

## ***Permafrost and Climate Change***

Bernhard Diekmann  
Alfred-Wegener-Institut für Polar- und Meeresforschung  
Forschungsstelle Potsdam  
Telegrafenberg A43  
14473 Potsdam, Germany

Bernhard.Diekmann@awi.de

In the course of ongoing global warming, environmental changes in the Arctic realm are most dramatic worldwide, comprising the shrinking of sea ice, the retreat of ice sheets and glaciers, sea-level rise, and the migration of vegetation belts. All these processes have strong impacts on living conditions for both animals and human beings. A serious problem, which often is underrated in the context of Arctic climate change, is the enhanced warming and degradation of permanently frozen ground (permafrost), which occupies about a fourth of Earth's land surface. In particular, permafrost is widespread in the northern-hemispheric polar and subpolar regions. The modification of permafrost affects the landscape in manifold ways, as it changes the extent of wetlands, deepens the active surficial thaw layer during summer, increases river runoff to the ocean, and destabilizes the Arctic coasts and unglaciated land surfaces. Though such changes pose inconvenience on infrastructure in regard to the stability of buildings, pipelines, railway tracks, and road constructions, these problems can be overcome by innovative technologies. An enduring and alarming side-effect of permafrost degradation, however, is the associated release of trace gases, contributing to the accelerated greenhouse warming of the atmosphere. With their widespread organic-rich soils and subbottom methane hydrates, the permafrost regions represent a huge carbon reservoir in a frozen state. At present, the incipient demise of permafrost leads to prolonged venting of methane and carbon dioxide through enhanced microbial metabolism in soils, strong coastal and fluvial erosion of carbon-bearing soils and sediments, and the thermal destabilization of frozen gas hydrates. The consequence of these processes for the climate system could be harsh but are not fully understood so far.