Matt Tuftedal, Master's Student, with the Department of Atmospheric Sciences at the University of North Dakota will defend his thesis titled "*Precipitation Evaluation of the North Dakota Cloud Modification Project (NDCMP) Using Rain Gauge Observations*" on Tuesday, July 9, 2019 at 10 a.m. in Ryan Hall Room 111. This seminar is free and open to the public. Faculty, staff and students are encouraged to attend.

Abstract

North Dakota farmers interest in using weather modification to increase precipitation and reduce hail damage resulted in a managed cost-sharing program, the North Dakota Cloud Modification Project (NDCMP), being started in 1976. The goal of this research is to determine the effectiveness of NDCMP by using the rain gauge observations of National Weather Service (NWS) Cooperative Observer Network (COOP) and North Dakota Atmospheric Resource Board Cooperative Observer Network (NDARBCON). The rain gauge analysis uses target and control regions. Target regions are selected from counties in District I and II that have participated in all 41 years of the NDCMP. Control regions are counties adjacent to the target counties. Precipitation is evaluated on a monthly and seasonal (June, July, and August) basis over the 41-year program.

Multiple analysis methods are used to examine the available rain gauge data. Rain gauge data is analyzed by overlaying a circle with a radius of 40 km over each target and control region. Rain gauges are weighted to a central point within the circle. Monthly and seasonal rainfall totals are calculated within these circles. Rain gauge data from the entire county is used to calculate monthly and seasonal rainfall totals. All rain gauges from the target and control regions are combined to generate one large target and control data set. Single and double ratios are calculated for each target and control region. Bootstrapping is applied to the single and double ratios to determine the natural variation of single and double ratios over the 41 years. A single and multiple linear regression for each target and control region's seasonal rainfall is used to predict what the rainfall in the target area would be without the seeding effect.

The circular method shows that four out of the nine double ratios have the target region receiving 2 to 8% more precipitation; however, increase is not statistically significant, based off a predetermined p-value of 0.10. The county-based method shows that six out of the nine double ratios have at least 2 to 10% more precipitation in the target than the control region. Of those six, two cases are determined to be statically significant (p-value < 0.10). Single linear regression methods show an increase of 1 to 12% in all but two of the target/control pairings when the standard error of the estimate is less than 1.50. Multiple linear regression shows an increase of 3 to 7% when the standard error is less than 1.50 in 7 out of 12 analyzed cases.