



Improving permafrost mapping from space with the addition of snow cover information

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Climate change scenarios predict that global warming will be greatest over high latitudes and that permafrost areas will be among the regions most heavily affected. Data obtained from space crafts offer a significant advantage for studies conducted in Arctic and sub-Arctic areas where measurement stations are geographically scattered. The land surface (skin) daily global temperature 1-km (LST) product of the MODerate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Terra and Aqua satellite platforms has been evaluated to delineate the limits of permafrost zones. An algorithm that compensates for the large number of cloudy days (more than 50% of cloudy days in every year in MODIS LST product) in Arctic regions was developed to determine mean monthly and annual surface temperatures as well as thawing and freezing indices for each 1 km pixel. The approach was then applied to produce regional maps of these variables across northern Canada and Alaska. The maps follow the logical (expected) geographical distribution of surface temperatures with isotherms corresponding to known climatic, permafrost and biogeographic boundaries or transition zones.

Although surface temperature is the most important parameter that controls the ground thermal regime of permafrost and can be determined with the approach described above, it requires further improvements. The surface temperature retrieved from MODIS LST is the "skin" temperature; in other words it is the envelope temperature above vegetation and water bodies in summer and at the air-snow interface in winter, rather than true soil surface temperature at the air-soil interface over permafrost terrain. New improvements involving the physical characteristics of surface materials (vegetation, snow, organic layers of soils, moisture content) are being made. Using northern Quebec (Canada) as a pilot study area, we will present improvements made to our approach by adding information on snow cover extent from the NOAA/NESDIS Interactive Multisensor Snow and Ice Mapping System (IMS) 4 km (2004-2008) and 24 km (2000-2004) resolution products.