Werner ECKERT[1]

On-line monitoring of internal wave activity using LakeESP (Environmental Sensing Platform)

[1]Israel Oceanographic and Limnological Research, The Yigal Allon Kinneret Limnological Laboratory, Migdal, Israel

The stratified period of warm-monomictic Lake Kinneret (LK), Israel, is characterized by strong (up to 15 m s^{-1}) daily westerly winds, which typically last from noon until sunset. As a result of this regular wind pattern, intensive internal waves are generated in the water column with amplitudes that in the sublittoral often exceed 10 m. Being exposed to turbulent benthic boundary mixing due to internal wave breaking, the sedimentary zone between 14 and 25 m depth should be the target depth for studying seiches-driven mixing processes and resuspension. The study of these processes and of the seiching process in general requires detailed information on the temperature displacements. and it has been our intention for a long time to deploy a thermistor-chain in the sublittoral zone. For this purpose we have recently purchased a LakeESP's (Environmental Sensing Platform) from Precision Measurement Engineering, Inc. (PME) with on-line data acquisition and it intended for the future to make the data available to GLEON.

Gideon GAL[1], Arkadi Parparov[1], and Paul C. Hanson[2]

Implementation of an ecosystem model for assessment of management policy based on sustainability and ecosystem stability criteria

[1]Kinneret Limnological Laboratory, IOLR, Migdal, Israel
[2]University of Wisconsin-Madison

We implemented a 1-D lake ecosystem model (DYCD), to the subtropical meso-eutrophic Lake Kinneret, in order to determine an acceptable management policy based on sustainability and stability criteria. To determine an acceptable policy based on sustainability criteria we applied a quantified system of water quality in conjunction with long term model scenarios under a wide range of nutrient loads. We used the combination of the scenario results and the WQ output to define a space of acceptable measures that will allow sustaining the lake ecosystem. We then used a simplified stability index in order to assess the relationships between management measures and ecosystem stability. We further examined the degree of overlap between sustainability derived limits and the limits permitting maintenance of ecosystem stability. The modeling results indicate that the measures required to maintain ecosystem stability differ from those required for sustainability. The application of a process based model, such as DYCD, has provided a means for examining the impact of external forcing on the lake ecosystem, beyond the observed historical conditions, and over extended periods of time. Our study

demonstrates one of the major advantages associated with the use of process based ecosystem models.

Hans Peter GROSSART[1]

Under ice bloom of Aphanizomenon flos-aquae results in extremely high bacterial activities -even at low temperatures

[1]Leibniz Institute of Freshwater Ecology and Inland Fisheries

In oligotrophic Lake Stechlin blooms of the cyanobacterium Aphanizomenon flosaquae are common in fall and winter. In the winter of 2009-2010 an extreme bloom had developed under the ice although light penetration due to intense snow cover was low. After 3 month of ice cover the bloom became senescent and was degraded almost completely by heterotrophic bacteria. These bacteria reached up to 10 um in size and showed extremely high production rates. The bacterial bloom was terminated by a bloom of heterotrophic flagellates and the ice off which led to a complete mixing of the lake. Our results indicate that temperature is not a limiting factor for heterotrophic bacteria and that under the right circumstances bacterial activities can be extremely high even at low temperatures. Therefore, we suggest that lake sampling needs to be performed year-round to understand and predict element and energy cycling through the microbial loop.

Matthew HIPSEY[1], Dennis Trolle, Paul Hanson and David Hamilton

A community-based model system for simulation of aquatic ecodynamics

[1]University of Western Australia

Numerous barriers to development of coupled hydrodynamic-biogeochemcial-ecological models of aquatic systems have recently been reported. Here we outline a new community-based initiative aimed at developing a cohesive model of aquatic ecodynamics that is able to overcome these barriers by facilitating inter-disciplinary collaboration and cross-domain synthesis. By instigating a common forum for aquatic ecosystem modellers we aim to (i) advance collaboration within the aquatic ecosystem modelling community, (ii) avoid 're-inventing the wheel', thus accelerating improvements to aquatic ecosystem models, (iii) facilitate a collective framework, using common code and a common vocabulary, (iv) increase the transparency of model structure, assumptions and techniques and the rigour by which we assess model function and (v) move towards an improved ability to integrate models with data from sensor networks. In doing so we aim to achieve a deeper understanding of aquatic ecosystem functioning, reduce uncertainty in predictions made by aquatic ecosystem models, and enable increased use of models

for research, policy and management.

