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Impacts of seasonal differences in surface energy flux balances over Arctic sea ice

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Over Arctic sea ice, energy flux terms frequently compensate each other providing negative feedbacks when large changes in individual terms occur. These negative feedbacks reduce the net energy effect of the large changes in the individual terms. However, these feedbacks or compensating effects also operate significantly different during the summer melt season than during the other times of the year. This presentation will illustrate the impacts of changes in individual energy flux terms and the compensating feedbacks using observations from the SHEBA data set for both summer and winter. The results illustrate the key influence of a fixed surface temperature during the summer melt season for allowing large excess energy fluxes that can melt significant amounts of sea ice. This summer surface energy flux balance is unique to the sea ice environment, and does not occur over land. In contrast, a variable wintertime surface temperature produces large compensating feedbacks permitting only small wintertime energy flux deficits. It also produces phenomena such as surface-based mixed layers, which occur entirely from longwave radiative effects and in the complete absence of solar radiation.