

Impacts of Snow Squalls on Pennsylvania Roadways

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Objectives

1. Derive basic statistics relating to the frequency of snow squalls in Pennsylvania and the risk associated with snow squalls as they impact Pennsylvania roadways
2. Identify antecedent conditions that exacerbate the impacts of snow squalls on road transportation
3. Develop snow squall safety campaigns and messaging for the public

Methods

Crash data for the cold season (October through March) from 2007 through 2016 was obtained from the Pennsylvania Department of Transportation (PennDOT).

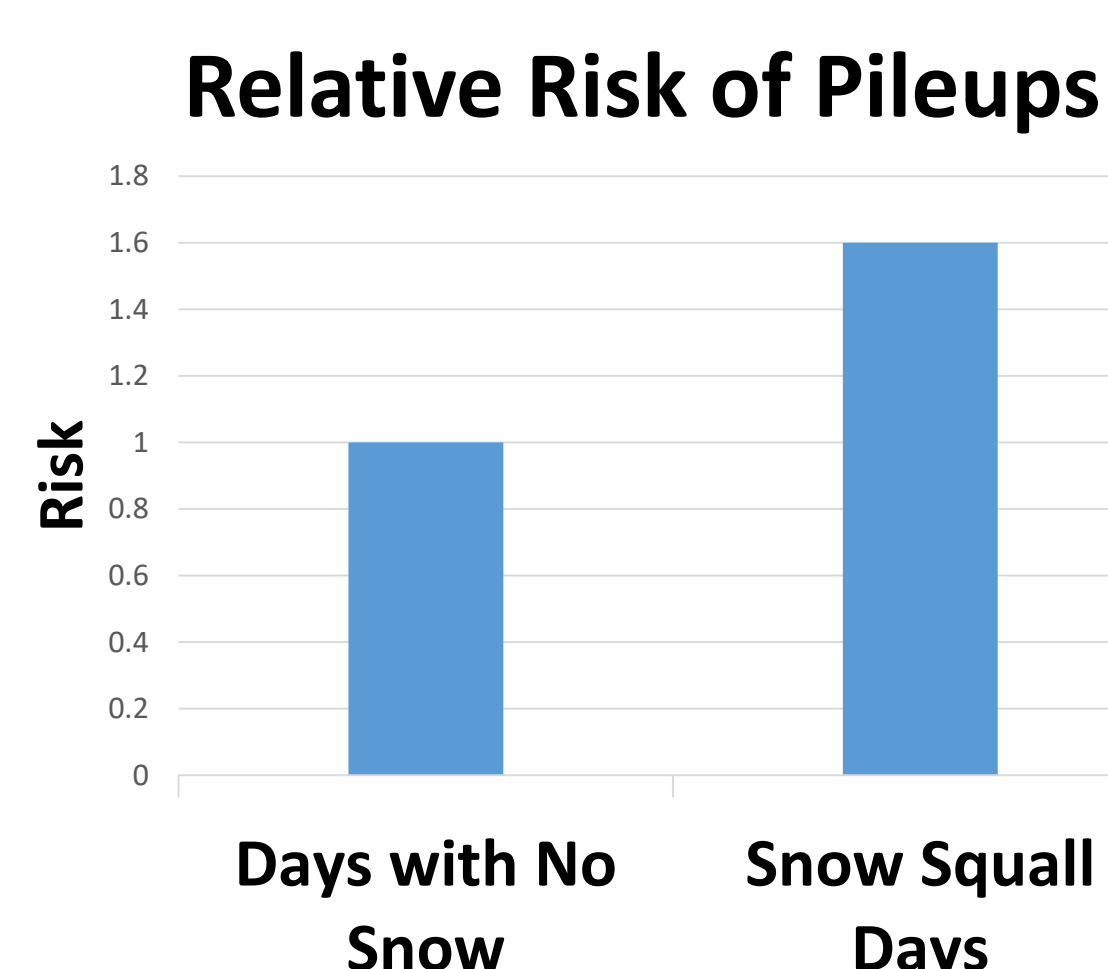
Archived radar imagery from each cold season (2007–2016) were analyzed along with WPC surface analyses to identify **snow squall events**, defined as periods when progressive, linear bands of snow were observed to have radar reflectivity of 30 dBZ or greater over Pennsylvania. Events characterized by quasi-stationary lake effect snow bands were not classified as snow squall events.

