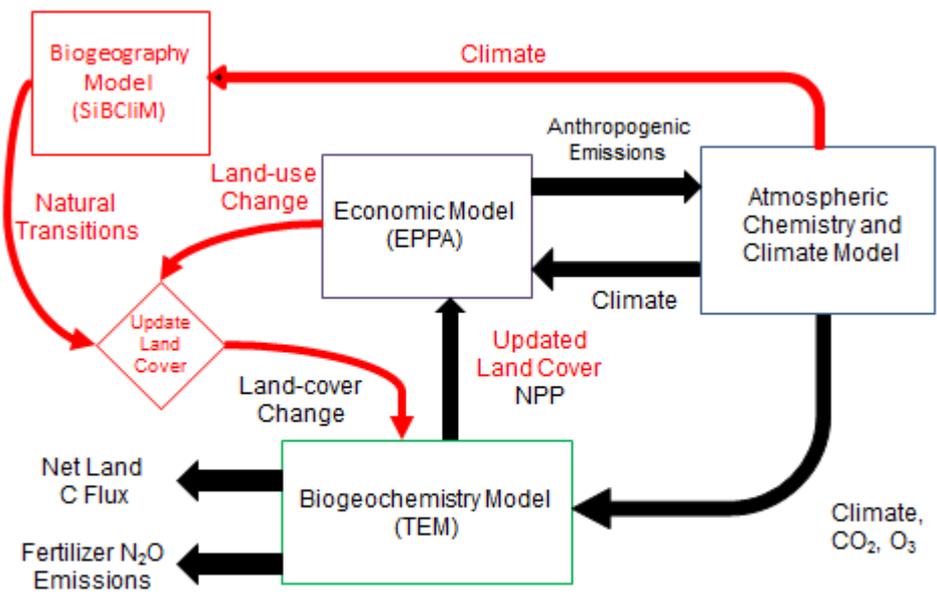


Synoptic datasets released for international research community by NOAA (2005) and Roshhydromet (2013)

- The second NEESPI phase (launched circa 2007) put forward environmental modeling with the major focus on blending regional climate, vegetation, carbon flux, permafrost, hydrological, and dust production models within a Northern Eurasia modeling suite to be linked to (embedded in) the state of the art Earth System models (cf., current and future publications of Qianlai Zhuang, Irina Sokolik, Alex Shiklomanov, Jiquan Chen and their Teammates).**



Darmenova et al. 2009



Kicklighter et al. 2014

The latest (present phase 3) NEESPI research foci consist from integrated assessments and projections and include a synergy of the knowledge gained from the analyses of the regional observational databases and from the development of and experimentation with regional Earth system modeling tools. In particular, in the last 3 years, four review books summarized knowledge of the regional Earth System status and dynamics.



Missing integration for Central Asia

- **We already have here:**
 - Several completed cryospheric studies (NASA, RAS, NGDC, St. Petersburg University, CAS)
 - Water management research (RAS, NASA, German Agencies)
 - Ongoing studies on dust storms in the context of global change (GaTech)
 - Ongoing Aral Sea field studies (RAS)
 - Strong regional collaborators.
- **Now it is a time to launch international integrative efforts**

TWO TYPES OF INTEGRATION PROJECTS

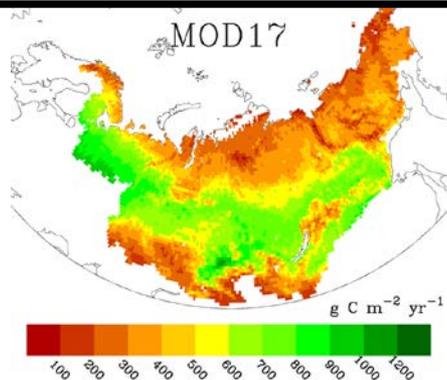
1. Summarize all what is known
2. Create tools that allow to use these summations now and for the future

Synthesis and Integration of Recent Research Characterizing the Carbon Cycle of Northern Eurasia

NASA Carbon Cycle Science - NNX11AR16G

Science Questions and Objectives of Study

- What is the magnitude of CO₂ and CH₄ fluxes from the land surface, including soils, wetlands and lakes, over seasonal and annual timescales. Which areas are sources and which are sinks?
- How will terrestrial ecosystems in Northern Eurasia respond to continued warming, and what are the dominant processes likely to affect future spatial and temporal carbon cycle dynamics?
- Can models which assimilate remote sensing and flux tower data accurately predict carbon spatio-temporal dynamics, from local scales to large region estimates?

