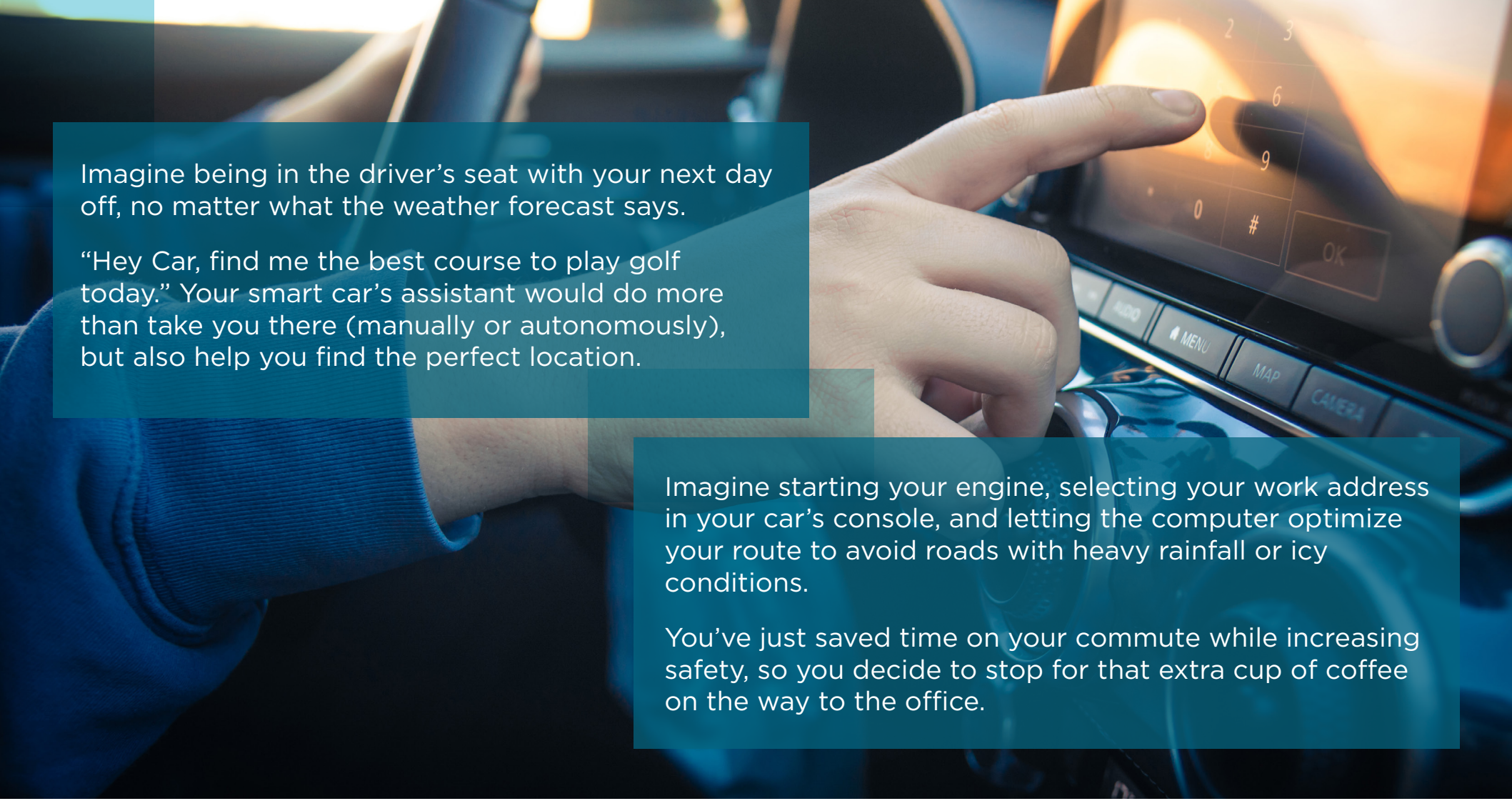
VAISALA

Road weather data

Drive the future of safer, more comfortable journeys



Imagine being in the driver's seat with your next day off, no matter what the weather forecast says.

