Time series analysis of snow cover duration in the Northern Hemisphere during the recent 20 years

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Snow cover is an important variable to be monitored from space for assessing the effect of the global warming on the Arctic region. We have been evaluated the long-term trends of snow cover duration in the Northern Hemisphere and revealed that the significant negative trends of annual snow cover duration (SCD) occurred in Europe region and positive trends in parts of the United States of America and Canada during the past two decades (2001-2020) as shown in Figure 1 (Hori et al., 2021). In this study we analyzed time series of snow cover durations for the eight zones (Z1-Z8) shown in Figure 1 where the trends of SCD were statistically significant. Z1, Z5, Z6, and Z7 are the zones which exhibit negative trends, whereas Z2, Z3, Z4, and Z8 exhibits positive trends. Figure 2 indicate the time series of SCD extracted for the eight zones. Among the eight zones, the slope of the time series of Z1 is the smallest (negative) and that of Z8 is the largest (positive) with exhibiting some yearly fluctuations. A contributing factor to the negative trends of SCD at Z1 is found to be the earlier snow melt in spring, while the positive SCD trends of Z8 is due to earlier snow fall in autumn (not shown in the figures). In addition, Z1 exhibits longer SCDs in the years of 2003-2006 and 2010 and shorter SCDs in 2007-2008 and 2014-2015, while Z8 exhibits shorter SCDs in 2004-2006, 2012, and 2015-2016 and longer SCDs in 2011, 2014, and 2018-2019. The yearly fluctuations of SCDs could be related to the atmospheric circulation patterns (e.g., meandering pattern of westerly winds) prevailing during those years. We plan to investigate the relationship between annual SCD and the atmospheric circulation pattern before the symposium.

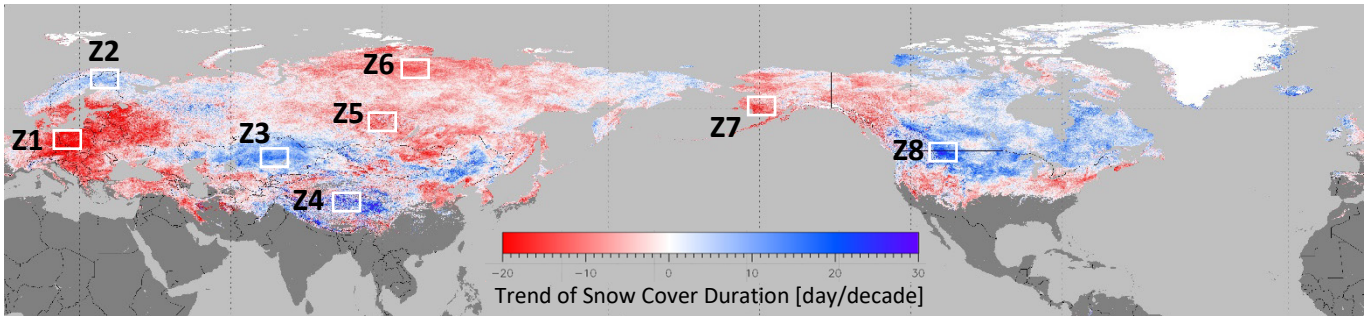

Figure 1. Spatial distributions of long-term trends of snow cover duration (SCD, day/decade) in the Northern Hemisphere for the period of 2001-2020 (20 years). The white boxes indicate the eight zones (Z1-Z8) from which the time series of SCD are extracted.

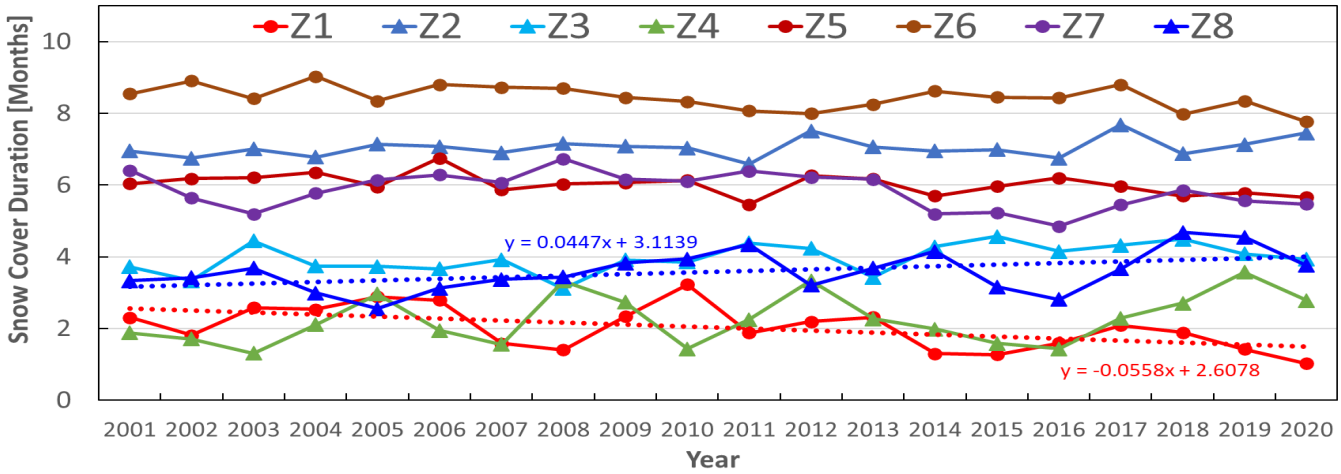

Figure 2. Time series of snow cover duration (SCD) extracted for the eight zones (Z1-Z8) shown in Figure 1.

References

Hori, M., M. Niwano, R. Shimada, T. Aoki, Heterogeneous response of snow cover in the Northern Hemisphere to the recent Arctic warming, The 12th Symposium on Polar Science, Online, 2021.