Public Trust in Changed Forecasts: Evidence from Atlantic Canada and Hurricane Dorian

Amber Silver[1], Joel Finnis, Brandon Behlendorf, and Emily Reid-Mussond

[1]Assistant Professor, College of Emergency Preparedness, Homeland Security and Cybersecurity
University at Albany, State University of New York

CORC COP Webinar | 16 November 2021

Outline

- **Introduction**

- **Case Study: Hurricane Dorian**

- **Methods**
    - Semi-structured interviews
    - Large sample questionnaire

- **Results**
    - Technical challenges experienced by forecasters
    - Subjective forecaster interpretation and inter-forecaster dynamics.
    - Perceptions of storm-related information among end-users

- **Discussion and Opportunities for Future Research**

Introduction

- Behavioral geographer.

- Research straddles the intersection of social science and meteorology

- End-users obtain, interpret, and respond to official and unofficial information before, during, and after extreme weather events.
  - Hurricane Juan (2003)
  - 2011 Goderich, Ontario tornado
  - Hurricane Harvey (2017), Hurricanes Michael and Florence (2018), and Hurricane Dorian (2019)

"How do public attention, risk perception, and decision-making influence behaviors?"

Hurricane Dorian
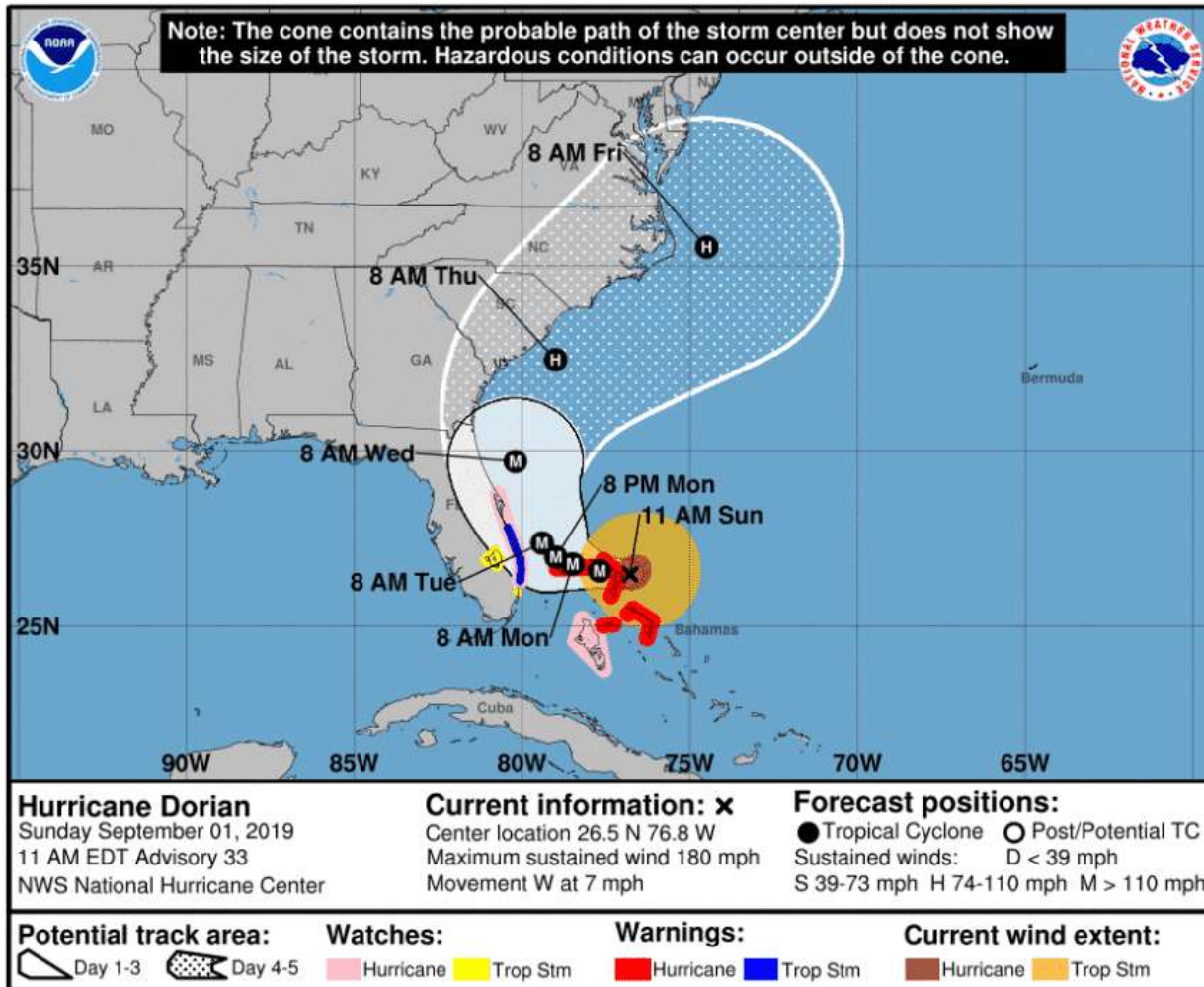
This Photo by Unknown is licensed under CC BY-NC-ND

