

## Role of atmospheric circulation in the negative correlation between sea ice extents in Okhotsk Sea and snowfalls in northern Japan

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In spite of being located in relatively lower latitudes, the Sea of Okhotsk is covered with sea ice and Japanese islands are with snow every year. This is because both the Sea of Okhotsk and Japanese islands are exposed in the wintertime to cold air flows from the eastern Siberia where extremely cold air masses are generated. In 1984, 2005 and 2005, however, heavy snowfalls occurred in Japanese islands while only 40% of the Sea of Okhotsk was covered with sea ice. In 1979, on the other hand, snowfalls are extremely light in Japanese islands while almost 90 % of the Sea of Okhotsk was covered with sea ice. The objective of this paper is to give a physical explanation for this negative correlation between the snowfall and sea ice.

We use objectively analyzed meteorological data (NCEP/NCAR reanalysis data) and satellite observations of sea ice extent (the Northern Hemisphere EASE-GRID Weekly Snow Cover and Sea Ice Extent, Version 3, available from the US National Snow and Ice Data Center) for the years 1971-2005. The sea level pressures and the 500 hPa heights are composited with respect to the weekly growth rate of sea ice extent and to the weekly snowfall amounts at Aomori and Shinjo. It has been found that, when a strong Aleutian Low is located near the Attu Island (near 52N, 180E), cold northwesterly winds blow over the Sea of Okhotsk and the sea ice field extends toward the downwind direction. In the meantime, relatively warm and weak westerly winds blow over Japanese islands, causing poor snowfalls there. When a strong Aleutian Low is located to the southeast of Kamchatka (near 49N, 170E), on the other hand, warm northeasterly winds blow over the eastern half of the Sea of Okhotsk and the sea ice field does not extend there. In the meantime, cold northwesterly winds blow over the Sea of Japan, causing heavy snowfalls in Japanese islands.

Consequently, it is concluded that the negative correlation between the sea ice extent and snowfall is caused by whether the cold air mass from the eastern Siberia blow toward the Sea of Okhotsk or toward the Sea of Japan and Japanese islands: When a strong Aleutian Low is close to the Kamchatka Peninsula, cold air masses blow toward the Sea of Japan, causing heavy snowfalls over Japanese islands and less extensive ice field in the Sea of Okhotsk. When a strong Aleutian Low is located far east of the Kamchatka Peninsula, cold air masses blow toward the Sea of Okhotsk, causing light snowfalls in Japanese islands and extensive ice field in the Sea of Okhotsk. In short, the position of strong Aleutian Low is responsible for the negative correlation between sea ice extents in the Sea of Okhotsk and snowfalls in Japanese islands.