NEESPI GHP Annual Project Report to the

Joint Meeting of the GEWEX Hydroclimatology (GHP) and Global Drought Information System *(GDIS) Panels (Pasadena, California, 10-13 September 2014).*

Northern Eurasia Earth Science Partnership Initiative (NEESPI)
Reporting Period: October 2013 – November 2014
Starting date: 2004
End date: 2015
URL:http://neespi.org
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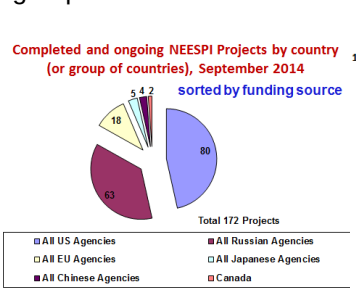
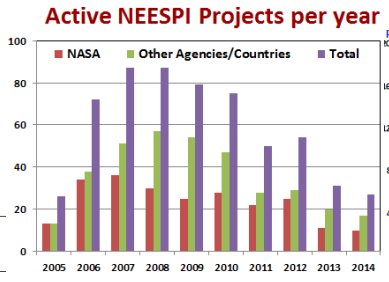
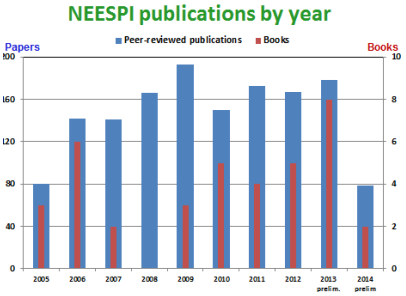
Project abstract:

- The premise - Northern Eurasia is a sensitive and rapidly changing area with the signal of climate change effects already observed in many components of the Earth's system. Space-based remote sensing provides unique information over this vast region. Additionally, this region of the globe experienced a shock impact of the abrupt institutional and economic changes due to the breakup of the Soviet Union.
- NEESPI Concept. We are living in the epoch of large changes in Climate, Environment, and Human Activities. All these changes now have become intertwined and affect each other => They have to be studied in a synergetic manner.
- **The goal – to study on climate-ecosystem interactions and societal impacts in boreal and non-boreal zones of Northern Eurasia. It's an international program involving 30 countries and more than 200 institutions. Over 800 scientists worked or are working under the NEESP Initiative umbrella.**
- Implementation - the NEESPI was implemented by developing international teams of scientists, reaching out to regional scientists to build partnerships and combine local data/knowledge with US, European, and Japanese science. Moreover, at NASA and RAS the implementation was done by soliciting research in US and Russia respectively and expanding international support by obtaining recognition/sponsorship from ongoing programs such as IGBP and WCRP. In the past 10 years, at each AGU and (recently at JpGU) Annual Meetings and EGU Assembly, NEESPI sessions have been organized. After the First NEESPII Science Team Meeting (IIASA, Laxenburg, Austria, February 2006), more than 30 dedicated NEESPI Workshops and 22 NEESPI Open Science Sessions at the International Meetings were convened. Two or more Early Career Scientists Summer Schools per year were organized in the past seven years (since 2009). During the Initiative life, more than 1470 papers and 38 books were published or are in press (http://neespi.org/science/NEESPI_publications.pdf). In particular, since 2010, about 745 peer-reviewed papers and/or book chapters were published or are in press. More than 80 PhD students defended their theses while working within the NEESPI framework. NEESPI has been an important element in the bi-lateral US-Russia group on climate.







- The future - NEESPI is in its concluding stage as a focused activity. The legacy of the program is in its established connections, ongoing synthesis of the previous studies and a new generation of scientists that came out from the NEESPI projects. Thirty eight books and over 1470 peer-review articles have been published and four more synthesis books are in preparation. Transition from NEESPI to Northern Eurasia's Future Initiative (NIFI) with a new Science Plan Preparation is planned.

1) Project activities over the last year

- **Science highlights:**

- Most of the PhDs degrees mentioned above were defended during the past 3-4 years.
- In the last year*, two overview* books and a dedicated journal issue (*Environ. Res. Lett*., 32 published articles).
- Currently, 27 NEESPI projects are active, including 10 projects that joined the Initiative in the past 12 months (typical duration of individual project within the Initiative is 3 years).

