

Scaled Equation and the Vapour Pressure of Supercooled Water

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The vapour pressure of supercooled water plays an important role in cirrus clouds, polar stratospheric clouds, and in a large volume of the atmosphere, where water is cooler than 0° C. Meteorology is interested in the properties of water at temperatures above 160 K, but there are only experimental data in the region above 233 K, and existing relations are valid mainly in the region above 0° C. Recently, Fuentevilla and Anisimov have published a scaled parametric equation of state that is universal in terms of theoretical variables and belongs to the three-dimensional Ising-model class of universality. The equation can be used for description and prediction of properties of supercooled water. The equation is based on one of the leading theories (increasingly supported by experiments) – the second-critical-point scenario – that proposes a liquid-liquid critical point in supercooled water. The main advantage of the scaled equation mentioned above is the possibility to predict some properties of supercooled water below the limit of homogenous nucleation, where it is very difficult to obtain experimental data. We have used this equation to predict the behaviour of c_p in the range of 150 K to 233 K and from a knowledge of c_p we have started our calculation of the vapour pressure in the range 130 K - 273 K. Our derivation of the vapour-pressure relation is based on the procedure from Murphy and Koop and is derived from the Clausius-Clapeyron equation.