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A calibration facility to provide traceable calibration to upper air humidity measuring sensors

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Accurate knowledge and high quality measurement of the upper air humidity and of its profile in atmosphere is essential in many areas of the atmospheric research, for example in weather forecasting, environmental pollution studies and research in meteorology and climatology.

Moving from the troposphere to the stratosphere, the water vapour amount varies between some percent to few part per million. For this reason, through the years, several methods and instruments have been developed for the measurement of the humidity in atmosphere. Among the instruments used for atmospheric sounding, radiosondes, airborne and balloon-borne chilled mirror hygrometer (CMH) and tunable diode laser absorption spectrometers (TDLAS) play a key role. To avoid the presence of unknown biases and systematic errors and to obtain accurate and reliable humidity measurements, these instruments need a SI-traceable calibration, preferably carried out in conditions similar to those expected in the field.

To satisfy such a need, a new calibration facility has been developed at INRIM. The facility is based on a thermodynamic-based frost-point generator designed to achieve a complete saturation of the carrier gas with a single passage through an isothermal saturator. The humidity generator covers the frost point temperature range between -98 °C and -20 °C and is able to work at any controlled pressure between 200 hPa and 1000 hPa (corresponding to a barometric altitude between ground level and approximately 12000 m).

The paper reports the work carried out to test the generator performances, discusses the results and presents the evaluation of the measurement uncertainty.

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