



— an OTT HydroMet brand —

RELIABLE DATA.  
CONFIDENT DECISIONS.  
SAFE ROADS.

MANAGE YOUR CRITICAL  
ROAD WEATHER CONDITIONS  
WITH LUFFT RWIS AND PAVEMENT SENSORS



# WEATHER IMPACTS SAFETY

Meteorological conditions have a strong, often severe impact on road safety. Monitoring the weather and its effect on road conditions can save lives and support winter maintenance services in their hard yet vital work.

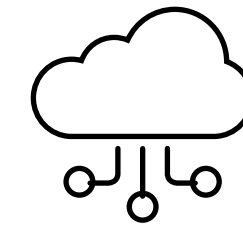
## Influence on safety and traffic time

Snow and ice reduce pavement friction and vehicle maneuverability, causing slower speeds, reduced roadway capacity, and increased crash risk. Each year, 24% of weather-related vehicle crashes in the United States occur on snowy, slushy or icy pavement and 15% happen during snowfall or sleet. Winter road maintenance accounts for roughly 20% of state DOT maintenance budgets. State and local agencies spend more than \$2.3 billion on snow and ice control operations annually. Although these numbers are taken from U.S. DOT statistics and vary a bit from country to country, they show the impact of weather on road safety.

## Excessive salting harms the environment

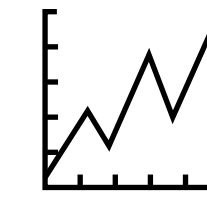
As much as 60 million metric tons (66 million tons) may be applied worldwide each year, 24 million tons solely in the United States. Unlike chemicals that break down into less harmful compounds, road salt persists and may remain in water and soil for years, until it eventually is diluted and carried away by moving water.

Making the right decisions in winter maintenance is not easy. To support the decision making during critical weather conditions and enable efficient use of salt, road weather stations are essential to understand the current situation.



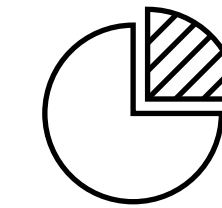
**536,731**

crashes caused by winter conditions annually in the U.S.



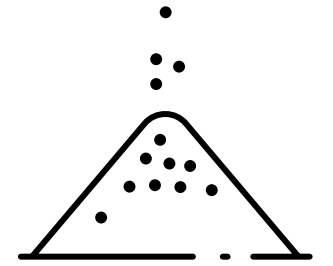
**\$2.3 billion**

spent by U.S. state & local agencies on snow/ice control every year!



**1,836**

deaths annually in US due to snowy or icy roads



**66 million**

tons of salt are estimated to be spread on roads worldwide per year (60 million metric tons)



## Choose proven Lufft solutions and benefit from

- **One source for turnkey, state-of-the-art Road Weather Information and Flood Warning systems**
- **Open interface protocols for easy integration into monitoring networks**
- **Experienced Service and Support Team**