The crash dataset from PennDOT was cross-referenced with the meteorological dataset of snow squall events to derive statistics regarding risks associated with snow squalls as they impact Pennsylvania roadways.

Snow Squall Statistics

- ❖ The analysis found 108 snow squall events in Pennsylvania during the 9 seasons studied
 - This comes to an average of 12 snow squall events per cold season
- ❖ During the cold seasons studied, Pennsylvania roads had 17% more accidents on snow squall days than on days without snow

- ❖ **Days with snow squalls saw a 60% increase in the number of pileups (defined as 6+ vehicles) when compared to days without snow**
 - **There were also 43% more pileups on snow squall days than non-snow squall days (includes synoptic snow)**

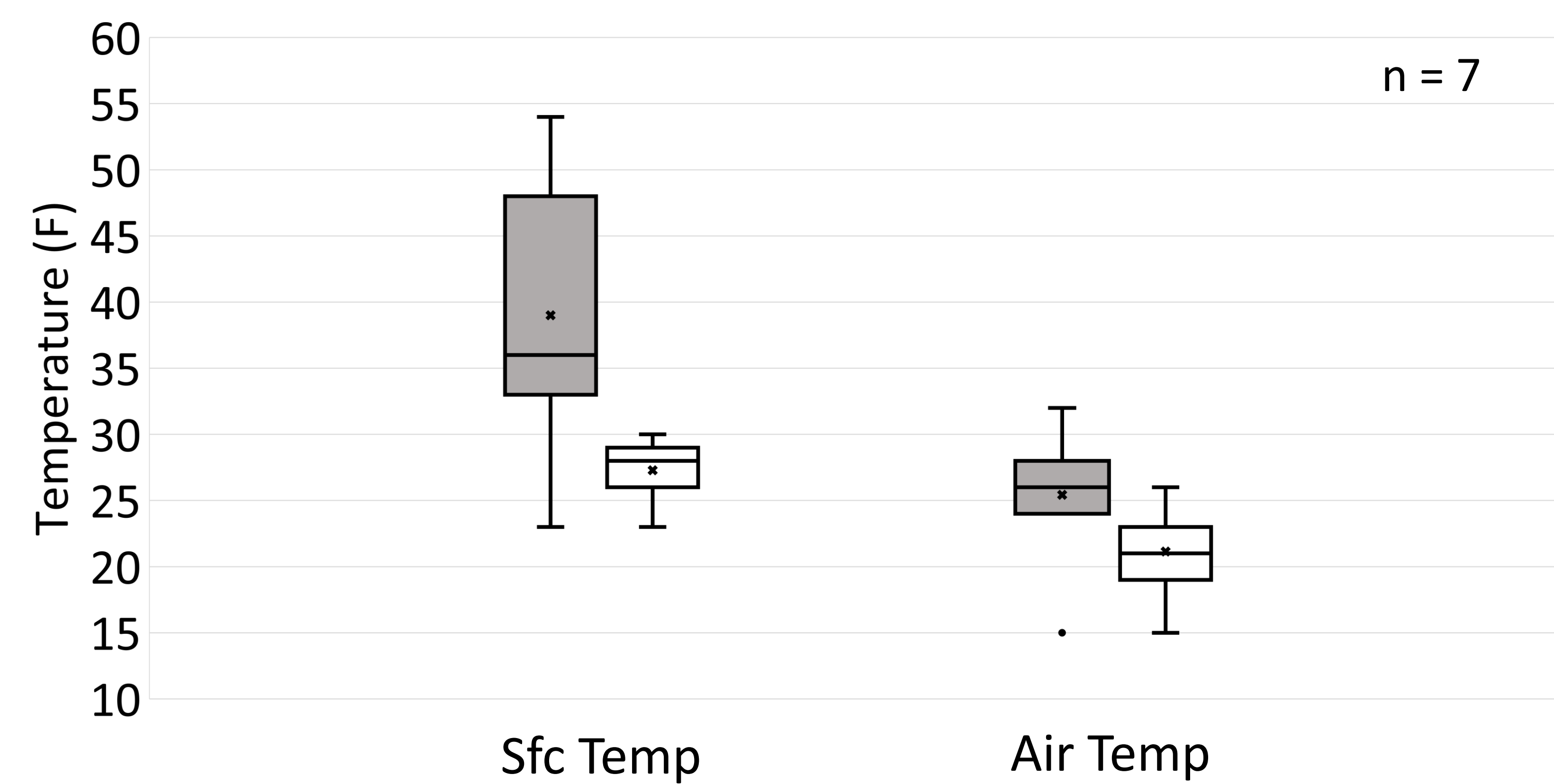