Bomchul KIM[1], Yoonhee KIM[1], Bu-Young Ahn[2], Karpjoo Jeong[3], Suntae Hwang[4]

Effect of monitoring frequency in inflowing stream upon the accuracy of water quality modeling in a reservoir (Lake Soyang, Korea)

[1]Kangwon National University, [2] Korea Institute of Science and Technology Information, [3] Konkuk University, [4]Kookmin University, Korea

Water quality of inflowing rivers is the major determinant of water quality modeling in reservoirs. However, water quality of streams vary in rain events and high frequency monitoring is required for an accurate prediction. Korea is located in summer monsoon climate region and annual precipitation is concentrated in episodic heavy rain events. Lake Soyang is the largest reservoir in Korea (depth 110m, volume 2.9 billion m^3) and receives turbid storm runoff on rain events through the Soyang River. TP increase drastically from 20 ug/L on dry days to >300 ug/L on rainy days in the Soyang River. Turbidity was monitored by a sensor at an interval of one hour in the river and used for water quality modeling by a 2-dimensional model (CE-QUAL W2). Virtual data of lower frequency were made by selecting data at regular intervals of 3, 6, 12, 24 hours, 2, 3, 5, 8 days. The result of simulations using different sampling intervals were compared with the result of one hour interval monitoring. Temperature and SS showed similar result for 1, 3, and 6hour interval. But discrepancies in SS prediction were observed for sampling interval of longer than 6 hours. It can be concluded that monitoring interval of less than 6 hour is needed for accurate prediction of water quality in this reservoir.

Alo LAAS[1], Tiina Nõges[1], Peeter Nõges[1], Toomas Kõiv[1]

First high frequency metabolism studies in large shallow Lake Võrtsjärv, Estonia

[1]Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences, Centre for Limnology, Rannu 61117, Tartu County, Estonia

Large and shallow (area 270 km^2; mean depth 2.8 m, catchment area 3100 km^2) Lake Võrtsjärv was intensively studied for more than 50 years before the monitoring buoy was deployed for high frequency measurements of lake physical and chemical parameters. Phytoplankton primary production (PP) in Võrtsjärv has been measured *in situ* with ^{14}C- assimilation technique already since 1982. PP has been measured mainly during ice-free periods from April to October with weekly to monthly intervals.

This study presents the first results of high frequency measurements in Lake Võrtsjärv that started with multisensor in year 2009 (May to late- July) and followed

with buoy in 2010 (mid-April to late-October). We estimated the net ecosystem production (NEP), lake respiration (R) and gross primary production (GPP) by continuous measurements of oxygen, irradiance, wind, temperature and chlorophyll a. There were three to five distinct peaks in gross primary production (GPP) and community respiration (R) during the summer season and lows from fall to spring after broad-scale changes in irradiance and temperature.

Mean pelagic NEP was 28 mmol O_2 m^{-3} d^{-1} (range of –46 to 112) in 2009 and -5 mmol O_2 m^{-3} d^{-1} (range of –131 to 120) in 2010. Calculated rates of metabolism varied also strongly: mean pelagic GPP was 90 mmol O_2 m^{-3} d^{-1} (range of 18 to 230) in 2009 and 75 mmol O_2 m^{-3} d^{-1} (range of 0.8 to 319) in 2010; mean pelagic R was 63 mmol O_2 m^{-3} d^{-1} (range of 8.7 to 249) in 2009 and 80 mmol O_2 m^{-3} d^{-1} (range of 7.2 to 412) in 2010. GPP was positively correlated with photosynthetically active radiation (PAR) and negatively with wind speed. Lake metabolism was annually balanced (mean GPP:R was1.81 in 2009 and 1.17 in 2010), with net autotrophy occurring mainly from mid-April to late-July (mean GPP:R 1.81 in 2009 and 1.61 in 2010), and net heterotrophy from August to late October (mean GPP:R 0.62 in 2010).

The studies of last two years confirm that the metabolism of Lake Võrtsjärv may switch between autotrophic and heterotrophic types twice per year. In the summer period lake is acting prevalently as a net autotrophic system while in the autumn and spring net heterotrophy prevails.

Don PIERSON[1,2]

Development of a simple phytoplankton model: Could this be a GLEON community project?

