

Coherent motion of turbulent thermal plume in stably stratified fluid

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Abstract. The purpose of this study is to clarify the existence of an ordered and large scale coherent motion in a turbulent plane thermal plume in a thermally-stable stratified fluid inside a comparatively large enclosure. First, the upper part of the thermal plume was carefully observed by a flow visualization. Secondly, a wave form of plume temperature variation was measured. Thirdly, a spectrum analysis was carried out on time series data of the thermal plume. Finally, physical characteristics were investigated on vortices in the thermal plume based on results of the wave form and the spectrum analysis of the plume temperature. As a result, the main conclusions are obtained as follows. (1) An existence of vortices near the upper part of the thermal plume was firstly found by careful flow visualization. (2) From the wave form of temperature variation and the spectrum analysis of the thermal plume, it was clarified that the vortices are generated in the transition state and are transported to the turbulent state. (3) The vortices are ordered and they behave as a large scale coherent motion in the turbulent thermal plume.