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Geodesy and ice: Is there still something to discover? (Vening Meinesz Medal Lecture)

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Within the lecture several aspects of geodetic research in ice-covered regions will be discussed.

The lecture begins with an introduction of subglacial lakes in Antarctica. For the most prominent one, Lake Vostok, the results of more than 10 years of research will be introduced. The ice flow regime, surface heights and their changes, the hydrostatic equilibrium and the mass balance were investigated. It will be discussed to what extent the results obtained in the Lake Vostok region are of relevance for mass balance studies of the Antarctic ice sheet.
During the last decade the negative mass balance of the Greenland ice sheet has been confirmed by many research groups. In this context, rapid changes in the ice-mass discharge of the outlet glaciers were observed. These temporal and also spatial changes in the behavior of the glaciers are not yet fully understood. We have used Landsat data to investigate about 300 glaciers in Greenland covering a time span of more than 20 years. Some examples concerning temporal changes of ice flow velocities and glacier front positions will be shown and discussed.
The knowledge of glacial isostatic adjustment (GIA) is an important prerequisite for ice-mass balance studies based on satellite gravimetry. In Greenland, Patagonia and Antarctica present-day vertical crustal movements were and are being determined using GPS observations on bedrock. The interpretation of the obtained signals for the three regions addresses different aspects of the incorporation of GIA into geodetic-glaciological research.