

# NEW POSSIBILITIES BY COMBINING PASSIVE AND ACTIVE MEASUREMENT SURFACE SENSORS

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## Introduction

Detection of the de-icing chemical concentration in terms of Freeze Temperature is still an important key parameter for winter maintenance decision support systems. There are many reasons for choosing passive measurement methods for the detection of freeze point, for example the quick response time, low power consumption, and the application of well know type of salt mixture and so on. But there are also many reasons for choosing active measurement methods, for example at airports, where often non dissociating de-icing chemicals are used and so on.

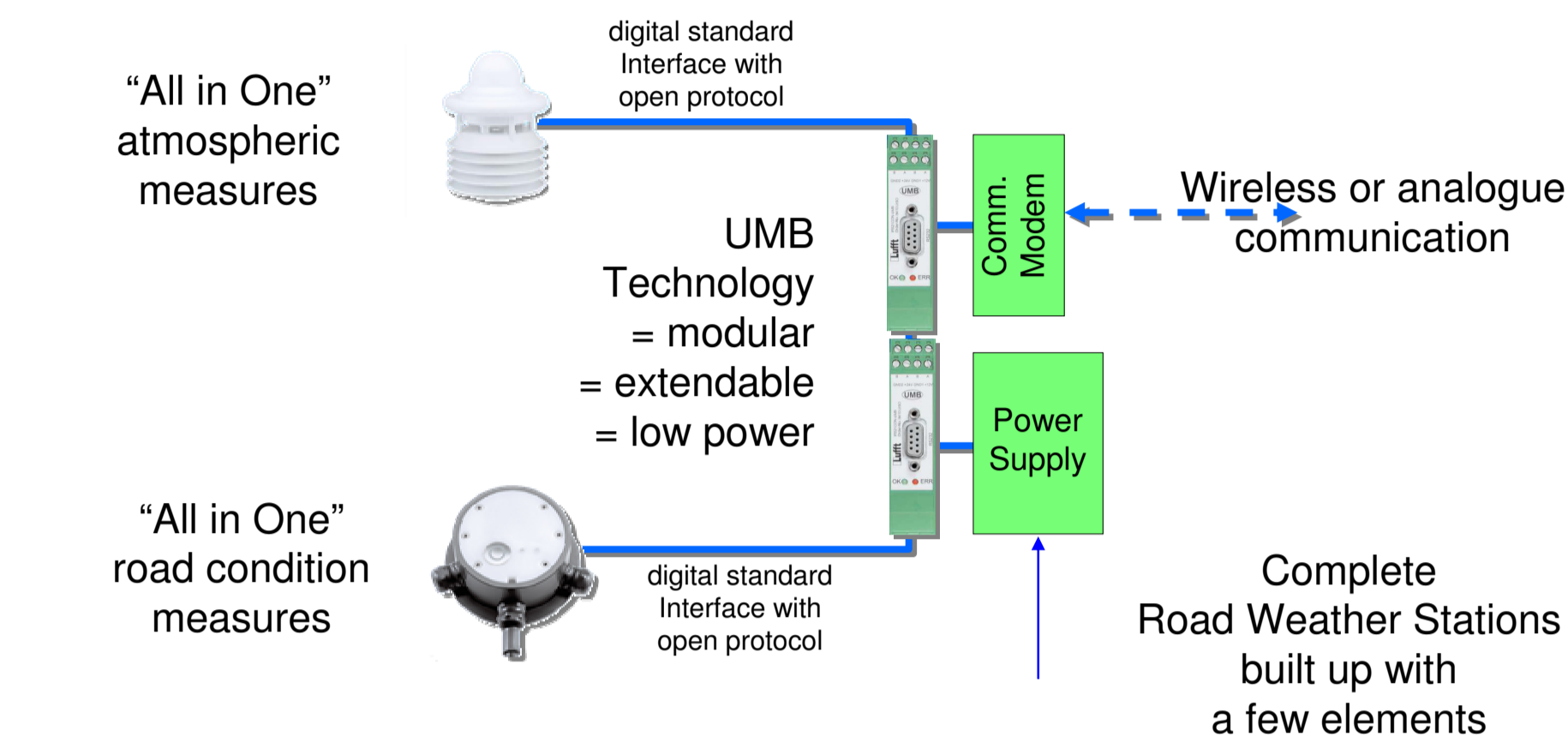
An active sensor is only capable in measuring the freeze temperature and also not able to provide accurate measurement of surface temperatures because of the influence of the necessary cooling and heating energy. And also detailed surface condition classes are not supported by active sensors.

