Urban Subsurface Environments

Newsletter Volume 4 October 2007

Project Activities and Plans

Makoto Taniguchi, RIHN

The full implementation of the project "Human Impacts on Urban Subsurface Environment" continues in 2007 and the project members have conducted field experiments, surveys and data gathering in the target cities.

Summary of the field activities of the Heat, Material, and Urban Socio-economic groups and initial research results are featured in this volume of our project's newsletter. This issue also contains report on the role and functions of the GIS Working Group.

Several activities have been conducted since the start of FY 2007. Different groups have conducted their field research in the following areas: Bangkok (Socio-economic Group, Water Group); Jakarta (Gravity Group; Heat Group); Manila (Material Group) and Taipei (Heat Group; Urban Geography Group). Some of the reports from these field surveys are featured in this issue.

To cap this year's achievements and research progress, we will have a domestic meeting in Kumamoto on November 19-21, 2007. At the end of this year we will co-sponsor the International Symposium on"Current Problems in Groundwater Management and Related Water Resources Issues" in Bali, Indonesia on December 4-5, 2007. This is in partnership with the Indonesia Institute for Sciences (LIPI). All sub-group leaders, our project partners from Bangkok, Jakarta, Manila, Seoul and Taipei, and some project members from the USA and Japan, will give oral presentations in the symposium. After the symposium, we will hold the RIHN Workshop which will be our venue to discuss with our foreign partners the progress of the project and areas for improvement in the future. The workshop will be held from December 7-8. We are quite fortunate that Bali, Indonesia is also the venue of the UN Framework Convention on Climate Change (UNFCCC) COP 13, so we will a parallel event to this meeting in a special session entitled, "Impacts of Global Climate Change and Subsurface Environments".

We will also have the signing of the Cooperative Agreement with the Korea Research Institute for Human Settlements (KRIHS) during the symposium.

Next year, our project is one of the organizers of the conference, "HydroChange 2008: Hydrological changes and management from headwater to the ocean", in Kyoto, from October 1-3.

Inside this issue

Role of GIS Working Group (Cont.)	2
Report from the Heat Group	4
Report from the Material Group	6
Development of dating method for ground water using Kr-85	8
Report from the Socio-economic Group	12
Human Impact on Groundwater Condition in Jakarta Metropolitan Area	15
Joint Research with RIHN	18
RIHN Corner	20

Role of GIS Working Group

Yu Umezawa[1] and Akio Yamashita[2]

[1]RIHN, [2]Rakuno Gakuen University

Introduction

The Geographic Information System (GIS) is a common platform to synthesize various data sets together with the information of the location. This will help us to 1) store the data, 2) understand the relations between the associated attributes, and 3) show the results to researchers and ordinary people in a visually nice format.

In our project, Urban Geography Group is mainly in-charge of GIS studies, but it was hard for them to process various specific data sets collected by the other groups. For example, we need to treat groundwater quality data referring to the water sampling depth, groundwater flows and the time lag in which surface environment affects the subsurface environments. Therefore, we decided to organize the GIS Working Group (hereafter GIS_WG), which consists of 1 or 2 representatives from each sub group (Fig. 1 B).

GIS_WG have discussed the detail about data gathering and how to synthesize various data sets of different resolutions in time and space, so that we can crystallize the rough ideas suggested at the Leader's Meeting (Fig. 1). As of September 2007, 15 members has joined in the GIS_WG mailing list (gis_wg_24fr@ml.chikyu.ac.jp) and often communicated using e-mail. Following the decisions of the GIS_WG, we are trying to collect data from our network, consisting of RIHN project members and other cooperative institutes (Figs. 1-C and 1-D)

We plan to give a presentation about the framework and current progress of our GIS work at the domestic project meeting in Kumamoto in November 2007, and at the workshops in Bali in December (Table 1). We would appreciate any constructive suggestions from the participants.

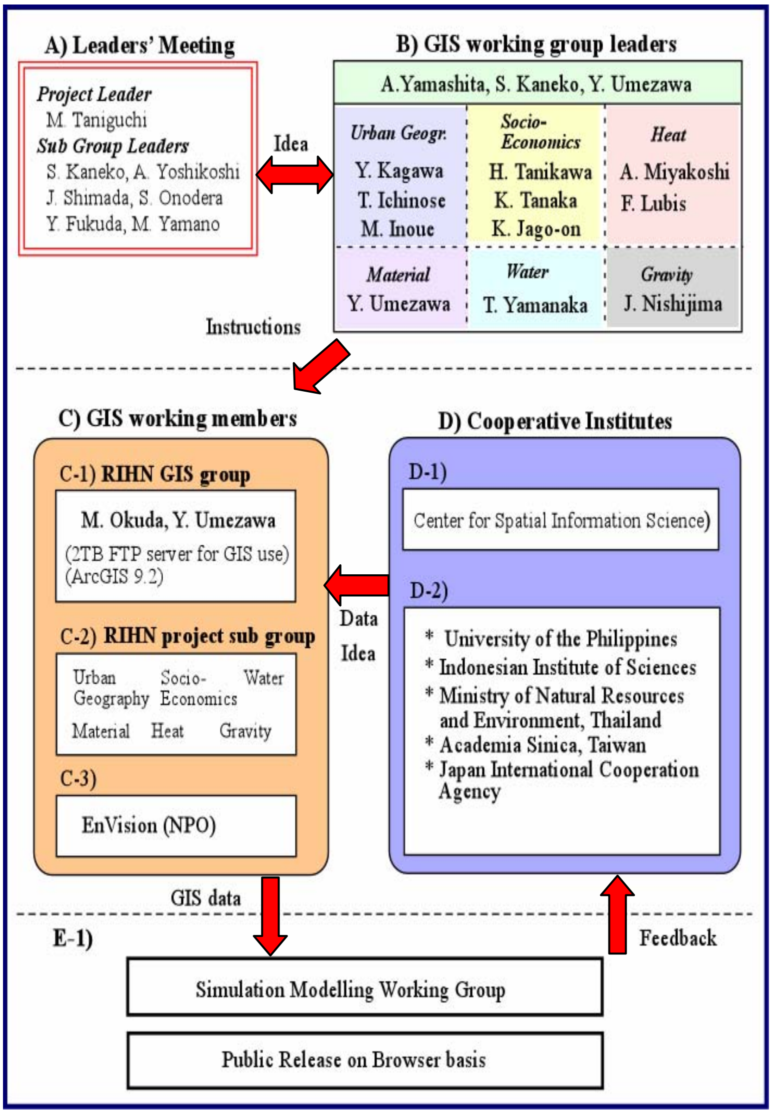


Figure 1. Schematic system of GIS work in the RIHN project

Main Objectives of the Present GIS work

To create a land-use map (0.5 km grid size) of 3 or 5 periods in each megacity based on the 1/50,000 topographic map, to understand the trend of spatial expansion of city areas during an arbitrary period from pre-urbanization to present (Fig. 2).

To collect historical data from census, papers and public reports, in addition to the data collected in our observation and field surveys at each city,

Urban Geography Group: population, land use

Socio- Economics Group: economics, statistics

Water Group: groundwater level, groundwater abstraction

Material Group: pollutant concentration, salinity level

Gravity Group: land subsidence

Heat Group: subsurface temperature profile

Synthesize the data set and analyze the relations between associated attributes.

Gathering Topographic Map and Statistical Data

Through the kind support from our foreign counterparts and domestic project members, we have collected topographic maps and GIS data. As of September 2007, we have almost collected latest topographic maps (1/50000 resolution) at the targeted cities except for Jakarta and Seoul. On the other hand, old maps have collected only at Tokyo and Osaka cities. We'd appreciate any information about these maps.

All the maps are scanned, saved as TIFF format (300 dpi) and stored at FTP server for GIS purpose (2TB). The information of the maps owned by our project are shown on the metadata list (Excel format), which Dr. Manabu Inoue (Ritsumeikan Univ., Japan) are managing, so that all members can access the information and easily get the electric map with geo-reference from the server. The Universal Transverse Mercator (UTM) coordinate system, which we are using for each city, are Zone 47, 48, 51, 52 and 53 for Bangkok, Jakarta, Taipei and Manila, Seoul, and Osaka and Tokyo, respectively. Based on these topographic maps, we are creating land-use map of 0.5 km mesh size with a support of EnVision (NPO, Sapporo, Japan). We aim to finish creating land-use maps of 3 or 5 time-stages at each city within 2 years.

To collect historical statistical data (e.g., water levels and water quality at monitoring wells, land subsidence) at each city is another challenging task for us. For example in Osaka, several data have been collected by Osaka Prefecture and Ministry of Land, Infrastructure and Transport, separately. These data sets often lack the location information, analytical method, altitude information, and so on. Though it takes time to fill up the information and to communicate with the staff at these governmental offices, we are gradually continuing these processes.