This Photo by Unknown Author is licensed under CC BY

Hurricane Dorian

Rationale

- There is considerable debate about whether (and how) inaccuracies and/or inconsistencies in forecasting will affect end-user trust in future warnings.

- Hurricane Dorian provided the opportunity to explore the intersection between these concepts as its messaging was at times both *inaccurate* and *inconsistent*.

  RQ1: What challenges did ECCC-CHC experience when forecasting this storm?

  RQ2: How did end-users perceive storm-related information?

Methods

RQ1: What challenges did ECCC-CHC experience when forecasting this storm?

- Semi-structured interviews with ECCC meteorologists in Dartmouth, Nova Scotia

- <u>Interview themes</u>: meteorological work practices, forecast evaluation, understanding of end-user needs, and end-user interactions

- Analysis was conducted using thematic coding facilitated through NVivo software with a code list developed iteratively by the research team.

Methods

RQ2: How did end-users perceive storm-related information?

- Disseminated using the Qualtrics on-line survey platform between late September and late October 2019 to residents of Atlantic Canada.

- <u>Questionnaire themes</u>: perceptions of official and unofficial forecasts; trust and credibility; and information seeking and sharing behaviors.

- Included sample quotas for age, gender, and population size relative to each province.

Semi Structured Interview Results

Prediction during Hurricane Dorian was a collective, inter-jurisdictional, and interpretive process.

Notable challenges included:

1. Inaccuracies in the primary numerical weather prediction (NWP) model used by the ECCC-CHC

2. Uncertainty regarding Dorian's strength

3. Differing risk communication perspectives among meteorologists tracking the system.

Semi Structured Interview Results

CHC meteorologists identified **persistent inaccuracies** in the storm's track as represented by the NWP simulations produced internally by ECCC.

Dorian illustrates the value of **expert review of forecast guidance** by trained meteorologists, providing greater flexibility to accommodate the best available information.

… [during extreme weather events] you can't put as much trust in what the model is doing. That was a problem, I don't know if you guys have heard, is that our model didn't have the right track … [we] basically had to take what the model was saying, move it, move the track to where it was actually going to be and then…do all the wind forecasts in their heads. …you have to use your short-term forecasting knowledge and completely throw away what the model has. (ECCC Meteorologist, gender and age redacted)

Semi Structured Interview Results

Hurricane Dorian proved **difficult to categorize** as it approached Atlantic Canada. The respondents commented on the difficulties, particularly when predicted severity decreases as an event approaches.

[As Dorian] was coming toward Nova Scotia, it was category two at one point, but it was transitioning into being post-tropical….It was basically [a nightmare] trying to figure out how intense it even was, in the first place... And they ended up doing a really good job of it, at the Hurricane Centre but, like they were run off their feet. (ECCC Meteorologist, gender and age redacted)

So before the day-shift left, I said, 'Okay, so what are you guys comfortable with?' If I go this far, and I select these areas, and I go with the hurricane watch for that whole area, are you guys comfortable with that? You're coming back tomorrow morning, you're going to have to build on that, right? The worst thing you want to do is to have to back-peddle, backtrack, right? So, it's always better to build up your events. (ECCC Meteorologist, gender and age redacted)

Semi Structured Interview Results

Weather forecasting is a **collaborative, iterative process** that spans shift rotations, weather offices, and international borders. Meteorologists quickly learn their colleagues' **subjective forecast and risk messaging styles and inclinations**, and they may adjust their own messaging as a result.

Respondent: …Miami had just upped [Dorian winds] to 85 knots. I said, "Well, not really sure about that kind of idea." So then a few hours later down in Miami NHC, they call us…"I'm going to lower that. I can't see how it's going to be that strong…" So what changed? The data didn't change.