A well know manufacturer and developer of passive and active surface sensors recently now introducing an innovative solution in combination of passive and active measurement transducers.

The combination is able to provide all useful parameters for winter maintenance decision support and also for traffic control purposes. The Parameters are for example active Freeze Temperature, detailed surface condition classes, salt concentrations, surface temperature and waterfilm depth and a lot more.

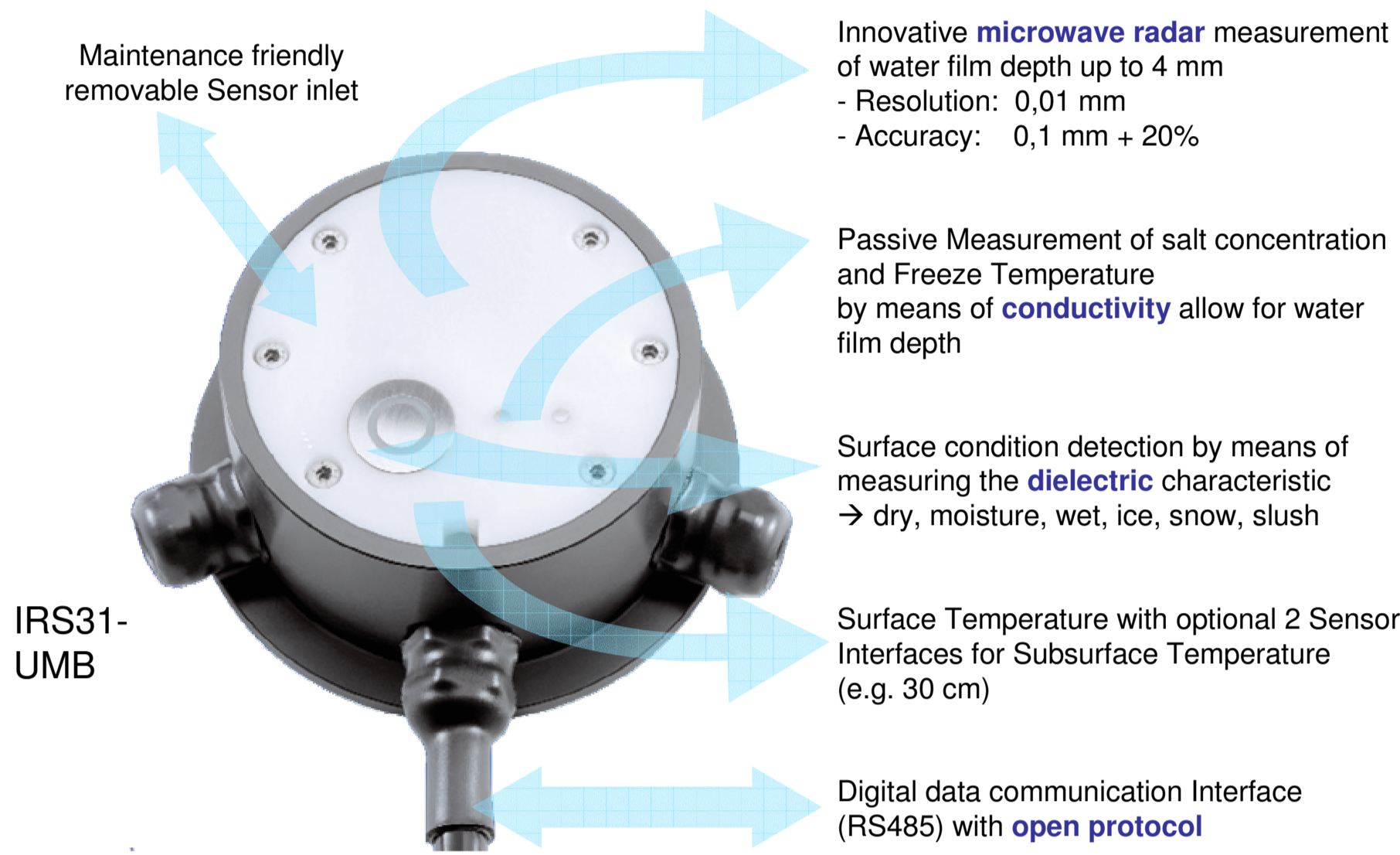
The paper describes the basic technical solution and field application results. There is also a comprehensive comparison between the different surface condition detection methods in-pavement and non-invasive technologies.