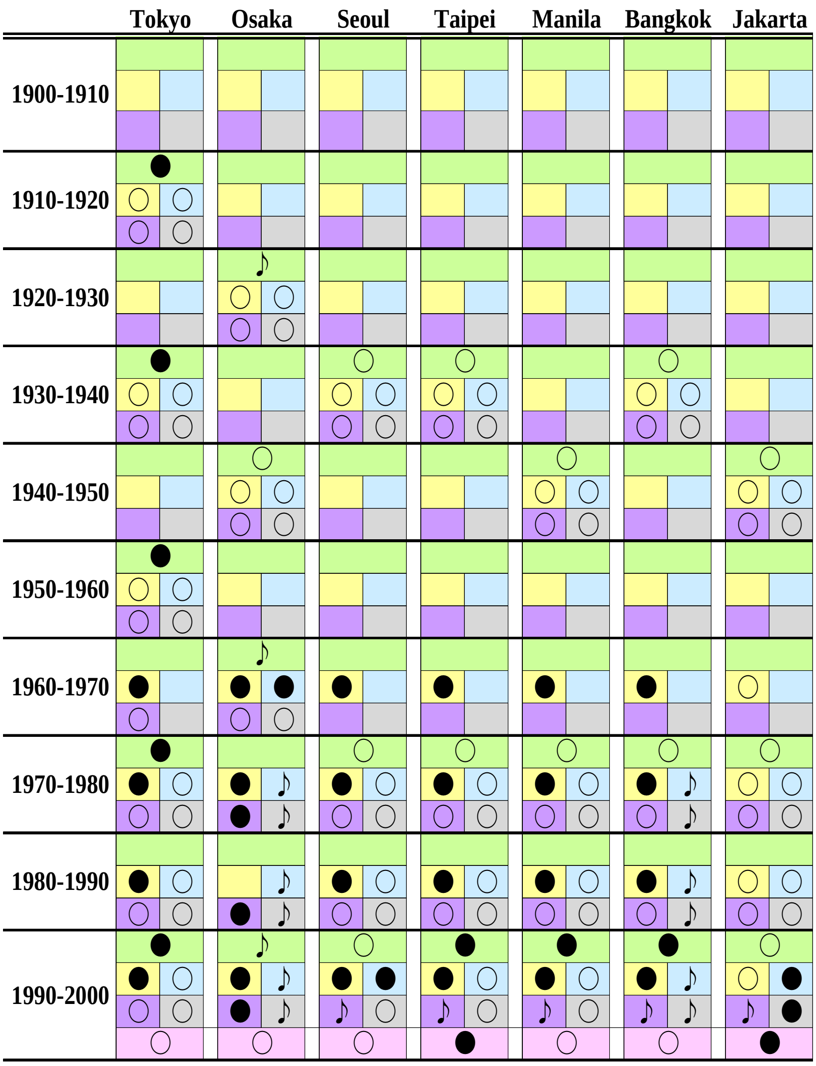
We would like to ask our members for further support to collect these basic statistical data, especially from foreign cities. Basically we are storing our data using non-proprietary and open data formats such as the Shape File format for vector data and the Geotiff format for raster data.

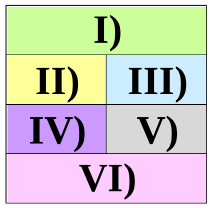
On the other hand, some of GIS_WG members also join the joint research program with Center for Spatial Information Science (CSIS), The University of Tokyo (http://www.csis.u-tokyo.ac.jp/english/). With this program, we can access many useful data (e.g., census, DEM data with 50 m resolution) for research purposes only.

Output of the results

Basically any statistical data and any other raw data originally collected and transformed to format basis by members will be shared with other project members after a given period, and the creator has priority to use the data for the papers. We, especially the Urban Geography Group, plan to have a special symposium at the Annual Meeting of the Association of Japanese Geographers (http://wwwsoc.nii.ac.jp/ajg/english/web/index.html) next year, and contribute to a special issue in an academic journal to introduce our studies.

Date	Contents
Dec. 2006	• GIS working group was organized
Jan. 2007	• The FTP server (60MB) for GIS WG was preapred
Mar. 2007	• 1st GIS WG meeting was held at RIHN (Taniguchi M, Yamashita, Taniguchi T, Jago-on, Umezawa, Hosono, Yamanaka, Miyakoshi, Nishijima, Okuda, Inoue)
Apr. 2007	• A part-time technical staff for GIS study was hired at RIHN
May 2007	• Core group meeting was held at Rakuno Gakuen Univ. (Yamashita, Kaneko, Umezawa)
	• Core group meeting was held at Makuhari Chiba (Taniguchi M, Yamashita, Umezawa, Hosono)
June 2007	• Large volume FTP server (2TB) for GIS WG was installed
Nov. 2007	• Presentation at the conference, "CSIS DAYS ", the Tokyo Univ., Japan
Nov. 2007	• Accomplishment of the land-use map of 2 or 3 periods at Osaka and Tokyo
Dec. 2007	• 2nd GIS WG meeting will be held at Kumamoto, Japan
	• Presentation at the RIHN workshop held at Bali, Indonesia
Feb. 2008	• Accomplishment of latest land-use map at 7 mega-cities
	• Accomplishment of synthesizing GIS-based data set on the land-use map. (Interim Evaluation for our Project)
Dec. 2008	• Accomplishment of the land-use map of 2 or 3 periods at 7 mega-cities
2009	• Preparation for the contribution to spatial issue
2010	• Releasing web site exhibiting "Subsurface environments at Asian Cities"





I) ***Urban Geography Group*** : Land use data, population
II) ***Socio-Economics Group*** : economic development indice
III) ***Water Group*** : water level, water abstraction
IV) ***Material Group*** : pollutant contamination
V) ***Gravity Group*** : land subsidence
VI) ***Heat Group*** : subsurface temperature profile

♪ : Data have almost been processed on the GIS base.
● : Data have almost been collected
○ : Still surveying and collecting

* Achievement was roughly estimated by Y. Umezawa.

Report from the Heat Group

Makoto Yamano

Earthquake Research Institute, The University of Tokyo

The Heat Group aims at revealing subsurface thermal anomalies in urban areas caused by human activities. For this purpose, we have been conducting measurements of vertical temperature profiles in boreholes, which will be used for the reconstruction of the ground surface temperature (GST) history for the last several hundred years.

In 2007, we carried out field surveys in three areas, Taiwan (including Taipei), Jakarta, and Osaka (Figs. 1 - 3). Temperature profile measurements in boreholes were made at 31 stations, mainly in groundwater monitoring wells. Many of the measurements were made in the wells visited in 2005 or in 2006 (i.e. repeated measurements), while 11 wells were newly logged in Taiwan and Osaka. The depths of the wells range from 40 to 310 m.

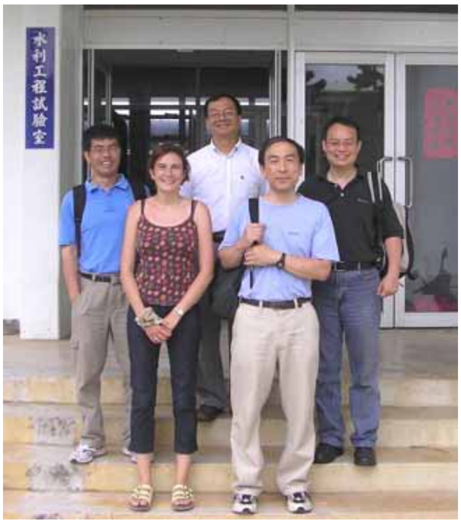


Fig. 1. Temperature measurement for the 2007 Taiwan survey at the National Pingtung University of Science and Technology.

Fig.2. Groundwater monitoring well in the schoolyard of an elementary school in Taiwan.

Stability of borehole temperature profiles

It is important to measure borehole temperature profiles repeatedly at some time intervals to examine whether the temperature profiles are stable. Since the thermal diffusion through rocks is a very slow process, temperature profiles measured in boreholes should not change significantly if they are not affected by temporally variable groundwater flows. The stability of the temperature profile is therefore one of indicators of disturbance by groundwater flow.

In Taiwan, we conducted temperature logging in eight boreholes both in November 2005 and in June 2007. The temperature profiles in these two periods were almost identical in some holes, but quite different in others (Fig. 4). The shapes of the temperature profiles in holes X and Y were similar, whereas the stability of the profile was very different. In hole Z, no appreciable temperature change was detected in spite of the rather distorted temperature profile indicating influence of groundwater flow. These examples demonstrate the necessity of repeated temperature logging.

Fig.3. Temperature profile measurement at a station in Osaka.

Long-term temperature records

We have been monitoring borehole temperature and soil temperature at selected stations in the Taipei, Bangkok, and Jakarta areas to investigate how the GST variation is propagated downward (Fig. 5). During the surveys in Taiwan and Jakarta in 2007, we were able to recover borehole and soil temperature data for 11 months to 1.5 years.

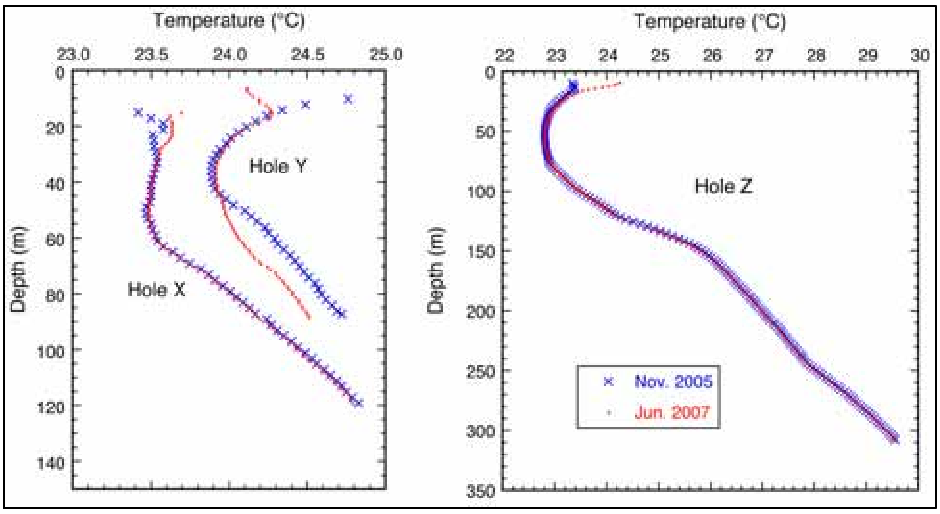


Fig. 4. Temperature-depth profiles in three boreholes in the Taipei area measured in November 2005.

Fig. 6 shows temperature records obtained at three depths in a borehole in the Taipei area. In addition to long-term variations and a quick event observed at all the depths, short-period variations were detected at a depth of 25.0 m. A blowup of the 25.0 m temperature record (Fig. 6b) demonstrates that it apparently contains one-day and one-week components. It strongly suggests that the short-period variations are related to human activities.

Examples of soil temperature records are shown in Fig. 7. They are the temperatures measured at 0.5 m and 1.0 m below the ground surface at a station in the City of Jakarta. Typical features of thermal diffusion process can be recognized in the plot: the amplitude decays and the phase is delayed with depth. Significant temperature decrease observed in early February 2007 is a result of a major flood in the Jakarta area.

In the city of Osaka, we have started periodic temperature logging (once a month) in two shallow wells, which are 45 m and 54 m deep. It will show how the temperature profiles change with time in the depth range where ongoing propagation of the effect of surface warming can be observed.

