

A hypothesis of Cloud-Phytoplankton-Ocean interaction in the subarctic North Pacific

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Abstracts

It is known by the ship observations that the subarctic North Pacific is frequently covered by low-level clouds (LLC) and fogs during spring to summer. It is also confirmed by the historical records of air temperature that the air-mass in the boundary layer over this ocean is rather uniform and colder, by about 5C, than that over lands in the same latitude band. This air mass occasionally blows toward southwest and bring cold summer to Japan, which causes serious agricultural damages and called "Yamase event". In order to understand formation process of the cold air-mass over the subarctic ocean, the role of LLCs is investigated using the ISCCP (International Cloud Climatogy Project) data set. To estimate the LLC radiative forcing, radiation at the top of LLC and cloud-free surface is calculated by a radiative transfer code. The short wave radiation is reduced to 50% because of reflection at the cloud top. In contrast, the upward long wave radiation at the cloud top does not differ so much from that at the ocean surface because the altitude of cloud is low and the top temperature is close to SST. The strong contrast in the net radiation over the lands and oceans north of 40N is evident, and this is the main reason for generation of the cold air mass over the subarctic North Pacific during spring to summer. The satellite ocean color data shows that the surface Chl-a distribution also shows a front around 40N. A possible mechanism of interaction among the low-level cloud, phytoplankton and ocean will be presented.