

## CV Prof. Dr. Alfred Wüest

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**Name** WüEST, Alfred, Dr sc nat

**Personal data** born 28 Aug. 1956, Grossdietwil, Switzerland, Swiss citizen; married; 2 sons.

### **Education**

Ph.D. Swiss Federal Institute of Technology (ETH) Zürich and Eawag, 1984 - 87

Post-diploma Post-diploma study "Urban Hydrology and Water Pollution Control"; Swiss Federal Institute of Technology (ETHZ), 1983 - 84

M.Sc. Experimental Physics, University of Zürich, 1976 - 82.

### **Professional Experience**

since 2015 Member of the Directorate of Eawag

since 2013 Director of the Limnology Center, EPFL Lausanne

since 2012 Professor, Physics of Aquatic Systems Laboratory, ENAC, EPFL Lausanne  
Margaretha Kamprad Chair

2008/9 Scientific visitor at the University of Zambia (Lusaka) and UBC (Vancouver)

2006 - 2012 Department head of "Surface Waters - Research and Management", Eawag

since 2002 Titular professor for Aquatic Physics, D-USYS, ETH Zürich

2000 - 2005 Department head of "Applied Aquatic Ecology", Eawag

1998/9 Scientific visitor at the Institute of Ocean Sciences, Sidney (BC), Canada

1996 - 1997 Department head of "Environmental Physics", Eawag

since 1989 Head of the *Aquatic Physics* group, Eawag

1987/88 SNSF post-doc, Applied Physics Laboratory, UW, Seattle, USA.

### **Research Interests**

- Small-scale turbulence in natural waters: boundary layer mixing, stratified turbulence, double-diffusion
- Bubble plume modeling, oxygenation, destratification, oxygen depletion in lakes / reservoirs
- Lake ecology, nutrient/biogeochemical fluxes, management and restoration of lakes
- Downstream effects of energy production (pumped-storage hydropower and heating/cooling)
- Anthropogenic effects on aquatic ecosystems and mitigation.

### **Some (Past) Professional Activities**

Head of the expert group "Assessment of ecological changes Brienzersee"; Co-editor Aquatic Sciences; AE for Water Resources Research and L&O-FE; Scientific/Technical Board for Lake Restoration on Swiss Plateau. Member of the scientific coordinating committee for the Nyiragongo Crisis (UN-OCHA); Expert to the Dutch Environmental Impact Assessment Commission (Lake Kivu). Expert to the Worldbank and Rwanda on methane extraction in Lake Kivu. Expert to the International Commission (IGKB) on Lake Constance.

### **Teaching**

Courses on aquatic physics, management of aquatic systems and interdisciplinary water management courses; short courses at Eawag (Peak); several EFM international summer schools, EFM lakes and reservoirs U of Grenoble. Supervisor of 12 completed PhD theses and 28 MSc projects.

### **Publications**

113 reviewed (ISI entry) papers; 22 book chapters and >2000 pages of expert/consulting services (mainly to water authorities).

## **Publications last five years - Prof. Dr. Alfred Wüest**

All publications can be downloaded from: <http://www.eawag.ch/de/abteilung/surf/publikationen/>