Fig.5. Temperature sensors and recorders used for soil temperature

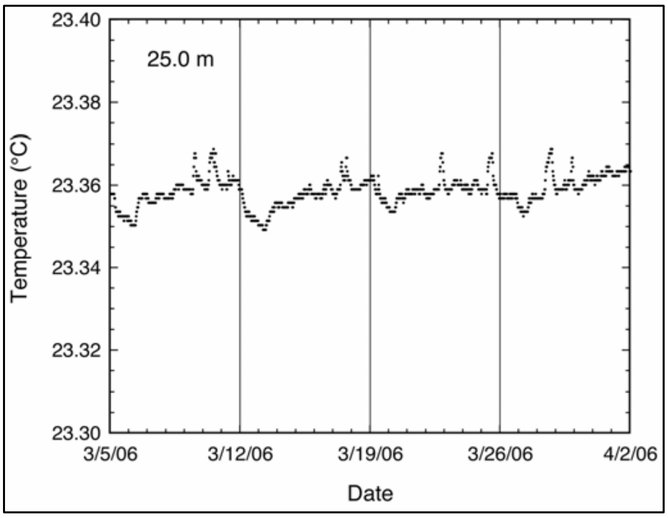


Fig.6 (a). Long-term temperature records obtained in a borehole in the Taipei area.

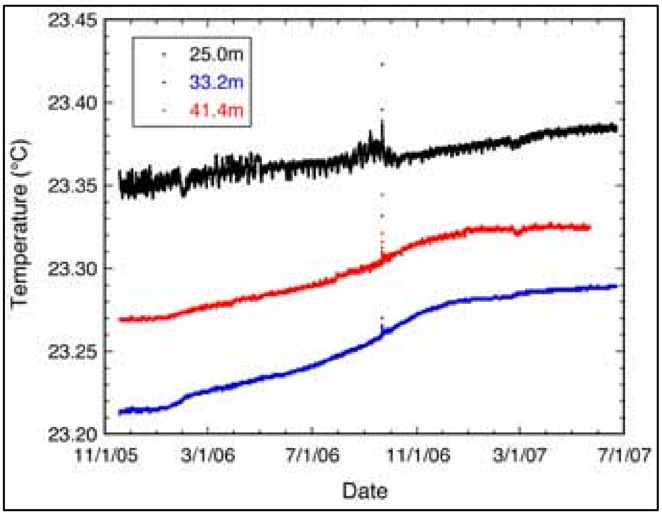


Fig.6(b). Blow-up of the temperature record at a depth of 25.0 m.

Preliminary results of GST reconstruction

We attempted the reconstruction of GST histories from some of the temperature profiles measured in the Taipei, Bangkok, and Jakarta areas. Preliminary results obtained for the Bangkok area are shown in Fig. 8. All of the reconstructed GST histories show surface warming in the last century. The amount of the temperature increase is greater in the city than in the northern rural area, which may be attributed to the heat island effect.

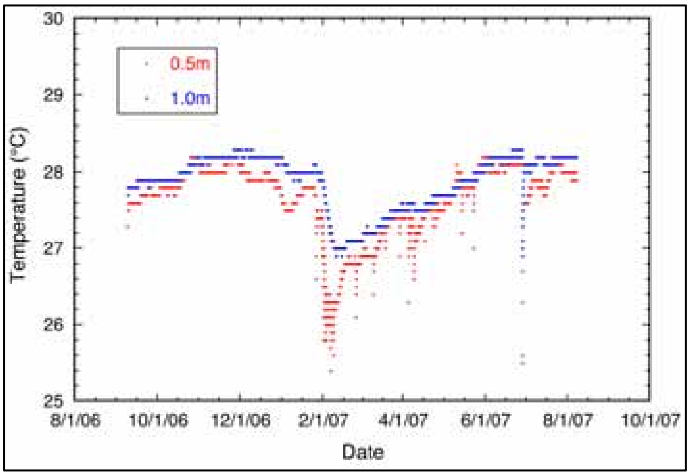


Fig.7. Temperature records 0.5 m and 10 m below the ground surface at a station in Jakarta.

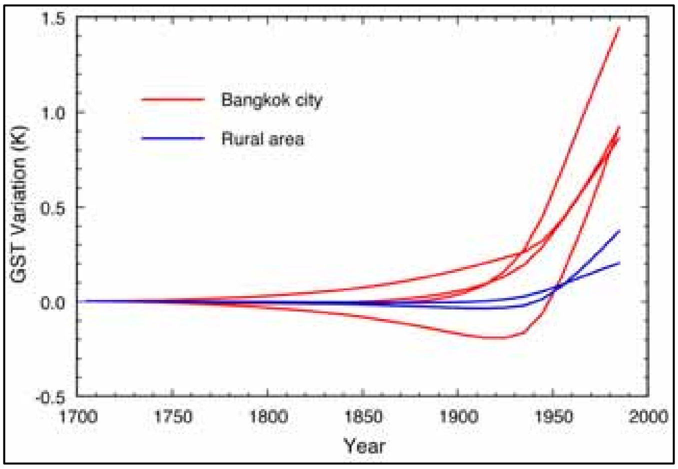


Fig.8. GST histories reconstructed from borehole temperature profiles in the Bangkok area.

Report from the Material Group

Research Aspects of Material Group in Second Year of the Project: Comparison of results in each mega-cities

Shin-ichi Onodera

Graduate School of Integrated Arts and Sciences, Hiroshima University

Introduction

We conducted the intensive researches in each main city in 2006, the first year of this project. Some of the results will be published. We confirmed the some accumulation conditions of pollutants and groundwater and solute flux with it into the ocean in each city. But some collected samples have not been analyzed. Based on the results, we decided the plan in 2007, the second year of the project. We would like to show that as well as some proceedings of our research in this news letter.

Research Members

Our group is composed of Japanese core and student members, and field counterpart members in Korea, Taiwan, Philippine, Thailand, and Indonesia. 8 Japanese members participated in field researches in the first year of this project and pre research. The detail is as follows,

- Core member: Shin-ichi Onodera (Hiroshima Univ.), Takanori Nakano (RIHN), Takahiro Hosono (Akita University), Yu Umezawa (RIHN), and Tomotoshi Ishitobi (RIHN).
- Student member: Mitsuyo Saito (Hiroshima Univ.)

Research Results

The results are summarized as follows:

1) Huge accumulation amount of trace metal, dissolved nitrogen, and chloride in groundwater, especially in Jakarta and Bangkok,

2) Various N origin and denitrification by using N isotope distribution in groundwater,

3) Less terrestrial submarine groundwater discharge but huge material flux by total SGD.

We will introduce our progress and discuss in the Bali workshop in December..

Research Plans

Our research season was still only dry season in main fields, Bangkok and Jakarta. We will consider the flash discharge of solution by SGD during a wet season, in next February in Jakarta and next April in Bangkok.

We constructed a monitoring station of SGD and material load in Manila with automated seepage meter and piezometers of two depths for manual water collection. The researcher in Manila will conducted the monitoring those and estimated those.

We have some future work in terms of coastal sediment, one is the Pb isotopic and chemical analysis of sediment in each city for the reconstruction of variation in sedimentation rate and material load with urbanization, and second is the reconstruction of variation in solute load with recirculated SGD.

We are also going to apply these research methods in our next research in Jakarta. First one is the system to analyze dissolved N_2/Ar in groundwater for the amount of denitrification in groundwater and nitrate content during groundwater recharge. Second one is 222Rn analysis system for the quantification of SGD and seawater intrusion.

Third one is the research combining the seepage meter, piezometer and tracer methods for the quantification of input of seawater into sea bed as a source of recirculated SGD and seawater intrusion.

Fig. 1. Analysis system for dissolved N_2/Ar

Fig. 2. Monitoring station of SGD in Manila

Fig. 3. In situ checking of Rn analysis system

Fig. 4. System combining seepage meter and piezometer

Development of dating method for ground water using Kr-85

Noriyuki Momoshima[1], Yasunori Mahara[2], Jun Shimada[3], Makoto Taniguchi[4]

1: Kyushu Univ., 2: Kyoto Univ., 3: Kumamoto Univ., 4:RIHN

Introduction

Groundwater dating is an essential issue for researches which focus on groundwater movement and movement of materials in the groundwater. Most ideal tracer for groundwater dating would be tritium (radioactive hydrogen isotope with 12.34 year half-life) originated from nuclear testing carried out in 1950s-1960s. The major release of tritium from nuclear tests to the environment occurred in 1962-63, which is possible to consider as a kind of pulse input. The release-history of tritium to the environment by nuclear tests is well documented and makes it possible to use as a dating tracer for the groundwater which contains bomb tritium supplied by rain. After the test ban treaty in 1963, tritium concentrations in the environment have been decreasing and even in groundwater containing rain supplied in 1962-63, the tritium activity has decreased to about 8 % due to radioactive decay.

Kr-85 is a radioactive gas; mostly produced by fission of uranium in nuclear fuel used at nuclear power reactors, has been released to the environment during a reprocessing process at nuclear fuel re-processing plants operating at Sellafield and La Hague in Europe and soon Rokkasho, Japan. Kr-85 has 10.76 years half-life and emits beta ray with a maximum energy of 687 keV. Chemically, Kr is stable and a non reactive element, thus all of the K-85 associated with nuclear fuel re-processing plants has been released to the environment without any recovering steps. Kr-85 dissolves in water by Henry's law with stable Kr isotopes, Kr-80, Kr-82, Kr-83, Kr-84 and Kr-86, the atmospheric concentration of stable Kr is 1.4 ppm. To use of Kr-85 as a dating tracer is an attractive idea because of the conservative character of Kr in groundwater. There have been several challenges to use Kr-85 as a tracer for groundwater dating (Nevinskii and Tsvetkova, 2003; Sidle, 2006).

Atmospheric Kr-85 concentration has been measured and an increase in concentration is clearly observed along with the increase of peaceful use of nuclear energy (Hirota et al., 2004; Okai et al., 1984). The atmospheric concentration of Kr-85 will increase until the release from uses of nuclear energy counterbalances with radioactive decay.

Our purpose is to establish a dating method of groundwater that uses Kr-85. The method consists of two parts, a recovery of Kr from groundwater and an analysis of Kr-85. In this paper, we focus on the latter part, which is the development of the analytical method of Kr-85.