"Hey Car, find me the best course to play golf today." Your smart car's assistant would do more than take you there (manually or autonomously), but also help you find the perfect location.

Imagine starting your engine, selecting your work address in your car's console, and letting the computer optimize your route to avoid roads with heavy rainfall or icy conditions.

You've just saved time on your commute while increasing safety, so you decide to stop for that extra cup of coffee on the way to the office.

Road weather data is rapidly expanding the possibilities for automotive safety and comfort. From infotainment to automated destination routing, major auto manufacturers are finding innovative ways to deliver the future of driver convenience.

Explore our road weather data solutions, and see how Vaisala technology is helping automotive manufacturers drive the future of the in-car user experience while enhancing safety and passenger comfort.

Contents

Challenges and opportunities

Foul weather can wreak havoc on roads: It frequently causes traffic jams and accidents, not to mention costs for everyone involved. Wet pavement, snow and ice, fog and wind catch drivers off guard with almost no time to react.

The good news? Road weather information and forecasting can help. Road weather data goes beyond general weather conditions by providing information about the road surface itself. This data delivers concrete ROI by helping to reduce:

- Injury and death
- Traffic congestion
- Logistics and trucking delays
- Repair costs

Greater awareness and preparation can lead to fewer fatalities and injuries. When drivers (or even the car) are aware of current and near-future road conditions on the road, they can prepare by changing course or driving style.

Weather-aware vehicles can reduce accidents by avoiding certain road conditions and send intelligent alerts that help drivers change speed or routes. Navigation systems can reduce drive times and improve the driver experience.

The bottom line: Better road safety and fewer accidents can save thousands of lives and billions of dollars per year.

The high cost of weather on U.S. roads: Annual statistics [1,2,3]

22% of all crashes: US **$53B**

23% of highway congestion: **$87B**

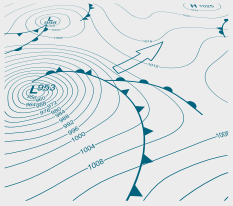
6,000 fatalities and **445,000** injuries: **$62K** average for each non-fatal crash

What is road weather data?

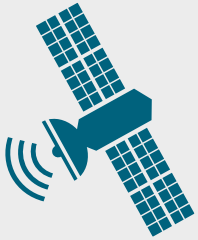
Weather forecasting indicates what is happening in the air. Road weather forecasting indicates what is happening on the road surface. There are several steps in the forecasting chain where measurements play a crucial role:

Acquiring global current atmospheric conditions

Collecting measurements into global weather



Refining global weather models



Using the latest weather station, radar, and satellite data to improve short-range forecasts or nowcasts

How a road weather forecast is created

The road weather model is a physical model of the main processes affecting the road surface. It consists of three separate models:

Energy balance model: predicts the surface temperature such as calculating the temperature rise when black asphalt gets warmer under sunlight.

Material balance model: tracks and categorizes the amount and state of water and chemicals on the road surface such as adding water to the water category when it's raining.

