Statistical Analysis of the 2008, 2010, and 2012 POLCAST Data Set

David Delene and Jamie Ekness

Abstract: The Polarimetric Cloud Analysis and Seeding Test (POLCAST) field projects were sponsored to determine the effectiveness of hygroscopic seeding in North Dakota. The POLCAST field projects conducted randomized hygroscopic seeding while obtaining airborne and radar observations. The Thunderstorm Identification Tracking and Nowcasting (TITAN) program is used to analyze radar data from the POLCAST field projects (33 usable cases) to determine differences in rain rate and total rain amount between seeded and non-seeded clouds. The single ratio of 1.56 is determined for seeded to non-seeded cases over the first 60 minutes rainfall amount after case selection. The rainfall increase for seeded cases is due mainly to the storm lifetime increasing by 41 %. The single ratio results are collaborated by the double ratio (seed/non-seed), which is 1.85. The double ratio is the single ratio of rain amount for 20-60 minutes after case selection normalized by the single ratio rain amount for 0-20 minutes after case selection. Hence, the double ratio accounts for cloud system variability. The Mann-Whitney test gives a significance (p-value) of 0.063 for the double ratio analysis of the POLCAST data set. Bootstrapping analysis of the POLCAST data set indicates that 50 cases (an additional 17 usable case) would provide a statistically significant (p-value < 0.05) double ratio. While the statistical analysis show an increase in North Dakota rainfall from hygroscopic cloud seeding, additional analysis is required to determine a seasonal increase and cost-benefit of an operational program.