Permafrost in the 21st Century

BROWN, JERRY. International Permafrost Association, Woods Hole, MA 02543, USA

Twenty-five percent of the land mass of the Northern Hemisphere, the Antarctic continent and some mountainous regions of South America are underlain by permafrost conditions; or earth materials that remain below freezing for more than several years. Permafrost is currently warming in many regions of the Earth. Temperature variations in permafrost are indicative of changes in surface boundary conditions, in part the result of changes in climate and differences in surface and subsurface conditions, including snow cover, vegetation, geomorphology, geology, and ground-ice content. Models of permafrost distribution under different 21st century climate scenarios predict decreases in the areal extent of near-surface permafrost. The initial results are destabilization and erosion of the thawing, ice-rich ground, and increased slope instability in the mountains. Permafrost degradation has important implications for engineered structures and landscape processes including those related to hydrology, vegetation, and sources and sinks of greenhouse gases. In order to evaluate the magnitude of the changes in the permafrost temperature of the Earth, an international global monitoring system (Global Terrestrial Network-Permafrost; GTN-P) is under development. This information is required for the improvement of predictive models and impact assessments including those of the Intergovernmental Panel on Climate Change (IPCC), and to further our understanding of the responses of permafrost conditions and processes to climate variability and change.