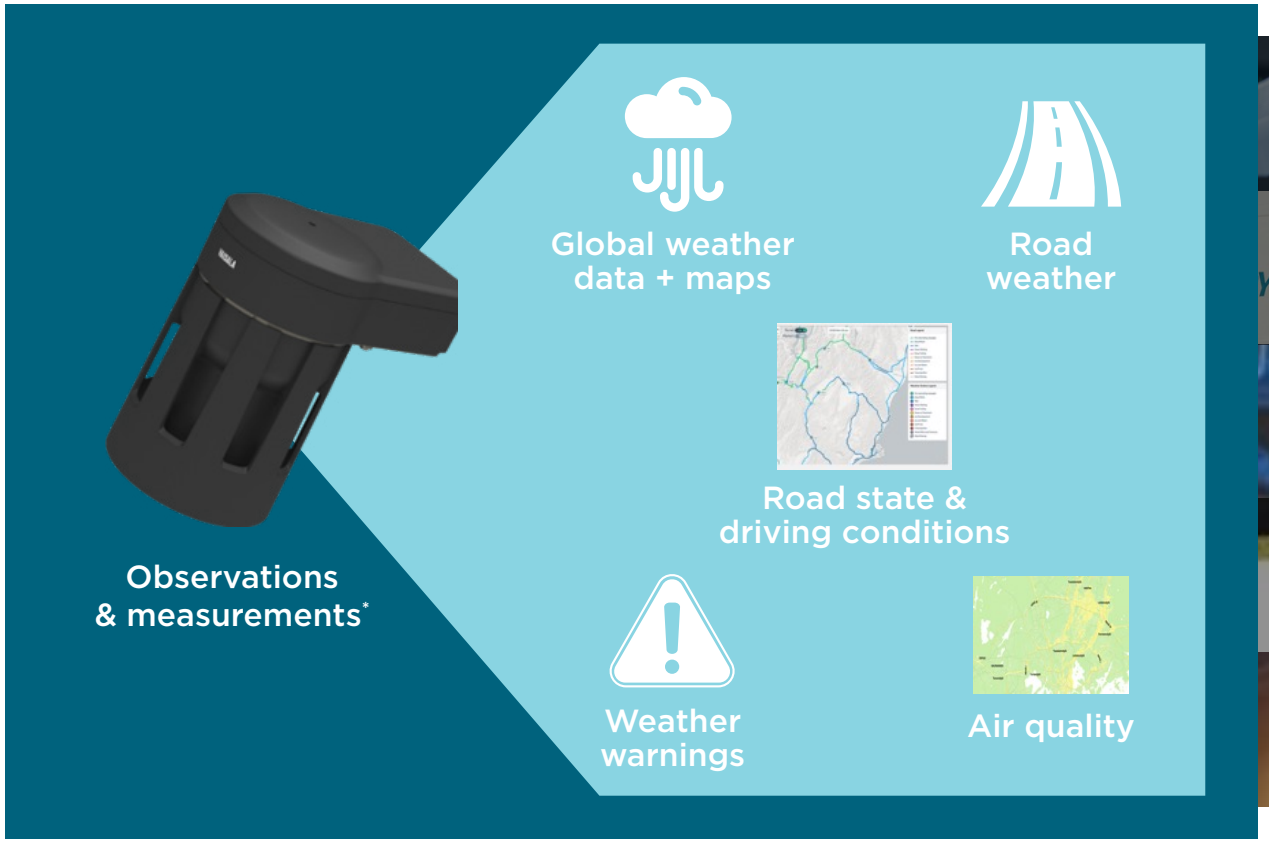
Forecast site information: processes hyperlocal features such as bridges, water bodies and traffic profiles that can create microclimates.

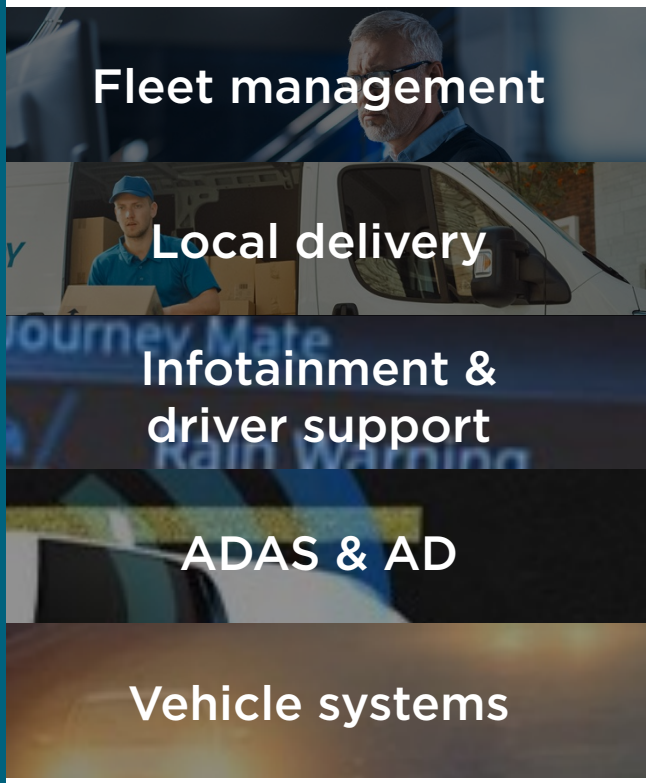
Data delivery: human and auto interfaces