Experimental

2.1 Separation system

Kr-85 emits beta-ray and gamma ray, however, the measurement of gamma ray is not suitable for low level samples because of a small emission probability of the gamma ray and rather high background counts associated with the gamma ray measurement system. We develop an analytical procedure applicable to low level samples such as Kr-85 in groundwater and measurement method of Kr-85 which uses a low background liquid scintillation counter. The analytical procedure adopted is similar to that basically developed for the measurement of atmospheric K-85 because the composition of gas recovered from groundwater would resemble to that of air. A diagram of the analytical system for atmospheric Kr-85 is shown in Fig. 1. Air is introduced to the system by a pump through a dust filter and a flow rate and volume of air is measured with a flow meter. Water vapor and CO_2 is eliminated with a molecular sieve 13X column and Kr is trapped in a charcoal trap cooled at liquid nitrogen temperature.

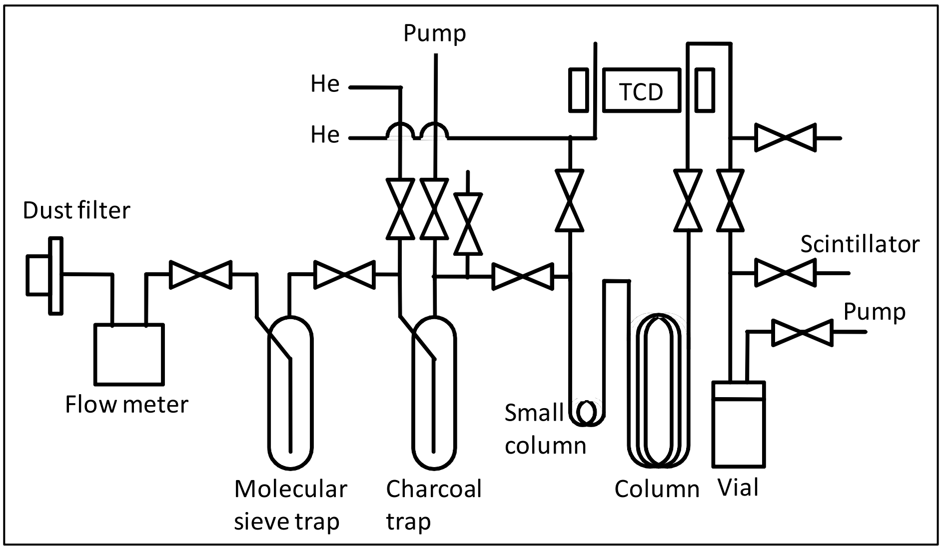


Fig. 1 A diagram of analytical system for Atmospheric Kr-

Fig. 2 A gas chromatograph

The trapping efficiency of the charcoal trap is almost 100% for Kr but O_2 and part of N_2 is also trapped. Large amounts of O_2 and N_2 make it difficult to isolate Kr with a separation column, so the purification of gas in the charcoal trap is necessary. After the necessary volume of air is sampled, the coolant of the charcoal trap is changed to dry-ice and He started to flow to the charcoal trap. The purification by flow of He reduces the amounts of O_2 and N_2 at the charcoal trap considerably. Isolation of Kr with other gases is carried out by gas chromatograph using a 6 m long separation column in which molecular sieves 5A with 30-60 mesh are packed. The gas chromatograph is shown in Fig. 2 (Shimazu GC 8A), in the figure the door is open and the separation column is seen. The separation of Kr and other gases is carried out at room temperature (25 ºC) or -16 ºC with He carrier. The flow rate of He carrier is 40 ml/min. The isolated Kr is introduced to liquid scintillation counting vial, cooled at liquid nitrogen temperature and dissolved in scintillation cocktail. For dating with Kr-85, specific activity of Kr-85, a ratio of Kr-85 to stable Kr should be determined. Then we developed a Kr recovery system which can determine the amount of Kr introduced to the counting vial for Kr-85 measurement. The Fig. 3 shows the air sampling system; the yellow color flow meter is located upper, the molecular sieve 13X column is fixed on a stand, the charcoal trap made with stainless steel is seen on the green color panel, and the air pump is placed on the floor. The Kr recovery system is shown in Fig. 4. The isolated Kr with the gas chromatograph is moved to an aluminum bag by confirming Kr and other gas component peaks in gas chromatogram. Two aluminum bags are seen upper part of the Fig. 4. The Kr in the aluminum bag with He carrier is introduced to a 100 ml volume of quart-counting vial cooled at liquid nitrogen temperature using a peristaltic pump. Kr is effectively fixed on silica gel placed in a bottom of the 100ml quart-counting vial (few mm heights) and He is returned to another aluminum bag. The 100ml quart-counting vial is seen at the left side of the peristaltic pump in Fig. 4 and stable Kr gas bomb for standardization of Kr peak in gas chromatogram is seen behind of the peristaltic pump. An amount of Kr returned to the aluminum bag without fixed on the silica gel is determined by gas chromatography to know Kr introduced to the 100ml quart-counting vial. Scintillation cocktail is put into the 100ml quart-counting vial cooled at liquid nitrogen temperature through a line connecting the 100ml quart-counting vial and a scintillation cocktail reservoir. The 100ml quart-counting vial is removed from the Kr recovery system and capped tightly at frozen condition of the scintillation cocktail.

Fig. 3 The air sampling system

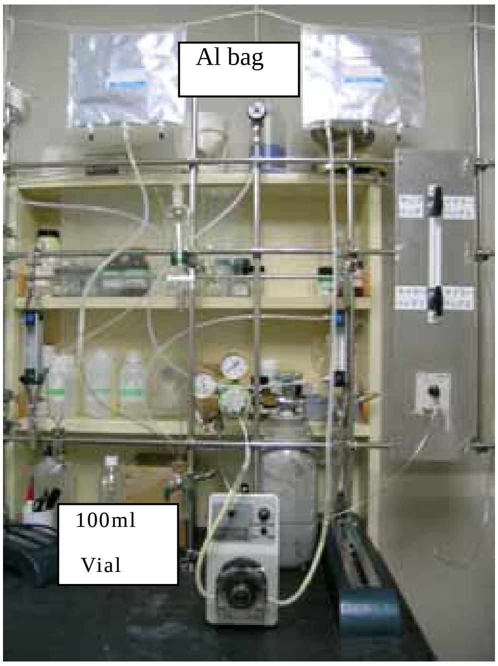


Fig. 4 The Kr recovery system

Measurement system of Kr-85

The activity in 100ml quart-counting vial is measured with a low back ground liquid scintillation counter (Aloka LSC 5) which is specially developed for low level counting of beta ray emitting nuclides. Scintillation cocktail for Kr-85 measurement is prepared by dissolving scintillator PPO in pseudocumene.

3. Results

3.1 Removal of O_2 and N_2 from the charcoal trap

Separation of Kr with other gases is very important because uncompleted separation will result in an increase of gases introduced to the 100ml quart-counting vial, which would decrease trapping efficiency of Kr in the vial. Major gas component in air is N_2 and O_2 and probably in groundwater, too. During the trapping process of Kr from air to the charcoal trap, O_2 and considerable amounts of N_2 is also trapped. The removal of O_2 and N_2 from the charcoal trap with He at dry ice temperature is quite effective as shown in Figs. 5 and 6.

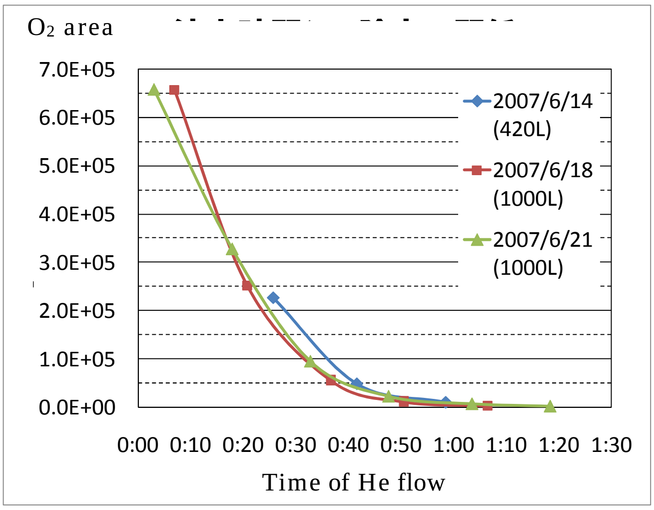


Fig. 5 Removal of O_2 from charcoal trap with He

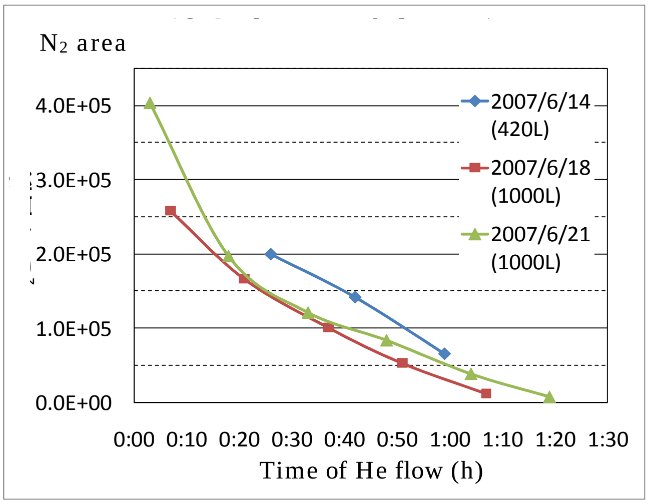


Fig. 6 Removal of N_2 from charcoal trap with He

The O_2 and N_2 removed with He from the charcoal trap is measured as a function of time. In these experiments, enough volumes of air were introduced to the charcoal trap cooled at nitrogen temperature and after changing the coolant to dry ice, He started to flow to the charcoal trap at a flow rate of 1000 ml/min. The volumes of air introduced to the charcoal trap are listed in Figs. 5 and 6. A similar or less amount of gas is expected when groundwater of 10,000 liters was treated and dissolved gases were recovered at 100% efficiency. The O_2 concentrations have decreased with time in similar manners regardless the volumes of air introduced to the charcoal trap (Fig. 5). After one hour flow of He, the O_2 concentration decreased to almost the detection limit of the gas chromatograph. The decreases of N_2 were not consistent, showing slight differences, probably due to strong adsorption on charcoal (Fig. 6). One hour flow of He, however, reduced N_2 concentrations to allowable level for next Kr separation step with the separation column. After removing O_2 and N_2 from the charcoal trap, the charcoal trap is heated at 200 ºC for 20-30 min and Kr and other trapped gasses were transferred to a small trap equipped in the gas chromatograph cooled at liquid nitrogen temperature.