- **Scientific achievements and ongoing research issues:**

1. Integration of field observations, remote sensing products, and hydrological and permafrost modeling provided estimates of contemporary regional methane and CO_2 fluxes, their future projections under different scenarios of climatic change and land use
2. Modeling the carbon dynamics of the Eurasian Boreal Forest, tundra, and steppe zones
3. Field studies of land cover, land use, and energy and water budgets dynamics over the circumpolar boreal zone and Eurasian dry lands provided reliable ground-based test sites for remote sensing products
4. Integration of in situ observations, remote sensing products, and aerosol dynamics modeling provide projections of regional and inter-continental dust storm propagation and tools for mitigation of these natural disasters
5. Studies of the relationships between weather, extreme fire events, and fire-induced land cover change in Siberia provided (a) satellite-based wildfire monitoring system, (b) understanding of processes that control fire regime and land cover dynamics, and (c) projections of future land cover development in interaction with forest
6. Studies of the processes, and predictability of changes in the hydrological cycle of the Northern Extratropics with focus on extremes and cryospheric decay
7. Large-scale socio-economic changes in Northern Eurasia in the past two decades were studied in particular in relationship to changes in land and water use (land abandonment and overexploitation, pollution, desertification, poor management of water resources) and degradation of social infrastructure
8. Contemporary topical and regional informational data bases were created in the United States, Germany, Russia, and China
9. Infrastructure Projects: International Research Labs on Hydrology and Agroecology

- **New projects/activities put in place last year**

The following nine projects which are in support of the NEESPI Science Plan, were launched during the past 12 months with duration for three years:

1. Evaluating critical thresholds of climate change impacting major regional environmental systems in Russia for developing adaptation strategies. PI: Oleg Anisimov, Russia

2. The development of ecosystem spatial-temporal thermodynamics theory and methods of thermodynamic variables measurement. PI: Yuriy Puzachenko, Russia

3. 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. PI: Qianlai Zhuang, USA

4. LCLUC Synthesis: Ecosystem-Society Interactions on a Changing Mongolian Plateau. PIs: Jiquan Chen and Daniel G. Brown, USA

5. Combining remote sensing and field studies for assessment of landform dynamics and permafrost state on Yamal. PIs:Annett Bartsch, Austria and Marina Leibman, Russia

6. Creation of Laboratory of Agroecological Monitoring and Ecosystem Projecting, "LAMP". PIs:Riccardo Valentini, Italy and Ivan Vasenev, Russia

7. Understanding the linkages between climate, land use, and land degradation in Central Asia. PI: Irina Sokolik, USA

8. How Environmental Change in Central Asian Highlands Impacts High Elevation Communities. PI:Geoff Henebry, USA

9. Arctic climate change and its impact on environment, infrastructures and resource availability. PI: Peter Koltermann, Germany/Russia

10. Title tentative "Carbon cycle in the Russian Arctic". PI: Igor Semiletov, Russia/USA

- **Workshops and meetings (Open Science Sessions) held /organized in the past 12 months:**

1. September 14-20, 2014, Kislovodsk, Russia. All-Russia Early Career Scientists *Conference and School*
2. June 18 - 22, 2014, Ulaan-Baatar, Mongolia. *Mongolian Synthesis Workshop*.
3. June 28 – July 5, 2014, Tomsk, Russia. International Conference and Early Career Scientists School on Environmental Observations, Modeling and Information Systems "*ENVIROMIS-2014 Event*"
4. April 25-May 2, 2014, Vienna, Austria. European Geosciences Union General Assembly. Special NEESPI Session BG5.1; "*Environmental, socio-economic and climatic changes in Northern Eurasia and their feedbacks to the Global Earth System*"
5. April 7-10, 2014, Beijing, China. MAIRS Open Science Meeting Future Earth in Asia. Two Special NEESPI Sessions: *Future Earth in Northern Asia*.
6. December 9-13, 2013, San Francisco, California. American Geophysical Union Annual Fall Meeting. NEESPI Open Science Session: *Environmental, Socio-economic and Climatic Changes in Northern Eurasia and their Feedbacks to the Global Earth System*.

Additionally, NEESPI scientists participated in the NASA Land Cover and Land Use Change Program Science Team Meeting, USA, GEWEX Open Science Conference, The Netherlands, as well as to several other international meeting and workshops.

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- Issues that GHP needs to consider or for which advice is sought
  - Assistance in our transition efforts from NEESPI to Northern Eurasia's Future Initiative (NIFI) is sought.

2) Planed Panel activities for next year

- ***Planned new scientific activities:***

- Organizing of the *International Distributed Research Labs* focused on key science questions to study in Northern Eurasia will continue.

- Papers to the ongoing *Environ. Res. Lett*. Special NEESPI Issue are still being accepted for the next few months.