### Road Weather Monitoring by Lufft

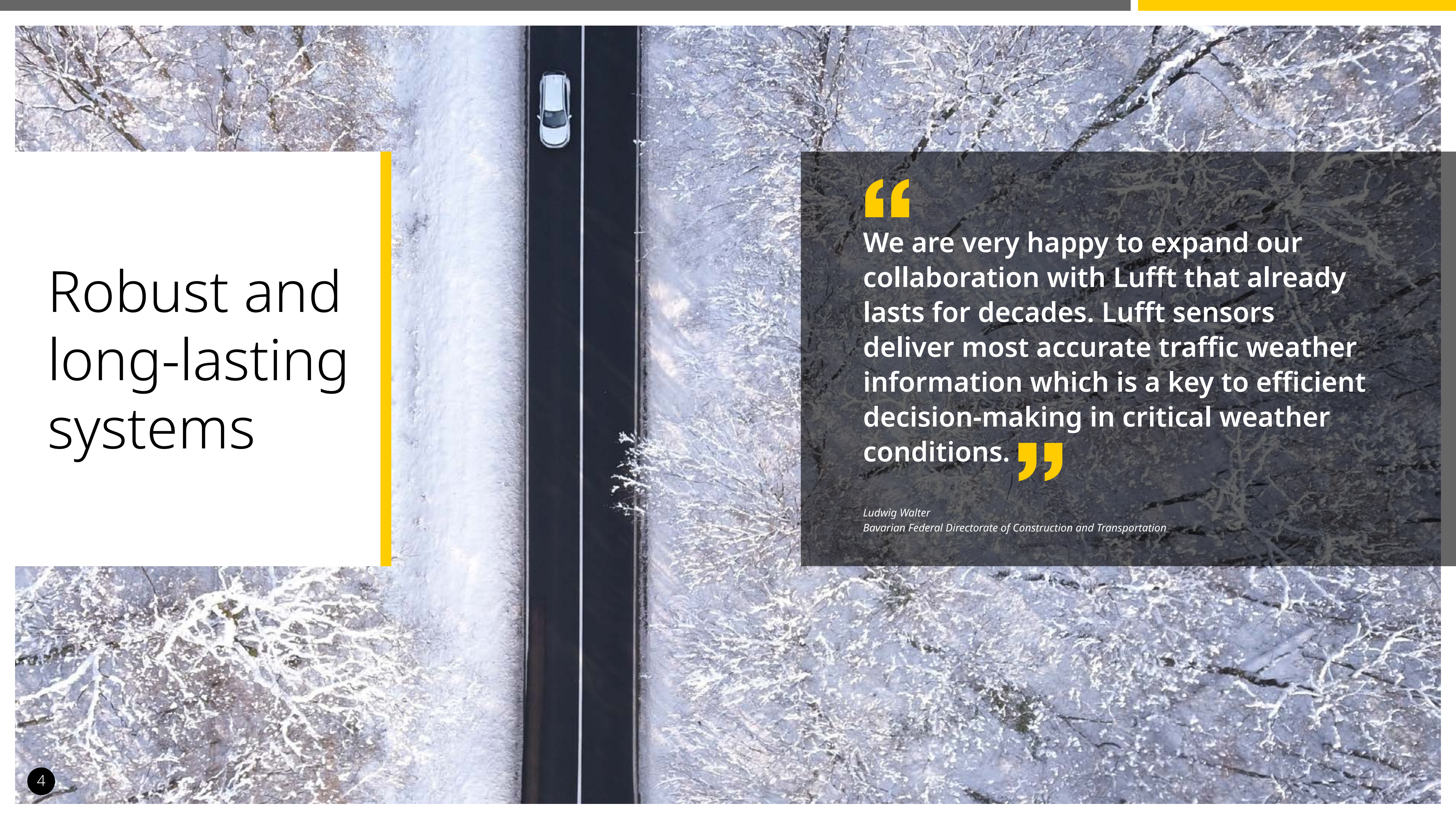
Around the world, professionals rely on stationary and/or mobile road weather information systems by Lufft, a trusted product brand of OTT HydroMet.

Our solutions are substantial for Ice and Road Weather Detection (RWIS), Traffic Control or Vehicle Management Systems (VMS), road maintenance depots, and operation managers to monitor road conditions, friction, temperatures, visibility and more.

Data is used to design efficient operational plans and to keep roads free from snow, ice or water film layers to protect from dangerous traffic situations.

As a leading provider of innovative and easy-to-integrate solutions, we offer customizable options for road weather applications.





# Robust and long-lasting systems

“

We are very happy to expand our collaboration with Lufft that already lasts for decades. Lufft sensors deliver most accurate traffic weather information which is a key to efficient decision-making in critical weather conditions.”

*Ludwig Walter*

*Bavarian Federal Directorate of Construction and Transportation*

# Sensor Technologies – Road Conditions

There are basically three types of road weather sensors. RWIS professionals distinguish between invasive, non-invasive and mobile sensors. Each type has its strengths and benefits. An ideal road weather monitoring network features all types of sensors for synergy effects.

## Invasive Sensors

Invasive sensors are flush-mounted, thus physically built into the road. To measure a broad range of parameters, a combination of passive and active sensors has proven best. Passive sensors reliably detect road surface temperature, water film height up to 4mm, freezing temperature, ice percentage, friction and road condition (dry/damp/wet/ice or snow/moist with salt/wet with salt). The elaborate two-part housing design allows easy maintenance/re-calibration and low energy consumption allows solar operation. A combination of passive and active sensors can measure freezing points for different de-icing materials (NaCl, MgCl, CaCl).

