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鉛直１次元熱力学モデルによる北極海の海氷の経年変動の解析
Sumilations of interannual variations in Arctic sea ice thickness with a one-dimensional vertical thermodynamic model

森本 有利恵 [1*], 山根 省三 [2]
Yurie Morimoto[1*], Shozo Yamane[2]

[1] 同志社大学工学研究科, [2] 同志社大学理工学部
[1]Graduate School of Engineering, Doshisha University, [2]Faculty of Science and Engineering, Doshisha University

Recently, Arctic sea-ice in summer decreases and the rate of decrease increases. The decrease of Arctic sea-ice affects on the climate not only in Arctic region but also in mid-latitudes, such as Japan. We have investigated the factors affecting on the interannual variations in sea ice thickness around Arctic sea ice by means of numerical experiments with a one-dimensional vertical thermodynamic model, introduced by Bitz and Lipscomb (1999). The model needs four surface flux inputs to calculate the temporal variations of sea ice thickness: downward shortwave radiation, downward longwave radiation, sensible heat, and latent heat. These four inputs are generated from the daily Japanese 25-year Reanalysis (JRA-25) and JMA Climate Data Assimilation System (JCDAS) from 1979 to the present, averaging over the area of 75-90N and 135-225E. The influences of each surface flux input on the interannual variations in sea ice thickness have been examined by conducting numerical experiments with some inputs for some seasons replaced by their 33-year daily climatology. The interannual variability and trend of the sea ice thickness in the control experiment, with all four inputs having interannual variability in all times, are in reasonable correspondence with those of the observed sea ice extent in the area. It is found that this correspondence is mainly attributed to the interannual variations in summertime longwave radiation, and that the interannual variations in summertime shortwave radiation play a role in suppressing the influences of longwave radiation. The recent decrease in sea ice extent brings the increase in upward sensible and latent heat flux from the ocean, and promotes the formation of thick sea ice in cold seasons. However, the promotion is almost canceled by the simultaneous increase in downward longwave radiation, presumably owing to the increase in air temperature and water vapor content. The results obtained with the model exhibits a strong sensitivity of the interannual variations in sea ice thickness to summertime (June and July) downward radiations.

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