



## **Overview of past, ongoing and future efforts of the integrated modeling of global change for Northern Eurasia**

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Northern Eurasia is both a major player in the global carbon budget (it includes roughly 70% of the Earth's boreal forest and more than two-thirds of the Earth's permafrost) and a region that has experienced dramatic climate change (increase in temperature, growing season length, floods and droughts) over the past century. Northern Eurasia has also undergone significant land-use change, both driven by human activity (including deforestation, expansion of agricultural lands and urbanization) and natural disturbances (such as wildfires and insect outbreaks). These large environmental and socioeconomic impacts have major implications for the carbon cycle in the region. Northern Eurasia is made up of a diverse set of ecosystems that range from tundra to forests, with significant areas of croplands and pastures as well as deserts, with major urban areas. As such, it represents a complex system with substantial challenges for the modeling community.

In this presentation, we provide an overview of past, ongoing and possible future efforts of the integrated modeling of global change for Northern Eurasia. We review the variety of existing modeling approaches to investigate specific components of Earth system dynamics in the region. While there are a limited number of studies that try to integrate various aspects of the Earth system (through scale, teleconnections or processes), we point out that there are few systematic analyses of the various feedbacks within the Earth system (between components, regions or scale). As a result, there is a lack of knowledge of the relative importance of such feedbacks, and it is unclear how policy relevant current studies are that fail to account for these feedbacks.

We review the role of Earth system models, and their advantages/limitations compared to detailed single component models. We further introduce the human activity system (global trade, economic models, demographic model and so on), the need for coupled human/earth system models and Integrated Assessment Models (IAMs), a suite of models that couple human activity models to Earth System Models. Finally, we conclude the presentation with examples of emerging issues that require a representation of the coupled human/earth system models.