## Non-contact Sensors

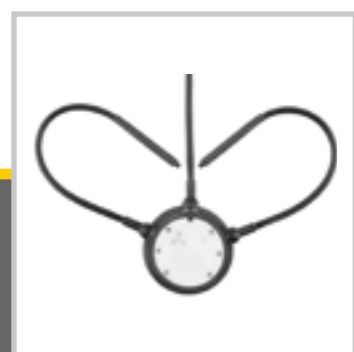
A single measurement point is often not reflecting the actual road conditions. Optical, non-contact methods sample a representative

surface area instead of a point. They take advantage of the properties of light that breaks through obstacles. By working without direct contact, optical sensing results in a very simple installation without impairment of the surroundings. Non-invasive road weather sensors are mounted up to several meters above the ground and can even monitor bridges. They measure surface conditions such as wetness, ice, snow, or frost as well as water film heights, ice percentage in water and dew point temperature. These measurements determine the friction coefficient on the road.

Although easy to install and to integrate into existing networks, optical sensing provides accurate results. Note that water film height is measured in micrometers. From as little as 10 micrometers, a road is no longer dry. With more than 700 micrometers (0.7 mm), there is a risk of hydroplaning.

## Mobile Sensors

A dense network of stationary sensors is essential to reliably monitor the roads within a certain area. However, there always will be places that are not covered by neither invasive nor non-contact sensors. To fill these gaps or to identify important places for a permanently installed road weather station, the Lufft MARWIS is a perfect addition to every monitoring network. The award-winning sensor can be mounted on nearly every car or bigger vehicle, making it extremely flexible. It measures up to 100 times per second, while the measuring vehicle is in motion and reports data in real-time. With mobile sensors you get full view on the road conditions in real time, avoid data gaps, avoid oversalting and save costs.



### Invasive Road Sensor

e.g. IRS31Pro-UMB

Flush-mounted in the road for direct measurement.  
Best way to detect ice percentage and freezing temperature on the road surface.



### Non-Contact Road Sensor

e.g. Lufft NIRS31

Non-invasive road weather sensor working with optical principle, mounted several meters above the surface at bridges or masts. Measures wetness, ice, snow, or frost as well as water film heights, ice percentage in water and freeze point temperature.



### Mobile Road Sensor

e.g. Lufft MARWIS

Mobile non-contact road sensor detecting road conditions in real time while driving.  
Ideal to fill data gaps and to identify high-risk places.



## Flexible solutions fitting your purpose

“

Now we have a system that can detect when the road or bridge deck might be slippery, and automatically activate lights on the signs to call more attention to drivers' message.”

*Garrett Dawe  
North Region Operations Engineer, Michigan DOT*

# Sensor Technologies – Weather Monitoring

Keeping your fingers on the pulse of the road is the core discipline of every winter maintenance and road service. Monitoring atmospheric conditions adds significant value to local forecasting and puts the actual road conditions in a broader context.

Slippery roads and bad visibility do not come out of the blue but as consequences of adverse atmospheric conditions. In order to display the optimum speed regarding the given actual conditions via variable warning signs, Traffic Management Systems (TMS) require real-time information, not only about road conditions but also wind (on bridges) as well as visibility. Other applications equally benefit from monitoring atmospheric conditions. We compiled a collection of helpful sensor types to upgrade your monitoring network and improve your data quality.

## Weather Stations

To know the fundamental atmospheric conditions across your road network, you need weather stations where the action is. Depending on the application, essential parameters are air temperature, humidity, air pressure, as well as wind speed and direction. Compact all-in-one weather sensors from the proven Lufft WS series are key components in the broadest range of environmental monitoring solutions. Easy installation and configuration as well as integration into existing monitoring systems and software solutions make it a basic tool for reliable weather monitoring.

## Visibility Sensors

Adverse weather conditions, such as fog or heavy snowfall, can further impair the driver's visibility and increase the risk of an accident. Limited visibility can lead to particularly serious accidents. Visibility sensors help to detect the visibility range and provide essential data to Traffic Management Systems that warn drivers to adjust their speed. Lufft visibility sensors provide highly accurate results with minimum maintenance and absolute reliability. They are suitable for extreme ambient conditions, are seawater resistant, active spider defense, compatible interfaces for easy integration into existing networks.