### **a) Peer-reviewed publications (last five years)**

#### **2014**

- Kiefer, I, D. Odermatt, O. Anneville; A. Wüest, D. Bouffard (2015). Application of remote sensing for the optimization of in-situ sampling for monitoring of phytoplankton abundance in a large lake. *Science of the Total Environment*. *Science of the Total Environment* **527–528**: 493–50. Doi: 10.1016/j.scitotenv.2015.05.011
- Ross K.A., E. Gashugi, A. Gafasi, A. Wüest, and M. Schmid (2015). Characterisation of the subaquatic groundwater discharge that maintains the permanent stratification within Lake Kivu; East-Africa. *PLoS ONE* **10(3)**: e0121217. doi:10.1371/journal.pone.0121217
- Tsimitri C., B. Rockel, A. Wüest, N. M. Budnev M. Sturm, and M. Schmid (2015). Drivers of deep water renewal events observed over 13 years in the South Basin of Lake Baikal, *J. Geophys. Res. Oceans* **120(3)**: 1508–1526, doi: 10.1002/2014JC010449.
- Fink, G., M. Schmid, B. Wahl, T. Wolf and A. Wüest (2014a). Heat flux modifications related to climate-induced warming of large European lakes. *Water Resources Research*, **50**: 2072 – 2085, doi: 10.1002/2013WR014448.
- Fink, G., M. Schmid and A. Wüest (2014b). Large lakes as sources and sinks of anthropogenic heat: Capacities and limits. *Water Resources Research*, **50**: 7285–7301, doi: 10.1002/2014WR015509.
- Müller B., R. Gächter, and A. Wüest (2014). Accelerated water quality improvement during oligotrophication in peri-alpine lakes. *Environmental Science & Technology*, **48(12)**: 6671–6677, doi: 10.1021/es4040304.
- Muvundja, F.A., A. Wüest, M. Isumbisho, M. B. Kaningini, N. Pasche, P. Rinta and M. Schmid (2014). Modelling Lake Kivu water level variations over the last seven decades. *Limnologia - Ecology and Management of Inland Waters*, **47**: 21-33, doi: 10.1016/j.limno.2014.02.003.
- Pitarch J., D. Odermatt, M. Kawka, and A. Wüest (2014a). Retrieval of vertical particle concentration profiles by optical remote sensing: a model study. *Optics Express*, **22(S3)**: A947 - A959, doi: 10.1364/OE.22.00A947.
- Pitarch J., D. Odermatt, M. Kawka, and A. Wüest (2014b). Retrieval of particle scattering coefficients and concentrations by genetic algorithms in stratified lake water. *Remote Sensing*, **6**: 9530-9551, doi: 10.3390/rs6109530.
- Scheifele B., R. Pawlowicz, T. Sommer, and A. Wüest (2014). Double diffusion in saline Powell Lake, British Columbia. *Journal of Physical Oceanography*, **44(11)**: 2893-2908. doi: 10.1175/JPO-D-14-0070.1.
- Schmid, M., S. Hunziker, and A. Wüest (2014). Lake surface temperatures in a changing climate: a global sensitivity analysis. *Climatic Change*, **124(1-2)**: 301-315, doi: 10.1007/s10584-014-1087-2.
- Sommer, T., J.R. Carpenter, and A. Wüest (2014). Double-diffusive interfaces in Lake Kivu reproduced by direct numerical simulations. *Geophysical Research Letters*, **41**: 5114–5121, doi: 10.1002/2014GL060716.

- Toffolon M., S. Piccolroaz, B. Majone, A-M. Soja, F. Peeters, M. Schmid and A. Wüest (2014). Prediction of surface temperature in lakes with different morphology using air temperature. *Limnology and Oceanography*, **59**(6): 2185–2202. doi: 10.4319/lo.2014.59.6.0000.
- Wüest A, Anselmetti FS, Arey JS, Ibelings BW, Loizeau JL, Vennemann T, Lemmin U (2014) Into the abyss of Lake Geneva: the elemo interdisciplinary field investigation using the MIR submersibles. *Aquatic Sciences*, **76**(Suppl 1): S1–S6, doi: 10.1007/s00027-014-0353-8.

## 2013

- Finger, D., A. Wüest, and P Bossard (2013). Effects of oligotrophication on primary production in peri-alpine lakes. *Water Resources Research*, **49**(8): 4700–4710, doi: 10.1002/wrcr.20355.
- Jordanoska, B., T. Stafilov, A. Wüest, (2013). Assessment of ecological importance and anthropogenic change of subaquatic springs in ancient Lake Ohrid. *Water Research and Management*, **3**(2): 9-17.
- Kunz, M.J., D.B. Senn, B. Wehrli, E. M. Mwelwa, and A. Wüest (2013). Optimizing turbine withdrawal from a tropical reservoir for improved water quality in downstream wetlands, *Water Resources Research*, **49**: 5570–5584, doi: 10.1002/wrcr.20358.
- Razmi, A.M., D.A. Barry, R. Bakhtyar, N. Le Dantec, A. Dastgheib, U. Lemmin, and A. Wüest (2013). Current variability in a wide and open lacustrine embayment in Lake Geneva (Switzerland). *J Great Lakes Research*, **39**: 455 – 465. doi: 10.1016/j.jglr.2013.06.011.
- Sommer, T., J.R. Carpenter, M. Schmid, R. G. Lueck, M. Schurter, and A. Wüest (2013a), Interface structure and flux laws in a natural double-diffusive layering, *Journal Geophysical Research C Oceans*, **118**(11): 6092 - 6106, doi: 10.1002/2013JC009166.
- Sommer, T., J.R. Carpenter, M. Schmid, R.G. Lueck, and A. Wüest (2013b). Revisiting microstructure sensor responses with implications for double-diffusive fluxes. *Journal of Atmospheric and Oceanic Technology*, **30**(8): 1907 – 1923. doi: 10.1175/JTECH-D-12-00272.12012.

