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Vortex Dynamics from 2D PIV Data in a Bubble Plume DUNCAN BRYANT, SCOTT SOCOLOFSKY — Bubble plumes are commonly used for aeration and destratification in lakes and show potential as a delivery method for carbon sequestration. The need to design bubble plumes for these uses has led to an increase in research and development of models. However, the dynamics of turbulence in bubble plumes has yet to be quantified. Physical experiments were conducted to quantify turbulence in bubble plumes with air flow rates of 0.5, 1.0, and 1.5L/min. A camera imaged the bubble plume illuminated along a plane with an Argon-Ion laser at 250Hz. The images were processed to remove all bubbles resulting in a new image with only seeding particles. These images were processed using Particle Image Velocimetry giving 2D vector fields for the fluid phase. These vector fields were spatially analyzed to identify vortices and their properties in the field of view. The results show that the expected non-dimensional vortex size is the same for all three flow rates. The results also show that when properly non-dimensionalized the time-average vortex properties such as size and circulation across the width of the bubble plume are similar for all three air flow rates. Finally, the data is used to find the turbulent energy spectrum and the characteristic length scale within the plume. These results agree with the identified vortex results and show the modulation of the turbulence due to the presence of bubbles.

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