## Precipitation Sensor

There are many factors that impact the state of water falling down from the sky. Depending on air

temperature, pressure, and humidity precipitation can occur as rain, snow, sleet, or hail. For road safety applications, knowing the exact type of precipitation is at least as important as it is for meteorologists. Laser disdrometers are proven instruments to detect the type, speed, and size of hydrometeors, i.e. falling water particles.

## Water Level Sensors

Roads close to inshore waters and bridges over a river are potentially exposed to flood risks. Gathering precise data on the water level at the right place can help to safeguard risky roads in time. Proven radar technology allows for lightweight compact design enabling easy mounting on bridges, extension mounting bracket or inside a small protective housing.



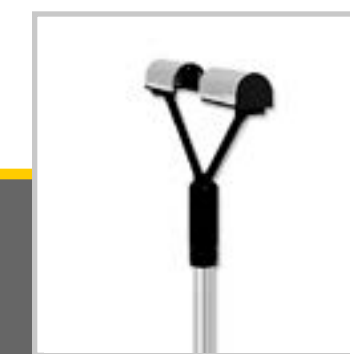
### Compact Weather Station

Lufft WS Series, e.g. WS600  
Compact all-in-one weather sensor for measurement of temperature, relative humidity, air pressure, wind direction and wind speed, and precipitation type and intensity. Integrated design with ventilated radiation protection. Maintenance-free operation.



### Visibility Sensor

Lufft VS2k-UMB  
The Lufft VS2k-UMB visibility sensor measures visibility up to 2000 m, ideal for road traffic applications on motorways, highways or bridges. Easy calibration functionality, sea waterproof housing and (active) spider defense. Also available as a model for 20,000 m.



### Disdrometer

OTT Parsivel<sup>2</sup>  
Laser disdrometer for comprehensive measurement of all precipitation types. This advanced instrument captures both the speed and the size of falling particles.



### Water Level Sensor

OTT RLS  
Non-contact water level sensor with pulse radar technology. The OTT RLS combines a large measurement range with a small blanking distance and narrow beam width. Low power consumption makes it ideal for remote or solar powered sites.

# Lufft Road and Runway Sensors

Road and Runway Conditions



	WS100	WS200-UMB	WS300-UMB	WS301-UMB	WS600-UMB	WS700-UMB	VENTUS-UMB	V200A-UMB
Wind speed		✓			✓	✓	✓	✓
Wind direction		✓			✓	✓	✓	✓
Wind gust							✓	✓
Temperature			✓	✓	✓	✓		
Virtual temperature							✓	✓
Relative humidity			✓	✓	✓	✓		
Air pressure			✓	✓	✓	✓	✓	✓
Precipitation quantity	✓				✓	✓		
Precipitation type (non-specified liquid & solid)	✓				✓	✓		
Precipitation type (sleet, freezing rain, hail)	✓							
Precipitation intensity	✓				✓	✓		
Radiation				✓		✓		
Operation in extreme conditions							✓	