## 2012

- Carpenter, J.R., T. Sommer and A. Wüest (2012). Simulations of a double-diffusive interface in the diffusive convection regime, *Journal Fluid Mechanics*, **711**: 411 - 436. doi: 10.1017/jfm.2012.399.
- Müller, B., L.D. Bryant, A. Matzinger, and A. Wüest (2012). Hypolimnetic oxygen depletion in eutrophic lakes. *Environmental Science & Technology*, **46** (18): 9964 – 9971, doi: 10.1021/es301422r.
- Odermatt, D., F. Pomati, J. Pitarch, J. Carpenter, M. Kawka, M. Schaepman and A. Wüest (2012). MERIS observations of phytoplankton blooms in a stratified eutrophic lake. *Remote Sensing of Environment*, **126**: 232 - 239.
- Bonalumi, M., F.S. Anselmetti, A. Wüest, and M. Schmid (2012). Modeling of temperature and turbidity in a natural lake and a reservoir connected by pumped-storage operations. *Water Resources Research*, **48**: W08508. doi:10.1029/2012WR011844.
- Schmid, M., K. Ross, and A. Wüest (2012). Comment on “An additional challenge of Lake Kivu in Central Africa – upward movement of the chemoclines by Finn Hirslund”. *Journal of Limnology*, **71**(2): 330 - 334, doi: 10.4081/jlimnol.2012.e35.
- Carpenter, J.R., T. Sommer and A. Wüest (2012). Stability of a double-diffusive interface in the diffusive convection regime. *Journal of Physical Oceanography*, **42** (5): 840 - 854. doi: 10.1175/JPO-D-11-0118.1.

## 2011

- [Bonalumi, M., F. S. Anselmetti, R. Kaegi, and A. Wüest (2011), Particle dynamics in high- Alpine proglacial reservoirs modified by pumped-storage operation, *Water Resources Research*, **47**: W09523, doi:10.1029/2010WR010262.
- DelSontro T, M.J. Kunz, T. Kempter, A. Wüest, B. Wehrli, and D.B. Senn (2011). Spatial heterogeneity of methane ebullition in a large tropical reservoir. *Environmental Science & Technology*, **45**: 9866 – 9873. doi: 10.1021/es2005545.
- Kunz, M. J., A. Wüest, B. Wehrli, J. Landert, and D. B. Senn (2011), Impact of a large tropical reservoir on riverine transport of sediment, carbon and nutrients to downstream wetlands, *Water Resources Research*, **47**: W12531, doi:10.1029/2011WR010996.
- Kunz M. J., F. S. Anselmetti, A. Wüest, B. Wehrli, A. Vollenweider, S. Thüring, and D. B. Senn (2011), Sediment accumulation and carbon, nitrogen, and phosphorus deposition in the large tropical reservoir Lake Kariba (Zambia/Zimbabwe), *Journal Geophysical Research*, **116**: G03003, doi: 10.1029/ 2010JG001538
- [28] Lorrai, C., L. Umlauf, J.K. Becherer, A. Lorke and A. Wüest. (2011). Boundary mixing in lakes: 2. Combined effects of shear- and convectively induced turbulence on basin-scale mixing. *Journal Geophysical Research C Oceans*, **116**: C10018, doi:10.1029/2011JC007121.
- Pasche, N., M. Schmid, F. Vazquez, C. J. Schubert, A. Wüest, J. D. Kessler, M. A. Pack, W. S. Reeburgh, and H. Bürgmann (2011). Methane sources and sinks in Lake Kivu, *Journal Geophysical Research*, **116**: G03006, doi: 10.1029/2011JG001690.

