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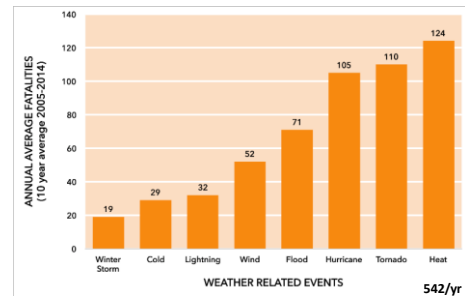
## Drive and/or Ride Safely Whatever the Weather

William P. Mahoney III  
Interim Director  
Research Applications Laboratory  
National Center for Atmospheric Research (NCAR)

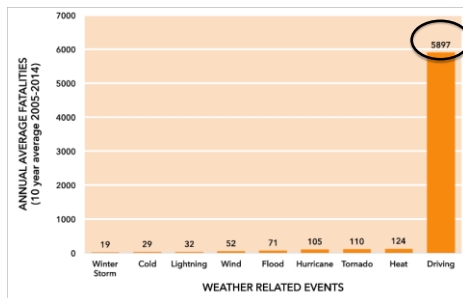
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WHERE DISCOVERIES BEGIN

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### Weather Fatalities by Category



### Road Weather Related Fatalities



### Road Weather Impacts (2005-2014 FHWA)

- 1.26 million weather related vehicle crashes per year
- 22% of all crashes are weather related
- 445,000 injuries
- 6,000 fatalities
- CVO's lose ~32 billion vehicle hours of delay due to weather related congestion



### Road Weather Impacts



Flooding



Snow/ice



Fog



Low Friction



Washouts



Severe weather  
(hail, wind, tornado)

### Road Weather Impacts - Conditions

Weather/Road Condition	% of weather related crashes
Wet pavement	73% (907,000)
Rain	46% (573,000)
Snow/Sleet	17% (210,000)
Icy pavement	13% (152,000)
Snow/Slushy pavement	14% (174,000)
Fog	3% (29,000)
Totals >100% due to condition overlap	

Source: FHWA Road Weather Management Program

## Industry: "Automated Vehicles will Improve Safety by Eliminating the Driver"

THE CONVERSATION  
ENGINEERING

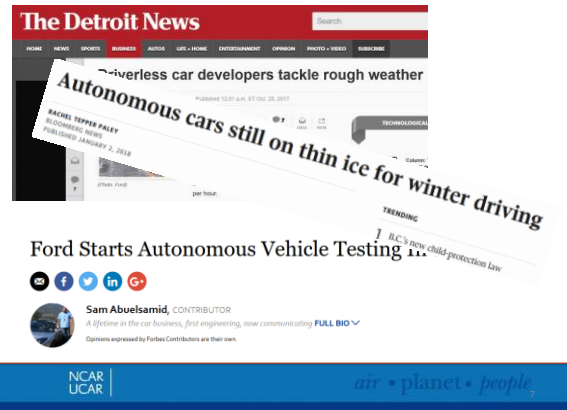
### Are Autonomous Cars Really Safer Than Human Drivers?

Most comparisons between human drivers and automated vehicles have been at best uneven—and at worst unfair

By Peter Harnack, The Conversation EE on February 3, 2018

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## Imperative



1. The autonomous vehicle industry must be proactive in preparing for ADAS operations in poor weather/road conditions
2. Slow degradation of autonomous systems due to environmental conditions is possibly more dangerous than an obvious failure

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## Surface Transportation Weather Research & Development



### Goals

- Reduce road weather related crashes
- Improve mobility across all modes
- Utilize vehicle data to improve local condition diagnoses
- Support ADAS & autonomous R&D and R2O

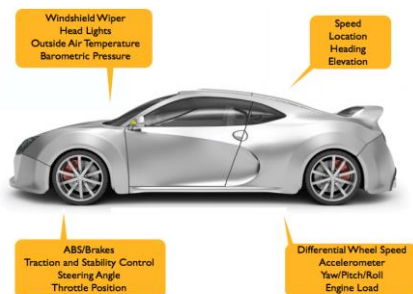
### Overarching Need

- National-scale, high-fidelity, seamless road weather diagnostic and prediction capability (weather + pavement condition) that will inform drivers and ADAS of imminent hazards or changes in the local environment

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## Current Vehicle Data



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## Future Vehicle Data

### Sensor Suite



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## Pikalert® Vehicle Data Translator

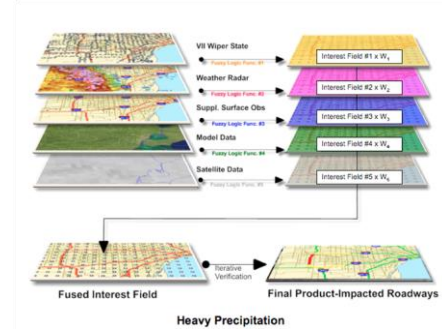
- Ingest, QC, process, and utilize vehicle data to improve weather and road condition diagnosis and predictions per road segment
- Goal – To create a new surface observation dataset (300 million vehicles)
- Convey real-time hazard information to vehicle driver and ADAS technologies



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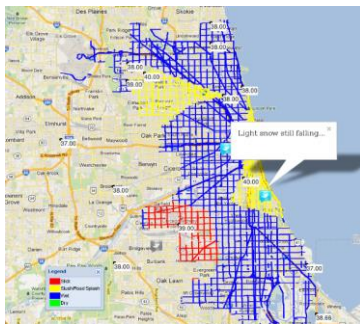
## Pikalert® Vehicle Data Translator



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## Pikalert® Motorist Advisory & Warning



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## Road Weather Hazard Information Needs

Weather and road condition information is vital to moving forward with ADAS and autonomous vehicles

- Driver information
- ADAS
- Travel time estimation
- Incident management
- Emergency management
- Optimum routing guidance
- Understanding local weather and road conditions for driver behavior & crash analytics for insurance industry



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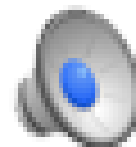


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## Boundary Layer Characterization Can Support UAS Operations

Mt. Hood



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SAVE THE DATE **23-24 October 2018**



NTSB Auditorium | Washington, D.C.

## **AUTOMATED VEHICLES & METEOROLOGY SUMMIT**

Bringing together the weather enterprise, advanced driver assistance system, and aerial and surface automated vehicle industries to discuss meteorological needs and impacts