Abstract: Non-stationary spatial variation makes it difficult to establish real-time areas of control and effect in weather modification, and non-stationary temporal variation makes the comparison of long-term averages from limited climatic records also open to question. Here we describe a statistical methodology that addresses both problems in the context of an analysis of a 2008 trial of a ground-based ionization (rainfall enhancement) technology known as Atlant. The approach is based on building a statistical model for daily rainfall that makes use of daily gauge level rainfall data, orographic and daily meteorological covariates, as well as dynamically defined downwind areas to capture the level of exposure to Atlant operation. Subject to some important caveats, this type of dynamic control demonstrates a clear rainfall enhancement signal at both a simple observational level and when a random effects model is used to control for unmeasured covariates. Rainfall downwind of the Atlant test site was 15% higher than rainfall in the control (crosswind or upwind) areas. Based on these results, a randomized cross-over trial with two sites was conducted in the same area in 2009. Preliminary results from this trial appear to support the conclusions reached in the earlier trial, with an estimated rainfall enhancement of again around 15%, based on a simple ‘double ratio’ analysis as well as a more sophisticated random effects regression analysis.