

# Sediment oxygen uptake in Lake Geneva

R. SCHWEFEL<sup>1</sup>, D. BOUFFARD<sup>1</sup>, L. D. BRYANT<sup>2</sup>, A. WÜEST<sup>1</sup>

<sup>1</sup> *Physics of Aquatic Systems Laboratory, Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland*

<sup>2</sup> *Helmholtz Centre for Ocean Research, Kiel, Germany*

Between 1960 and 1980, the trophic state of Lake Geneva (situated between France and Switzerland) has changed from oligotrophic to eutrophic. Since then, the areal hypolimnetic oxygen demand of  $1.31 \text{ gm}^{-2} \text{ d}^{-1}$  is now the highest measured in Switzerland and low oxygen contents of less than  $4 \text{ mg l}^{-1}$  regularly occur in the deepest parts (300m deep). Oxygen depletion is to a large amount driven by sediment oxygen uptake (SOU). In a large and complex lake like Lake Geneva, SOU can vary significantly temporally and spatially and is strongly dependent on the diffusive boundary layer (DBL) thickness which in turn varies with bottom boundary layer (BBL) currents.

In this study, an automated microprofiling system (MiniProfiler MP 8, Unisense) is used to measure oxygen concentration at the sediment-water-interface in sub-millimeter resolution. An attached oxygen optode (Aanderaa) enables in-situ calibration of the oxygen sensors. Here we present the first series of microprofile measurements in Lake Geneva at locations situated in varying depths. On the basis of the microprofiles, SOU and DBL thickness is calculated. Parallel measurements with a 2 MHz uplooking ADCP (Aquadopp HR, Nortek) in close proximity provide information about the BBL currents at the measurement site. The results give a first insight into the spatial variability of SOU in a large lake and the dependency of DBL thickness on BBL currents which was already observed in smaller lakes [Lorke *et al.*, 2003, Bryant *et al.* 2010] and coastal areas [Wang *et al.* 2013].

## REFERENCES

- Bryant, L. D., C. Lorrai, D. McGinnis, A. Brand, A. Wüest and J. C. Little, 2010. Variable sediment oxygen uptake in response to dynamic forcing *Limnology and Oceanography*, 55, 950-964.
- Lorke, A., B. Müller, M. Maerki, A. Wüest, 2003. Breathing sediments: The control of diffusive transport across the sediment-water interface by periodic boundary-layer turbulence. *Limnology and Oceanography*, 48, 2077-2085.
- Wang, J., H. Wei, Y. Lu, L. Zhao, 2013. Diffusive boundary layer influenced by bottom boundary hydrodynamics in tidal flows. *Journal of Geophysical Research C: Oceans*, 118, 5994-6005.