3. 2 Separation of Kr and other gases with separation column

Separation of Kr and other gases with the 6 m long separation column is shown in Fig. 7. The separation times and an order of O_2, N_2 and Kr are function of the column temperature. At room temperature (25 ºC), the separation order is O_2, N_2 and Kr. At -16 ºC column temperature, the separation order of N_2 and Kr is reversed as shown in Fig. 7. At 0 ºC column temperature shows unsatisfactory separation of N_2 and Kr. If the amount of N_2 is large, the Kr peak would appear on the tail of N_2 peak when the separation is carried out at room temperature. No overlap of Kr with N_2 is supposed at-16 ºC separation because N_2 peak appears after Kr peak.

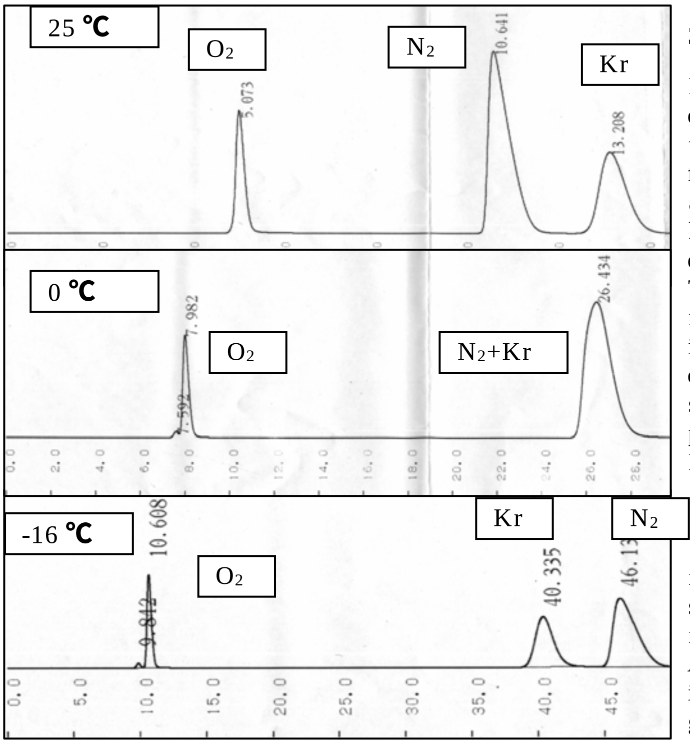


Fig. 7 Separation of Kr and other gases

3.3 Separation of Kr in air

Performance of the present system was examined by isolation of Kr in air. Air volumes of 420 and 1000 L were introduced to the charcoal trap cooled at liquid nitrogen temperature at a flow rate of 5.6 – 5.9 L/min. In both cases the removal of O_2 and N_2 with He was done at flow rate of 1000 ml/min for 1 hour and the separation column of Kr and other gases was operated at room temperature with He flow rate of 40 ml/min. The results are shown in Fig. 8. The amounts of O_2 and N_2 remained in the charcoal trap were low enough and not influenced at all on separation of Kr with the separation column. After the peak of Kr, CH_4 followed. The results suggest a good performance of the Kr separation system and proving applicability for recovered gas from groundwater. However, CO_2 and CH_4 would be contained sometimes at high contents in groundwater. The concentration of CO_2 in air is low of 340 ppm which is completely removed in the molecular sieve 13X column. Use of a high capacity molecular sieve 13X column or a chemically removing system such as absorption by alkaline solution would be necessary if recovered gas from groundwater contains high amount of CO_2. An oxidation system of CH_4 would be necessary before introduction to the charcoal trap for recovered gas from groundwater when it contains a large amount of CH_4

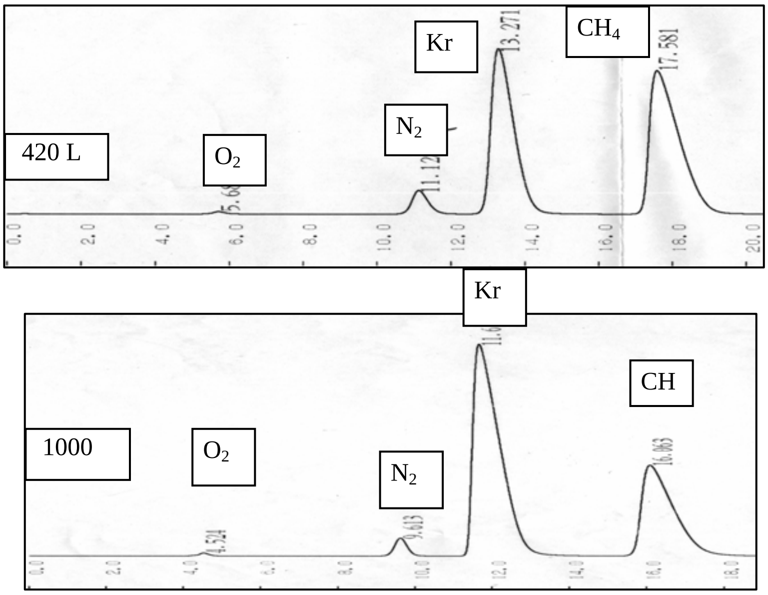


Fig. 8 Separation of Kr in air

3.4 Measurement of Kr-85 with liquid scintillation counter

Kr is well dissolvable to organic solvents while He solubility is low that make it possible to dissolve isolated Kr to organic solvent at high efficiency.

Background counting rate of the 100ml quart-counting vial was examined and is compared with 100 ml volume of Teflon-counting vial and conventional 20ml low potassium glass-counting vial (Fig. 9) The background counting rate of the 100ml quart-counting vial was about 9 cpm and is comparable to that of the 100 ml volume of Teflon-counting vial, indicating a very low content of radioactive materials in quart. A synthesized quart, not a natural one was used to make the 100ml quart-counting vial that reduced the background counting rate as low as possible and is comparable to that of Teflon-counting vial. The conventional 20ml low potassium glass-counting vial had about an half background counting rate due to one fifth volume of scintillation cocktail.

No leakage of Kr-85 from counting vial is necessary during measurement of Kr-85. Standard Kr-85 diluted with N_2 gas was purchased from CERCA, France and an aliquot of the Kr-85 standard gas was injected into the scintillation cocktail in a 100ml quart-counting vial, 100ml Teflon-counting vial and 20ml low potassium glass-counting vial to examine tightness of vial. A large escape of Kr-85 from the 100ml Teflon-counting vial was observed. The 100ml quart-counting vial shows constant counting rate for the period of 70 hours examined, suggesting tightness of the cap and no escape of Kr-85 from the vial (Fig. 10). In a practical aspect of sample measurement, 24 hours counting time would be necessary to gain statistically significant counts, especially for samples with low Kr-85 content. The counting rate of the 20ml low potassium glass-counting vial showed a slight decrease in counts with time, probably leakage of Kr-85 from the vial occurred. To keep tightness of the 20 ml low potassium glass-counting vial, a silicon packing was used in the cap as a sealing material. Silicon absorbs organic solvent well and that would be the reason for leakage of Kr-85 from the 20ml low potassium glass-counting vial. Material other than silicone is necessary to be used for sealing.

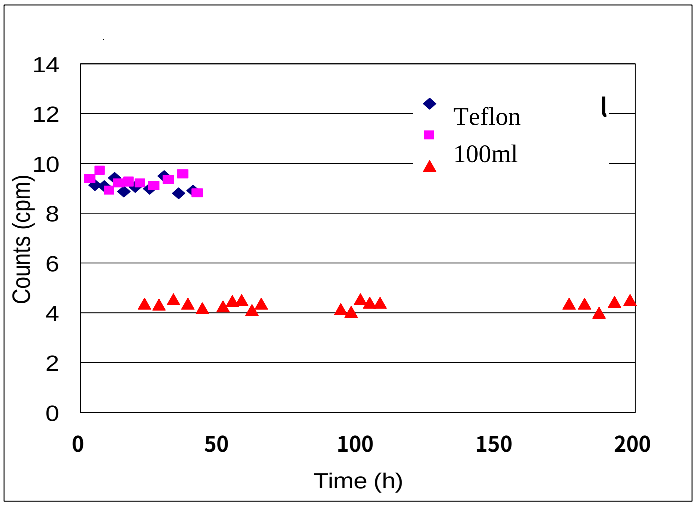


Fig. 9 Background counting rate

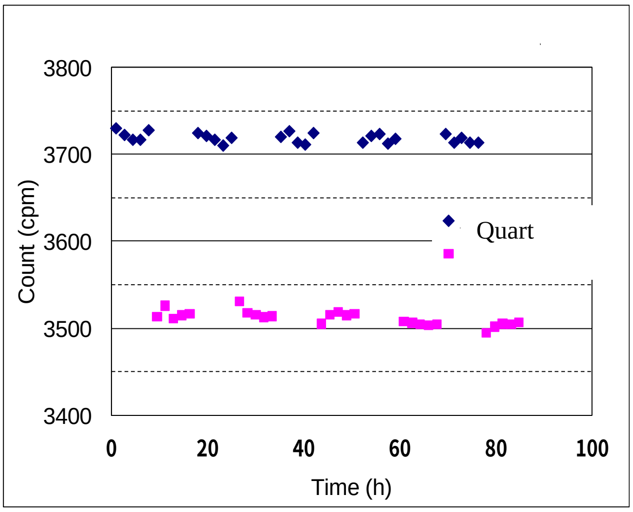


Fig. 10 Change of Kr-85 counts with time

4. Conclusion

The analytical method for atmospheric Kr-85 which is well applicable to gas recovered from groundwater was developed. Kr in air is collected in the charcoal trap cooled at liquid nitrogen temperature. The removal of major air component, O_2 and N_2 from the charcoal trap is achieved by flow of He at dry ice temperature. Complete separation of Kr from other gasses is done using the 6 m long molecular sieve column at room temperature. The large volume-counting vial specially prepared for low level measurement with synthesized quart showed very low background counting rate and no leakage of Kr from the vial. Isolation of Kr in 1000 liter air was satisfactory which proves the applicability of the present method to gas recovered from large volumes of groundwater.

