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THE EFFECT OF DOWNWELLING LONGWAVE RADIATION ON ARCTIC SUMMER SEA ICE

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A decrease of the Arctic sea-ice extent has been observed during the last decades, with largest negative trends during summer (approx. 13% per decade during 1979 to 2012). Besides this trend, summer sea ice shows large year-to-year variability – e.g. the sea-ice extent in the year 2013 was around 30% (1.7 million square km) higher than the extent in 2012. Several processes, such as changes in surface-air temperatures (Overland et al., 2008), ocean conditions (Comiso et al., 2008), as well as changes in the radiative fluxes associated with e.g. changes in the cloud cover (Francis and Hunter, 2006), have been attributed to control the Arctic sea-ice decline. In contrast, the processes contributing to the large interannual variability are not yet well understood.

Several studies show that the greenhouse effect associated with the advection of humid air into the Arctic during spring plays an important role for the initiation of the sea-ice melt (e.g. Kapsch et al., 2013). In years with an enhanced transport of humid air into the Arctic more clouds and water vapor are present. Therefore, more downwelling longwave radiation reaches the surface, resulting in an earlier melt onset (Mortin et al., in prep). Consequently, the ice albedo decreases earlier in the season than normal and more shortwave radiation is absorbed by the surface throughout summer. This shortwave radiation feedback further enhances the sea-ice melt. We hypothesize that enhanced downwelling longwave radiation is predominantly important for the timing of the melt onset, while shortwave radiation becomes important only after the melt season has started. But what is their individual contribution to the evolution of the summer sea ice? To investigate the importance of these processes for the sea-ice variability a coupled global climate model is applied. Experiments are designed to approach the question: How important are downwelling longwave and shortwave radiation during different times of the melt season for the development of the end-of-summer sea-ice cover? Further, as alterations of the downwelling radiation in spring lead to changes of the ice cover (albedo, thickness), other feedbacks (changes in clouds, ice mobility) might become important for the ice evolution as well. These and other questions concerning the importance of downwelling radiation on the interannual sea-ice variability will be addressed.

Comiso, J. C., C. L. Parkinson, R. Gersten and L. Stock. Accelerated Decline in the Arctic sea ice cover. Geophys. Res. Lett. 35, L01703 (2008).
Francis, J. A. and E. Hunter. New Insight Into the Disappearing Arctic Sea Ice. EOS T. Am. Geophys. Un. 87, 509511 (2006).
Kapsch, M.-L., R. G. Graversen, and M. Tjernström. Springtime Atmospheric Energy Transport and the Control of Arctic Summer Sea-Ice Extent. Nature Clim. Change, doi:10.1038/nclimate1884 (2013).
Overland, J. E., M. Wang and S. Salo. The recent Arctic warm period. Tellus 60A, 589-597 (2008).