Interviewer: The forecaster shift changed.

Respondent: Yeah. And subjectively the way you look at something is going to be different than the way [another person] looks at something. That's human nature right? And knowing the personalities the way that I do…one of them goes by the data and tends to err on the side of caution which means the path of least regret.

Semi Structured Interview Results

In edge events, these subjective shifts may only reflect minor differences in weather impacts, but they can trigger a change in risk communication. This raises concern within ECCC about how storm categories are **interpreted by the public**.

> …as a forecaster you have to think what's the public impact, like how are they going to perceive that? (ECCC Meteorologist, gender and age redacted)

> But then when [NHC] said Cat 2 then all of sudden people start freaking out… This is now Cat 2, this is serious…the public knew all along about Dorian, …but now it's a Cat 2 and it's very near to us. It's funny how the public perceives that. But really it was only…five knots [difference] at the center of the low. So the forecast was basically the same. (ECCC Meteorologist, gender and age redacted)
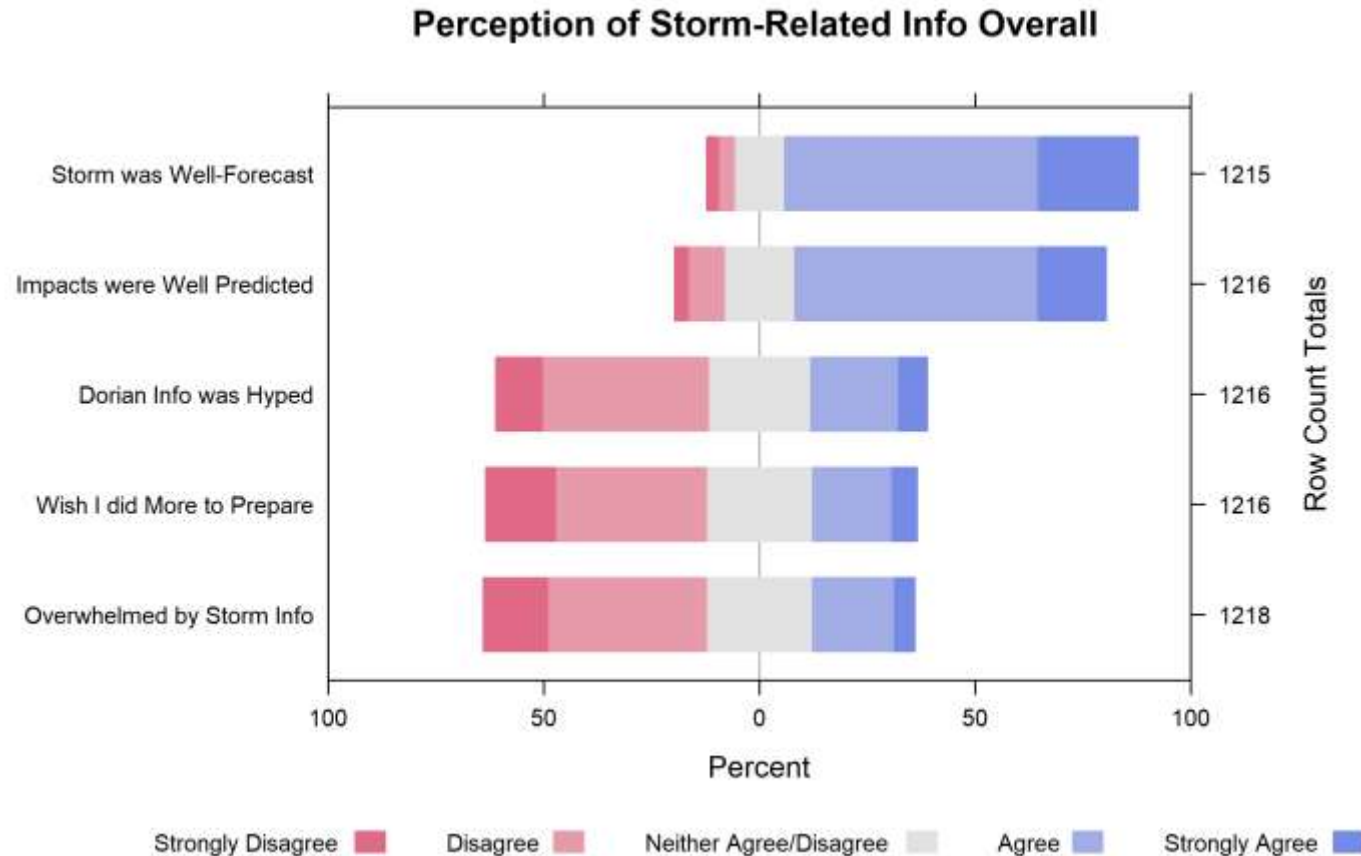
Questionnaire Results

Figure 1: Responses to five-point Likert Scale questions on perceptions of general storm-related information.

