

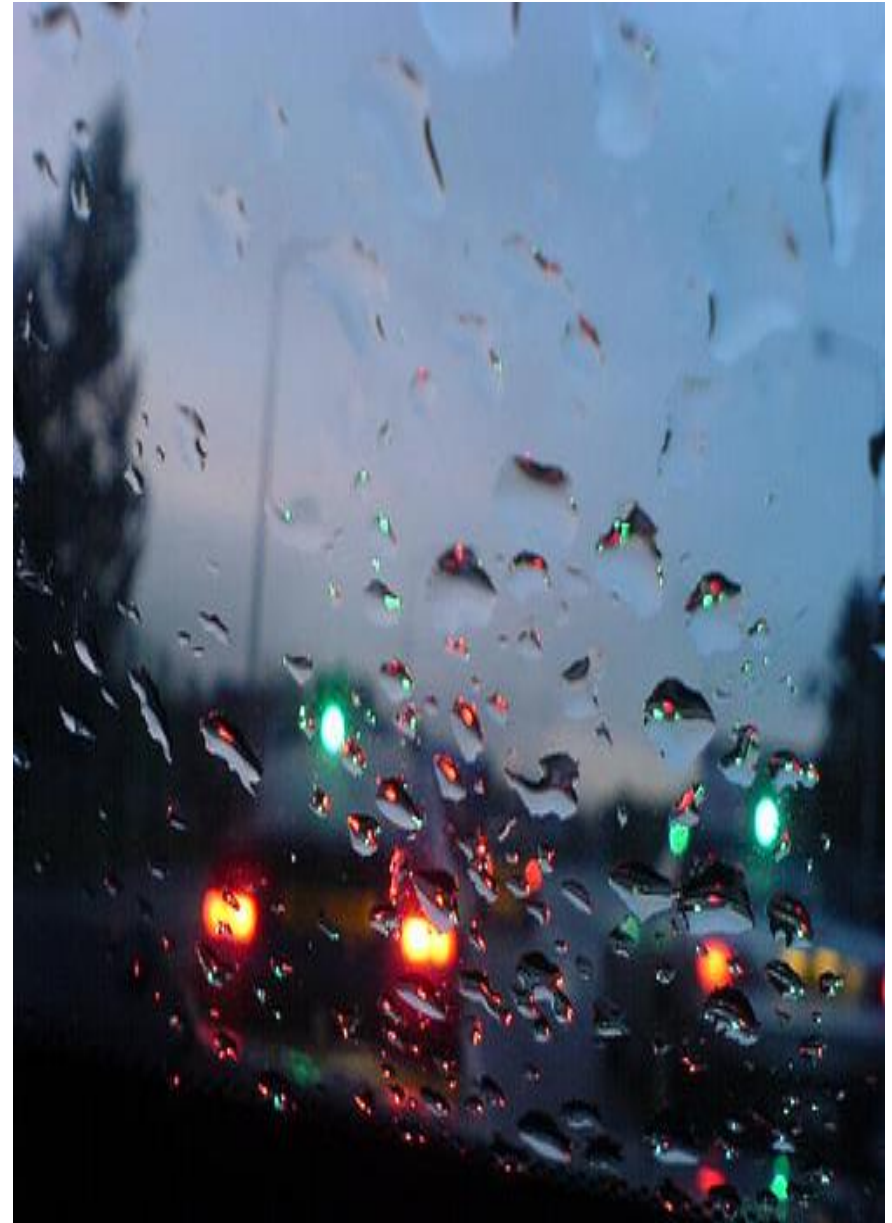
An overview on the effect of weather and traffic conditions on road safety



