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Field work at Lakes Nyos and Monoun by Tokai team

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Introduction

As you know, our SATREPS project will end in March 2016. The number of opportunities at which Japanese teams and IRGM team work together, is limited. We need to share the technique for observation, analysis of water and maintenance of instruments necessary for the monitoring of Lake Nyos and Monoun in order to mitigate the disaster. I wish the member of project join the campaign described as follow.

Activities

1. Installation of Automatic Observation Buoy (AOB) at Lake Nyos
2. Regular monitoring at Lake Nyos and Monoun

Member of Tokai team

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2. Seigo OOKI
3. Yu OGINUMA
4. Hajime YOSHIDA (Engineer of the buoy manufacturer)

Schedule

Date (2014)		Activity
23th Feb	Sun	Leave Japan
24th	Mon	Arrive at Yaounde
25th	Tue	Visit JICA office et al
26th	Wed	Leave Yaounde to Bamenda
27th	Thu	Leave Bamenda to Nyos
28th	Fri	Installation of buoy and monitoring of lake
1th March	Sat	Installation of buoy and monitoring of lake
2th	Sun	Installation of buoy and monitoring of lake
3th	Mon	Installation of buoy and monitoring of lake
4th	Tue	Installation of buoy and monitoring of lake

5th	Wed	Leave Nyos to Bamenda (H Yoshida moves to Yaounde directly)
6th	Thu	Monitoring of Lake Monoun
7th	Fri	Monitoring of Lake Monoun
8th	Sat	Monitoring of Lake Monoun
9th	Sun	Leave Bamenda to Yaounde
10th	Mon	JCC meeting at MINRESI
11th	Tue	Visit Nkolbison Lab.　Leave Yaounde at night
12th	Wed	Arrive at Paris
13th	Thu	Leave Paris
14th	Fri	Arrive at Haneda Japan

Details on the activities

1. Installation of automatic observation buoy

Function and purpose of Automatic Observation Buoy (AOB).

AOB is only installed in the Lake Nyos. AOB measures the temperature and conductivity of lake water at various depths automatically and periodically, for example, once per hour. The obtained data is transmitted to satellite by radio wave. The satellite relays the data to Internet. IRGM will accept the data in real time through general e-mail client software. The data is critically important to the real time monitoring for Lake Nyos.

Fig. 1.　Main body of AOB

Fig. 2　AOB in Lake Ikeda Japan for the test of function.

The big red disk is the main body of AOB (Fig.1 and 2).　A stainless wire hangs on in lake water from the bottom of AOB main body.

Fig. 3 Temp and conductivity sensor unit attached on the stainless wire.

Several temperature and conductivity sensors (Fig. 3) are fixed on the wire at various depths. The data is transmitted to the control unit (Fig. 4) through the stainless wire.

