FLOWKAR: USING HIGH-RESOLUTION DATA FROM VEHICLE SENSORS TO IMPROVE OPERATIONAL WEATHER PRODUCTS

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The demand for higher spatial and temporal resolution of routine weather products is rising. Among potential users is the car industry and autonomous driving community, eager to asses all possible environmental conditions necessary to gauge driving safety. On the other hand, passenger cars already generate large amounts of data, which mostly relate to the operation of the vehicles, but also include environmental data, for instance temperature, pressure, precipitation, or visibility.

To explore the mutual benefits of data exchange between passenger vehicles and weather services, Germany's National Meteorological Service (Deutscher Wetterdienst), cooperates with the German car manufacturer AUDI AG in the joint research project FloWKar (1), which started in September 2017.
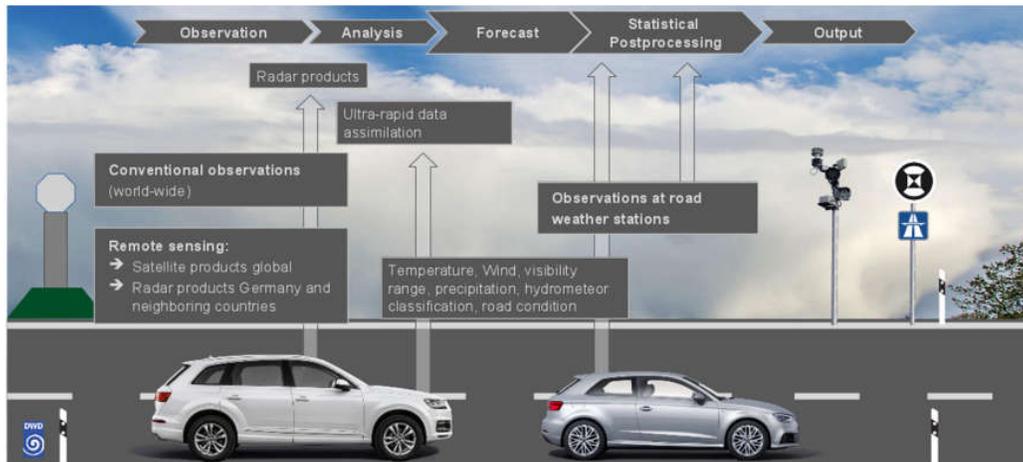

Fig. 1. Concept for using vehicle sensor data and combining it with existing data sources and meteorological methods.

For the German Meteorological Service, the goal is to assess how environmental data from millions of cars on Germany's roads can be used, in real-time and respecting data protection laws, to improve weather products, nowcasting, and weather models (**Fig. 1**).

The observations on-board passenger vehicles will fill observational gaps between weather stations and road weather stations, with a special focus on the German road network. The nowcasting of precipitation events is expected to benefit from vehicle data by providing information near the ground in high spatial and temporal resolution, where quantitative precipitation estimates as well as hydrometeor classification based on radar remote sensing alone prove difficult.

Vehicle data, such as temperature and pressure will be employed in a unique new ultra-rapid data assimilation cycle within the regional operational weather model COSMO-DE. In 5-minute time steps, vehicle data will be used to optimize model performance near the ground. This is expected to improve model predictions for mountainous and coastal areas. It will also play a role in proceeding towards higher spatial and temporal model resolution by providing the necessary observations at correspondingly high resolutions.

Model output statistics may use the additional data to optimize model output for specific locations that prove pivotal to driving safety, e.g., for extreme cold spots in the road network.

The main challenges are expected to be

- the proper assessment of the passenger vehicle sensor data quality according to weather service standards, before incorporating the data into existing operational methods
- the planning of measurement campaigns with accompanying mobile weather service equipment
- the development of suitable data models to produce reliable meteorological information by combining available sensor data
- the real-time exchange of data between commercially available vehicles and weather service with time resolution on the order of a few minutes
- and to verify the benefit for meteorological operational methods from incorporating vehicle sensor data.

References:

1. Brief project description (website of German Federal Ministry of Transport and Digital Infrastructure) https://www.bmvi.de/SharedDocs/DE/Artikel/DG/mfund-projekte/flotten-wetter-karte-flowkar.html
2. Press release (website of Deutscher Wetterdienst – German Meteorological Service) https://www.dwd.de/DE/presse/pressemitteilungen/DE/2017/20171115_audi.html
3. mFUND funding initiative (website of German Federal Ministry of Transport and Digital Infrastructure) http://www.bmvi.de/SharedDocs/EN/Articles/DG/mFund-overview.html