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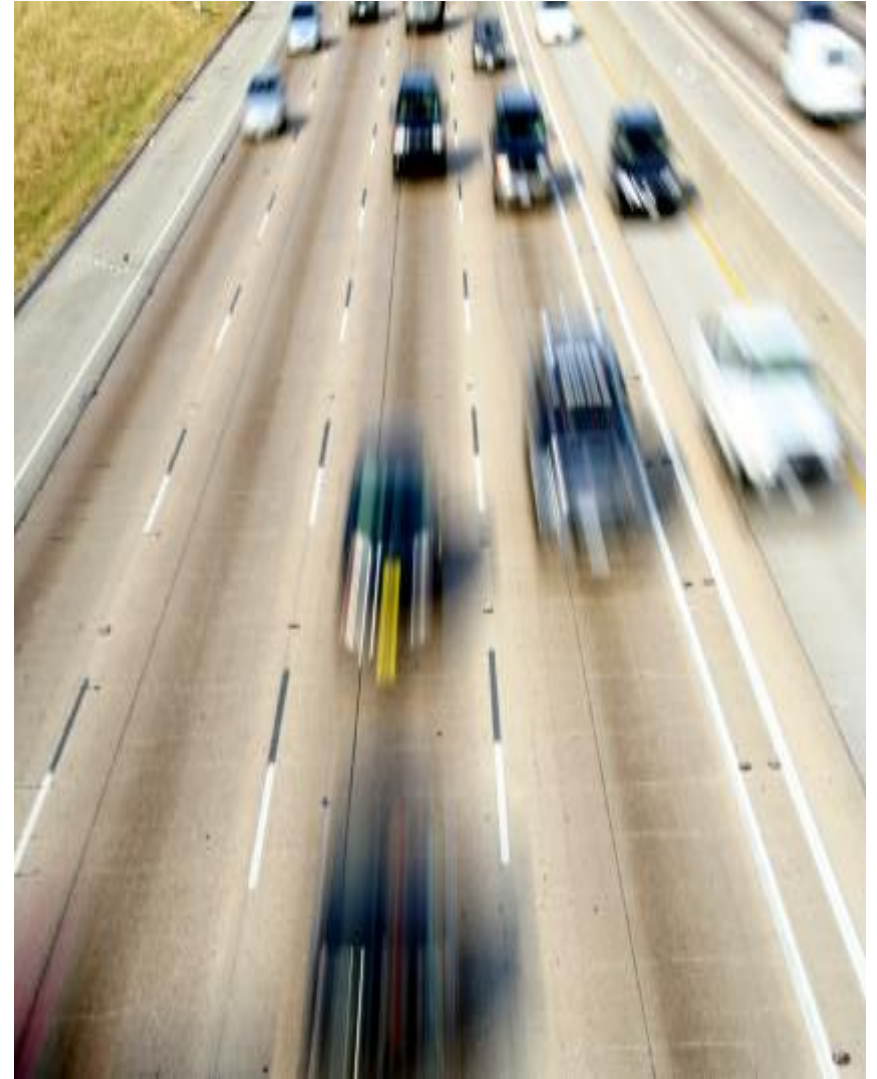
Introduction

- Road safety is a **complex scientific field** with high need for multi-parameter, multi-level and multi-disciplinary analysis.
- Very often we look where the **data** are and not where the **problem** is.
- Traffic and weather parameters play a major role on road safety, however their **combined effect** has not been examined properly so far.
- The objective of this presentation is to provide an **overview** on the effect of weather and traffic conditions on road safety and identify future challenges.



Traffic parameters (1)

- Dominance of a **macroscopic** approach especially in early studies.
- The majority of studies have considered the effect on AADT (Annual Average **Daily Traffic**).
- **Speed** is explored mainly at macroscopic level.
- Less attention is devoted to the other traffic parameters such as traffic **density** and occupancy.
- **Short-term variations** in traffic parameters are rarely explored.