## New Intelligent Sensor Technology

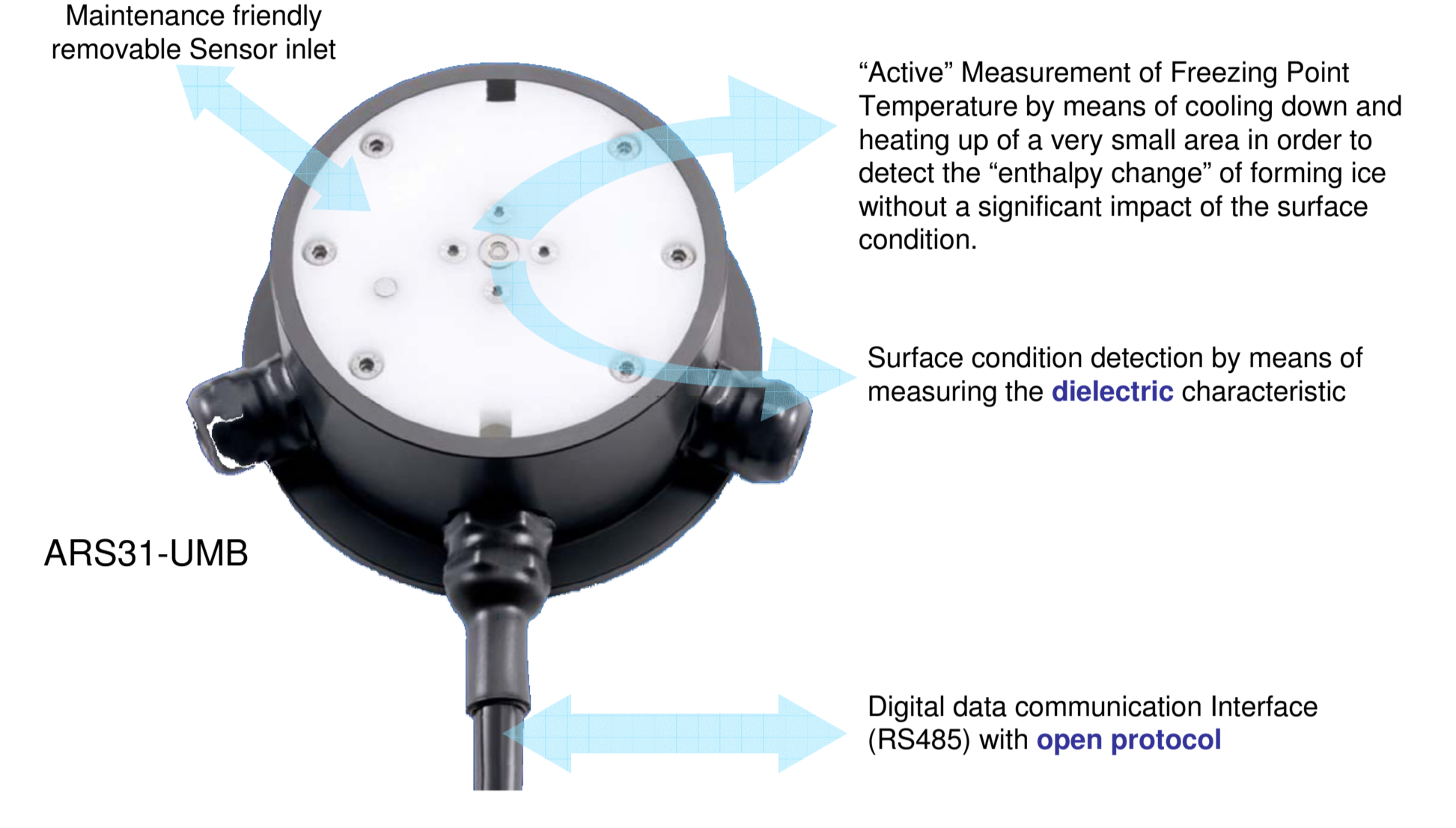


This technology makes it affordable to densify the data acquisition network in order to enhance the capability of providing optimal Road Weather Condition Information

