Destratification induced by bubble plumes as a means to reduce evaporation from open impoundments

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Abstract

The use of thermal mixing by means of compressed air appears to have important potential for evaporation suppression on deep reservoirs. Current methods used to reduce evaporation from open-water impoundments such as floating covers, modular covers, monolayers and shade structures have many disadvantages and negative impacts on the environment. These methods impact the natural/modified aquatic ecosystem established in the dam; alter aesthetic qualities; increase the risk of dam failure in times of flood; could potentially lead to an oxygen reduction in the water; and may compromise the natural water treatment functions and operations such as the reduction of harmful bacteria, exposure to sunlight (form of disinfection) and natural and mechanical aeration thereby increasing treatment costs.

The methodology proposed in this paper to help reduce evaporation losses from open-water impoundments, which indirectly addresses problems of water shortage and the associated economic impacts, involves the destratification of the water body using a bubble plume operated with minimal energy input to reduce surface water temperatures, with, a subsequent reduction in evaporation.

The literature, although limited, indicates that this proposed method has merit and requires further research to identify specific reservoirs (size, depth, usage) that could benefit from such a destratification system. Evaporation suppression of as high as 30 % was achieved in some case studies.

Keywords: bubble plume, destratification, evaporation reduction, evaporation suppression