EGU2020-12003
https://doi.org/10.5194/egusphere-egu2020-12003
EGU General Assembly 2020

Understanding moisture transport associated with strong cyclones in the New Arctic

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The Arctic climate system is undergoing rapid and drastic change in recent decades, with the thinning and loss of sea ice coverage and a warming and moistening atmosphere since the 2000's; coining the term the 'New Arctic'. This New Arctic ice pack is more vulnerable to external forcings, and with the increase in open water and warmer temperatures it is suggested that this could impact the moisture transport into the Arctic. In fact, all aspects of the hydrologic cycle are likely affected by and also feedback on these large and rapid changes in the New Arctic. However, the majority of the precipitation and moisture transported into the Arctic Ocean is that associated with cyclones, but one caveat is that the true magnitude of precipitation during these events remain uncertain, and a better understanding of the intensity, frequency, and phase of this precipitation is critically needed specifically for the freshwater and energy budget of the New Arctic.

Our work aims to track the moisture and precipitation associated with strong cyclones that terminate in the Arctic in order to improve our knowledge of the frequency, intensity and phase of the moisture, how and if it is changing in the New Arctic on an annual, seasonal and regional basis. In order to do this we will create a database of strong Arctic cyclone trajectories and Lagrangian track the moisture associated with them using ERA-Interim reanalysis. To balance the moisture budget we will constrain the net precipitation using NASA GPM precipitation and AIRS evaporation data at each time step. We propose a novel approach to achieve a more comprehensive, balanced moisture transport associated with Arctic cyclones in an Optimal Estimation and Lagrangian Framework (OELaF) allowing for the fundamental moisture processes associated with Arctic cyclones to be better observed and investigated. In this new work, we plan to apply this method with a few cyclones in the winter months of 2015-2017.