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Comparison of Two Extreme Minimum Arctic Sea-Ice Extents: The Record High During 1996 and Record Low During 2007

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Reanalysis data sets can be an essential tool for investigating extreme climate events, especially over data-sparse regions like the Arctic. A warming Arctic climate is undergoing significant environmental changes, perhaps most evident by the reduction of Arctic sea-ice extent and thickness during the summer. Several factors are believed to have significant impacts on the coverage and thickness of the Arctic sea-ice. These include dynamic and thermodynamic forcing parameters such as large-scale atmospheric circulation patterns, downwelling radiative fluxes, advective heating, and wind stress. In this study, we will examine the 2007 recorded minimum and 1996 recorded maximum September sea-ice extents using the two most widely used datasets: NCEP II and NASA's MERRA reanalysis. We will also investigate the major similarities and differences in atmospheric variables between the two reanalysis data sets, to gain a better understanding of the factors that contributed to the two extreme events. Similarities and differences in both the cloud and radiation impacts as well as the influence of large-scale dynamics on the Arctic sea-ice extent will be evaluated in this study. We intend to utilize the new, high resolution MERRA reanalysis data set to gain further insight into the possible factors driving the interannual variability in summer Arctic sea-ice extent. Preliminary results using the NCEP Global Reanalysis II data set suggest that years of significantly low summertime Arctic sea-ice extent are associated with increased surface temperatures, cloud cover, and downwelling longwave fluxes and decreased downwelling shortwave fluxes, as evident during the summer of 2007. Persistent anti-cyclonic summertime circulation and an associated strong anomalous pressure gradient was present across the western Arctic and Beaufort Sea during 2007, while negative MSLP anomalies were present over the central Arctic during 1996. The NCEP II reanalysis also indicated that the record melt year (2007) was accompanied by strong anomalous southerly flow across the western Arctic and East Siberian Sea enhancing poleward heat transport into the area, while northerly wind anomalies were present across the western Arctic during the summer of 1996 aiding in the transport of sea-ice outwards towards the Siberian coastline. We will compare these results from the NCEP II reanalysis with the new MERRA reanalysis to examine and recognize similar patterns in location and magnitude of anomalies and identify the major discrepancies that exist between the two reanalyses.