Thermodynamic Analysis and Experimental Confirmation of the Effect of Atmospheric Pressure on the Ice Point

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We performed detailed thermodynamic analysis of the temperature of the ice point (phase equilibrium between ice, liquid water, and atmospheric air) as a function of atmospheric pressure. This analysis made use of accurate international standards for the properties of water and ice, and of available high-accuracy data for the Henry's constants of atmospheric gases in liquid water. The result is an ice point of 273.150 02 K at standard atmospheric pressure, with higher ice-point temperatures (varying nearly linearly with pressure) at lower pressures. The effect of varying ambient CO_2 concentration is found to be significant in comparison to other uncertainties in the model. The thermodynamic model is compared with experimental measurements of the temperature difference between the ice point and the triple point performed at elevations ranging from 140 m to 4302 m, with atmospheric pressures from 100 kPa to 60 kPa. Good agreement is obtained between the experiments and the thermodynamic analysis.