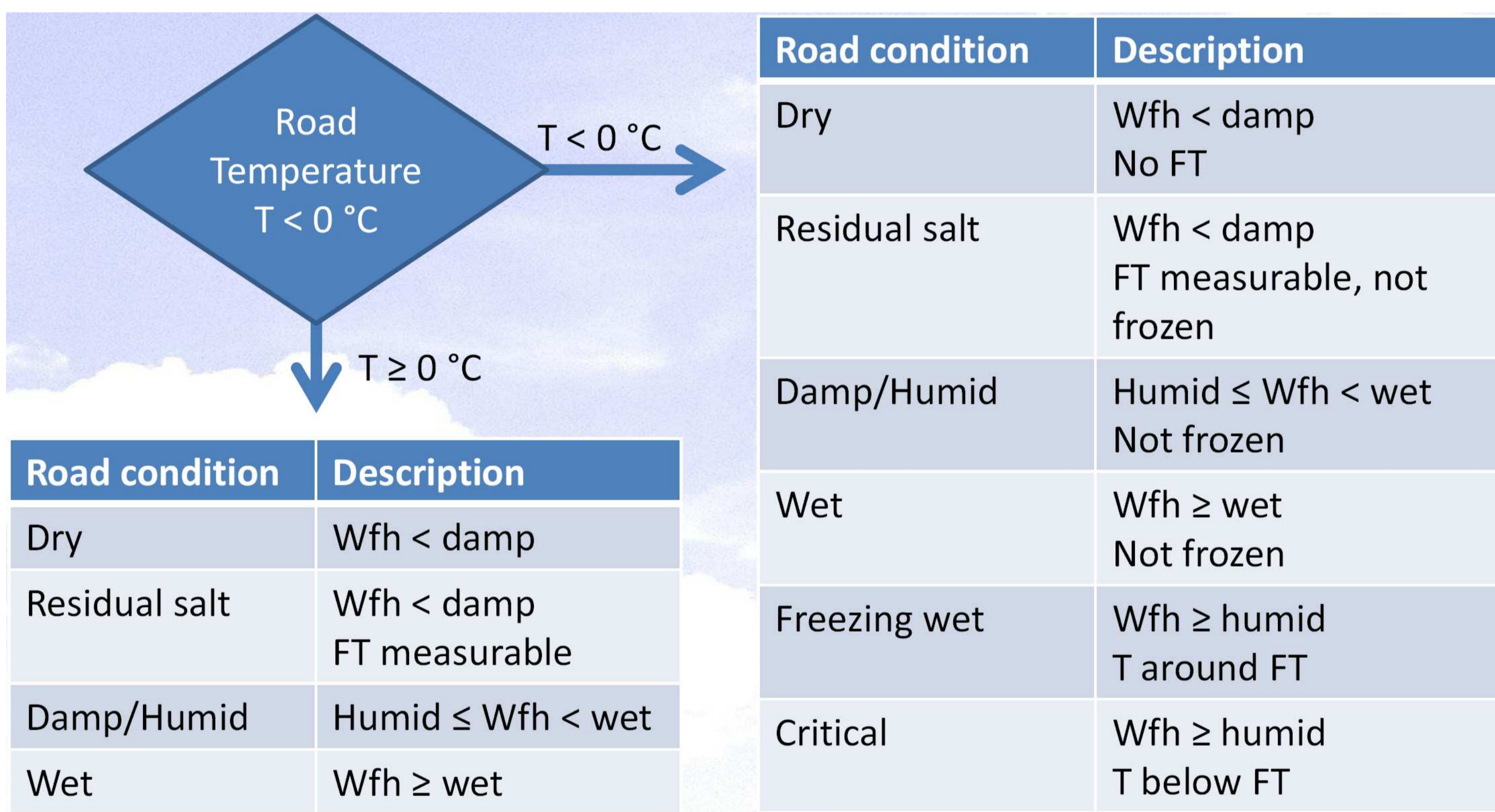
## Intelligent and compact device for a complete road condition measurement