Questionnaire Results

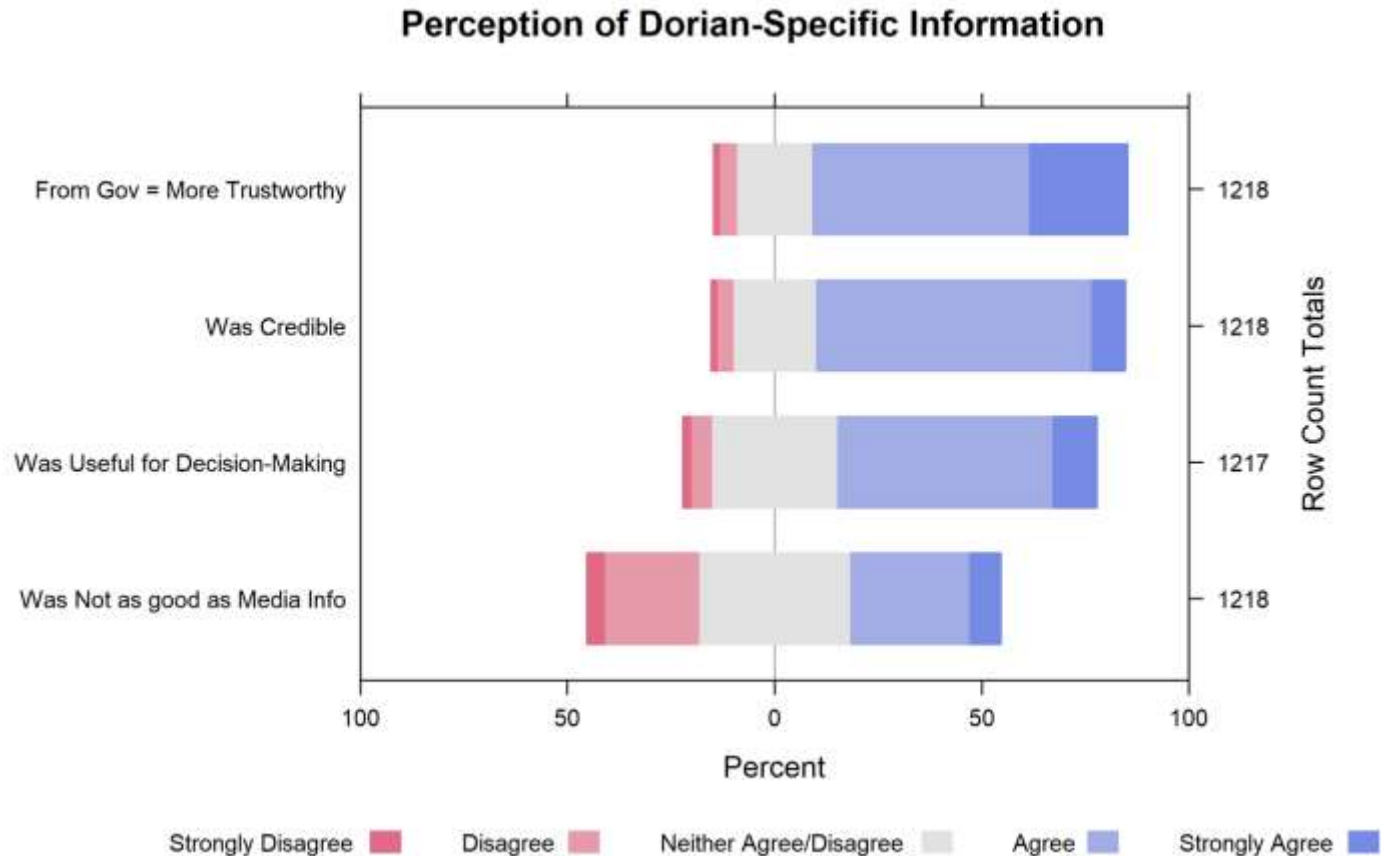**Perception of Dorian-Specific Information**

Figure 2: Responses to five-point Likert Scale questions on perceptions of storm-related information found on Twitter.