5. References

Hirota, M., Nemoto, K., Wada, A., Igarashi, Y., Aoyama, M., Matsueda, H., Hirose, K., Sartorius, H., Schlosser, S., Schmid, S., Weiss, W. and Fujii, K. (2004) Spatial and Temporal Variations of Atmospheric ^{85}Kr Observed During 1995-2001 in Japan: Estimation of Atmospheric ^{85}Kr Inventory in the Northern Hemisphere. J. Radiat. Res., 45, 405-413.

Nevinskii, O. and Tsvetkova, T. V. (2003) ^{85}Kr extraction from water samples. Atomic Energy, 95, 801-806.

Okai, T., Takashima, Y., Shiraishi, N. and Matsuoka, N. (1984) Measurement of Krypton-85 in the Atmosphere with a Portable Apparatus. J. Rdaioanal. Nucl. Chem., 81, 161-165.

Sidle, W. C. (2006) Apparent ^{85}Kr ages of groundwater within the Royal watershed, Maine, USA. J. Environment. Radiactivity, 91, 113-127.

Report from the Urban Socio-Economic Group

Shinji Kaneko[1] and Karen Ann B. Jago-on[2]

[1]IDEC, Hiroshima University, [2]RIHN

In this issue, the Urban Socio-economic Group presents a summary of the research accomplishments of the members of our group and the meetings that we have conducted this year, as well as the results of the field survey in Bangkok.

After the field surveys in Seoul and Taipei, some group members went to Metro Manila, Philippines and Bangkok, Thailand in December 2006 and May 2007, respectively. Prof. Imai also went to Bangkok last January 2007. The members who went to Bangkok last May 2007 were Dr. Kaneko, Prof. Imai, Prof. Fujikura, Dr. Zhang and Karen, while in Manila, only Karen went to conduct initial field survey.

The group meetings were held last April 2007 and October 3, 2007. In the meeting last October 2007, research accomplishments of the group members have been reported.

During the previous year, the major research achievements of the group are given below:

1) Summary of causal relations of subsurface environmental issues in reference to the DPSIR framework through a comprehensive review of existing studies;

2) Rich datasets on social and environmental conditions are obtained during the survey in Bangkok;

3) Longer-term statistical database on demography and water use for the selected seven cities is developed; and

Research Members

Shinji Kaneko (IDEC, Hiroshima University)

Akimasa Fujiwara (IDEC, Hiroshima University)

Ryo Fujikura (Faculty of Humanity and Environment, Hosei University)

Tsuyoshi Imai (Faculty of Engineering, Yamaguchi University)

Toru Matsumoto (Faculty of Environmental Engineering, University of Kitakyushu)

Zhang Junyi (IDEC, Hiroshima University)

Hiroki Tanikawa (Faculty of Systems Engineering, Wakayama University)

Katsuya Tanaka (IDEC, Hiroshima University)

Backjin Lee (Korea Research Institute for Human Settlements)

Xue Yonghai (Faculty of Environmental Engineering, University of Kitakyushu)

Karen Ann Jago-on (RIHN)

4) Methodological progress in individual researches including comparative study on the changes in nitrogen balance of city with substance flow model , and estimation of stock and thermal capacity of city to cope with subsurface environmental issues.

Fieldwork in Bangkok, Thailand

May 27-31, 2007

The survey to Bangkok was conducted from May 27-31. The objective of the survey was to gather relevant information on the urbanization of Bangkok and the influences of increasing population and human activities on surface water quality and quantity and on the subsurface environment.

During the survey, the group has visited 13 offices and institutions and collected data not only from reports but also from several presentations and discussions with experts and government personnel in Bangkok and Thailand. The offices visited are the following:

I. Bangkok Metropolitan Administration (BMA)

- Department of City Planning; Department of Drainage and Sewerage; Department of Environment, Department of Traffic and Transportation

II. Department of Public Works and Town and Country Planning, Ministry of Interior

III. Pollution Control Department, Ministry of Natural Resources and Environment (MONRE)

IV. Department of Groundwater Resources, MONRE

V. Office of Agricultural Economics, Ministry of Agriculture and Cooperatives

VI. Office of Transport and Traffic Policy and Planning

VII. Mass Rapid Transit Authority

VIII. Metropolitan Waterworks Authority

IX. National Statistics Office of Thailand

In Bangkok we were very glad to gain the cooperation and assistance from local government offices in acquiring the needed information on urban development and subsurface environmental issues.

The Bangkok Metropolitan Administration was created in 1985 so the information before 1985 can be found from different national agencies (Ministry of Interior, Ministry of Natural Resources and Environment, etc.). However, at present most of the information on Bangkok and its vicinities can be obtained from the Bangkok Metropolitan Administration.

Bangkok's population has grown from around 1.3 million in 1950 to more than 6 million in 2005. In the 1950s, as the surface water supply failed to cope with the increase in population, industries, commercial establishments and housing developments, the city began to extract groundwater resources.

The increase in population in Bangkok from the 1950s is accompanied by the growth of the economy and the rise in the number of industries, businesses, and housing developments. As Bangkok began to develop, the surface water supply failed to cope with the increasing demand from the population and industries. Figure 1 shows the volume of water produced and supplied by the Metropolitan Waterworks Authority (MWA) since 1972. This graph also shows the trend in the ratio of non-revenue water which is still around 30 percent until this time.

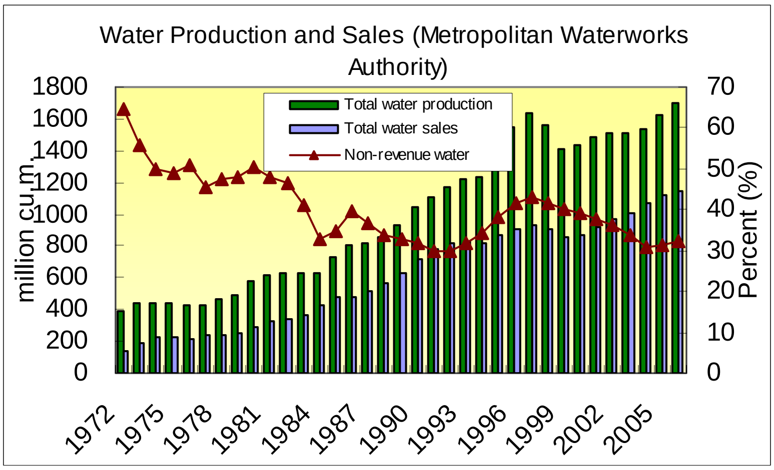


Fig. 1. Volume of water produced and distributed by MWA[1]

The utilization of groundwater resources for the public water supply began in 1954 while private abstraction of groundwater resources started in 1961. Figure 2 below shows groundwater use in Bangkok and the adjacent provinces of Nonthanburi, Pathum Thani and Samut Prakan from 1954 to the present.

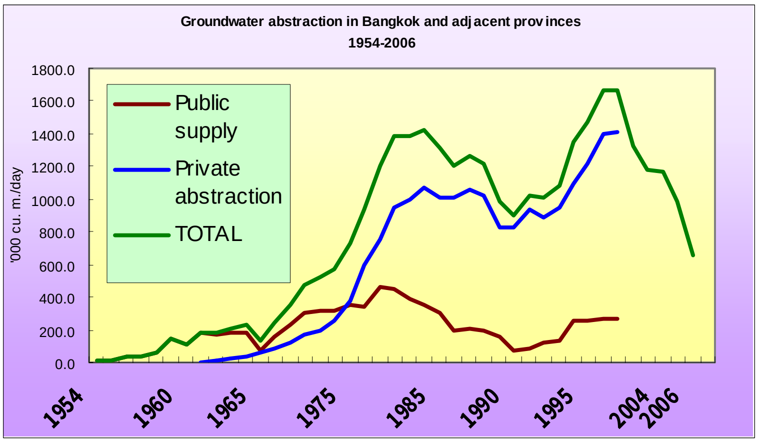


Fig. 2. Groundwater abstraction by type of use[2]

Fig.3 The group with Ms. Suthimol Kessomboon of the Department of Drainage and Sewerage (DDS), BMA

Fig. 4. Equipment for monitoring of water quality at Chao Phraya Basin at the BMA.

During the large scale groundwater development for public supply, the rate of abstraction was around 8.4 cubic meters per day. Total groundwater abstraction began to increase and first peaked in 1984 with a rate of 1.4 million cubic meters per day and then it decreased from 1985-1990. A large proportion of the groundwater withdrawn is for industrial (private) purposes. From 1991-1997, private use of groundwater increased again, however, from 2002, the total rate of abstraction started to decrease until the present. The MWA also limited the use of groundwater from 2001 and expanded the use of surface water resources.

In Bangkok, most of the groundwater extraction is done from the depths of 100m to 250m within the three productive aquifers, Phra Pradaeng (PD), Nakhon Luang (NL) and Nonthanburi (NB), as the second, third, and fourth freshwater layers below the ground surface. In the early stage of development, pumpage was mainly from the Nakhon Luang aquifer which is concentrated in the central Bangkok area. Withdrawal of water from the Phra Pradaeng area aquifer was also initiated and grew at an increasing rate because of the availability of good quality water and due to its shallower depth however, with the spread of population and industrial growth to the eastern part of Bangkok since 1958, the major pumping zone shifted to the eastern part (Das Gupta and Sabanathan, 1988). Groundwater is also extracted for industrial purposes from 550 meters in the Pak Nam (PN) aquifer in Samut Prakan province, south of Bangkok (Ramnarong, 1999). The trend in groundwater levels in sampling wells in Bangkok is shown in Figure 5. The increased quantity of water withdrawal has caused a massive decline of piezometric levels in all these aquifers from a few meters below ground surface in 1955 to around 50 meters below in 1982 and 1997. The massive decline of groundwater level in Bangkok has caused land subsidence problems and flooding.