## Active Measurement of Freeze Temperature provided by a compact Road Surface Sensor



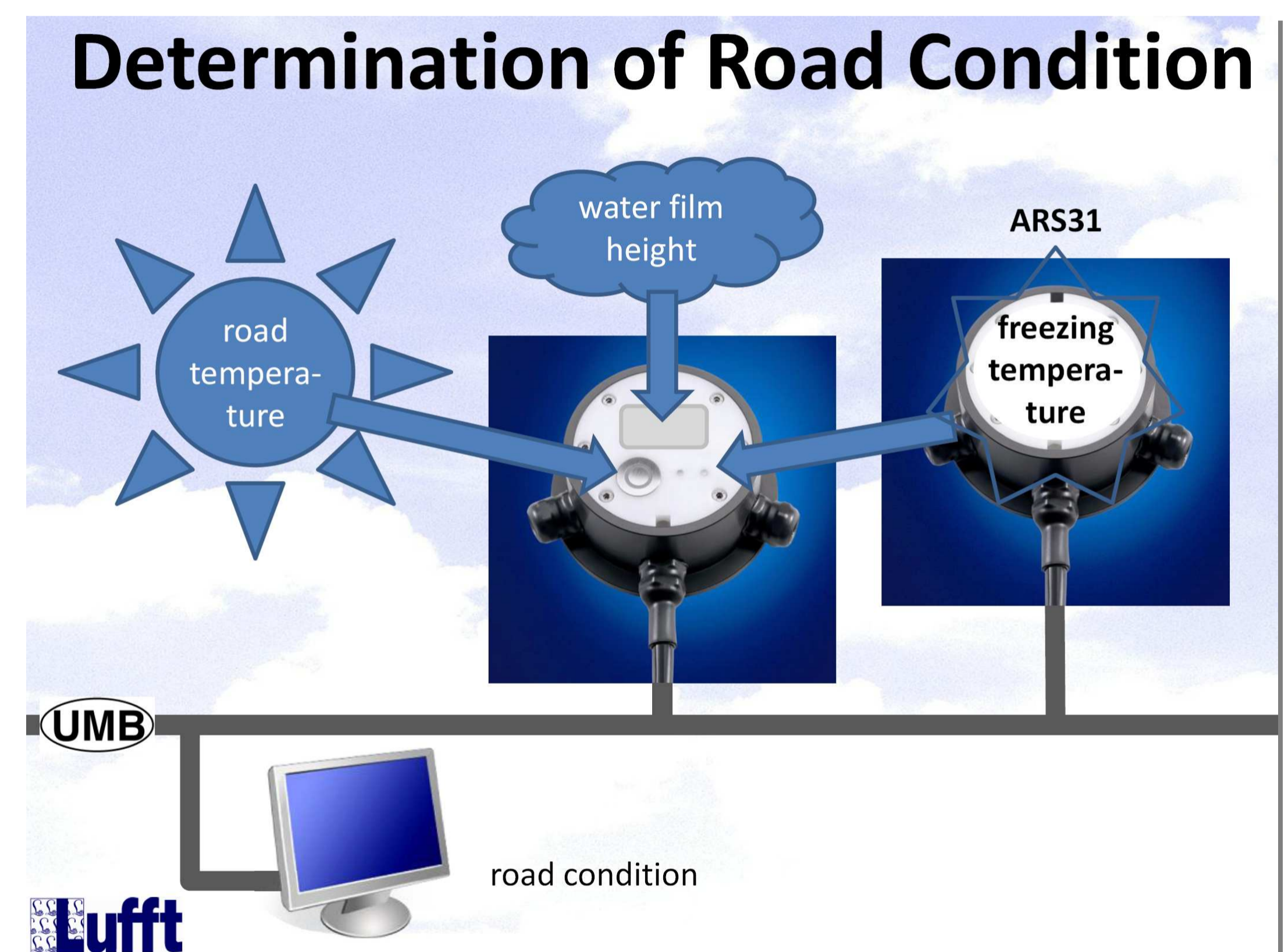
## Classification of Road Surface condition



Explanation to acronyms:  
 Wfh = Waterfilm height, FT = Freeze Temperature, T = Road Surface Temperature