- Transition from NEESPI to Northern Eurasia's Future Initiative (NIFI) with a new Science Plan Preparation and re-establishing relationships with international Science Institutions

- ***Planned workshops or meetings***

1. December 15-19, 2014, San Francisco, USA. Open NEESPI Session at the Annual Fall AGU Meeting (deadline passed; 41 abstracts submitted)
2. April 9-12, 2015, Charles University in Prague, Czech Republic, Workshop "Ten years of Northern Eurasia Earth Science Partnership Initiative (NEESPI): Synthesis and Future Plans"
3. April 13- 19, 2014, Vienna, Austria. Open NEESPI Session at the Annual EGU Assembly
4. July dates TBD, 2014, Novosibirsk, Russia. CITES Educational Scientific Event and Science Conference
5. December, 2015, San Francisco, USA. Open NEESPI/NIFI Session at the Annual Fall AGU Meeting.

Foreseen risks for the project activities next year and which mitigation strategies are in place.

- Governmental induced restrictions on collaboration (e.g., travel support for guest scientists, NASA collaboration with *Chinese and Russian Institutions*)
- Visa hardships (fees, waiting time, unexpected and unexplained rejections)

The only feasible mitigation strategy we have in place is a diversification of support for key (prioritized) research directions

3) Contributions to the GEWEX Science Questions

- GSQ1: Observations and Predictions of Precipitation
  - Updated bias-corrected precipitation data set for the former USSR was prepared;
  - International Lab. for Studying the Hydrological Cycle in the Northern Extratropics was established in Moscow, Russia.
- GSQ3: Changes in Extremes
  - Several papers on precipitation extremes and droughts were published;
  - Further work is planned to assess and project extreme events (dry and wet spells, floods, droughts, forest fires, *and* dust storms) in the NEESPI domain.
- GSQ4: Water and energy cycles
  - Several studies on regional (continental) water, energy, and carbon cycles, have been conducted, are planned, published and/or submitted for publication.

4) Activities contributing to the WCRP Grand Challenges as identified by the JSC

Improved understanding of the interactions of clouds, aerosols, precipitation, and radiation and their contributions to climate sensitivity

- Muskett, R. 2014: MODIS-Derived Nighttime Arctic Land-Surface Temperature Nascent Trends and Non-Stationary Changes. *American Journal of Climate Change*, **3**, 169-177, 2014. doi: 10.4236/ajcc.2014.32016.
- Muskett, R. 2014: Arctic Diurnal Land-Surface Temperature Range Changes Derived by NASA MODIS-Terra and -Aqua 2000 through 2012. Atmos. and Climate Sci, **4**, 231-240, 2014. doi: 10.4236/acs.2014.42026.

Cryosphere response to climate change (including ice sheets, water resources, permafrost and carbon)

- Groisman, P.Ya., E.G. Bogdanova, V.A. Alexeev, J.E. Cherry, and O.N. Bulygina, 2014: Impact of snowfall measurement deficiencies on quantification of precipitation and its trends over Northern Eurasia. *Ice and Snow,* **2 (126**), 29-43.
- Shiklomanov, A. I. and R. B. Lammers, 2014: River ice responses to a warming Arctic – recent evidence from Russian rivers. *Env. Res. Lett*., **9**, 035008

Science underpinning the prediction and attribution of extreme events

- Krichak S.O, J. Barkan, J.S.Breitgand, S. Gualdi, and, S.B. Feldstein 2014: Role of the export of tropical moisture into midlatitudes for extreme precipitation events in the Mediterranean region. *Theor. Appl. Climatol.,* doi: 10.1007/s00704-014-1244-6.)
- Schubert, S., H. Wang, R. Koster, M. Suarez, and P. Groisman, 2014: Northern Eurasian Heat Waves and Droughts. *J. Climate,* 27, No. 9, 3169-3207. doi: 10.1175/JCLI-D-13-00360.1
- Zolina, O.G., C. Simmer, A. Kapala, P. Shabanov, P. Becker, H. Mȁchel, S. K. Gulev, and P.Ya. Groisman, 2014: Precipitation variability and extremes in Central Europe: New view from STAMMEX Results. *Bull. Amer. Meteorol. Soc.***95***,* 995-1002 (doi: 10.1175/BAMS-D-12-00134.1).

Provision of skillful future climate information on regional scales (includes decadal and polar predictability)

- Shkolnik, I.M. and S.V. Efimov, 2013: Cyclonic activity in high latitudes as simulated by a regional atmospheric climate model: added value and uncertainties. *Environ. Res. Lett.* **8** 045007 (12pp) doi:10.1088/1748-9326/8/4/045007.
- Kicklighter, D. W., Y. Cai, Q. Zhuang, E. I. Parfenova, S. Paltsev, A. P. Sokolov, J. M. Melillo, J. M. Reilly, N. M. Tchebakova and X. Lu . 2014. Potential influence of climate-induced vegetation shifts on future land use and associated land carbon fluxes in Northern Eurasia. *Environ. Res. Lett*, **9**, 035004,

Past and future changes in water availability (with connections to water security and hydrological cycle)

