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Humidity is measured by a portable Vaisala HMI36 humidity transmitter at the Length Laboratory of MIKES. Pictured HMI36's successor HMI38.

The Centre for Metrology and Accreditation (MIKES)

Interferometric Measurements

The Centre for Metrology and Accreditation (MIKES) coordinates the Finnish Measurement Standards System (FINMET) and offers Finnish Accreditation Services (FINAS). It works to ensure that the measurements, tests and inspections conducted in Finland are reliable and internationally commensurate. Vaisala's instruments are used at MIKES' Length Laboratory to measure pressure, humidity and carbon dioxide content.

MIKES' Length Laboratory is located in Helsinki, Finland. Its director, Dr. Antti Lassila, is responsible for calibrations and research projects.

MIKES provides source traceable length calibrations in Finland

"The Length Laboratory of MIKES is the National Standard Laboratory for length. Its main purpose is to establish the SI unit meter, and to make it available to other societies to allow traceable length calibrations in Finland," explains Mr. Lassila.

The meter is determined by three 633 nm He-Ne lasers, stabilized for the hyperfine absorption components of the transition 11-5, R(127) at $^{127}I_2$. The relative standard uncertainty of the determination is 2.5×10^{-8}. These lasers are used

Dr. Antti Lassila is the Director of the Length Laboratory of MIKES.

to calibrate the operating wavelengths of commercial and other lasers, and laser interferometers. In order to transfer the length scale to material objects, MIKES uses a gauge block and line scale interferometers. With these interferometers, it is possible to compare the length of gauge block or line separation of the line scale with the wavelength of a stabilized laser. The standard uncertainties for calibration of a 1-meter steel gauge block and a 1-meter steel line scale are 55 nm and 75 nm, respectively. The laboratory also has a 30-meter long bench in an air-conditioned (20±0.5 °C, 50±5% RH) room for interferometric calibration of tapes and other distance measuring devices.

Updated Edlén's formula

In interferometric measurements, one of the fundamental sources of uncertainty is the refractive index of the medium, since it has direct influence on the wavelength of light. At MIKES' Length Laboratory, the refractive index of air is determined by using an updated Edlén's formula [1, 2] with environmental sensors.

The updated Edlén's formula has more accurate forms for the density of air and the refractivity of water vapor. It also operates very well for standard air. The standard uncertainty of the formula itself, for determination of the refractive index of air over a wavelength range of 350-650 nm, is 1×10^{-8} in normal laboratory conditions (CO_2 content 450±50 ppm) .

Vaisala instruments used at MIKES

The various environmental parameters are measured by the following instruments. Air temperature is measured by four Pt100 temperature sensors, pressure is measured by a Vaisala PTB200A digital barometer, and humidity by a portable Vaisala HMI 36 humidity transmitter and two units of the Vaisala HMP 35b probe. Air temperature, pressure and humidity are measured at estimated uncertainties of 10 mK, 5 Pa and 0.2 K (dew point) with a regular one-year calibration period. The carbon dioxide content is monitored regularly by a calibrated Vaisala GMW20 CO_2 transmitter. The overall standard uncertainty for the refractive index of air with these sensors is 3×10^{-8}.

"Vaisala's instruments were an easy choice for the pressure and humidity measurements, since they have fast response times and are reliable. Moreover, they can be easily connected to automated measurement systems, and offer suitable levels of uncertainty at reasonable cost." ■

References

[1] B. Edlén, The Refractive index of air, Metrology 2 (1966) 71-80.

[2] K. P. Birch and M. J. Downs, An updated Edlén equation for the refractive index of air, Metrology 30 (1993) 155-162; Correction to the updated Edlén equation for the refractive index of air, Metrology 31 (1994) 315-316.

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Vaisala Awarded Contract for Atmospheric Environment Service

Vaisala has been awarded a contract by the Atmospheric Environment Service, a division of the Canadian National Weather Service. Under the terms of the contract Vaisala will supply electronic station barometers to replace the mercury barometers currently used by Environment Canada and its clients for weather observation throughout Canada.

Vaisala is pleased to announce a contract award by the Atmospheric Environment Service, a division of the Canadian National Weather Service. Vaisala was selected to supply electronic station PTB220 barometers for weather monitoring throughout Canada.

Digital barometers at airport locations

Mercury barometers pose a risk to both the environment and the personnel using them. The mercury barometers in use at the observation stations are up to 70 years old. There is therefore an increasing risk of human exposure to leaking mercury and environmental contamination.

The pressure measurements performed by the observation staff at airport locations are used to compute altimeter settings, which are given to incoming aircraft for landing purposes. If an incorrect altimeter setting is given to an aircraft, the consequences could be significant. It could mean that the pilot believes the aircraft is higher above the ground than it actually is. When combined with conditions of poor visibility and/or low cloud cover, this could result in an aircraft accident. A zero tolerance policy for altimeter setting errors has been stated by NavCanada. This policy requires that multiple-cell (three or more cells), electronic, digital barometers be installed at airport locations, and that automated altimeter calculation and reporting procedures be instituted.

Vaisala's unique PTB220 digital barometer design incorporates the three-cell redundancy required to give the necessary level of confidence in the measurement. The PTB220 was one of seven barometers approved for operational use by the Atmospheric Environment Service, and allowed to take part in the bid. After many months of technical evaluation and testing, Vaisala's PTB220 was chosen as the product that best fits the tough requirements and stringent specifications.

Protecting passengers, personnel and the environment

Delivery of the barometers will begin in the fall of 1999. The project to replace all the mercury barometers will continue through the year 2001. When completed, this project will eliminate the potential health risk to observation personnel and the potential contamination of the environment, as well as helping to ensure the safety of all passengers flying in and out of Canada for years to come. ■