- ❖ Although the number of accidents and pileups increases on snow squall days, the fatality rate (number of fatalities per crash) is not higher on snow squall days than on non-snow squall days or days without snow

Antecedent Conditions

The National Weather Service began issuing snow squall warnings operationally in 2018. These warnings are intended to be issued for areas expected to see heavy snow with brief blizzard-like conditions and a potential for a flash freeze of snow and ice on roadways. What antecedent conditions favor a potential flash freeze during snow squalls?

Surface (left) and Air (right) Temperatures Before (gray) and During (white) Snow Squalls



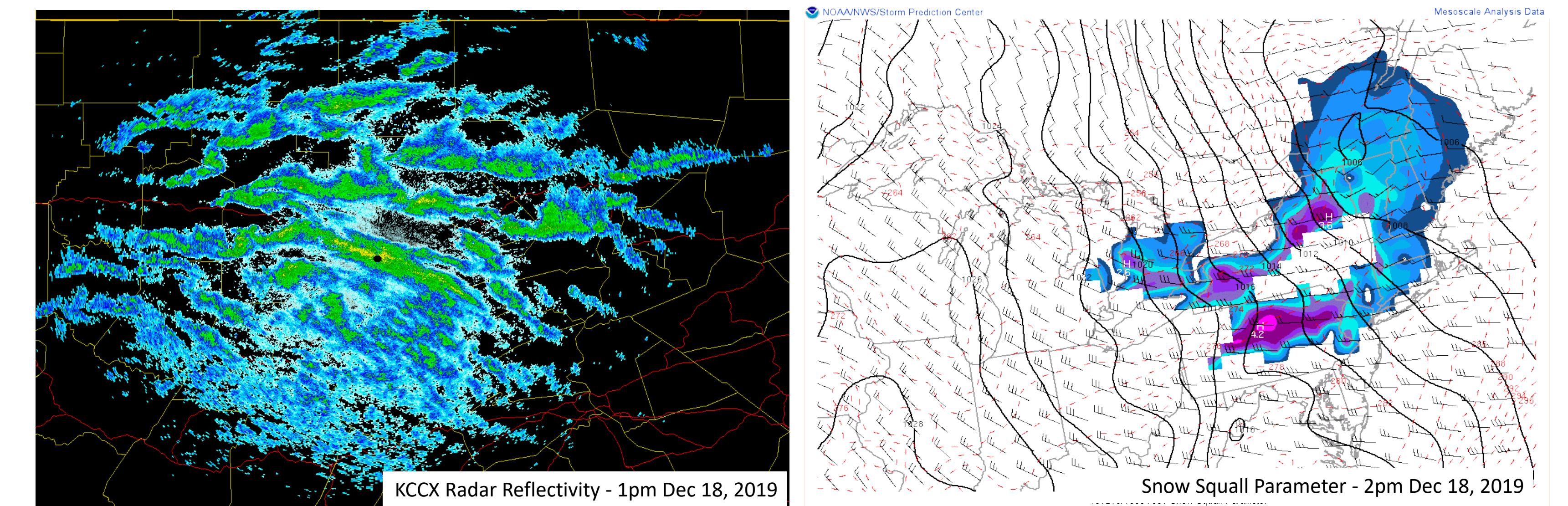
Although the sample size is small, we have begun to look at PennDOT Road Weather Information System (RWIS) road surface and air temperatures before and during snow squalls that were a factor in major pileups

