Cold land processes in the Northern Hemisphere continents and their coastal zones: regional and global climate and societal-ecosystem linkages and Interactions (*IPY 138*).

1. General questions.

What are the critical questions that need to be addressed within the NEESPI framework regarding cold land processes?

- Their dynamics

What are the criteria for determining if a cold land surface process is important for NEESPI?

- Importance to society
- Availability of appropriate expertise and data

What cold land processes need to be considered and what is the relative importance of each of them?

- Permafrost thaw
- Snow cover changes
- Glaciers' retreat
- Vegetation changes
  - Sublimation and evaporation
  - Runoff generation
  - Soil Moisture
  - Land-atmosphere interactions
  - Biogeochemical fluxes
  - Coastal processes

2. What do we need to provide in terms of knowledge and data products?

a) By the end of this phase of NEESPI (2015)?

i) Estimates and syntheses related to land use and global changes in terms of impacts on:

- permafrost temperature and stability and the active layer processes,
- hydrological cycle and the surface water regime,
- changes in the arable land,
- water resource management decisions due to glacier reductions, changing water use patterns, changing seasonality, etc.
- coastal changes due to thermal erosion and marine ice reduction
- condition, productivity, and dynamics of vegetation
- forest composition and wildlife habitat.

ii) new understanding of:

- feedbacks to the global earth system
- the role of natural geomorphological processes in changing landscapes,
- the role of anthropogenic and natural disturbances (e.g., fire) on the ground thermal regime and the stability of permafrost affected regions,
- the integrated surface/subsurface hydrological system,
- the role of vegetation, soil, and land use on the hydrologic cycle,
- the net impact of thawing permafrost on the carbon cycle,

- the role of regional models in integrating processes,
- the potential benefits of including human processes in regional and global models
- impact of glacier reduction on ecosystems, landscape transformation, hydrological cycle and surface water regime,
- human life in Arctic and Northern Eurasia mountains.

iii) a suite of regional models as a key to integration processes in high latitudes

b) in order to meet the expectations of IPY (2010)?

- synthesis of the net role of surface and subsurface processes on the hydrologic system.
- exploitation of remote sensing in monitoring change in the land surface.
- understanding of processes that cause landscape change (e.g., development, reindeer, climate, etc)

3. Where are we now relative to these goals and how has NEESPI contributed with research that has been done to date?

These activities are listed in the reports of the RAS and US NEESPI representatives and on the NEESPI web site.

4. What specific steps do we need to take in the next two years to ensure:

a) that the goals for NEESPI IPY projects are met?

-carry out a PILPS-type model intercomparison for the NEESPI Arctic Ocean Basin,
- develop a fully coupled regional climate models using state of the art land surface schemes,
- seek opportunities to interact with social scientists regarding the human dimension aspects of NEESPI with appropriate groups (The American Association of Geographers, The Russian Geographical Society, IHDP, etc),
- develop techniques for modifying statistical distributions of hydrological variables based on observed changes in seasonality.
- take steps to more effectively utilize remote sensing products (e.g., soil wetness products) in hydrologic modeling.
- explore the possibility of launching a GEO task related to NEESPI data systems and services,
- assess the available inventories of wetlands and small lakes over the NEESPI area to determine if they meet the requirements of hydrologic modelers for this type of information.
- develop a plan to use data from the heat balance network in NEESPI energy budget studies and hydrologic models.

b) that we can effectively address the priority NEESPI questions by 2015:

- develop a scientific foundation for understanding the consequences of abrupt global and regional changes in the NEESPI area,
- explore the concept of risk management as a means of integrating NEESPI science into a regional policy framework.
- develop a strategy for using remote sensing data and reanalysis products in the earth system modeling over the NEESPI domain.