RECESSION OF ICE SHEETS AND GLACIERS AND THE DEGRADATION OF PERMAFROST

Summary

Polar regions are an object of study of several disciplines, including cryology. The cryosphere embraces snow cover, sea ice, ice sheets, shelf ice, glaciers and ice caps, permafrost, as well as river and lake ice. The aim of the present paper is to address problems of the distribution and disappearance of glaciers and permafrost as an effect of the observed climate change leading primarily to a warming of the polar zones. Glacier ice found on the surface of the Earth is one of the most sensitive geoindicators of the climate change taking place in the geosphere. There is some inertia in the observable and measurable response of glacier systems relative to the change. It is estimated that for the Marine Antarctic region the delay may be some 25 years. Another feature characteristic of the recession of ice sheets and glaciers is the different rate of retreat of their fronts depending on location: ice sheets and glaciers ending on land usually display a much slower recession rate than those reaching the sea. This is combined with local, regional and global weather anomalies in temperature and precipitation which, together with the features of the bedrock, can sometimes seriously affect the recession pattern of individual glaciers. In the article examples are given of glacier recession in Greenland, Spitsbergen, Antarctica, and the Antarctic Peninsula. The areas emerging from under the ice are among the fastest, most dynamically evolving ones in the world, undergoing processes of geosuccession. Apart from an increase in the thickness of the active layer, a rise in the temperature of permafrost itself can be observed. What favours the penetration of heat into the ground is the increasingly frequent absence of snow cover, or a clear reduction in its thickness. Those changes make continuous permafrost pass into discontinuous and then sporadic permafrost. In the Arctic regions permafrost degradation has the greatest impact on construction and network infrastructure, like roads, railway lines, and telecommunication facilities. Higher air temperatures, the recession of glaciers, a lower depth of freezing, and changes in the amount and quality of precipitation lead primarily to a shift of the climatic-vegetation zones northwards and the climatic-vegetation altitude zones upwards. This situation has brought about an extension of the growing season by 30-40%. The result has been geoecological transformations among the glacial, proglacial, periglacial and paraglacial systems at a variety of spatio-temporal scales that form the present-day landscape structure of the polar zones in the northern and southern hemispheres, and in high-altitude areas.