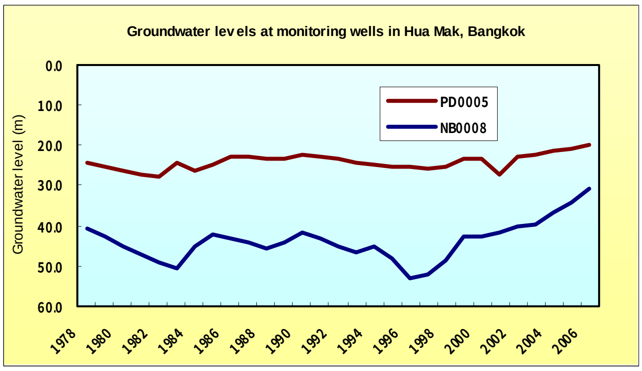


Fig. 5. Groundwater levels at monitoring wells in Bangkok[2]

In order to mitigate these groundwater problems, several measures have been undertaken and these include: (1) Institutional arrangements; (2) Groundwater resources evaluation; (3) Groundwater Act; and (4) Mitigation of Groundwater Crisis and Land subsidence program. The Groundwater Act of 1977, with amendments in 1992 and 2003, provides for the framework for the management of groundwater resources in Thailand, which include restrictions and control on drilling and pumpage, introduction of groundwater charges in 1985, and the creation of groundwater fund.

References

[1] Annual report of Metropolitan Waterworks Authority, various years

[2]Source of basic data: Department of Groundwater Resources, MONRE, Thailand

Ramnarong, V. Evaluation of groundwater management in Bangkok: Positive and negative. In: Chilton, J, editor. Groundwater in the Urban Environment: Selected City Profiles. New York: Taylor & Francis 1999; 51-62.

Das Gupta, A, Babel, MS. Challenges for Sustainable Management for Groundwater Use in Bangkok, Thailand. Water Resources Development 2005; 21(3):453-464.

Human Impacts on Groundwater Condition in Jakarta Metropolitan Area

Robert Delinom

Research Center for Geotechnology, Indonesian Institute of Sciences

Study Area

As a part of RIHN 2-4FR project, the main objective of this study is to identify how critical the degradation is of the subsurface environment of Jakarta Area due to human activities. Overexploitation of groundwater has become a common issue along the coastal area where good quality groundwater is available. This study presents the results of the following activities: analysis of water level decreasing in 51 monitoring wells and 50 dug and hand-drilled wells and an analysis of long period records of the surface level.

Fig.1. Location of Jakarta, Indonesia

The City of Jakarta is the capital of the Republic of Indonesia and occupies the coastal plain area which borders the Java Sea to the North. The elevations of this plain vary from 0 to 1,000 m above sea level. It is one of the most developed basins in Indonesia and is located between 106° 33' - 107° E longitude and 5° 48' 30" - 6° 10' 30" S latitude covering an area of about 652 km². It has a humid tropical climate with annual rainfall varying between 1,500 – 2,500 mm and is influenced by the monsoons. The population of Jakarta at present is around 7.5 million (**Jakarta Local Government Website, 2007**) and the population density is presented in Table 1.

Table 1. Population Density in Jakarta Area (persons/km²)

No.	Area	Density
1.	South of Jakarta	11,676
2.	East of Jakarta	11,157
3.	Central of Jakarta	18,746
4.	West of Jakarta	12,426
5.	North of Jakarta	8,267
6.	Seribu Island	1,616
	Density Average	11,272

(Source: BPS Prop. DKI Jakarta, 2003).

It represents the official number of population actually living in the Greater Jakarta Area. The reality which is faced by Jakarta is that many people who are working in Jakarta during the daytime are living in the adjacent cities i.e., Bogor, Depok, Tanggerang, and Bekasi (Bodetabek Area). Since the operation of the Jakarta – Bandung Highway, some people living in the cities of Purwakarta and Bandung have also become commuters. This circumstance has caused the population of Jakarta to increase up to 10 or 11 millions during the weekdays.

It is obvious that urbanization has increased the water demand in this area. As the drinking water which is supplied by surface water only covers 30% of water demand, people are harvesting the available groundwater in the basin.

Geological Setting

According to Engelen and Kloosterman (1996), structurally, the Jakarta groundwater basin is part of the so called a Northern Zone comprising the low hilly areas of folded Tertiary strata, and coastal lowlands bordering the Java Sea. The base of the aquifer system is formed by impermeable Miocene sediments which are cropping out at the southern boundary of the basin. The basin fill, which consist of marine Pliocene and quaternary sand and delta sediments, is up to 300 m thick. Individual sand horizons are typically 1 - 5 m thick and comprise only 20% of the total fill deposits. Silts and clays separate these horizons. Fine sand and silt are very frequent components of these aquifers

Groundwater Level Monitoring

Groundwater level monitoring, either of shallow or deep groundwater, which is discussed in this paper, was conducted between 2001-2005. There are 50 wells for monitoring the shallow ground water level which are located on the area of 50 Elementary schools. There are 51 wells for monitoring deep groundwater level which are randomly distributed within the Jakarta Basin area.

Generally, the shallow groundwater monitoring wells were located in the ground of state elementary schools. They were constructed from 4 inches diameter pipes reaching between 12 to 20 meter depth. No data of screen positions were available and the wells are open-ended. The water level measurements were carried out once a month during the 2002 to 2005 period. Those wells were located on the Bogor Alluvial Fan with an unconfined aquifer. Based on the water level measurement data of the 2002 - 2005 periods, it was shown that in general the shallow groundwater level has a negative trend or they were decreasing. This is shown on Figure 3.

The deep groundwater monitoring wells have been constructed within the period of 1994 to 2000. Total of the monitoring well is 51 wells and only 30 wells were equipped with automatic water level recording (AWLR) of which 1 (one) was defected and could not be used even manually. Based on range of screen depths, which was assumed to be identical with the aquifer position, those 50 wells could be grouped into 5 clusters i.e. 0 – 40 meters, 40 – 95 meters, 95 – 140 meters, 140 – 190 meters, and 190 – 250 meters.

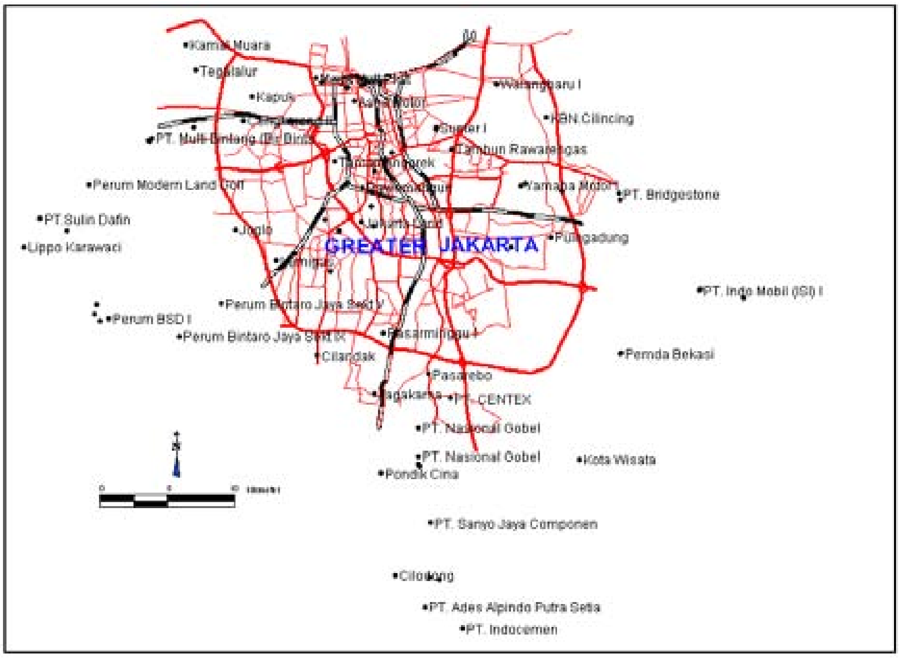


Figure 2. Location of Monitoring Wells

· Cluster 0 – 40 meter Aquifers

This cluster consists of 5 monitoring wells with water level fluctuated between – 2.18 to – 32.68 meters below sea level (b.s.l.). Most of those wells are located on the Bogor Alluvial Fan. Based on water level data of those wells, 1 well showed a positive trend (Bapedalda, Central of Jakarta), 1 well with a negative trend (Senayan, Central of Jakarta), and 3 wells just fluctuated as the season changed i.e., Pasar Rebo and Cilandak (South of Jakarta), Tongkol (North of Jakarta).

· Cluster 40 – 95 meter Aquifers

This cluster comprises 7 monitoring wells with water level ranging between – 4.12 to – 25.80 meters b.s.l. The seasonal fluctuating water level could only be observed at the Duren Sawit monitoring well in the eastern part of Jakarta. The wells which were located on the southern part of Jakarta (Jagakarsa, PT SCTI, and National Gobel) showed a positive trend, while all wells which were located in the central and northern part of Jakarta (Tongkol, Senayan, and Yamaha Motor), showed a negative trend. Generally, this cluster has a relatively balance between negative and positive trends.

· Cluster 95 – 140 m Aquifers

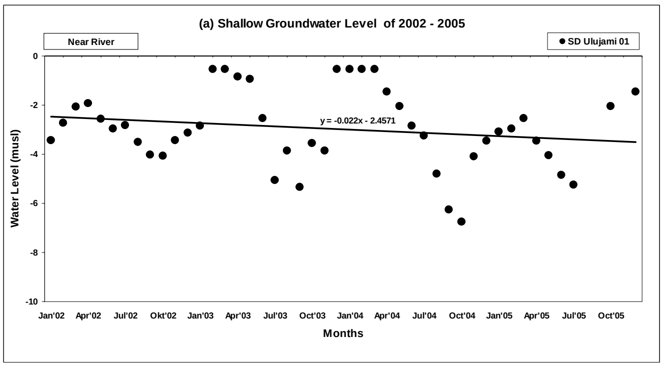
This cluster consists of 10 monitoring wells with water levels ranging between – 1.34 to -51.05 meter b.s.l. The water levels in the north-western part of Jakarta (Sunter, Kapuk and Jelambar) mostly show seasonal fluctuation. In the eastern part of Jakarta (Sinar Sostro), water level is relatively stable. A positive trend was observed in the northern part of Jakarta (Walangbaru and Tongkol) while a negative trend was observed in south and central Jakarta (Dharmawangsa, Joglo, Tegal Alur and Jakarta Land).