Questionnaire Results

Respondents indicated they received weather-related information from **a variety of official and unofficial sources**, which they checked throughout the duration of the storm:

"Between what EMO, the Weather Network and National Hurricane Center I knew it was going to hit my area harder than previously expected." (Female, 30-39 years old)

"I saw the forecast from various sites, including Environment Canada, about expected conditions and expected landfall" (Female, 30-39 years old)

"I used government websites to determine path of Dorian (e.g., NOAA, Environment Canada, NHC, the Weather Network, etc), and local radio (battery!) and my cell phone to monitor progress of storm, weather conditions, etc." (Male, 50-59 years old)

Questionnaire Results

Respondents also indicated that **Hurricane Dorian was well forecasted** in terms of its track, intensity, and impacts. Some respondents also took action to **prepare for and/or mitigate** against the storm based on information from trusted sources.

I felt that everyone did a fantastic job in prediction as well as getting things back to normal following the passing of Dorian (Female, 60-69 years old)

[A local meteorologist's] predictions about when/where the hurricane would make landfall influenced me to prepare more thoroughly than I have for past/smaller storms. (Female, 30-39 years old)

I didn't think it would really affect me at first, being in New Brunswick, but a meteorologist I follow was sharing wind speed predictions for my area and it was higher than I expected. I ended up doing a lot more outdoor preparation than I'd planned. (Female, 40-49 years old)

Questionnaire Results

Many respondents also indicated that they **monitored Hurricane Dorian's predicted track and/or intensity in advance** of its arrival in Atlantic Canada. These respondents were particularly affected by media coverage of the storm and its impacts in the Bahamas and the US

Watching how the storm affected Boston and New York helps because Nova Scotia usually gets hit similarly. (Female, 40-49 years old)

I saw on twitter that it hit the Bahamas on Sunday . . . The [NHC] says the dangerous storm will continue to press down Florida's east coast late Monday and late Tuesday, but its track will gradually swing north. (Male, 30-39 years old)

This was the first hurricane I've been through since moving from the Prairies to Atlantic Canada, and based on the information I seen about the Canadian landfall and the damage done to the eastern edge of the [USA] I knew I'd need to ensure I had the things to last me [three days minimum] without power. (Female, 18-29 years old)

In Summary

Forecasting is a **dynamic, iterative, collaborative process** that spans work shifts, meteorological offices, and even international borders.

Hurricane Dorian proved challenging to forecast for numerous reasons, which raised concerns about public perception and response.

- Meteorologists at the CHC emphasized forecast accuracy over forecast consistency.

- There were also internal discussions emphasizing the fact that there was not any single 'best' forecast.

Discussion

Respondents overwhelmingly agreed that the storm was well-forecasted and its impacts were well predicted.

Respondents sought out information from a variety of sources. This information included official forecasts, as well as news coverage of the storm's impacts on the eastern seaboard in the United States.

There was also a great deal of trust expressed in both the ECCC-CHC and the weather enterprise.

This prompted respondents to respond accordingly.

Questions?

Amber Silver

asilver@albany.edu

@avsilver

THE COLLEGE OF EMERGENCY PREPAREDNESS,
HOMELAND SECURITY AND CYBERSECURITY
UNIVERSITY AT ALBANY State University of New York

ECCC Canadian Hurricane Centre ✔
@ECCC_CHC

The Canadian Hurricane Centre will begin issuing bulletins on Hurricane Dorian on Wednesday. Long range models suggest the storm could affect parts of Atlantic Canada this weekend. Stay tuned.

8:35 AM · Sep 3, 2019 · Hootsuite Inc.

ECCC Canadian Hurricane Centre ✔
@ECCC_CHC

Get the latest on #DORIAN affecting #Atlantic #Canada: weather.gc.ca/hurricane/stat... #severewx

8:32 AM · Sep 7, 2019 · Hootsuite Inc.

39 Retweets   7 Quote Tweets   41 Likes

Questionnaire Results

Finally, it is interesting to note how often Hurricane Juan was mentioned in the context of Hurricane Dorian. More specifically, respondents used their experiences of Hurricane Juan and its impacts to contextualize official and unofficial information when deciding how to respond.