- ❖ Remarkable variation in road surface temperatures was noted before high-impact snow squalls. Road surface temperatures as warm as the mid 50s and as cold as the mid 20s were observed before high-impact snow squalls
- ❖ In nearly all cases, the antecedent air temperature was at or below freezing
- ❖ During the snow squalls, the road surface temperature typically fell to within a few degrees of the antecedent air temperature

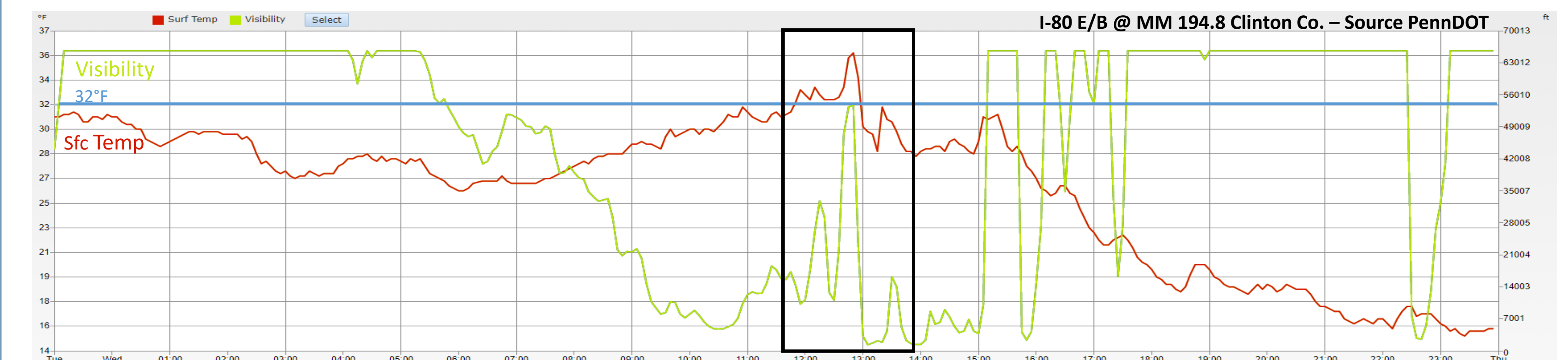
Discussion and Future Work

- ❖ The snow squall statistics derived in this study are for *snow squall days*, which includes crashes in squalls and outside of squalls. Because of this, the snow squall statistics may significantly underestimate the risk of driving through a snow squall. Future work may improve the relative risk statistics by doing a radar analysis to see which areas are being impacted by snow squalls during which time periods
- ❖ With only 7 cases so far, the antecedent road and air temperature portion of this study can be improved by adding more cases for robustness
- ❖ If there is a signal that antecedent road temperatures above freezing are more common ahead of high-impact squalls than road temperatures below freezing, work will need to be done to normalize by climatology to determine if this finding is significant

Case Study: December 18, 2019 Snow Squalls



During the daytime hours of Dec 18, 2019, several bands of heavy snow developed along and ahead of a weak arctic front as it pushed southeastward. This was a hybrid lake effect streamer / snow squall event with widespread coverage, presenting a challenging warning situation.



At the RWIS station nearest the pileup, visibility improved just before the snow squall hit Interstate 80, and the surface temperature rose to 36°F. Moments later, visibility dropped to near ¼ mile and the surface temperature dropped to 28°F. A pileup with 2 fatalities and 30 injuries occurred around 1 pm.

Safety Campaign

Because of the high impact nature of snow squalls in the Central Pennsylvania County Warning Area, our office is devoted to public outreach regarding snow squall safety. We have worked to produce outreach materials such as:



- ❖ Social media posts
- ❖ A snow squall educational video
- ❖ A snow squall brochure to be distributed at outreach events and at Pennsylvania rest stops
- ❖ Snow squall content in our spotter training talks

Acknowledgments

The authors gratefully acknowledge the contributions made by coworkers at NWS State College, as well as real-time and archive data providers including the Storm Prediction Center, the National Centers for Environmental Information, and PennDOT.