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The role of the Great Lakes as moisture sources in severe lake-effect snowstorms

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Heavy snowstorms are common meteorological phenomena in the North American Great Lakes region during autumn and winter months, usually associated with the intrusion of a cold and dry polar air mass over the warmer lake waters. It is well established that heat and moisture fluxes from the lakes are fundamental in the development of these episodes but an important question is still not totally clear; what exactly is the contribution of the evaporated water in the lakes to the large snow accumulations observed in this type of severe weather events?

Here, we use the regional atmospheric Weather Research and Forecasting (WRF) Model with an implemented moisture tagging capability to try to answer this main question for the recent and famous Great Lake-effect snowstorm of November 2014, the so called "Snowvember" by local residents. We perform simulations in a nested domain at 5km resolution with the tagging technique, demonstrating that about 30-60% of precipitation in the regions immediately downwind, originated from evaporated moisture in the Great Lakes. The largest contributions (50-60%) to the snow water equivalent are observed in the most severely affected areas, which suggests that evaporative fluxes from the lakes have a fundamental role in producing the most extreme accumulations in these episodes, resulting in the highest socio-economic impacts. In the future, this method could be systematically applied to many other events to draw a general characterization of the lakes moisture contribution to these heavy snowstorms.