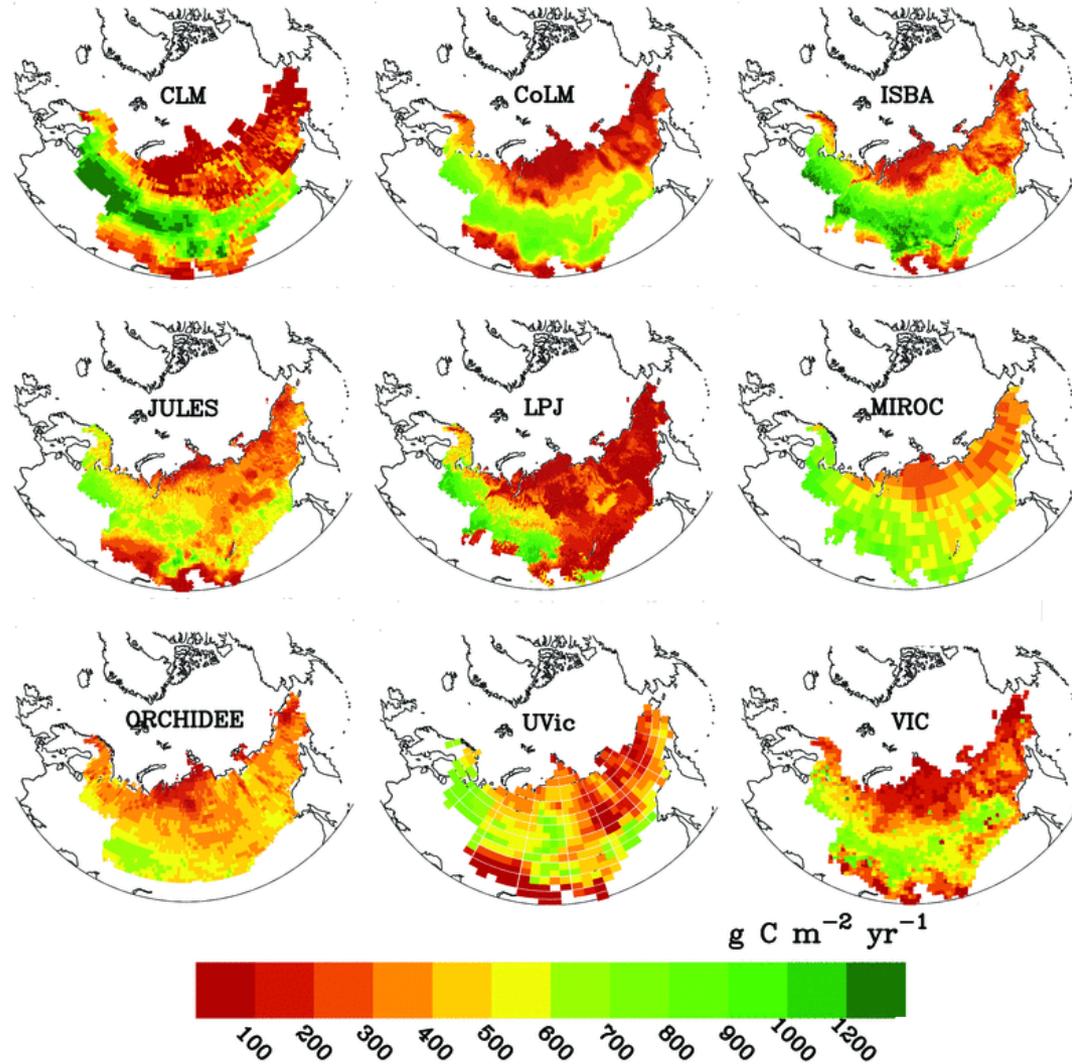


Benchmark

MODIS MOD17, 2000-2012

Michael A. Rawlins, PI, U of Massachusetts
Dennis P. Lettenmaier, Co-I, U of Washington
Kyle C. McDonald, Co-I, City College of New York