- **Route planning:** Provides contextual, timely weather information with ongoing driving, the chosen route or with driver input
- **The day before a trip:** Helps with route and schedule planning in advance by providing forecasted road weather and driving conditions
- **Starting a trip:** Provides actual road weather conditions as well as an alternate route when needed, and helps the driver understand whether they will be late
- **During the drive:** Keeps the driver up-to-date on changing conditions so they can adjust their driving speed or route, for example warning of upcoming icy roads

- **Advanced driver assistance systems (ADAS):** Optimizes the functionality of features according to conditions, such as adaptive cruise control and automated emergency braking
- **Autonomous driving (AD):** Increases the availability of automated driving features, improves comfort by avoiding sudden braking, and contributes to AD safety in combination with vehicle onboard technology
- **Vehicle performance optimization:** For example, an adjusted electrical vehicle range provides more precise charging ranges when a route is adjusted for road weather conditions, and when power is adjusted for windy conditions

API: Innovate with road weather data





Application programming interfaces (API) provide the most flexibility for innovative uses. Our customizable Road Weather Data APIs give you the accurate, actionable road weather data needed for enhanced safety, maintenance operations and efficiency.

* Vaisala Mobile Detector MD30, a mobile road and runway condition sensor for winter maintenance operations. Measures all key surface weather parameters and is suitable for snow plow trucks and other vehicles.

Road weather data: Check your sources

Accuracy and reliability are crucial to using weather data in vehicle applications. When selecting your weather data source, here are some important features to look for — Vaisala provides all of them.

See if the road weather information provider is committed to data quality KPIs and provides quality verification reports if requested.

Determine geographic coverage. Vaisala currently covers Europe and North America, with more regions to follow.

Evaluate what road classes will you need for more precise forecasts, such as highways, second class road networks and bridges.

Consider data freshness and update cycle: 15-minute updates offer fresh data input, computing and data transfer cost, as well as the dynamic nature of how quickly local road conditions might change.

Find out if automotive-grade SLA is available.

The three main factors that impact accuracy:

- Input atmospheric forecast data
- Quality of contextual information and shape file regarding the road network
- Quality of the road weather model creating the forecast

Future proof the in-car experience

Vaisala's DaaS offering is an optimal solution for supporting customer-specific integration requirements and innovation in customized user interfaces. The data is well-suited for OEM-specific embedded infotainment, navigation and map platform providers, automotive assistants and content aggregators, or as an input to consumer apps built for automotive.

With more than 20% of traffic accidents stemming from inclement weather, our wide-ranging service helps drivers remain aware of conditions along their routes and in close proximity to the vehicle's current location. Even in areas where weather measurements are harder to access, our technology is able to predict conditions according to a driver's route.

Get inspired with new ideas on how to use weather data for autonomous driving and infotainment systems. Contact us to start a conversation.

We believe in the relentless pursuit of quality and performance, anywhere and everywhere. Our expertise is built on more than 85 years of highly accurate observations. Weather-critical organizations — from the North Pole to the South Pole, from the ground to NASA on Mars — trust Vaisala to deliver a full service offering for measuring the weather.

Vaisala is the road weather specialist. With more than 20 years of road weather measurement experience, world-class auto manufacturers count on our highly accurate measurements and product expertise to help them deliver the future of the in-car user experience.

[1] U.S. Department of Transportation Road Weather Management Program, "How Do Weather Events Impact Roads?" https://ops.fhwa.dot.gov/weather/q1_roadimpact.htm

[2] World Economic Forum, "Traffic congestion cost the US economy nearly $87 billion in 2018" https://www.weforum.org/agenda/2019/03/traffic-congestion-cost-the-us-economy-nearly-87-billion-in-2018/

[3] U.S. Department of Transportation National Highway Traffic Safety Administration, "The Economic and Societal Impact Of Motor Vehicle Crashes, 2010 (Revised)", May 2015. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013

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