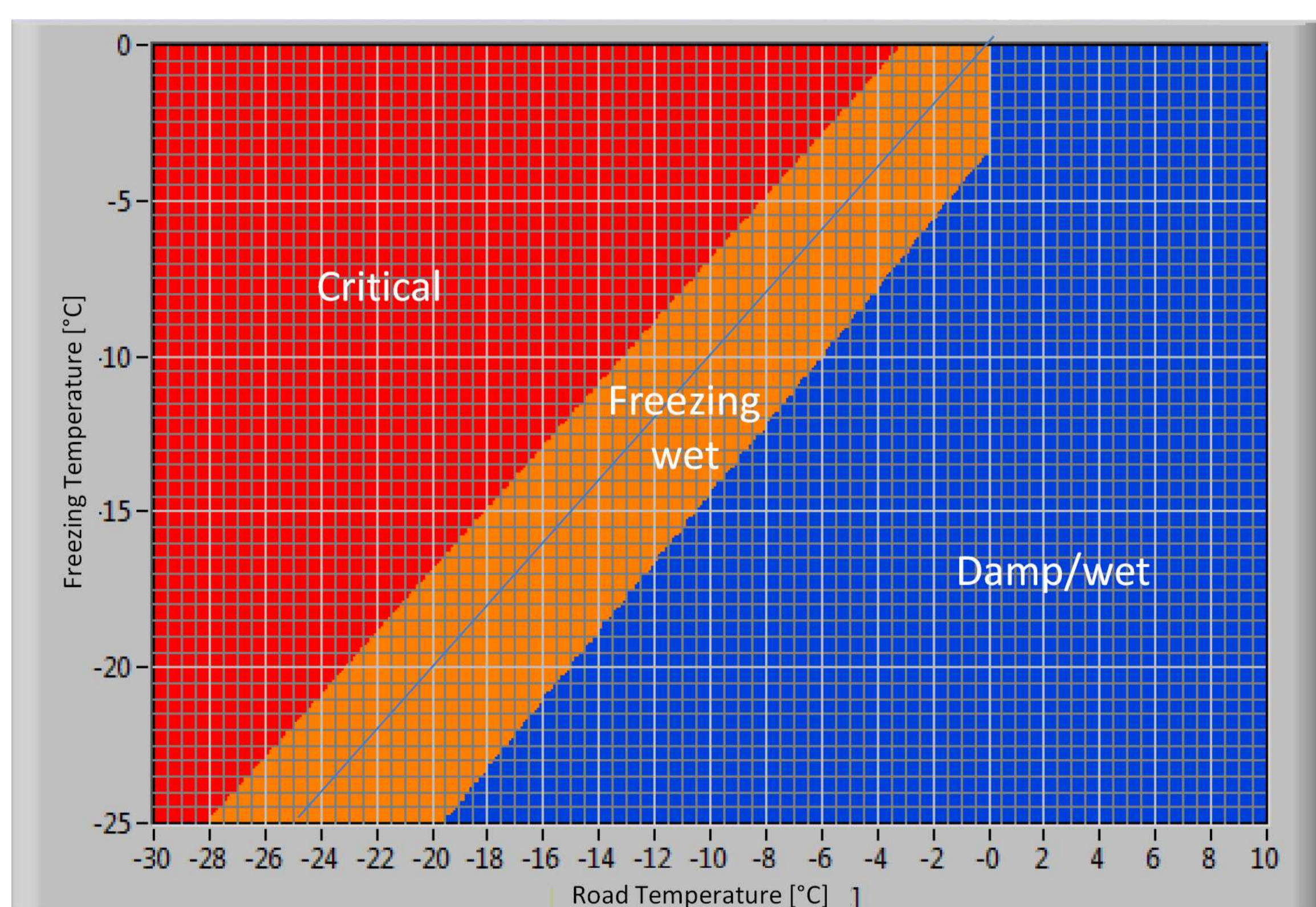
The graphic below show the flow diagram of how the classification could be performed by combining the passive and active measurements.

