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Modeling lake effect snow on December 24, 2001 over Lake Erie using mesoscale models MM5 and WRF - Sensitivity to convection and microphysics schemes and the temperature of Lake Erie

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Lake effect snow is a shallow convection phenomenon when cold air travels over a relatively warm lake. A severe case of lake effect snow over Lake Erie on December 24th, 2001 was studied with the mesoscale models MM5 and WRF, both using four nested domains. This case provided 93.5 inches of snow in Buffalo, killed three people and caused $10 million of material damage. Hence, the need for a reliable forecast of the lake effect snow phenomenon is evident. The mesoscale models simulate lake effect snow successfully. However, some significant differences between results with the microphysics schemes “simple ice” and “Reisner-Graupel” were found. Using the “simple ice” scheme, the convection is triggered much earlier in time compared to Reisner-Graupel. Furthermore, we find a large difference in the maximum precipitation between the different nested domains: Reisner-Graupel produces larger differences in precipitation between the domains than “simple ice”. Increased temperature of Lake Erie results in an exponential growth in the 24-hour precipitation. Despite the updated Kain-Fritsch scheme has especially been designed to cover shallow convection, only slight differences in precipitation occur between the updated and the original scheme.