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Enhanced albedo feedback resulting from a thinner arctic sea ice cover

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A technique to track the location and motion of sea ice parcels in the Arctic Ocean has been developed. This method blends the observations of passive microwave satellite imagery with buoy motions to yield a daily motion product. Given the ability of the Lagrangian ice tracking procedure to follow sea ice parcels as they advect through the Arctic Ocean, the drift track positions can be used to extract data from other data sets at the corresponding locations. We assemble a multi-parameter drift track data set using co-registered Advanced Polar Pathfinder products. This approach has been used to reconstruct the daily atmospheric forcings and sea ice surface properties for each tracked cell. Such a data set can be used to determine how each property evolves as a parcel of ice ages and moves through the Arctic. In addition to tracking the evolution of properties of a single ice parcel, we can also observe how characteristics of the sea ice change collectively. We utilize the ice type and albedo properties from the database to track the albedo of first-year and multiyear ice as it evolves through the summer. We observe the mean albedo (from the APP-x product) over all ice parcels identified as first-year ice (by the NASA Team Algorithm) to decrease rapidly during melt onset, as meltwater begins to form on the surface, and then continue to decrease into July as melt ponds form. This progression of albedo through late spring and early summer has also been noted by on-ice observers. We also find that overall, first-year ice has a lower albedo than multiyear ice, and younger multiyear ice has a lower albedo than older ice. Some differences also exist in the timing of change in albedo, with first-year ice albedo decreasing faster than for multiyear ice. These differences translate into more absorbed solar radiation by first-year ice during spring through autumn. This suggests a positive feedback that fosters ice melt and helps maintain a predominant first-year ice cover at the expense of older ice.