Geophysical Research Abstracts
Vol. 21, EGU2019-18627, 2019
EGU General Assembly 2019

Turnover in a Canadian Shield lake

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Spring and fall turnover events transport nutrients and oxygen vertically in the water column of temperate lakes, which otherwise have stable density stratification inhibiting mixing. However, lake dynamics during turnover has received little attention in the literature. In this study, a three-dimensional model (AEM3D) was used to simulate the hydrodynamics, during spring and fall turnover, of a small Canadian Shield lake during 2011 to 2018. The start date of convectively-induced mixing, in spring, ranged from the end of March to the end of April in different years and the duration of mixing also varied. Once mixed, the water column warmed at 0.02 to 0.03 ^{o}C per day until the onset of summer stratification. Fall turnovers had aduration of 20 to 60 days, while the water column cooled at 0.16 to 0.23 ^{o}C per day until complete mixing at the maximum density temperature. During fall turnover, the scale and the velocity of vertical plumes was larger (10^4 to $6.25*10^4$ m^2, -5 to 3.5 mm/s) in comparison to spring ($10^3$to 10^4 m^2, -1.2 to 0.7 mm/s). The numerical model reproduced plunging currents from differential cooling and warming in the shallower areas of the lake. Ongoing work is relating the surface heat flux to the duration and strength of spring turnover, as this can regulate vertical transport of nutrients and oxygen.