## 2010

- Jordanoska, B., M.J. Kunz, T. Stafilov, and A. Wüest. (2010). Temporal variability of physico-chemical properties of St. Naum karst springs feeding Lake Ohrid. *Journal of Environmental Protection and Ecology*. Ekol. Zašt. Život. Sred, **13** (1-2): 3-11.
- Bryant, L.D, D.F. McGinnis, C. Lorrai, A. Brand, J.C. Little, and A. Wüest (2010a). Evaluating oxygen fluxes using microprofiles from both sides of the sediment-water interface. *Limnology and Oceanography-Methods*, **8**: 610-627.
- Bryant, L.D., C. Lorrai, D.F. McGinnis, A. Brand, A. Wüest, and J.C. Little. (2010b). Variable sediment oxygen uptake in response to dynamic forcing. *Limnology and Oceanography*, **55**(2): 950–964.
- Lorrai, C., D. F McGinnis, P. Berg, A. Brand, and A. Wüest (2010). Application of oxygen eddy correlation in aquatic systems. *Journal of Atmospheric and Oceanic Technology*, **27**(9): 1533–1546.
- Matter M, F.S. Anselmetti, B. Jordanoska, B. Wagner, M. Wessels and A. Wüest (2011). Carbonate sedimentation and effects of eutrophication observed at the Kališta subaquatic springs in Lake Ohrid (Macedonia), *Biogeosciences*, **7**(11): 3755–3767.
- Matzinger, A., B. Müller, P. Niederhauser, M. Schmid, and A. Wüest (2010). Hypolimnetic oxygen consumption by sediment-based reduced substances in former eutrophic lakes. *Limnology and Oceanography*, **55**(5): 2073–2084.
- Schmid M., M. Busbridge, and A. Wüest (2010). Double-diffusive convection in Lake Kivu. *Limnology and Oceanography*, **55**(1): 225–238.

## b) Book chapters (last five years)

- Kunz M.J. and A. Wüest (2014). Impacts by dams: From water quality modelling to management optimization. In: Schleiss et al. (Eds), *Proceedings of the International Conference on Fluvial Hydraulics, RIVER FLOW 2014*, p 2357- 2362. Taylor & Francis Group, London, ISBN 978-1-138-02674-2. doi: 10.13140/2.1.1329.0886

- Brookes, J.D., M. Schmid, D. Skinner, and A. Wüest (2013), In search of strategies to mitigate the impacts of global warming on aquatic ecosystems, p 429 - 448, chapter 24 in C.R. Goldman, M. Kumagai, R.D. Roberts (eds) *Climatic Change and Global Warming of Inland Waters: Impacts and Mitigation for Ecosystems and Societies*, 2013 John Wiley & Sons, Ltd, Chichester, doi: 10.1002/9781118470596.ch24
- Wüest, A. and M. Schmid (2012). Physical Limnology. In: J. Fernando (ed), *Handbook of Environmental Fluid Dynamics*. Volume 1/K10858, Oxford: Taylor&Francis Group.
- Wüest, A., T. Sommer, M. Schmid, and J.R. Carpenter (2012). Diffusive-type of double diffusion in lakes – a review, p 271-284. Chapter 14 in W Rodi and M Uhlmann (eds), *Environmental Fluid Mechanics: Memorial Volume in Honour of Prof. Gerhard H. Jirka*, IAHR Monographs, CRC Press Taylor&Francis Group, Karlsruhe.
- Schmid, M. and A. Wüest (2012). Stratification, Mixing and Transport Processes in Lake Kivu, p 13 - 29. Chapter 2 in J.-P. Descy et al. (eds.), *Lake Kivu: Limnology and biogeochemistry of a tropical great lake*, Aquatic Ecology Series 5, doi: 10.1007/978-94-007-4243-7\_2, © Springer Science+Business Media B.V. 2012.
- Pasche, N., F. A. Muvundja, M. Schmid, A. Wüest, and B. Müller (2012). Nutrient cycling in Lake Kivu, p 31 - 45. Chapter 3 in J.-P. Descy et al. (eds.), *Lake Kivu: Limnology and biogeochemistry of a tropical great lake*, Aquatic Ecology Series 5, doi: 10.1007/978-94-007-4243-7\_3, © Springer Science+Business Media B.V. 2012.
- Wüest A., L. Jarc, H. Bürgmann, N. Pasche and M. Schmid (2012). Methane formation and future extraction in Lake Kivu, p 165 - 180. Chapter 10 in J.-P. Descy et al. (eds.), *Lake Kivu: Limnology and biogeochemistry of a tropical great lake*, Aquatic Ecology Series 5, doi: 10.1007/978-94-007-4243-7\_10, © Springer Science+Business Media B.V. 2012.
- Wüest A. (2010). Downstream relevance of reservoir management. In: U. Bundi (ed), *Alpine Waters*. Hdb Env Chem 6: 235–246, Springer-Verlag Berlin, Heidelberg.