- Liu Y., Q. Zhuang, Z. Pan, N. Tchebakova, D.Kicklighter, D.Miralles, J. Chen, A. Sirin, Y. He, J. Melillo. 2014: Responses of evapotranspiration and water availability to the changing climate in Northern Eurasia 2014. *Climatic Change* DOI 10.1007/s10584-014-1234-9
- Corobov R., Trombitsky I., Syrodoev G., Andreev A., 2014: *Climate change vulnerability: Moldavian Part of the Dniester River basin.* Eco-Tiras, Chisinau, 336 pp. (in Russian).
- Georgiadi A.G., Koronkevich N.I., Milyukova I.P., Kashutina E.A., Barabanova E.A.: 2014: *Contemporary and scenario runoff in the largest Russian rivers. Part 2. Volga and Don River basins*. Moscow, Maks Press. 214 pp.
- Georgiadi A.G., Koronkevich N.I., Milyukova I.P., Barabanova E.A., 2014:.The ensemble scenarios projecting runoff changes in large Russian river basins in the 21st century. In*: Evolving Water Resources Systems: Understanding, Predicting and Managing Water–Society Interactions*. Proceedings of ICWRS 2014, Bologna, Italy, June 2014. *IAHS Pub*l. **364**, 2014, p. 210-215.
- Partasenok, I.S., P. Ya. Groisman, R.S. Chekan, and V. I. Melnik, 2014: Winter cyclone frequency and following freshet streamflow formation on the rivers in Belarus. *Environ. Res. Lett.*, **9**, 09005 (13 pp). doi:10.1088/1748-9326/9/9/095005 *Environ. Res. Lett.* **9** (2014) 109602 (2 pp) doi:10.1088/1748-9326/9/10/109602

5) Cooperation with other GHP and WCRP projects (CLIVAR, CliC, SPARC), outside bodies (e.g., IGBP) and links to applications

- NEESPI scientists are closely involved in informal collaboration with BALTEX (now, *Baltic Earth*) and MAIRS (now, *Future Earth in Asia*) joint workshops and publications.
- Studies conducted in the NEESPI domain on extremes contributed and will continue to contribute to the WCRP cross-cutting project on extremes and anticipated cross-cutting projects on Sub-daily precipitation Intensity and Precipitation near °C.

6) List of key publications

- Publications related to NEESPI activities in 2014 are still being collected. Meanwhile in 2013, 179 peer-reviewed papers, books, and book chapters were published and in 2014, *according to an incomplete account*, 57 were published another 22 are in press or submitted. Their list is presented at http://neespi.org/science/NEESPI_publications.pdf. Below we list additionally a brief EOS overview report about the Initiative and a representative subset of publications that characterize research made within the NEESPI community in 2014.

- Groisman, P., S. Gulev, and Sh. Maksyutov, 2014: Earth System Studies in Northern Eurasia, *EOS*, **95**, No. 16, 133-135, 22 April 2014.
- Kicklighter, D. W., Y. Cai, Q. Zhuang, E. I. Parfenova, S. Paltsev, A. P. Sokolov, J. M. Melillo, J. M. Reilly, N. M. Tchebakova and X. Lu . 2014. Potential influence of climate-induced vegetation shifts on future land use and associated land carbon fluxes in Northern Eurasia. *Environ. Res. Lett,* **9**, 035004,
- Kukavskaya E.A., Ivanova G.A., Conard S.G., McRae D.J., Ivanov V.A. 2014: Biomass dynamics of central Siberian Scots pine forests following surface fires of varying severity. *International Journal of Wildland Fire*. **23** (6). 872-886. DOI: 10.1071/WF13043.
- Kuemmerle, T., L. Baskin, P. Leitao, A. Prishchepov, K. Thonicke, and V. C. Radeloff. 2014: Potential impact of oil and gas development and climate change on migratory reindeer calving grounds across the Russian Arctic. *Diversity and Distributions,* **20**(4): 416-429
- Liu Y., Q. Zhuang, Z. Pan, N. Tchebakova, D.Kicklighter, D.Miralles, J. Chen, A. Sirin, Y. He, J. Melillo. 2014: Responses of evapotranspiration and water availability to the changing climate in Northern Eurasia 2014. *Climatic Change* DOI 10.1007/s10584-014-1234-9
- Majorowicz J., Safanda J., Przybylak R., 2014, The Little Ice Age signature and subsequent warming seen in borehole temperature logs versus solar forcing model, *International Journal of Earth Sciences* (Geol Rundsch), 1163-1173, DOI 10.1007/s00531-014-1008-7.
- Muskett, R. 2014: MODIS-Derived Nighttime Arctic Land-Surface Temperature Nascent Trends and Non-Stationary Changes. *American Journal of Climate Change*, **3**, 169-177, 2014. doi: 10.4236/ajcc.2014.32016.