## The most reliable Measurements for Road/Runway Surface Conditions in Winter seasons



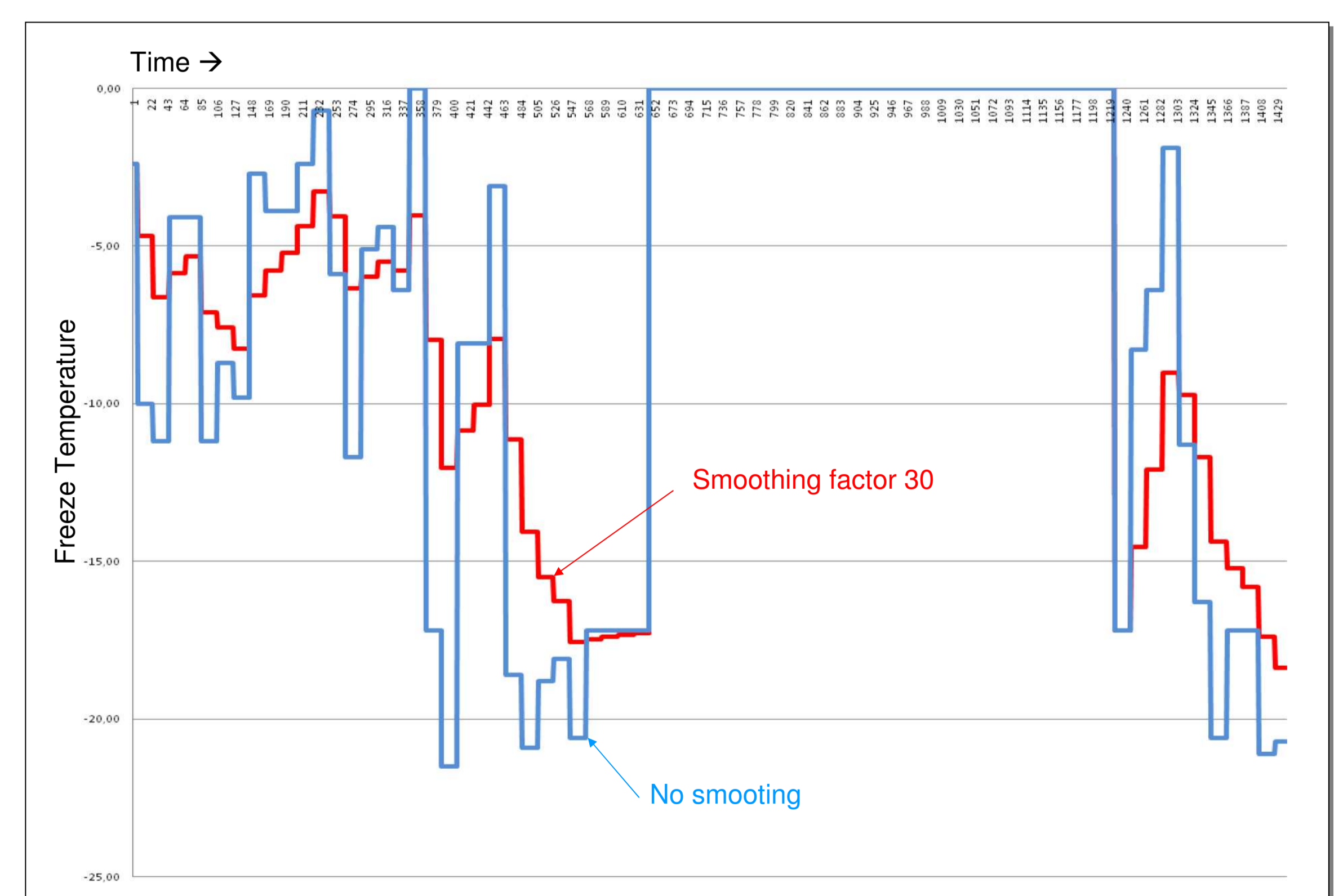
A combination of passive and active sensors is the preferred solution for reliable data for winter on-time treatments. Information such as surface temperature, water film height, Freeze point temperature are a prerequisite for good decision making. LUFFT has now tested a perfect sensor combination, a passive and active sensor, which are connected to the same measurement digital communication bus. Both sensors can exchange their reported data. Therefore the road condition detection, which need also measurement performed by passive sensors, but also need the freeze temperature in order to consider it by classifying the danger of slipperiness.

## Critical Road Surface Conditions



The diagram above shows the condition areas of freeze temperature versus road surface temperature and their association with road surface condition classes.

## Smoothing of Freeze Temperature Reports



Freeze temperature detection on a small spot of the surface often cause fast changing values. A configurable smoothing factor provides smoothing of the freeze temperature reports from the active freeze temperature sensor. This ensures more stable Road Condition reports.