[1]NYC DEP
[2]Erken Laboratory Uppsala University
dpierson@dep.nyc.gov

There are a number of phytoplankton models that are linked to hydrothermal models which operate in 1, 2, or 3 dimensions, and which simulate lake thermal structure, water balance, and material transport. These models are relatively complex, and able to simulate lake hydrothermal characteristics with a good degree of accuracy. Coupling algorithms describing lake chemistry and biology to hydrothermal models is clearly the most complete way to model the lake system, but at the same time can embed relatively simple water quality algorithms into a complex modeling framework that can be difficult for non-programs to understand, and which limits the opportunities to test and verify model algorithms.

I ask the question: Can water quality algorithms be tested in the simple framework of a two vertical layer model where the depth of the thermocline is a model input

that can be either derived from separate hydrothermal simulations or from measured buoy data? I present a preliminary model and some results from a reservoir system (water turnover time ~ 150d) that illustrates how this type of model can be used as a platform for testing and understanding phytoplankton algorithms. The purpose of this presentation is to stimulate discussion as to whether this type of model would be useful to the GLEON community.

Assaf SUKENIK[1]

ADVANCED MONITORING TECHNOLOGY FOR LAKE KINNERET
in situ remote measurement of photosynthetic activity of the phytoplankton community

[1]Kinneret Likmnological Laboratory, Israel Oceanographic & Limnological Research Migdal, Israel

Here we report on upgrading the real time monitoring capabilities of Lake Kinneret by a unique fluorometer, designed for direct measurement of photosynthetic activity of hytoplankton. A Flow-through based on a pulse amplitude modulation (PAM) fluorometer (FT-PhytoPAM) that identifies and quantify the activity of various phytoplankton groups, based on their typical pigment suits was designed to continuously work, as water is pumped via its measuring cell. The FT-PhytoPAM was integrated into the existing Lake Watch system (Ecoraft) to follow real time changes in quality and activities of phytoplankton populations. The system is accessed and operated via the internet. It pumps lake water from a given depth (1.5 m below water surface) and measure the photosynthetic activity of the phytoplankton community. Following the data acquired during December 2010 we could clearly show the domination of chlorophyte population over the population of cyanobacteria and other phytoplankton groups. The enhanced Chlorophyte signal suggested that the 2011 spring will be characterized once again by the absence of dinoflagellates. Remote operation of the FT-PhytoPAM and real time *in situ* measurements of photosynthetic activities of the phytoplankton community will be demonstrated.

Alejandro J. Vitale [1,2], Gerardo M.E..PERILLO[1,3], M. Cintia Piccolo[1,4] and Fernando Sidera[1]

Design, construction and installation of the IADO buoy at the Sauce Grande shallow lake

[1] Instituto Argentino de Oceanografía, Bahía Blanca, Argentina
[2]Departamento de Ingeniería Eléctrica y Computadoras, Universidad Nacional del Sur, Bahía Blanca, Argentina
[3]Departamento de Geología, Universidad Nacional del Sur, Bahía Blanca, Argentina
[4]Departamento de Geografía, Universidad Nacional del Sur, Bahía Blanca, Argentina

As part of IADO Limnology and Hydrology Program, a buoy has been fully designed and built at the Equipment Development Lab (EDL). The floating platform is 1 m in diameter and, including all the instruments, weights 35 kg. Although it can have a much large number of sensors, for its mooring at the Sauce Grande shallow lake (about 2 m depth) the buoy was only equipped with wind velocity and direction, humidity and air temperature for the meteorological parameters, while for the water parameters the buoy measures temperature, conductivity, suspended sediment concentration and water level. All sensors as well as the datalogger were also designed and built at EDL. Data is gathered every 5 min and transmitted to the IADO server every 30 min via GPRS. As the information is received, the data is automatically displayed on the emac.criba.edu.ar web page. The buoy was moored on February 17, 2011.

Luke A. WINSLOW[1] and Jordan S. Read[1]

Size Distribution of Lakes in the United States: A Brute Force Approach

[1]University of Wisconsin- Madison

Recently, environmental sciences are increasingly operating in a world with where the challenges and questions are presented at global scales. While a large amount of work has been done to examine terrestrial and ocean systems at global scales, and recently, work has begun to bring Limnology into a global perspective as well. Understanding globally the number, size, and distribution of lake systems represents one of the first and fundamental steps in that work.

We present work to examine the spatial extent and size distributions of lakes in the US. We show a very nearly complete datasets based on the US Geologic Survey Hydrography dataset of ~7 Million lakes. These data show a pareto-like size distribution of lakes in the US confirming previous studies. We expand on previous work and show how lakes in the US are spatially distribution and discuss possible implications this has.