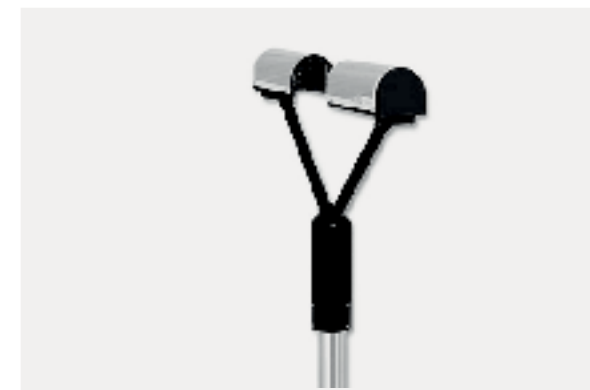
# Lufft Weather Sensors



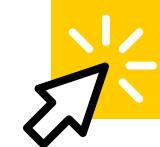
	IRS31Pro-UMB	ARS31-UMB	NIRS31-UMB	MARWIS
Mobile				✓
Invasive	✓	✓		
Non-Invasive			✓	✓
Surface temperature	✓	✓	✓	✓
Water film height	✓		✓	✓
Road/Surface Condition (dry, damp, wet, snow, ice)	✓		✓	✓
Road/Surface Condition (chemically wet, critically wet)				✓
Road/Surface Condition (moist with salt, wet with salt)	✓			
Freezing point	✓	✓	✓	
Freezing point, independent from deicing material		✓		
Friction (calculated)	✓		✓	✓
Depth temperature sensor(s)	✓			
Salt concentration measurement	✓			
Air temperature/humidity				✓
Ice percentage				✓
Dew point				✓



# Special Sensors by OTT HydroMet



	Lufft VS2k-UMB	Lufft VS20k	OTT Parsivel <sup>2</sup>	OTT RLS
Sensor type	Visibility Sensor	Visibility Sensor	Disdrometer	Water Distance Sensor
Measuring principle	Optical Sensing	Optical Sensing	Laser Detection	Radar
Parameter	Visibility from 10 to 2000 m	Visibility from 10 to 20,000 m	Precipitation Type Intensity Drop Size Distribution Radar Reflectivity	Water Level from 0.4 to 35 m
Special feature	Active spider defense	Active spider defense	Advanced technology for professional precipitation	Proven in hydrological applications worldwide, lightweight design for easy installation



Find our entire portfolio on the website

# Technical support from experts committed to your success

“

We made it! In Estonia we've connected six more Lufft weather stations to the internet. Many thanks for the good care and support.”

*Stanislav Metlitski  
Project Manager of Teede Tehnokeskus*



[More about this road weather project in Estonia](#)

# Lufft Communicator

The Lufft Communicator (LCOM) is an industrial PC with the Windows-CE operating system. It comes with a built-in 7 inch touch screen and serves as a complete service module superseding additional service PCs. The following interfaces are available for communication purposes: USB, CDMA modem (RS-232), Partyline modem (RS-232) or UMB bus (RS-485). Conversion to the following standard protocols can be made in combination with the UMB technology:

- TLS
- NTCIP
- TLS over IP with GPRS (ASFiNAG)
- DGT
- XML (ASFiNAG)
- Synop (in planning)

Remote access is available for software uploads and data analysis on the LCOM and UMB modules over the GPRS modem.



# Communication Paths

Measuring critical parameters with reliable instruments is key to keep an eye on both road and atmospheric conditions. But without seamlessly integrated systems to share data in real-time are equally, the best sensors cannot do their job.

Monitoring solutions by OTT HydroMet are designed for flexible and easy integration into any system or network. To support decision makers with a reliable and flexible solution, we developed the Critical Weather Device Controller. It consists of a controller module, the Lufft Communicator LCOM, which monitors different sensor channels and triggers relays based on user defined conditions.

This allows triggering of 3<sup>rd</sup> party devices such as:

- Turning on warning lights (beacons)
- Turning on a siren
- Displaying messages on a variable message sign (VMS)
- Enabling a de-icing system

## How the Critical Weather Device Controller works

The LCOM polls the sensor channels every minute and processes the alarm logic. When an alarm threshold is exceeded, the LCOM sends the Modbus®/IP command to a relay output module, e.g., Acromag, via Ethernet which in turn triggers the appropriate relay.



More about this Lufft Communicator LCOM

## State-of-the-art monitoring software with a browser-based GUI

# ViewMondo Traffic Weather Software

In critical situations, decision makers have to react within seconds. Reliably programmed and well-designed software as ViewMondo lends countenance to traffic monitoring professionals and provides perspective even in hectic situations.

With every additional station and sensor, a monitoring network performs better and provides more insights. Making these visible and delivering the most important information at a glance is what ViewMondo was developed for.

ViewMondo is provided as a cloud-based service. It is a state-of-the-art software package with a browser-based graphical user interface (GUI), and compatible with all modern browsers.

### Simple and intuitive usability

ViewMondo supports stationary sensors like the Lufft IRS31Pro and the Lufft NIRS31 as well as mobile sensors, i.e., the award-winning Lufft MARWIS. Depending on the application and the number of sensors in their network, users can select their preferred visual display mode. It is possible to create group tables with measure values from all related RWIS sites to quickly get an overview, either in a table or on a map with pan and zoom functionality. The color of each site's icon immediately indicates the current status (ok/warning/alarm/communication error).

