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AIRS satellite data reveal a warmer and wetter Arctic between 2003-2013

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Over the past decade the Arctic has seen unprecedented declines in the summer sea ice area, and as a result, the Arctic atmosphere during autumn and early winter has experienced positive trends in temperatures and water vapor, making the Arctic warmer and wetter. The Atmospheric Infrared Sounder (AIRS) has been collecting global, daily data since 2003 and is a useful, yet underutilized tool to study these atmospheric changes and their feedbacks in the Arctic. The most pronounced warming occurs between November- and April, with skin temperatures on average increasing 2.6 K and air temperatures increasing 1.7K between 2003-2013 over the Arctic Ocean. The total integrated column water vapor increased in all but two months, on the order of 0.33 kg m-2 between 2003-2013. In response to reductions in the summer sea ice cover, evaporation rates (i.e. moisture flux) increased between August and October by 1.6 x 10-3 g m-2s-1 (equivalent to 3.9 W m-2 latent heat energy) since 2003. Although most trends are positive over the Arctic Ocean, there is considerable annual variability. Increases in near surface specific humidity and in the moisture flux going into the sea ice surface in May lead to an earlier melt onset of the sea ice; warming skin temperatures in September lead to a delayed freeze-up of the sea ice.