

A 30-year trend of snow cover duration in the Northern Hemisphere derived from satellite-borne optical sensors

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Snow cover extent (SCE) has been an important observation target from space for weather prediction since 1960's. The National Oceanic and Atmospheric Administration (NOAA) has produced a historic record of weekly SCE charts in the Northern Hemisphere over three decades. The NOAA SCE has been widely used for climate studies. However, the production method of SCE has not been unified during the long-term operations. Thus, the accuracies of SCE detection are considered changeable. As an alternative product, a 30-year long SCE was derived in this study from radiances acquired with optical sensors onboard polar orbiting satellites by employing an objective analysis method. That is, only five spectral channels which are available during the whole analysis period were used for SCE detection. In addition to SCE, snow melt date (SMD), first snow date (FSD), and snow cover duration (SCD) were also derived from the SCE. The derived SCE exhibits negative trends in all seasons, which is partly inconsistent with those derived from NOAA SCE. The causes of the inconsistency are considered due to the coarser spatial resolution of NOAA SCE (i.e., pixel size is approximately 190 km whereas this study's SCE has 5km spatial resolution) and also due to the changeable snow detection accuracy. The trend of the derived SCD exhibits spatially asymmetric pattern over the Northern Hemisphere. That is, significant shortening occurs in western part of Eurasian Continent (EC), whereas weak shortening or even lengthening occurs in eastern EC and western North America Continents. From the comparison with SMD and FSD, the significant shortening in western EC is considered to be caused mainly by the delay of FSD toward later dates in autumn and partly by the advancement of SMD toward earlier dates in spring. The long-term SCE dataset will be used as a climatological baseline for a Japanese satellite mission named "Global Change Observation Mission-Climate" (GCOM-C) to be launched in 2017.

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