The station view on the other side highlights one respective station by displaying the current or latest measure values. Displaying the transferred image of an optional cam can provide additional insights. To investigate the conditions at a given time, easily navigate over time or select data from a date/time picker to show cam picture(s) and measure values for a specific time. Create monthly reports to retrace how conditions changed during a given time period.

### Individual setup

ViewMondo offers role-based user management to add users with different permissions and access. The software considers bigger teams' workers are based in various parts of a country or even around the world. Measure values are displayed individually according to the respective timezone. Support is offered in multiple languages (user based, currently English, German, French, Chinese).

For further analysis or processing, ViewMondo offers automatic, time and event triggered data export in CSV format and via FTP protocol. Of course, manual data export is always possible via the GUI.



ViewMondo gathers data in real-time and allows for documentation and archive purposes, too.



Users can get an overview of all sensors and zoom into single stations. Optional cameras provide additional insights.

## Bavaria

# Setting up 37 new RWIS stations against all odds

### Challenge

The Bavarian Federal Directorate of Construction and Transportation planned to extend its RWIS network. A tight time schedule and adverse weather posed challenges to the contractor.

### Solution

The scope covered various Lufft instruments like invasive sensors weather sensors WS600, tilt over masts, control cabinets, cameras, and modules for communication via 4G mobile routers and Wi-Fi.

### Benefits

Thanks to a synced product portfolio and a closely collaborative team, the 33 ordered stations were erected in a short period of time and the project managers ordered four additional stations.



[Discover more about our projects](#)



## Maryland DOT

# Mobile sensing supports efficient winter maintenance operation

### Challenge

Road weather networks typically include only stationary stations, that report the road conditions from the place of installation – but the major unknown is the situation between one and the other station.

### Solution

OTT HydroMet provided the Maryland Department of Transportation with mobile road sensors to equip their control vehicles to fill the data gaps and support decision making in winter maintenance.

### Benefits

Better basis of data to make smarter decisions, that improved safety on Maryland roads and optimized operational efficiency of winter maintenance.



[Download Maryland DOT Case Study to learn more](#)

## California DOT

# Retrofitting Caltrans' Road Weather Stations using existing infrastructure

### Challenge

Caltrans, the state's Department of Transportation, retrofitted several road weather stations after some years in operation. To act cost-efficiently, Caltrans wanted to install new equipment while keeping the existing infrastructure.

### Solution

OTT HydroMet provided a flexible system that both fully met the project requirements and fitted the existing infrastructure. The solution combined Lufft Communicator modules, Lufft weather sensors, and state-of-the-art precipitation measurement through OTT Parsivel<sup>2</sup>.

### Benefits

Caltrans received a concerted system of high-quality sensors and communication modules while keeping its infrastructure. Thanks to OTT HydroMet's flexible range of products and support, Caltrans saved time and costs.



[Read the whole story on our Blog](#)



## Technical Services Offenburg

# Bus with Mobile Sensor strengthens database

### Challenge

The Technical Services in the municipality of Offenburg (TBO), Southwest Germany, supervise a diverse area with steep hills and foggy valleys. To ensure safe traffic everywhere, solid knowledge on road conditions is key.

### Solution

Equipped with mobile road sensors Lufft MARWIS, vehicles monitor the situation in real-time while driving. In addition to their own motor pool, the TBO installed a MARWIS on a public bus.

### Benefits

More data helps to make confident decisions even in critical situations. Public buses gather it without extra effort. Sharing data with neighboring communities opens opportunities for synergies and safer roads, especially in areas between communities.



[Read the whole story on our Blog](#)

# Reliable Data. Confident Decisions. Safe Roads.

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Lufft is a well-established and proven OTT HydroMet product brand for meteorological monitoring solutions. Both road maintenance professionals and weather services around the world rely on Lufft sensors and solutions.

OTT HydroMet delivers superior customer outcomes by providing decision-makers with vital insights they trust. Our exceptional technical expertise and solutions seamlessly integrate hardware, software, and services across an unmatched range of environmental monitoring applications.

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