

Measurement of Physical structure in Kasumigaura using high resolution tow-yo instrument

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This study shows physical processes in Lake Kitaura, Kasumigaura, using field observations by YODA Profiler and Mooring system. Hypoxia and eutrophication have a bad influence on ecosystems in the study area. Understanding physical processes is essential to understand ecosystems in lakes and oceans. Lake Kitaura is a long lake in the north-south direction with 25 km and 4 km in the east-west. The stratified layer is generated due to strong incoming heat flux during the summer season. Mooring observation results show that the thin mixed layer was gradually thickened due to the wind stress and disappeared within several hours. Details of this mixing processes were further investigated by making use of a high-resolution tow-yo instrument, the YODA Profiler. The warm surface water was transported toward on the downwind side due to the wind stress. Small scale K-H instability like motions were observed during this event. According to the data from the YODA Profiler, the Wedderburn number can roughly explain the baroclinic and mixing structures in the east-west direction. However, the Wedderburn number is not able to be used for explaining quantitative vertical displacements of the thermocline, because the complexity of the observed density distribution. The vertical isotherm displacements can be simply explained by wind stress. Time series of the mixed layer depth were calculated to evaluate mixing in the lake. The mixed layer reached the bottom when the daily-averaged wind speed exceeded 8 m/s, resulting in complete vertical mixing. Results from the north-south long transect survey show wavy like baroclinic (or stripe-shaped) temperature distribution with a horizontal scale of several km. In addition, three dimensional numerical simulations were conducted using the SUNTANS. Model results also show a wavy like baroclinic structure in the north-south direction caused by the complicated coastal shape and east-west wind stress. The wavy like baroclinic structure is generated by convergence of warm water into bay-shaped areas.

Keywords: Thermocline, Mixed layer, Wind stress