Annual Gross Primary Productivity, 1960-2009 Land Surface Models – N. Eurasia Arctic Drainage Basin



Rawlins et al., in prep

New generation of NASA LCLUC Projects

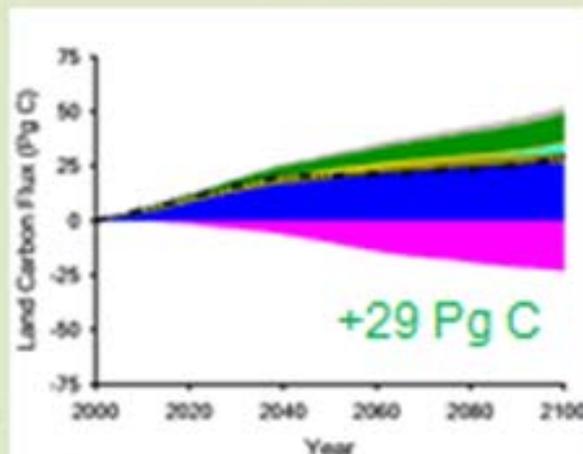
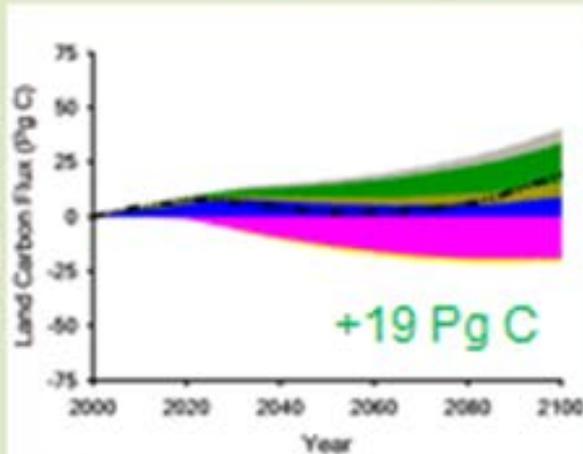
- **Jiquan Chen/University of Toledo.** **LCLUC Synthesis:** Ecosystem-Society Interactions on a Changing Mongolian Plateau
- **Irina Sokolik/Georgia Institute of Technology.** **Multiscale Synthesis** of Land Cover and Land Use, Climatic and Societal Changes in Drylands of Central Asia
- **Skip Walker/University of Alaska, Fairbanks.** **Yamal LCLUC Synthesis:** A Synthesis of Remote-Sensing Studies, Ground Observations and Modeling to Understand the Social-Ecological Consequences of Climate Change and Resource Development on the Yamal Peninsula, Russia and Relevance to the Circumpolar Arctic
- **Qianlai Zhuang/Purdue University.** Regional and Global Climate and Societal Impacts of Land-Use and Land-Cover Change in Northern Eurasia: A **Synthesis Study** Using Remote Sensing Data and An Integrated Global System Model

Net Land Carbon Fluxes in Northern Eurasia

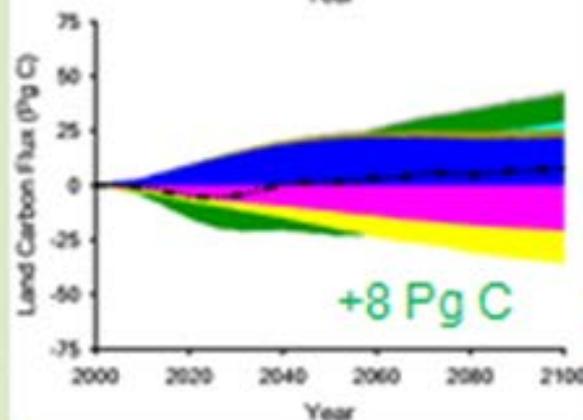
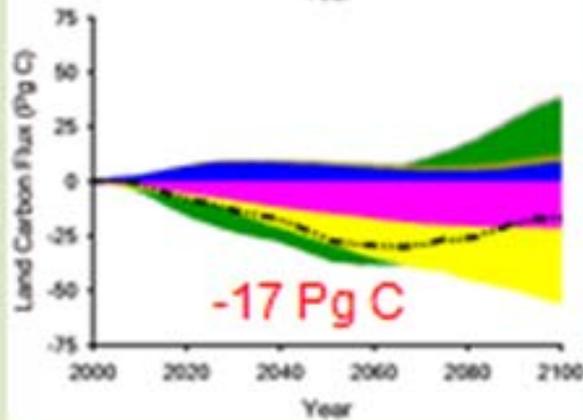
No Policy

