衛星観測による環北極域の積雪・曇天率分布の解析と今後の計画

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Satellite observations of the recent Arctic snow and cloud covers and future plan

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Recently, significant sea ice shrinkage has been observed due to the warming of the Arctic region. The spatial and temporal patterns of snow and cloud cover in the northern hemisphere, which are important factors affecting the Earth's climate system, are also expected to change due to the Arctic warming. Japan Aerospace Exploration Agency (JAXA) launched a satellite named "Global Change Observation Mission for Water (GCOM-W)" carring a passive microwave radiometer AMSR2 on May 18, 2012. In addition, JAXA will launch another GCOM satellite for climate study (GCOM-C) in 2016 which carries an optical sensor SGLI. Both GCOM satellites will observe the Earth environment such as sea ice, snow and cloud covers and so on in order to establish long-term satellite data record of those geophysical parameters. As a preparatory data set, JAXA has started to generate climate-related geophysical parameters using NASA's optical sensor MODIS data and distribute them to the public through the web site named JAXA Satellite Monitoring for Environmental Studies (JASMES) since 2008. In this study recent decadal trend of snow cover extent and cloudiness in the Arctic region were analyzed using JASMES data to examine the response of both snow and cloud cover in the Arctic region to the rapidly shirinking Arctic sea ice extent etc. Fig. 1 indicates 12-year trend of the snow cover extent in the northern hemisphere since 2000. Recent snow cover extent is found to decrease in summer and autumn and increase in winter and spring. Thus, due to the Arctic warming snow cover is considered to be shrinking in summer and autumn, whereas in mid-winter severe snow fall events have been frequently observed recently which is a cause of the observed positive trend of snow cover extent in winter. Wet snow fraction (not shown in the figure) is found to increase in summer at the rate of 6% per decade. This fact also suggests that the melting and shrinkage of snow cover extent is recently accerelated in the northern hemisphere. Cloud cover analysis shown in Fig. 2 indicated that arctic cloudiness (70-80 deg.N) in summer (three months average of June to August) exhibits close correlation with the monthly extent of the Arctic sea ice in September except for the year 2012 when strong polor cyclon attacked the Arctic sea ice in August, 2012. Recent thinning of the Arctic sea ice is considered to enhance its susceptibility to the variations of environmental factors such as cloud cover (solar insolation), wind, and sea surface temperature and so on. In next fiscal year the data period of JASMES snow cover data is planned to be extended to the past satellite record of around 1980's using NOAA/AVHRR observation data.

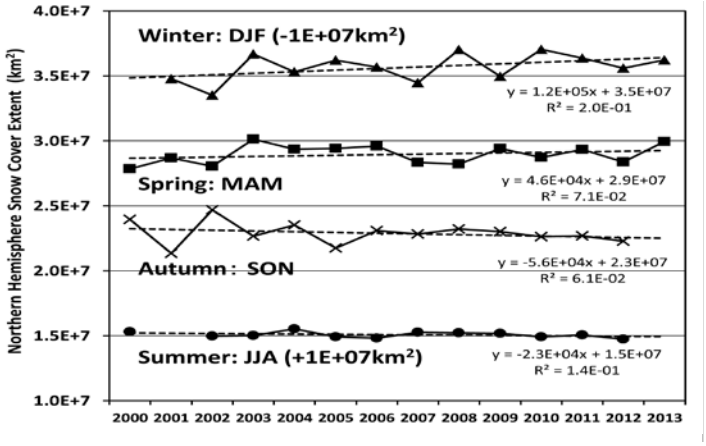

Figure 1. 14-year trend of snow cover extent in the northern hemisphere.

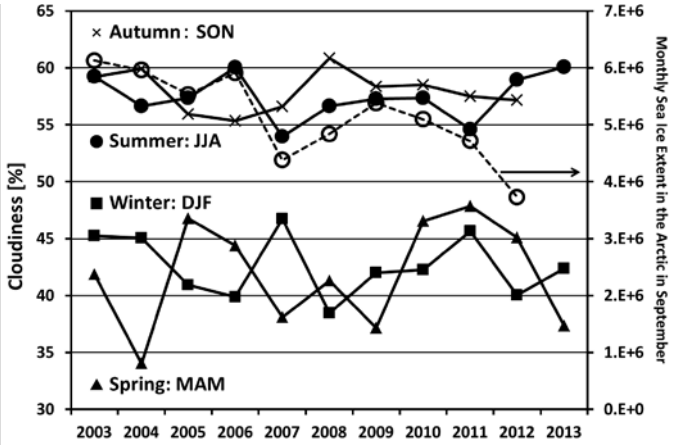

Figure 2. Decadal trend of cloudiness in the Arctic (70-80 deg.N)