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Probabilistic Forecast for 21st Century Climate Changes in High Latitudes of Northern Hemisphere.

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A number of ensembles of 21st century climate simulations have been carried out recently with the MIT Integrated Global System Model (IGSM) for different emissions scenarios. The uncertainties in climate system properties such as, sensitivity and rate of heat uptake by the deep ocean, are quantified by using the probability distributions derived from observed 20th century temperature changes. For no-policy (business-as-usual) emissions scenarios, high latitude annual-mean land temperature (north from 60N) by the end 21st century will increase by 5.2oC to 8.8oC (5 to 95 percentiles) as compared to present day, with a median warming of 6.7oC. In simulations with emissions scenarios aimed to stabilize CO2 at 750 ppmv and 550 ppmv, the median temperature increases are 4.4oC and 3.0oC, respectively. However, even in the latter case, there is more than a 95% probability for a warming by more than 2oC.
Natural methane emissions in high latitudes of Northern Hemisphere increase up to three times in the simulations with large temperature increases. As a result, more than 3 gigatons of additional methane due to increased high latitude emissions are released into the atmosphere from 1991 to 2100. This is, however, only about 3% of cumulative anthropogenic methane emissions. Additional surface warming in high latitudes does not exceed 0.5oC.