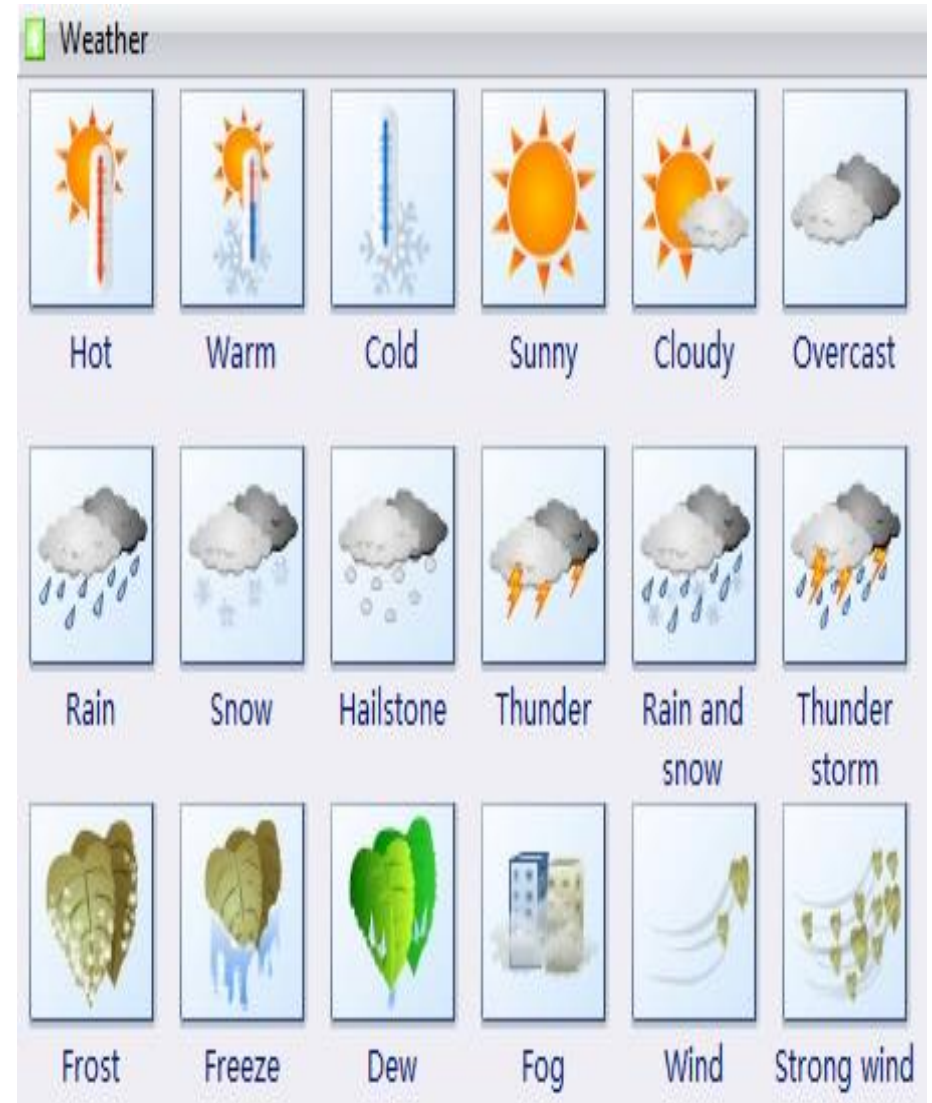
Traffic parameters (2)

- Quite a few **contradictory** findings exist.
- A number of studies indicate a **positive** linear relationship between flow and accident absolute figures.
- A **U-shaped** curve seems to describe the relationship between flow and accident rates.
- Increase in **speed limits** has been found to mostly have a straightforward increase in the number of accidents.
- Traffic **congestion** was estimated by using proxies and led to inconsistent effects on safety.



The effect of weather conditions

- Much research has been conducted.
- The most commonly considered parameter is precipitation (rainfall, rainfall intensity, snowfall).
- The lagged-effect of precipitation is also examined (time passed since last precipitation).
- Other weather parameters such as low visibility, temperature, wind etc. have not received so much attention.
- Data are usually aggregated daily, monthly or even annually.



The effect of precipitation (1)

- The **type of aggregation** is very important as it may lead to different effects of precipitation on road accidents (Eisenberg, 2004):
 - ✓ increased **monthly** precipitation is associated with reduced fatal traffic crashes.
 - ✓ **daily** data indicate a positive linear relationship
- Generally, a **positive linear relationship** between rainfall and accidents exists.
- Research results on the precipitation impact on accident **severity** are not converging.



The effect of precipitation (2)

- Other important findings from literature suggest that:
 - ✓ Risk rises rapidly when the time since last precipitation increases (**lagged-effect**).
 - ✓ *“Drivers are able to **compensate** for wet road conditions, but that reduced visibility during rainfall results in increased travel risk.”* (Andrey & Yagar, 1993, p. 468).
 - ✓ Studies in Mediterranean countries showed a **negative relationship** between adverse weather and accidents (Karlaftis and Yannis, 2010, etc.)



The effect of snow

- Some studies indicate that snowfall has a **negative** relationship with accidents (Fridstrøm et al., 1995).
- On the other hand, Andreescu and Frost (1998), found that the number of accidents **increased** dramatically with increased snowfalls.
- Eisenberg and Warner (2005), stated that snowy weather resulted in **less fatal crashes** than non-fatal and property damage crashes.
- In the same study, it is also stated that there were more fatalities in the **first snowy day** of the year than other snowy days.



