A Comparison of Atmospheric Moisture Transports from Reanalyses for the North Polar Cap

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A quantitative depiction of the atmospheric hydrologic cycle over the Arctic basin has significant relevance to a variety of weather and climate-related investigations. Although differences in surface moisture flux estimates among reanalyses have narrowed, large discrepancies persist among contemporary products. These discrepancies are associated with a poor representation of cold climate physical processes in global data assimilation models. In contrast to reanalysis prognostic surface fluxes, atmospheric moisture transport and convergence are generally considered to be more stable variables, and are a more direct product of data assimilation rather than the numerical weather prediction model. Additionally, moisture transport provides additional information that relates the surface flux to atmospheric circulation. In this study, a comparison of reanalysis moisture transport and convergence fields over the north polar cap (70°N - 90°N) is made using the reanalyses of the NASA Modern-Era Retrospective Analysis for Research and Applications (MERRA) and the European Centre for Medium-Range Weather Forecasts Interim Re-Analysis (ERA-I). The comparison is conducted over the period 1989-2009. A focus is placed on the mean spatial and temporal variability of the vertically-integrated flux and convergence fields. Comparisons are made with previous studies using rawinsonde and satellite data. Some questions of interest addressed by this study are as follows:

- How does the annual cycle of moisture convergence for the north polar cap compare among the reanalyses examined?
- Are there significant spatial differences in the meridional transport across 70°N between the reanalyses, and how do they compare with previous study?
- How do the spatial patterns of total, mean, and eddy moisture convergence differ among reanalyses?
- What are the temporal trends in reanalysis Arctic moisture convergence, and how do they relate to changes in atmospheric circulation and to changes in the observing system?

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