Geophysical Research Abstracts
Vol. 13, EGU2011-8835, 2011
EGU General Assembly 2011

Formation of melt ponds and resulting changes in surface albedo: Observations from the aircraft campaign MELTEX over the Beaufort Sea

Gerit Birnbaum (1), André Ehrlich (2), Christof Lüpkes (1), Jörg Hartmann (1), Wolfgang Dierking (1), and Bruno Schyska (1)

(1) Alfred Wegener Institute for Polar and Marine Research, Climate Science, Bremerhaven, Germany (Gerit.Birnbaum@awi.de), (2) Leipzig Institute for Meteorology, University of Leipzig, Germany

Melt ponds have a strong impact on the energy exchange between atmosphere, sea ice, and ocean. The most important effect is the enhancement of absorption of solar radiation caused by the considerably lower albedo of melt ponds than that of the surrounding snow/ice.
Between 11 May and 7 June 2008 an aircraft campaign (MELTEX) was performed over the southern Beaufort Sea to study melt pond formation and the impact of ponds on surface albedo in the initial stage of the melt season. The sea ice cover changed from late winter conditions to early summer conditions with the onset of melting and melt pond formation during several episodes with strong on-ice warm-air advection from the Canadian Coast. Between these warm episodes northerly flow with cold-air advection from the inner Arctic caused an interruption of melt pond evolution and even a temporary refreezing.
The employed aircraft POLAR 5 was equipped with a digital photo camera, a UV/VIS-line scanner, broadband radiation instruments, and a spectral albedometer with active horizontal stabilization as well as with meteorological basic instrumentation. Images of eleven flights in the area 69°N-74°N and 133°W-144°W were analyzed by means of unsupervised and supervised classification algorithms to calculate the concentration of different surface types.
In the final phase of MELTEX, a distinct north-south gradient in the concentration of melt ponds was observed. The Cape Bathurst coastal polynya separated drift ice in the north from a band of fast ice along the coast from the Amundsen Gulf to Alaska. Pond concentration was largest on fast ice with values of 17±8% on a flight section over the delta of the McKenzie River and with values of even 59±14% and 53±13% over Franklin and Darnley Bay, respectively. On a section over drift ice between 71°N and 73°N the concentration of melt ponds reached only 10.5±7.6% on 7 June the last day of the campaign.
For clear-sky conditions, surface albedo was derived from low-level flights. For fast ice with high concentration of ponds, the average broadband albedo varied between 0.30 and 0.53 in the delta of the McKenzie River and between 0.18 and 0.43 in the region of Franklin and Darnley Bay.
The situation in the drift ice zone was complex, because different surface types were present. A distinction is possible between open water, melt ponds, thin ice, bare ice, and snow covered drift ice. In the final phase of MELTEX, mixed surfaces showed highest albedo values in case of thick snow covered drift ice with shallow melt ponds. Here, the average broadband albedo was about 0.7. A detailed analysis of the spectral albedo, which was measured nearly in the full short-wave range from 250 nm to 2200 nm, is presented in case of multi-class surfaces.