Policy

No
Veg
Shifts



Veg
Shifts



Positive – C sequestered

Negative – C lost

Kicklighter et al. 2014 (*ERL*)

Future Plans

- Focus on our ability to project (i.e., on Modeling)
- Further Integrative Studies (e.g., on *Central Asia and Mongolian Plateau*)
- Data and Research Results Dissemination
- Outreach focused on early career scientists
- Strengthen links with *Baltic Earth and Future Earth in Asia*
- Large NEESPI Conference in May 2015 (*tentatively, in Prague, Czech Republic*) that will summarize the 12 years of NEESPI studies and launch the preparation of the following-up overview book
- Development of the *Future Northern Eurasia Program* that will be built upon NEESPI

Major NEESPI Science question remains intact:

- How do Northern Eurasia's terrestrial ecosystems dynamics interact with and alter the biosphere, atmosphere, and hydrosphere of the Earth?**

But it is the time to expand this academic curiosity question “**how?**” to another, more practical:

- What will the changes in this ecosystems dynamics and interactions mean for the societal well-being, activities, health, and strategic planning?**

Ten Research Foci emerged in discussions within the NEESPI community during the past 12 months making the following list:

Group 1

1. Global change and, in particular, **warming of the Arctic**
2. Increasing frequency and intensity of **extremes** (intense rains, floods, droughts, and wild fires)
3. Retreat of the **cryosphere**: snow cover, sea and ground ice
4. Changes in the terrestrial water cycle; quantity and quality of **water supply** available for societal needs)
5. Biosphere changes (**ecosystem shifts**; changes in the carbon cycle; land cover, desertification and dust storms)