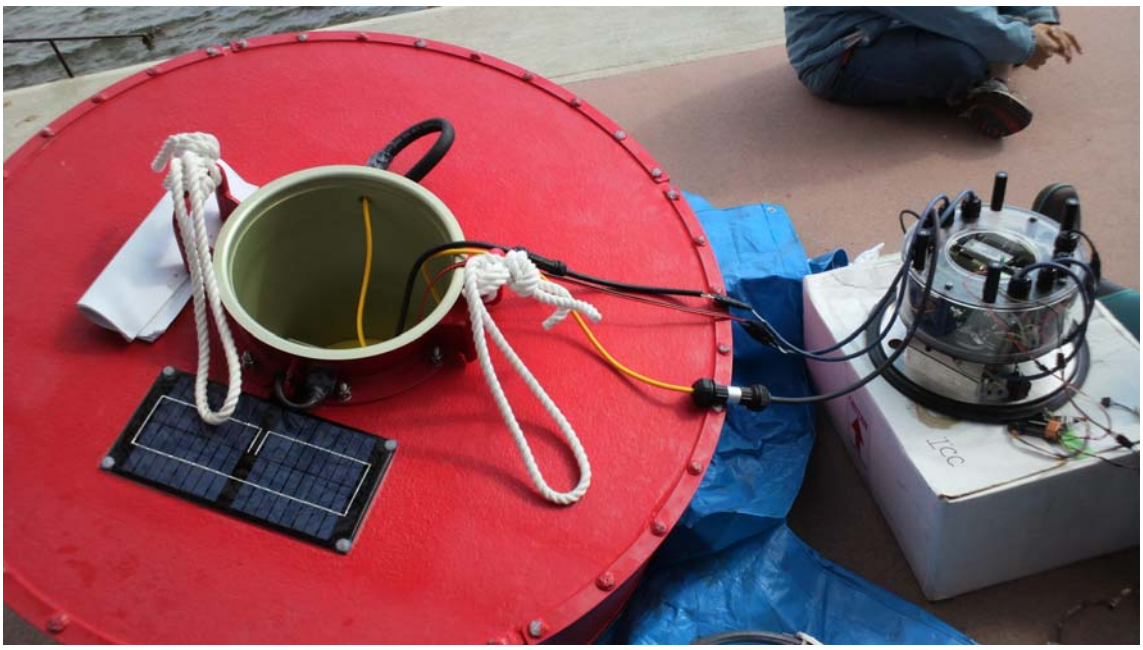

Fig. 4. Control unit of AOB (Right) and solar panel attached on float (Left).

AOB will be installed along the direction by H. Yoshida. We need to understand the structure of buoy system and the method of maintenance to keep AOB working over years after the termination of SATREPS project. The controller contains one sealed Pb battery. The each sensor unit contains Li battery. Those batteries should be replaced once per year. To remove the moss adhered on sensor, the stainless wire with sensors should be pulled out from the lake water and cleaned.

2. Regular monitoring at Lakes Nyos and Monoun

Items of observations

A: CTD measurement.

CTD is a data logger which collects the temperature, conductivity and pH of lake water. We can obtain the smooth profiles of the above data along the depth. CTD is the important and basic tool for lake study. The calibration before the observation by use of standard solution for pH and conductivity is necessary to obtain reliable data. The collected data is recovered by a note-PC through a cable. The details on those preparation and treatment are important to keep the CTD observation over long time at lakes by IRGM staff after the termination of SATREPS project.

B: Water sampling by use of Niskin sampler

With the Niskin sampler, we can collect the lake water at various depth. The collected lake water is shared with Tokai team and IRGM team then subjected to chemical analysis. The collected lake water is filtrated through a disk filter (0.45 micron meter of pore size) for anions analysis by use of IC. The filtrated water is also used for isotope analysis by use of Picarro.
Another aliquot of 100 ml filtrated water is acidified by adding 5ml 30 wt % of pure HNO3 solution to prevent the deposition of mineralized component. The acidified sample is used for the cations analysis by Atomic Absorption Spectrometer (AAS) which has been donated to IRGM recently.

C: MK sampling

MK sampling is a special method to fix CO2_aq by mixing with 5M KOH solution in situ. It is a reliable method to determine the total concentration of CO2. The total CO2 means the summation of CO2_aq, HCO_3^- and CO_3^{--}. I recommend IRGM will perform MK sampling annually after the termination of SATREPS project. We need to look at the change in the concentration of CO2 species because the limnic eruption is driven by the CO2_aq.

A 50ml plastic syringe containing 10 ml of 5M KOH solution is attached to a special device. The plastic syringe with the device is dipped into the lake water at a specific depth by use of calibrated steal wire. A metallic heavy messenger is send to the devise along the wire. The messenger hits the trigger of device resulting in the mixing of lake water with 5M KOH solution.

The lake water mixed with 5M KOH solution is subjected to the micro diffusion titration analysis. The apparatus necessary for this analysis has not yet been donated to IRGM. Therefore the sampling and analysis will be done by Tokai team only. However I wish the member of IRGM watch the work by Tokai team to know the MK method during this campaign.