THE INTERNATIONAL REVIEW OF WEATHER, CLIMATE AND HYDROLOGY TECHNOLOGIES AND SERVICES

Meteorological

TECHNOLOGY INTERNATIONAL

"A SOBERING MOMENT IN THE HISTORY OF OUR PLANET"

WMO secretary general Petteri Taalas reacts to news of record-shattering global warming temperatures and says the industry needs to invest in better disaster monitoring and early warning systems now

SMALL UAV RESEARCH

The use of small unmanned aerial vehicles for boundary layer measurements

AFRICA'S TAHMO

A dense network of 20,000 weather stations in sub-Saharan Africa

The compact weather sensor WS3000

WMO-COMPLIANT SENSOR LINE

Environmental sensor producer Lufft will be returning to the expo with a new WMO-compliant weather sensor line called The Reference. As part of this line, the WS3100 measures temperature, relative humidity, air pressure and global radiation. The latter is done through the use of a secondary CMP10 sensor from Kipp + Zonen, which offers the highest possible accuracy.

With an integrated design, the sensors are easy to install and require only one cable connection – as with all Lufft weather sensors. They come with a built-in wi-fi interface in addition to the classic RS485 module, making the network integration as simple as possible. The sensors' low-drift electronics, robust aluminum housing, detachable single components and fast sensor response time ensure that users can enjoy working with the weather sensor for decades.

Another highlight on display will be the new, seawater-resistant visibility sensor line. It comes with anti-spider defense, lens contamination detection and an SDI-12 interface.

In addition, the experienced sensor manufacturer, with sites in Germany, China and the USA, promises a surprising product premiere. The secret will be revealed at Meteorological Technology World Expo where visitors can discover more!

LUFFT
STAND 6110

COMPACT, DURABLE WEATHER SENSOR

RM Young will be attending the expo to showcase its new ResponseONE weather transmitter. The ResponseONE measures five key meteorological variables with one compact instrument. It is ideal for many weather monitoring applications requiring accurate, reliable measurement. The sensor features durable, corrosion-resistant construction, low power consumption, and user-tailored digital output. Ultrasonic wind speed and direction, barometric pressure, relative humidity and temperature sensors are carefully integrated in the rugged package. An integrated compass helps enable mobile applications. A variety of useful serial output formats are provided, including SDI-12, NMEA and ASCII text. Applications for the ResponseONE include industrial monitoring, transportation, environmental monitoring, agriculture, and energy production. It will be available in summer 2016.

RM YOUNG
STAND 5080

LOW-COST PILOTSONDE

GRAW Radiosondes will unveil its new wind-only radiosonde PS-15 (pilotsonde), which compliments the traditional GRAW radiosonde solutions by generating additional data at very low cost.

GRAW's traditional radiosondes, as well as the new pilotsondes, can both transmit information to the new ultra-mobile GS-U groundstation, which is compact, and has a totally weather-proof housing and an integrated battery pack.

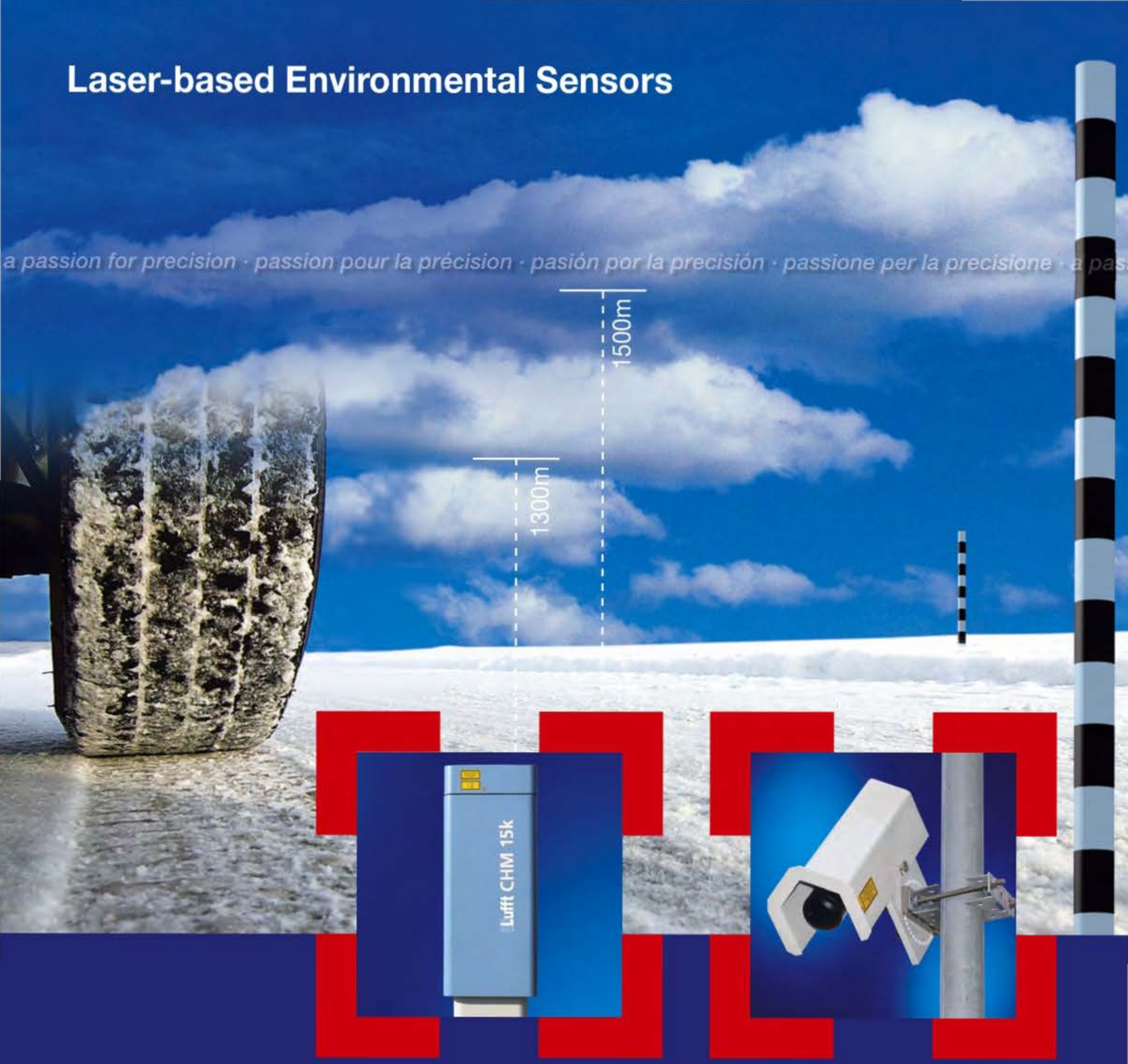
For distributed systems, GRAW will also showcase the new Ethernet-based groundstation GS-IP, which can be completely remote controlled by users from all over the world.

