## Accurate Vapour Pressure Measurements Over Supercooled Ordinary Water in the Temperature Range from 252 K to 273 K

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The saturation vapor pressure in equilibrium over liquid water and ice is of a great importance in climate science and in the field of humidity measurements and standards. An accurate knowledge of its value ensures a correct conversion between various physical quantities (e.g. dew/frost-point temperature, relative humidity, and amount fraction) that quantify the water vapor amount in a mixture of humid gases, such as humid air or technical gases. Accurate saturation vapor pressure measurements over supercooled water are strongly required in meteorology and atmospheric sciences as, in the high troposphere, liquid droplets can co-exist with ice particles even at temperatures down to 233 K, the limit of homogeneous nucleation at atmospheric pressure. An investigation on the water vapor – supercooled water equilibrium along the saturation line has been carried out at the Istituto Nazionale di Ricerca Metrologica (INRIM), in the temperature range from 252.26 K to 273.25 K, and is reported here. The experimental apparatus consists of a sample cell, made of a U-shaped borosilicate capillary tube, kept in a thermostatic bath at a constant temperature with millikelvin stability, connected via a manifold to a capacitive diaphragm pressure gauge used for direct pressure measurements. The measured pressure ranges between approximately 116 Pa (at T = 252.26 K) and 615 Pa (at T = 273.25 K). This article reports the water sample preparation, the measuring method, and the measurement corrections, as well as a comparison between the experimental and literature data against the available water vapor pressure formulations. Measurement results are discussed and uncertainty sources are estimated. The resulting expanded relative uncertainty (k=2) varies from 0.06 % at 273.25 K to 0.2 % at 252.26 K.