The effect of fog, wind and temperature

- Al-Ghamdi (2007), found that **fog**-related crashes have remarkably higher injury and fatality rates.
- Very few studies have examined the effect of **wind**. They mostly found no correlation, except for Baker and Reynolds (1992) who found an increase in overturning accidents involving high trucks.
- Contradictory results concerning the effect of air **temperature** and need further research.



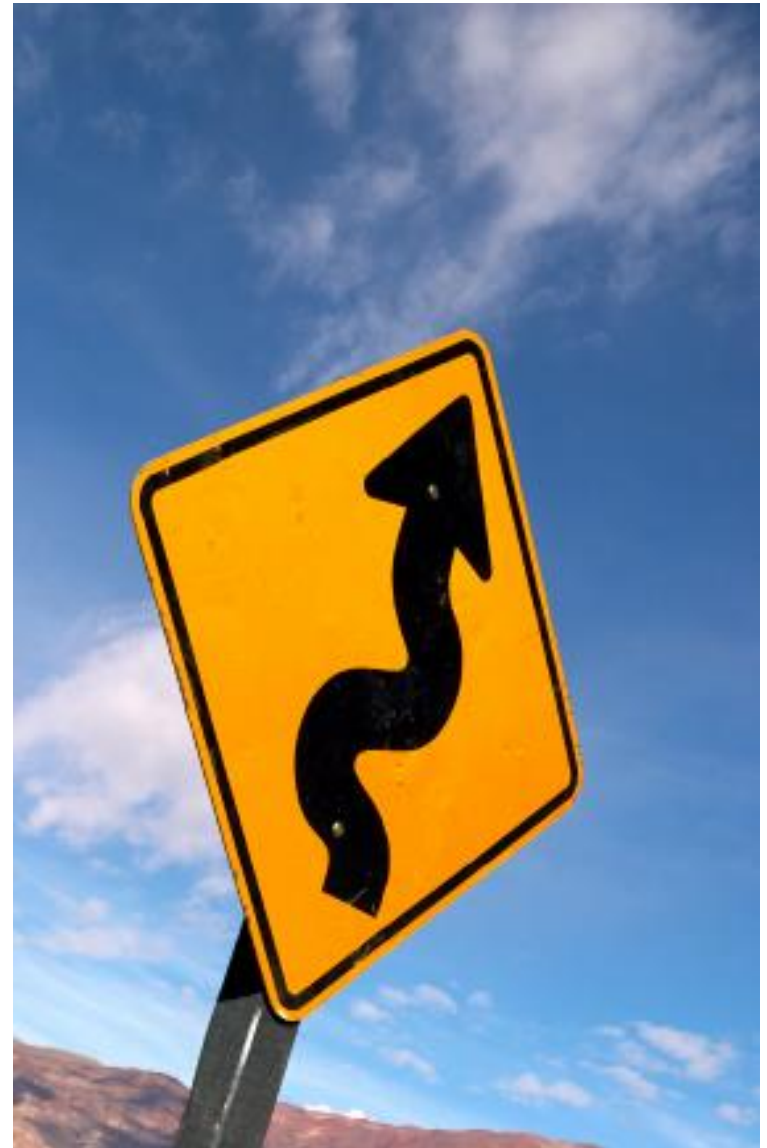
Exploitation of microscopic (real-time) data

- There is need for an aggregation level **under the daily level** both for traffic and weather data (Eisenberg, 2004)
- Weather and traffic parameters need to be explored quantitatively **prior to an accident** that has occurred.
- Today, **short term disaggregate data** (e.g. five minutes before the accident) are becoming more and more available, mainly on motorways.
- Microscopic traffic and weather data enable the exploration of the **combined effect** of weather and traffic parameters measured quantitatively prior to an accident.



Concluding remarks

- Traffic characteristics were found to have **mixed effects** on safety.
- **Precipitation** is the most commonly considered weather parameter. It generally increases accident frequency but its effect on severity is not clear.
- The effect of the other weather parameters needs further research and consideration.
- Application of **short-term traffic and weather data** can produce more straightforward results, allowing for the identification of their combined effect on traffic accidents.



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