And finally, the company will present a new safe solution for filling balloons with hydrogen.

GRAW RADIOSONDES
STAND 3020

Laser-based Environmental Sensors

a passion for precision · passion pour la précision · pasión por la precisión · passione per la precisione · a pas



CHM 15k
Cloud Height up to 15km/50000 feet

- *Aerosol Height Profiles*
- *Cloud Base Height*
- *Penetration Depths*
- *Mixing Layer Height*
- *Vertical Visibility*
- *Cloud Amount*

SHM 30
Snow Depth up to 10 meter/30 feet

- *Millimeter Precision*
- *Very Short Response Time*
- *Detection of Snow Events*
- *Independent on Temperature Changes*

Lufft

www.lufft.com

Helena Wingert, G Lufft Mess- und Regeltechnik

PUT TO THE TEST

Reliability should not be overlooked in weather measuring equipment. What is the best approach to ensure that weather stations continue to perform well and provide accurate measurement data?

Professional weather stations have had the potential to measure weather reliably for 15 years. However, users often assume that the sensors on the stations deliver accurate measurement data year after year and neglect to conduct checks. This is something that should not be overlooked.

Helmut Hager, manager of the calibration laboratory at Lufft, explains how the company ensures its measuring equipment is developed to help improve the reliability of weather data: "We always demand standards such as DIN EN ISO 9001 for quality management; DIN EN ISO 10012 for the management of measurement processes and measuring equipment; and ISO/TS 16949, which is a quality management system that has particular requirements for the automotive industry and is relevant for part servicing. We also undertake maintenance and calibration of the measurement devices for the environmental and industrial segments."

Operators of meteorological weather stations don't seem to be aware of the necessity for regular examinations. There have been various European projects to improve measuring certainty in the meteorological industry, such as the National Metrology Institute of Germany's (PTB) Metrology for Meteorology taskforce. PTB realized that the reliability of common weather models is dependent on robust and certain measurement data. The taskforce plans to improve the traceability of essential physical atmospheric parameters. These are used for climate modeling and consist of ground measurement, temperature, air pressure, wind velocity and direction measurements in the upper atmosphere, as well as global radiation measurement information. Moreover, PTB is concerned with the improvement of humidity measurement in the upper atmosphere. For this European project, special apparatus was developed to calibrate weather stations on-site, even for stations in the Himalayas, for example.

EQUIPMENT VERIFICATION

Calibration is normally documented through calibration certificates and many types exist. Certificates from national metrological institutes, such as PTB, the National Physical Laboratory in the UK, and the National Institute of Standards and Technology in the USA, are highly regarded and ensure direct traceability to the respective national standard.

Guaranteed traceability can also be certified by an accredited calibration laboratory. These are accredited according to the requirements of DIN EN ISO/IEC 17025 and by an official accreditation body within a particular country, such as the DAkkS in Germany and UKAS in the UK. These and other accreditation bodies are signatories to the multilateral agreements of the European Cooperation for Accreditation (EA) – a network of nationally recognized accreditation bodies, and to the International Laboratory Accreditation Cooperation for the mutual recognition of calibration certificates.

