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Effects of dominant wind events on Vidy Bay (Lake Geneva) hydrodynamics

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Field measurements and numerical simulations were carried out to examine the effects of meteorological conditions on the hydrodynamics in Vidy Bay. To simulate the flow field, a 3D finite difference hydrodynamic model (Delft3D-FLOW) was employed that simulated all of Lake Geneva. High-resolution bathymetry and a non-uniform grid system were applied. Detailed over-lake maps of wind, temperature and humidity were used as input to drive the model. An accompanying Lagrangian drifter experiment was conducted in the bay to capture local current patterns and meteorological data. Acoustic Doppler Current Profiler (ADCP) and drifter data were compared with numerical results and a reasonable agreement was achieved. Meteorological conditions were categorized in a limited set of typical events and then several numerical scenarios based on typical conditions were simulated. Numerical and experimental results showed that Vidy Bay currents vary strongly temporally and spatially. In addition, typical current patterns were found depending on the predominant wind regimes and lake thermal structure. Numerical results confirmed that there is a strong correlation between wind event and current directions, while the magnitude of the undertow is largest for south-westerly winds (Vent). The model is able to reproduce the velocity profiles and the temperature structures during events.