I saw the severity of the storm and know that Hurricane Juan in 2003 was really bad, so I went to the grocery store stocked up on non-perishables to eat and water and filled by bathtub with water to sustain myself for 72 hours which is the amount of time I was without electricity. (Male, 30-39 years old)

Having lived through Hurricane Juan in 2003, I knew the impact Hurricane Dorian would have based on the estimated strength at landfall. We prepared by putting away lawn furniture and securing anything that could move. We also purchased a large quantity of fuel for our generator and a couple 18L water jugs for drinking water. (Male, 30-39 years old)
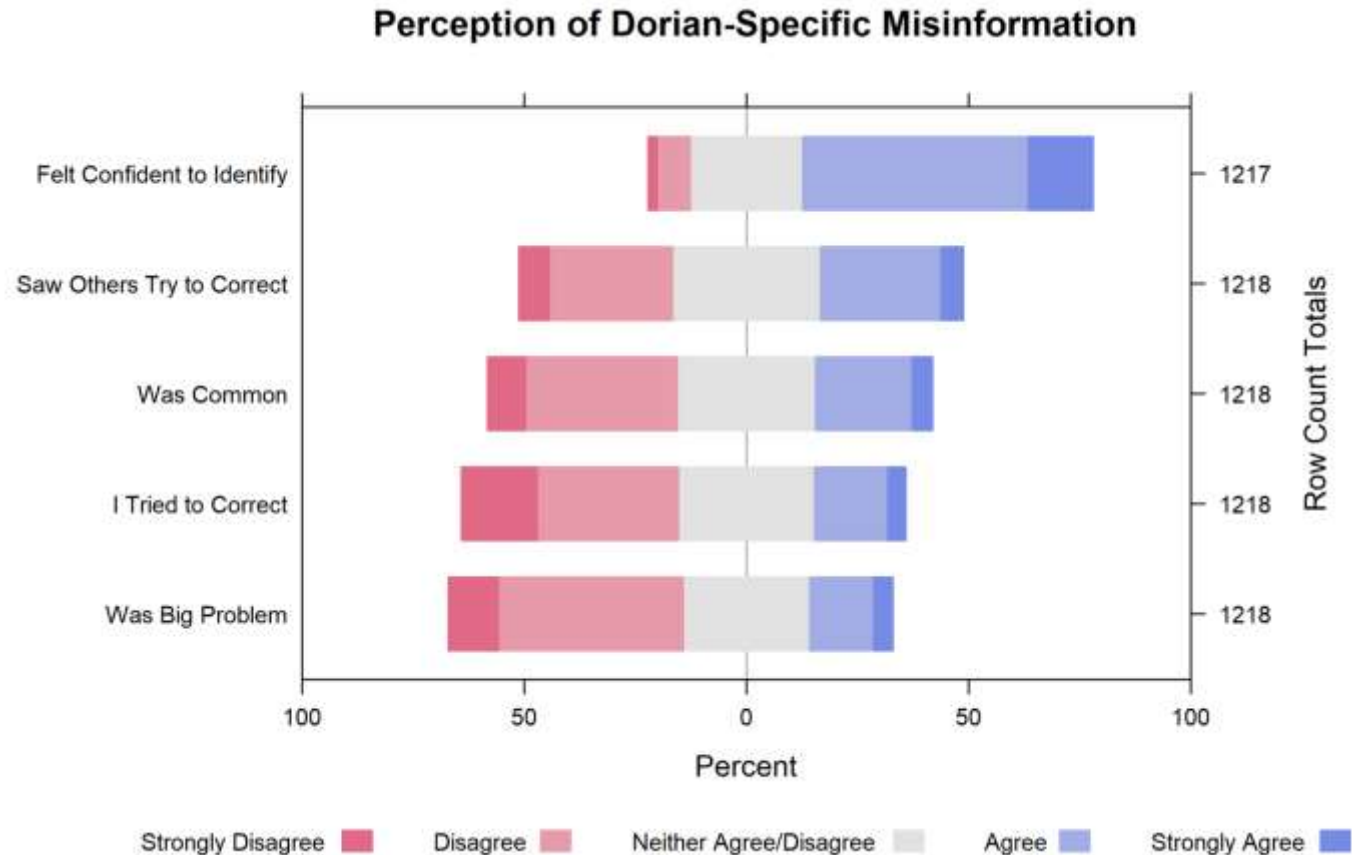
Questionnaire Results

Perception of Dorian-Specific Misinformation

Figure 3: Responses to five-point Likert Scale questions on perceptions of storm-related misinformation and gossip found on Twitter.