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Moisture flux increases seen in the Arctic between 2003-2013

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The moisture flux (i.e. evaporation) plays an important role in the Arctic energy budget, the water-vapor feedback and Arctic amplification, but is one of the most uncertain variables. The Boisvert et al. [2013] moisture flux scheme (BMF13) is based on application of the Atmospheric Infrared Sounder (AIRS) data, which produces high quality, global, daily atmospheric temperature and moisture profiles even in the presence of clouds. Comparing the results of BMF13 against the ERA-Interim reanalysis, we found differences up to 55 Wm-2 in the surface latent heat flux in the Beaufort-East Siberian Seas (BESS). We found out that the quality of the input data for the BMF13 and ERA-Interim flux schemes was the main cause for the differences. Differences in the input datasets cause moisture flux estimates to differ up to 1.6 x10-2 gm-2s-1 (40 W m-2 latent heat flux) in the BESS region, when both datasets were applied to the BMF13 scheme. Thus, the input datasets, AIRS version 6 and ERA-Interim reanalysis, were compared with a variety of in situ data. In skin temperature ERA-Interim had twice as large an error as AIRS version 6, but smaller errors in air specific humidity. The results suggested that AIRS data and the BMF13 scheme are a good option to estimate the moisture flux in the Arctic. Moisture flux rates, produced using AIRS data, from the Arctic Ocean and surrounding seas were found to have increased between 2003-2013 by 7.2x10-4 g m-2s-1 per year (equivalent to 1.79 Wm2 in latent heat). This is a 7% increase in the average moisture flux each year and a 1.2% increase in the global ocean latent heat flux, with some months increasing more than others. The largest increases seen are in the central Arctic during the spring and fall where there has been a reduction in sea ice cover, and an increase in sea surface temperatures. Increases in the moisture flux from the surface also correspond to increases in total atmospheric column water vapor and low-level clouds, especially in the central Arctic regions. Changes in the atmospheric water vapor in the surrounding seas (e.g. East Greenland) are most likely due to lower-latitude transport of moisture rather than from the surface. Yearly, the moisture flux from the surface supplies about 10% of the total column atmosphere water vapor.