Geophysical Research Abstracts
Vol. 14, EGU2012-3260, 2012
EGU General Assembly 2012

Arctic Cloud Cover Characteristics from MODIS, CALIOP, and CloudSat

M. C. Chan and J. C. Comiso

NASA Goddard Space Flight Center, Cryospheric Sciences Laboratory, Greenbelt, MD, United States (josefino.c.comiso@nasa.gov)

Cloud cover as inferred from the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP), Cloud Profiling Radar (CPR) on board CloudSat, and Moderate Resolution Imaging Spectroradiometer (MODIS)is studied over the Arctic Region. For MODIS, it is well known that cloud discrimination has been a challenging problem over snow and sea-ice surface types due to the limited thermal and visible contrast between clouds and the surface and is further exacerbated with the occurrence of low-level inversion. On the other hand, active sensors, such as CPR and CALIOP utilizes the return signal from radio waves or light pulses to identify cloud cover and is generally known to perform well even on cold and highly reflective surfaces, although they have several issues that are identified. In this study, Arctic cloud fraction during the months of February and September (2007 and 2010) were estimated and statistics of collocated data were created to investigate how the data can be combined to improve our characterization of the Arctic cloud cover. CALIOP being the most sensitive sensor was chosen to be the baseline for comparison. Cloud fraction from MODIS indicates fewer clouds when compared to that of CALIOP, differing by more than 50%, over sea ice and Greenland. In open water areas, MODIS overestimates cloud cover by as much as 30% thereby exhibiting a suspiciously big change in cloud fraction between sea ice and open water at the edge of the sea ice cover. CloudSat, on the other hand, appears to consistently underestimate cloud fraction on all surface types compared to CALIOP. In general, MODIS misses 26% of the clouds in the entire Arctic and 42% of the clouds in sea ice covered regions (concentration > 90%) in winter. During the summer, the performance improves to 8.7% in the entire Arctic and 13.5% in sea ice regions. Over Greenland, MODIS misses 17.3% and 13.3% for summer and winter, respectively. Furthermore, over open water, MODIS improves dramatically being able to properly detect cloud features 98.5% and 99.65% of the time over winter and summer, respectively. Interestingly, CloudSat misses 18.7% of the clouds in winter and 23.3% during summer over the entire Arctic. Sample cases where there exists considerable disagreement were analyzed and with the derived cloud characteristics from MODIS and CALIOP, we are able to establish that cloud height and geometrical/optical thicknesses are key reasons why some of the clouds were not detected. It is apparent that the three systems when used concurrently provide a more complete representation of the Arctic cloud cover.