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Northern Eurasia: evaluating processes and feedbacks in the context of climate change

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Northern Eurasia is undergoing significant changes associated with warming climate and with socio-economic changes during the entire 20^{th} century. Climatic changes over this vast landmass interact and affect the rate of global change through atmosphere-terrestrial-cryosphere feedbacks and through strong biogeophysical and biogeochemical couplings. Current and future interactions and feedbacks to the global system of *this carbon-rich, cold region component of the Earth system* remain to a large extent unknown. Recent analyses of coupled Atmosphere-Ocean General Circulation Models (AOGCMs) suggest that while model representation of precipitation in the Arctic has modestly improved since the IPCC Third Assessment Report (TAR), there are still large uncertainties in model representation of both precipitation and underlying processes that drive the carbon, hydrology and energy cycles of the northern high latitudes. Model representation of snow, snow redistribution, permafrost, effects of lakes and wetlands are marginal, a problem that is compounded by large uncertainties in observations. Many of the global modeling groups are developing Earth system model components that represent processes specific to the high-latitudes, including organic soils, permafrost, wetlands, ice sheet dynamics and/or biogeography; however, there is no robust or rigorous methodology for testing and evaluating model implementation.

A multiple model intercomparison that evaluates biogeochemical, hydrological and

biophysical processes and feedbacks in the northern high latitudes with a focus in northern Eurasia across modeling scales is under discussion with the Northern Eurasian Earth Science Partnership Initiative (NEESPI) community. Proposed modeling groups include Earth System Model/AOGCMs, Earth System Models of Intermediate Complexity (EMICs), global Dynamic Vegetation Models (DGVMs), Regional Climate and Air Pollution Models (RCM) customized to northern Eurasia domains, and Stand-level individual based models (IBMs). We suggest an implementation strategy for protocols and results of a cross-model evaluation and solicit input for integration with the International Polar Year syntheses.