The third type of verification is a factory or ISO (International Organization for Standardization) calibration certificate. For this kind of documentation, reference traceable test equipment is used. For this, the manufacturers of measurement instruments usually deliver their sensors with a calibration certificate. This must be different from the factory test report. During factory certification, individual calibration results are listed and

From left: CHM adapter frame, Simulator and smart application displayed on a tablet

Cloud height simulator kit with tablet

On-site calibration at Albis Pass, Switzerland

then a factory test report is prepared, which approves the equipment or provides information on how it should be improved.

At the end of the equipment production process, Lufft in Fellbach prepares its own in-house factory certificates. These show that all available measurement parameters have been checked via reference devices and deviating measurement points have been monitored. A second examination is then carried out at defined measurement points for the available parameters, such as a temperature of 5.99°C, a relative humidity of 50%, or at an air pressure of 984.2hPa After double-checking all the equipment, a final precision statement is then written on the factory certification.

Other measurement technology companies use procedures in which, for instance, the adjustment points are variable. Some adapt the certified measurement reference points to the sensor characteristic curve. These are the exact same values as the ones at which the device was calibrated and adjusted previously. Through this, the factory certificate shows zero percent derivations.

However, this makes the certificate interpretation partly intransparent and complicated for both sensor users and the calibration technicians. Furthermore the adaption according to the sensor characteristic curve doesn't show whether the values around reference points have the same perfect accuracy. It is quite possible that they scatter around the points of zero percent derivation.

Weather station calibration

Lufft weather sensor production line

RELIABILITY DURING OPERATION

When selecting weather station equipment, it is always wise to pay attention to real factory certificates with real calibration results. Once the weather station has been selected and installed, the operators should check whether the measurement values are plausible. This can be achieved through reference measurements using a calibrated comparison measurement device. This process has been performed regularly in the pharmaceutical industry for some time in the form of an installation qualification (IQ).

Operators should also ensure that they regularly undertake maintenance and calibration of the weather station. The inspection interval for this is dependent on the operating conditions. In general terms, inspection should take place once a year. In the pharmaceutical industry, this standard process is called operational qualification or performance qualification (PQ).

For many station operators it is very time-consuming and costly to send single components to a calibration laboratory for maintenance. Therefore many operators look for on-site calibration solutions. As measurement instruments become more precise and complex, such on-site examination is not always possible. In these cases, operators can use special simulation devices, which can prevent the need to deploy instruments to the calibration laboratory for testing. One example of an on-site simulation auxiliary tool is Lufft's CHM Simulator, which is able to simulate clouds with the help of a special device. The name equipment refers to the Lufft cloud height sensor CHM 15k, which can measure up to 15km high and can detect different types of clouds.

Lufft calibration laboratory

The CHM Simulator consists of a cloud simulator, a special template for positioning the device, as well as a smart application that operators can use to adapt the required cloud heights and depths. The CHM 15k and the app are paired via Bluetooth. The simulator's photo sensors absorb the laser beam and emulate a highly precise reflection. This allows the simulation of a certain cloud height and layer thickness, which can be set to a precision of 10m. The sensors' LEDs send a signal to the ceilometer and imitate the desired cloud characteristics. Through this, the measurement accuracy of the CHM 15k can easily be checked. In addition, operators can test how well the CHM 15k can manage disturbances caused by light with the help of the DC light or backlight. The sensor can issue the device check results directly. Some of the results – such as laser frequency – can be made accessible through the simulator app or the UMB protocol.

ADJUSTING EQUIPMENT

Measurement certainty is not only about calibration and comparing environmental sensors, but also about how to adjust them in the best way. This is especially important when considering wind measurements as many factors contribute to the precision of the measurement results.

Wind measurements are a good example. The fact that anemometers sometimes deliver different measurement results in different wind tunnels is nothing new. Requirements for wind tunnels are described in IEC 61400-12-1. The standard states that the blockage ratio in a wind tunnel must not be bigger than 0.05 for closed measurement sections. Measurement results have shown that this requirement alone isn't sufficient. The deviations aren't a result of measurement inaccuracy, but are caused by flow effects. These are dependent on the wind tunnel's design, its measurement length and flow field, the installation position of the reference and the specimen, or any other factor which can cause flow distortion. The effects must be detected, corrected and eliminated.

Lufft has developed its Wind Second Measurement Control software, which makes comprehensive corrections possible. It is only available on request and gives customers the ability to program self-developed corrections into a sensor. It enables wind-sensor operators to adjust all ultrasonic wind sensors from Lufft according to the particular wind tunnel. For this, flexible, multidimensional correction tables are available, enabling correction of wind velocities and directions.

All these fields of application and the examples are an introduction into the world of measurement certainty. The smooth and accurate operation of measurement systems is too important to be neglected, especially in big networks. ▮

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