Vidy Bay hydrodynamics under typical meteorological conditions

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Vidy Bay (Lake Geneva, Switzerland) is the site of a sewage outfall, located 700 meters offshore at a depth of 30 meters. Estimates of water circulation in this area are required to assess the transport and fate of water quality components. Numerical simulations and field measurements were carried out to examine current patterns in this area. A commercial 3D finite-difference hydrodynamic model (Delft3D-FLOW) was used. The simulations, which incorporated a non-uniform grid system, sigma coordinates and high-resolution bathymetry, covered all of Lake Geneva. In addition to local stream and River Rhone inflows, detailed, spatially distributed lake-wide wind, temperature and humidity data were used as model boundary conditions. Several scenarios based on typical meteorological conditions were simulated to determine the water currents in the lake and, particularly, in Vidy Bay. Different patterns were found depending on the wind regimes and lake thermal structure. A Lagrangian drifter experiment was conducted in the bay to capture current patterns and to measure local air and water temperature, as well as wind velocity. The modeling results and field data compared well. The results demonstrate that Vidy Bay displays high temporal and spatial variability due to the variable forcing and relatively rapid hydrodynamic response to changing conditions.

Keywords: Lake hydrodynamics, water circulation, water pollution, Lagrangian drifters, numerical modeling, Delft3D-FLOW, Lake Geneva.