Continuation of the list

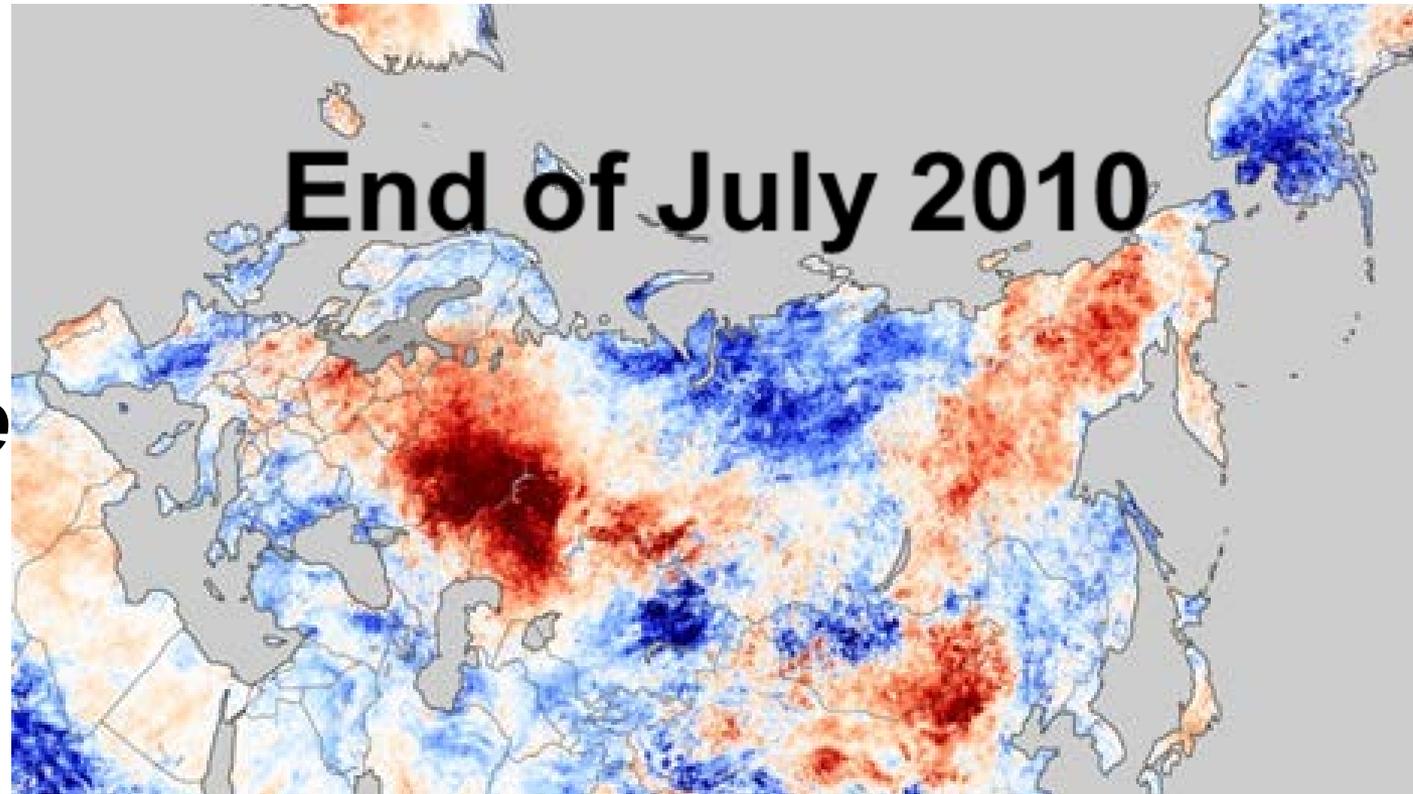
Group 2

6. Pressure on agriculture and pastoral production (growing supply demand, changes in land use; food security)
7. Changes in infrastructure (roads; new routes; construction codes; air, water, and soil pollution; strategic planning)
8. Societal actions to mitigate negative and benefit from positive consequences of environmental changes
9. Assessment / Quantification of the role of Northern Eurasia in the global Earth and Socioeconomic systems

Group 3

10. Using newly available advanced research tools
 - (a) Observations (e.g., GPM)
 - (b) Models (e.g., new ESMs)

a. Focus on extremes:
**Mechanisms of extremes in
changing climate and environment**



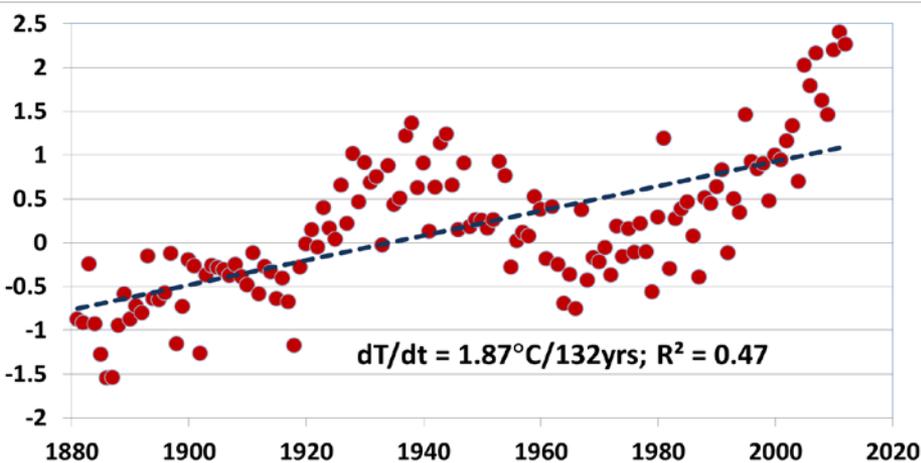
**Tempera-
ture
Anomalies**

Northern Eurasian Heat Waves and Droughts

Siegfried D. Schubert, Hailan Wang, Randal D. Koster, Max J. Suarez, and Pavel Ya. Groisman
J. Climate, May 2014, Vol. 27, No. 9 : pp. 3169-3207(doi: 10.1175/JCLI-D-13-00360.1)

b. Global impact of the Arctic warming:

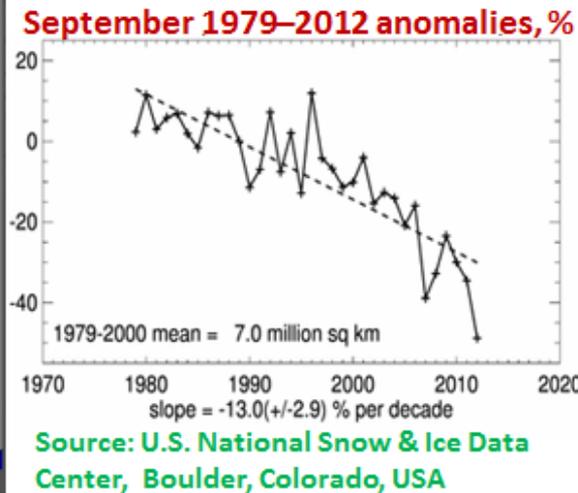
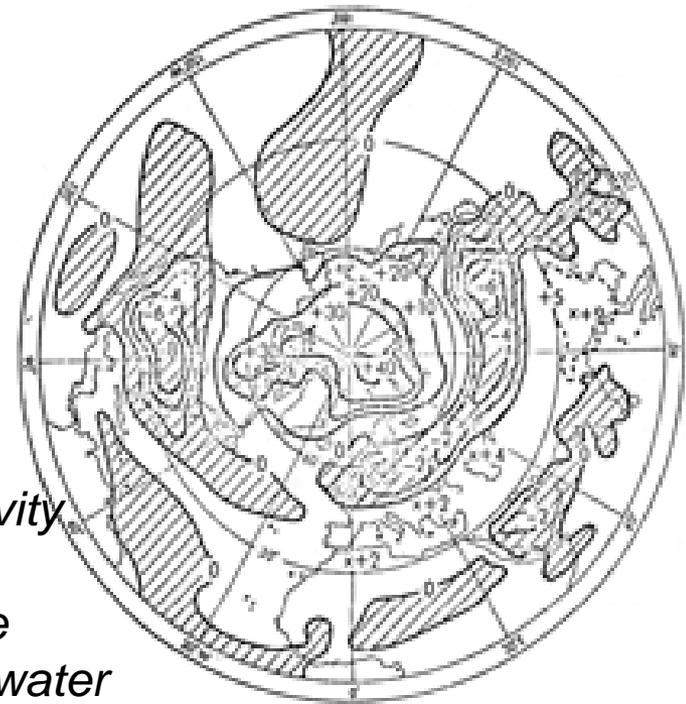
Annual surface air temperature anomalies area-averaged over the 60°N - 90°N latitudinal zone



Northern Hemisphere sea ice extent as of mid-September 2012 and September sea ice extent anomalies, %



One of the first UCMO GCM sensitivity experiments with polar ice replaced by water at 0°C. Changes in January surface air temperature, °C (Newson 1973).



Condensed set of science foci for regional projects that will succeed

NEESPI

- a. Mechanisms of extremes in changing climate and environment**
- b. Global impact of the Arctic warming**
- c. Changing carbon cycle and land cover due to a. & b.**
- d. Global food, water, environment security due to a, b, & c**
- e. Societal feedbacks to detrimental changes (adaptation & mitigation)**
- f. Active use of new research tools**

FOR MORE INFORMATION SEE THE NEESPI WEB SITE:

<http://neespi.org>



(COURTESY PHC)



Side Note:
*“NEESPI” is pronounced
approximately like the
Russian phrase for
“Don’t sleep”*

Northern Eurasia Earth Science Partnership Initiative

谢谢!

Thank you!

Спасибо!