### **c) Expert services / consulting (last five years)**

- Wüest A. und G. Fink (2014). Potential zur Wärme- und Kühlenergienutzung aus dem Vierwaldstättersee – Machbarkeit. Bericht Aufsichtskommission Vierwaldstättersee & Umwelt und Energie, Kanton Luzern, Dezember 2014, 24 p plus Anhang.
- Wüest A., G. Fink und H. Ehmann (2014). Empfehlungen für eine nachhaltige Wärmenutzung am Bodensee. Richtlinien. KlimBo Teilprojekt 4.h, Landesanstalt für Umwelt, Messungen und Naturschutz. November 2014, 4p und Anhänge
- Gaudard A., D. Bouffard and A. Wüest (2014). Alternatives for the development of the EPFL water intake in Lake Geneva. Report APHYS-14-1 pour EPFL.
- Fink G., M. Wessels und A. Wüest (2014). Einfluss auf den Bodensee durch klimatische und hydrologische Entwicklungen im Einzugsgebiet. Partikeltransport in den Bodensee. KlimBo Teilprojekt 1a, 1b & 1d. Landesanstalt für Umwelt, Messungen und Naturschutz. August 2014.
- Wüest A., G. Fink und U. Lang (2014). Anwendung eines dreidimensionalen Modells und Verifikation des Wärmehaushaltsmodells für Auswirkungen von Wärmenutzungen. KlimBo Teilprojekt 4.f, Landesanstalt für Umwelt, Messungen und Naturschutz. Mai 2014, 16 p.
- Wüest A., G. Fink und H. Ehmann (2014). Szenarienbasierte Empfehlungen für eine nachhaltige Wärmenutzung am Bodensee - Richtlinien. KlimBo Teilprojekt 4.h, Landesanstalt für Umwelt, Messungen und Naturschutz. November 2014, 4p und Anhang.
- Bouffard D. et A. Wüest (2013). Analyse des fluctuations de température dans la station de pompage de l'EPFL. Report APHYS-13-1 pour EPFL.

- Müller, B. und A. Wüest (2013). Entwicklung der Sauerstoffzehrung im Hallwilersee. Bericht an BVU, Abteilung für Umwelt, des Kt. Aargau, 33 p.
- Wüest A. (2012) Potential zur Wärmeenergienutzung aus dem Zürichsee – Machbarkeit. Bericht AWEL Zürich und Energiebeauftragter Stadt Zürich, Dez. 2012, Eawag Kastanienbaum, 16 p.
- Zimmermann, U., T. Wagner, K. Cao, R. von Schulthess, M. Brögli, R. Gächter, and A. Wüest (2012). Lake Dianchi Kunming, Project Clear Lake. Summary Phases 1, 2 and 3. Schlussbericht und Zusammenfassung. Report Government Province Kunming, 86 p.
- Müller, B., L. Och und A. Wüest (2012). Entwicklung des Phosphorhaushalts und der Sauerstoffzehrung im Sempacher- und Baldeggersee. Bericht an Uwe Kt. Luzern, 46 p.
- Wüest A. (2011). Sihlentlastung in den Zürichsee. Kommentare zur Machbarkeitsstudie, Bericht an AWEL Kt. Zürich, 12 p.
- Wüest, A., und B. Müller (2010). Abnahme des Phosphorgehalts im Zugersee - Stand 2010. Bericht für AfU Kt. Zug, 28 p.
- Wüest, A. (2010). Belüftung Greifensee im Sommer 2009. Bericht an AWEL Kt. Zürich, 25 p.