Dynamics of High Altitude Balloon Ascents

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The goal of this research project was to further understand and quantify the ascent dynamics of high altitude air balloons. Creating a mathematical model that accurately reflects experimental results allows for a better understanding of the physical processes that take place as well as improve flight path prediction. The drag and gravitational forces acting on the balloon were equated to the buoyancy force. This equation was then solved for the velocity. It was possible to find all variables as a function of altitude for the velocity except for the drag coefficient. Three different models of increasing complexity were created that avoid computing the drag coefficient as a function of altitude. After analyzing the balloon data from three separate balloon launches, there is agreement among the three models and data at lower altitudes (up to approximately 10,000 meters). The models have varying degrees of success at higher altitudes.