# Cool Pool Project: Watertown


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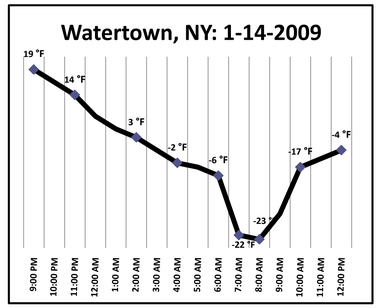
## Introduction:

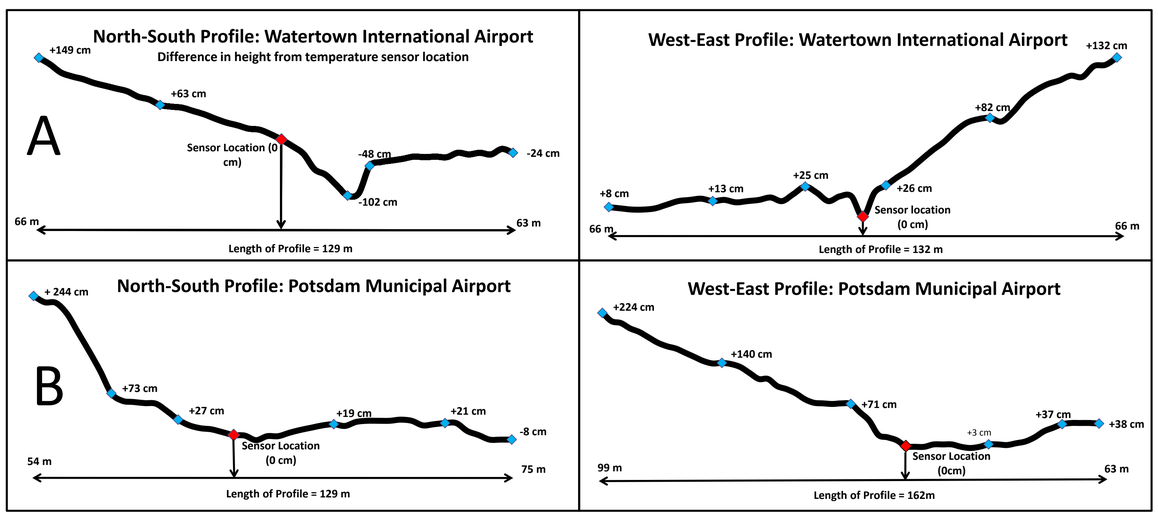
An episode of extreme cooling took place in Lewiston County, New York on January 14, 2009 under radiational cooling conditions. On that day, the early morning temperature at the Watertown Automated Surface observing Systems (ASOS) station, dropped down to -22°F from -6°F within one hour. Several mesonet stations within the area also reported similar events, dropping as low as -28°F. At the same time, other stations were reporting lows of only -16°F. All stations are located along the St. Lawrence River in upstate NY.




The goal of the Cool Pool project is to investigate the hypothesis that the stations reporting abnormally low temperatures are located within topographic depressions. During radiational cooling conditions, this cools air drains into and pools within the depressions in the landscape. Eventually, this pooling will accumulate until it reaches the height of the station thermometer. We hypothesize that it is at this time that the rapid drop in air temperature is recorded. Data for the months of November 2009 – January 2010 was analyzed for this purpose.

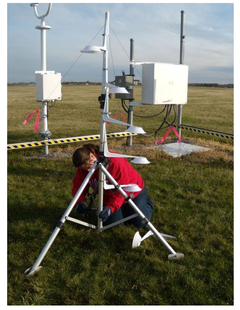
## Methodology:


To explore the hypothesis that the locations experiencing the abnormally low temperatures are within depressions in the topography, the terrain of the area surrounding the weather equipment at the Watertown International Airport (A) and Potsdam Municipal Airport (B) were profiled. Using a visual scope and stadia rod, the terrain was profiled to a vertical accuracy of 1 cm, at three meter horizontal increments.




What was found is that the locations are located at the bottom of a slope rather than in a depression on the landscape. This seems to support a phenomena knows as in-situ cooling rather than the cool pool theory.

## Methodology:

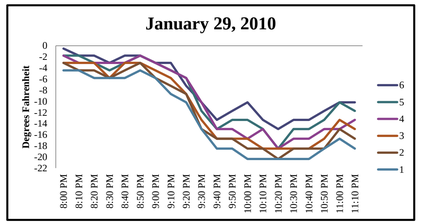


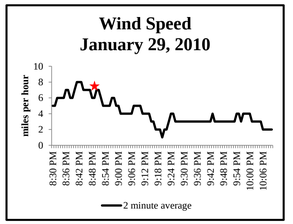
To further explore the 'cool pool' hypothesis at the Watertown site, an instrument tower was constructed. This tower consists of six temperature data loggers each placed at one foot intervals along the height of the tower. If cool air pools at the site, we anticipate recording this buildup of cool air (drop in temperatures) at progressively higher heights.

Each data logger is set to record temperatures at ten minute intervals. The loggers are attached to arms connecting them to the main tower and placed around in a spiral-like design. This ensures that each data logger is exposed equally to the sun and over a grass surface. Also, the loggers are protected by white plastic bowls to ensure rain and/or snow does not interfere with the instruments.

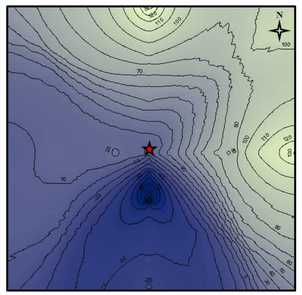
## Results and Discussion:

Four events were identified based on certain criteria set. This stated that there must be a decrease in temperature of at least 11°F within 60 minutes, or at least 14°F within 90. The date of January 29, 2010 will be used as an example of what was observed at the Watertown location.




Around the same time the event started, winds began to die down in the area. This supports radiational cooling conditions which require clear skies and light winds. At 6:56 PM winds were recorded at 10 MPH, at 7:56 and 8:56PM they had fallen to 6 MPH. This corresponds with a start time of 8:50 PM.



According to data from the Watertown ASOS station, winds at that time were coming from a north/north-west direction. As shown in a topographic map and the profiles of the site, winds were being obstructed by higher elevation. In situ-cooling occurs when a blockage of winds prevent mixing of cool and warm air. Cool air is then allowed to build up in that area. Radiational cooling as well as this natural barrier in the terrain fit those requirements. The three other events identified shared those qualities: light winds from a north or north-west direction and clear skies,.

## Future Work:

Future work for this project should involve a more in depth survey of the location. Ideally, more transects done in longer lengths should be used to complete this step. This will also allow for a more accurate topographic map to be constructed, with contour lines that are truer to what is actually present at the site locations. Also, I recommend a change in the equipment used for future studies. Temperatures were recorded as low as -28.72°F at the height of one foot (January 30, 2010). In order to maintain accuracy, data loggers with the ability to record temperatures at or beyond a minimum of -40°F would be useful. The ability to record relative humidity and/or dew point would also be helpful for investigating the possibility of in-situ cooling, mainly due to the suggestion that this tends to occur when the air is dry rather than saturated.


## Acknowledgements:

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