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A Long-Term Gridded Sea Ice Product for Use in Reanalysis and Diagnostic Studies

2011

Abstract: The 30-year timeframe of gridded pan-Arctic sea ice data sets limits their utility in reanalysis and climate diagnostic applications. The one available pan-Arctic database extending back to the 1800s is the Hadley Centre's HadISST, in which the gridded sea ice is essentially climatological prior to the 1950s, especially in the winter half of the year. The proposed project will synthesize various historical datasets that have recently become available for inclusion in a pan-Arctic sea ice dataset spanning 1870-2010. These historical datasets are available at the National Snow and Ice Data Center in various formats, resolutions and time spans. The fusion process will entail digitization of an Alaskan regional data set; regridding of various other datasets for the Canadian, North Atlantic and Russian sectors of the Arctic; assignment of weights to the various datasets in areas of spatial/temporal overlap, and a time-space interpolation using seasonally varying basis functions to fill data voids. The final product will be made available in a hierarchy of four versions, ranging from ice extent (ice/no ice only) with no interpolation, to ice-covered area (concentrations) with interpolation of data voids, enabling users to select the level of certainty that best meets their particular needs. The gridded fields will be accompanied by software to enable users to construct climatological probabilities, ice duration statistics, and ranges of variability on a regional basis. The products will also include a monthly gridded sea ice thickness product, based on satellite-derived concentration and ice motion fields, for the period 1978-2010. Finally, the 140-year sea ice database will be used in a diagnostic assessment addressing two key questions: (1) Is the present reduction of sea ice coverage indeed unique relative to the historical record extending back to 1870? (2) Is the rapidity of the retreat of ice in the last five years unique in the longer historical record?