[EE] Evening Poster | M (Multidisciplinary and Interdisciplinary) | M-ZZ Others

[M-ZZ39]Environmental, socio-economic and climatic changes in Northern Eurasia

convener:Pavel Groisman(NC State University Research Scholar at NOAA National Centers for Environmental Information, Asheville, North Carolina, USA), Erwan Monier(Massachusetts Institute of Technology), Shamil Maksyutov

Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

We invite presentations on the biogeochemical and hydrological cycles, climate and ecosystem interactions in Northern Eurasia (land-cover and land-use change, atmospheric aerosols, soil, and permafrost changes that affect and are being affected by human activity, climate and ecosystem change), human dimension, and tools to address the Northern Eurasia studies.

In environmental studies, our Session foci are on the carbon cycle of Northern Eurasia and on the permafrost changes in Siberia, Asian Mountains, and the Arctic coastal regions.

In the regional water cycle studies, our Session foci are on the changing distribution of precipitation intensity, frequency, especially, in the cold/shoulder season transition periods when surface air temperature is close to 0 deg. C, and on the pattern and seasonal cycle changes of runoff.

In the human dimension studies, our Session foci are on assessments of impact of the ongoing environmental changes in Northern Eurasia on the human well-being and on mitigation strategies development in response to harmful consequences of these changes.

Among the tools, a special attention at the Session will be paid to the perspectives of improving the coupling between the human and natural systems, through the use of Earth system models and integrated assessment models, to explore interactions and feedbacks between the various components of the coupled human-Earth system and to understand the role of Northern Eurasia in the global Earth system.

Three particular regional foci of this Session will be the studies of changes that impacts regional sustainable development in the Dry Latitudinal Belt of Northern Eurasia, the Eurasian Arctic, and the boreal forest zone of Northern Eurasia.

We invite also early career scientists associated with (or interested in) the Northern Eurasia Future Initiative (http://nefi-neespi.org/NEFI-WhitePaper.pdf).

[MZZ39-P04]Siberian potential forest types and phytomass projected from CMIP5 climates in the 21st century

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Keywords:boreal forest, climate change, CMIP5, bioclimatic modeling, Siberia

Ecological-bioclimatic modeling have demonstrated the potential for profound effects of GCM-projected climate change on the distribution of terrestrial ecosystems and individual species: biomes shift northwards; conifer forest decreases; dark-needled (*Pinus sibirica, Abies sibirica,* and *Picea obovata*) forests decrease, light-needled deciduous (*Larix spp.*) and evergreen (*Pinus sylvestris*) forests increase, forest-steppe dominance increases, and steppe is converted to semidesert in the south. Fire and the thawing of permafrost are expected to be the principal mechanisms that will shape new zonal vegetation.

Our goal was to predict vegetation, forest and phytomass changes in Siberia (60 – 140° E and 42 – 72° N) by the late 21st century using our bioclimatic models and explicit changes in the permafrost distribution projected from the baseline period 1960-1990 through the century to the 2080s. We used twenty climate models (GCMs) of the Coupled Model Intercomparison Project phase 5 (CMIP5) and two climate change scenarios to characterize the range of climate change: mild climate (Representative concentration pathway, RCP 2.6 scenario) and sharp climate (RCP 8.5 scenario). In addition five of the twenty GCMs that projected the largest dryland extents were used to characterize the driest potential conditions in the future. 20 GCM-based ensemble means of January and July temperature and precipitation indicate both temperature and rainfall increase over Siberia: 3.4°C (RCP 2.6) – 9.1°C (RCP 8.5) in mid-winter; 1.9°C (RCP 2.6) – 5.7°C (RCP 8.5) in mid-summer; 60 mm (RCP 2.6) – 140 mm (RCP 8.5). As predicted from the CMIP5 models, Siberia would be characterized by milder and more moderate climates with less permafrost coverage by the 2080s.
With these projected climates, the forest would: 1) shift to the north, expand in area at the expense of tundra and gain in phytomass in the RCP 2.6 ensemble climate; 2) shift to the north, but remain the same in area and phytomass in the RCP 8.5 ensemble climate; 3) shift to the north, decrease in area and lose in phytomass in the RCP 8.5 driest ensemble climate. Under the warmer and drier projected future climate, about half of Siberia would be suitable for the forest-steppe ecotone and grasslands rather than for forests. Water stress tolerant light-needled taiga (*Larix spp.* and *Pinus sylvestris*) would have an increased advantage over water-loving dark-needled taiga (*Pinus sibirica, Abies sibirica,* and *Picea obovata*) in a new climate. The permafrost-tolerant *L. dahurica* taiga would remain the dominant forest type across the permafrost areas. Accumulated surface fuel loads due to increased tree mortality from drought, insects and other factors, especially at the southern forest border and in interior Siberia (Yakutia), together with an increase in severe fire weather would likely lead to increases in large, high-severity fires, which are expected to facilitate vegetation progression towards equilibrium with the climate.
Figure. The vegetation distribution over Siberia predicted at 1960-1990 (left) and at the 2080s by the ensemble of twenty GCMs (center) and the ensemble of 5 driest GCMs (right) under sharp RCP 8.5 scenarios. The white line shows the southern border of Russia. Vegetation types: 1. Dark-needled (*Pinus sibirica, Abies sibirica, Picea obovata*) forests; 2. Light-needled (*Larix spp., Pinus sylvestris*) forests and forest-steppe; Grasslands: 3. Steppe; 4. Semi-desert; 5. Tundra.