Geophysical Research Abstracts
Vol. 21, EGU2019-15064-1, 2019
EGU General Assembly 2019

Lateral variability of mixing in Lake Geneva

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In large lakes, basin-scale processes such as internal waves and gyres induce lateral variability in almost all aspects of water constituents. Emerging measuring techniques, coupled together with 3D numerical models, have opened the possibility to investigate the lateral variability of physical processes. However, the distribution of small-scale turbulent quantities in basin-scale processes remains overlooked. In this work, we explore the lateral variability of mixing in Lake Geneva, using a buoyancy controlled autonomous underwater vehicle (aka glider). In addition to the standard water quality payload (e.g. temperature, chlorophyll-a, dissolved oxygen, etc.), the glider was equipped with a micro-structure sensor to estimate turbulence parameters and mixing through the water column. These observations allow us to analyse small-scale variations of temperature gradients and turbulence, driven by basin-scale dynamics, along thousands of meters. Additional field measurements of currents using standard moorings revealed the presence of internal Poincaré waves and surface gyres. The glider-based lateral temperature structure and the in-situ currents are compared to the 3D hydrodynamic model Delft3D. Our results offer a novel in-situ glance of (i) enhanced turbulence and mixing close to the lake boundaries and (ii) internal waves and gyres modulating mixing processes in the lake interior.