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Earlier disappearance of the snow cover in the central Siberia as seen from satellite observations of surface albedo

Kunio Rikiishi[1*], Ryuhi Furihata[1]

[1]Hirosaki University

Snow albedo, i.e., reflectance of solar radiation at the snow surface, is generally controlled by water and impurities contained in the snow cover and by the grain size in it. The albedo decreases significantly in the snow-melting season for the reason that snow-melting produces water and helps the grain size grow through the repeated process of thawing-refreezing. Accordingly, satellite observations of snow albedo have information on snow-melting which plays a vital role in the recent decline of the cryosphere.
In this study we have analyzed the data set of daily satellite observations of snow albedo over the central Siberia for the 22 years of 1982 to 2003. The clear-air albedo estimates are corrected for the effects of solar height, satellite angle, and water vapor. The original data with the 25 km x 25 km resolution are averaged over the area of one degree latitude and one degree longitude. First, the seasonal change of albedo has been calculated, and then the central Siberia has been divided into four regions according to the albedo values at Julian day 120 (April 30). Mean seasonal changes of albedo for the four regions shows that the snow albedo decreases most rapidly in Julian days 170 ? 180 when the solar radiation is at its maximum. While the albedo decreases at a somewhat lower rate in the region of lower albedos (or southern latitudes), it decreases at a higher rate in the region of higher albedos (or northern latitudes). Note that the northern Siberia receives more solar energy than southern latitudes in June-July, and yet is colder than the southern latitudes. These facts suggest that the snow-melting is mainly controlled by the solar radiation, not by air temperature, in Siberia.
Linear trends of albedo have been calculated as a function of Julian day from the 22-year observations. It has been found that in the 22 years the snow albedo has decreased by about 0.1 in Julian days 170-180. This may be responsible for the earlier snow-melting in recent years in the Central Siberia.

Keywords: snow albedo, snow melting, Siberia