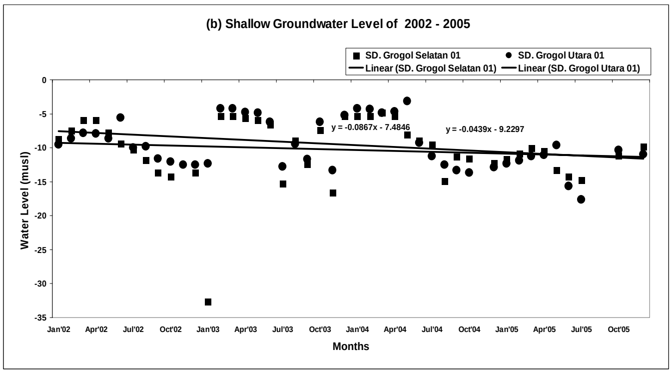
· Cluster 140 – 190 m Aquifers

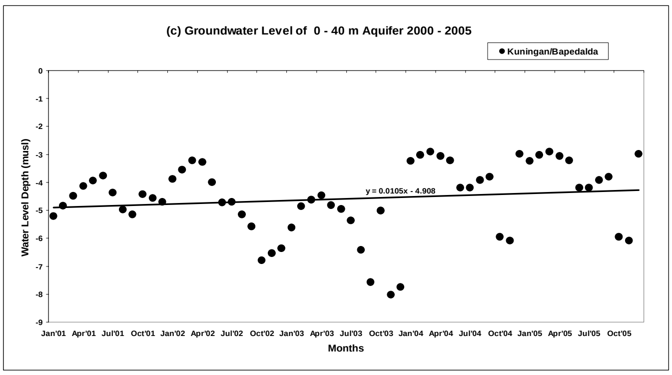
Five (5) monitoring wells belong to this cluster. The water level ranges between – 10.56 to -31.82 meters b.s.l. In the eastern part (Tambun Rengas), the water level trend tends to be positive, while the other four wells which are located in the central part (DPR/MPR and Gedung Jaya) and in the northern part (Kamal Muara and Sunter) of Jakarta tend to show a negative trend. Therefore, for this cluster, generally, the water levels are decreasing.

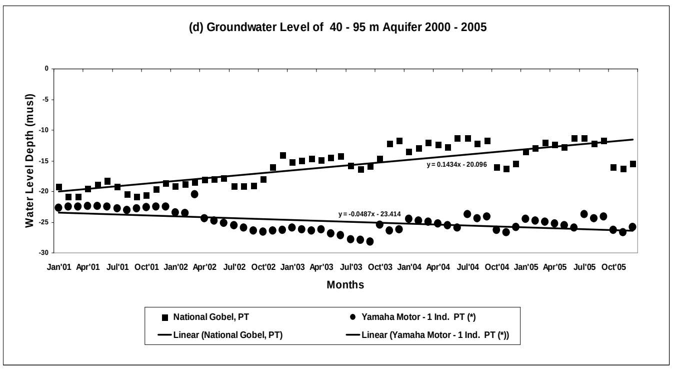
· Cluster 190 – 250 m Aquifers

Within this deepest aquifer, 6 monitoring wells were drilled. Only one well (Walang Baru in northern part of Jakarta), showed a positive water level trend. The other 5 wells, Cakung (north-east), DPRD DKI (central), Pasar Minggu (south), Sunter (north-west), and Tongkol (north), showed a negative trend. Generally, the water levels of this aquifer are decreasing.









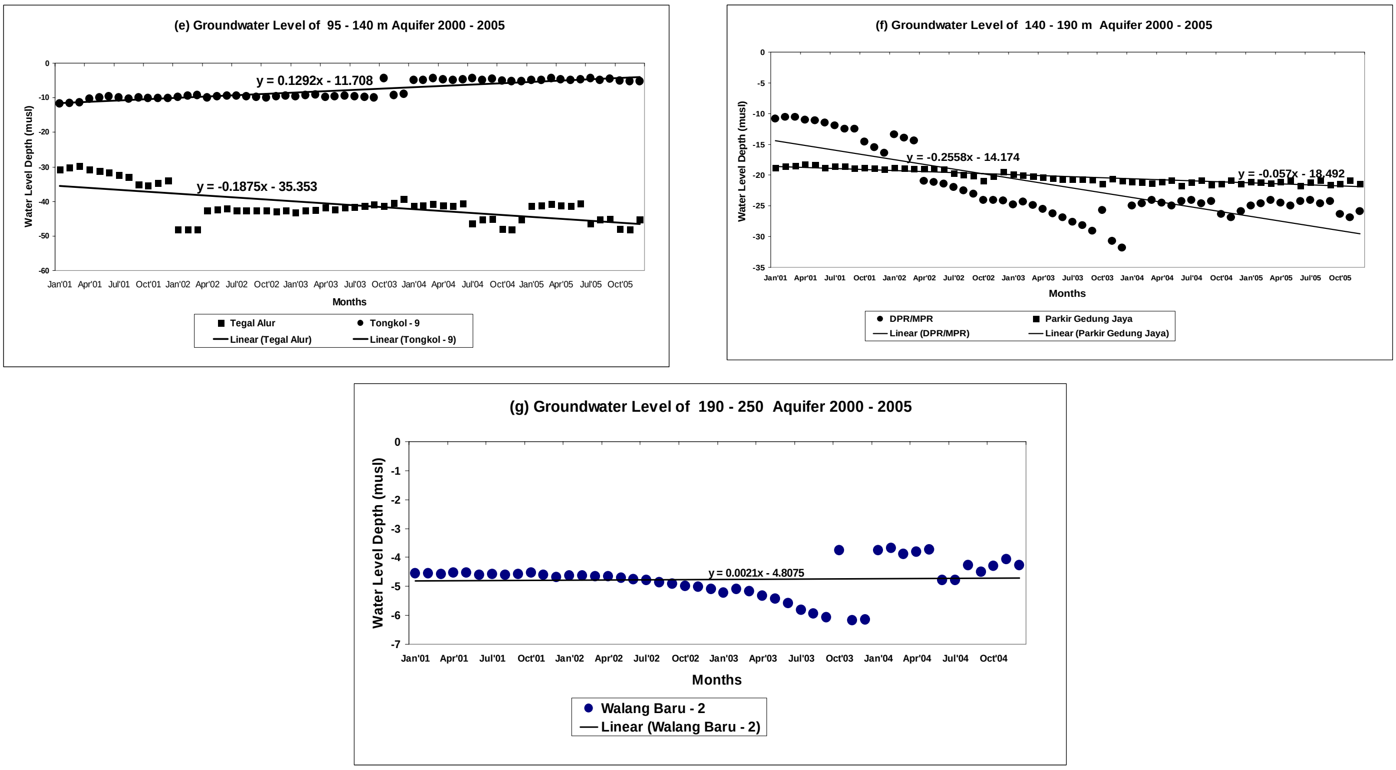


Figure 3. Groundwater Level Fluctuations between of 2002 – 2005

Preliminary Remarks

Based on the above analysis, it is obvious that the use of groundwater has greatly accelerated conforming to the rise of its population and the development of the industrial sector, which consumes a relatively huge amount of water. The result of analysis showed that the most declining water levels were found in western, northern and central part of Jakarta. The relationship of water level decline and population density can be seen on the central and western part of Jakarta, while the industrial impact to groundwater level occurred in northern part of Jakarta. This remark should be validated by another sub-surface condition, such as land subsidence, groundwater quality, etc. And it will be obtained after all sub-surface conditions analyses are finished next year.

References

Assegaff, A., Pindratno, H., 2006, *Keberlanjutan Airtanah Bebas di Wilayah Propinsi Jakarta dan Sekitarnya*, yearly report, Jakarta Mining Agency, unpublished, Jakarta.

Bapeda DKI Jakarta and LPPM-ITB, 2004, *Potensi Polusi dari Tangki Penyimpanan BBM and Logam Berat in Propinsi Jakarta*, yearly report, unpublished, Jakarta.

Bapedalda DKI Jakarta, 2003, *Buku II*, http://bps.jakarta.go.id/

Engelen, G.B., Kloosterman, F.H., 1996, Hydrological *System Analysis, Method, and Application*, p.140-144, Kluwer Academic Publisher, Dorddrecht, The Netherlands,

Fachri M, Djuhaeni, Hutasoit L.M & Ramdhan A.M, 2003, *Stratigrafi dan Hidrostratigrafi Cekungan Airtanah Jakarta*, Buletin Geologi Vol 34, No.3 Institut Teknologi Bandung, Indonesia. P 169-189

Geyh, M.A., Soefner, B., 1996, *Groundwater mining study by simplified sample collection in the Jakarta Basin aquifer, Indonesia*, International Atomic Energy Agency. Proceedings Series pp. 174-176.

Jakarta Mining Agency and Trisakti University, 2001 - 2005, *Analisis dan Evaluasi Sumur Pantau (AWLR)*, Yearly report, unpublished.

Jakarta Mining Agency and Trisakti University, 2004, *Pengukuran Muka Airtanah Musim Penghujan*, Yearly report, unpublished.

Schmidt & Butkuss, 2004, *Groundwater Modeling in the Greater Jakarta Area, Indonesia*. Symposium CCOP, Tsukuba, Japan.

UNEP, 2002, *Groundwater and its susceptibility to degradation: A global assessment of the problem and options for management*, UNEP Website.

Joint Research with RIHN

Mitsuyo Saito

JSPS research fellow, Graduate student of Graduate School of Biosphere Sciences, Hiroshima University

I'm Mitsuyo Saito from Hiroshima University, Japan. Now I'm in the 3rd year of PhD. My major is hydrochemistry and environmental hydrology. In my PhD thesis, I'm studying about Nitrate (NO_3^-) transport and attenuation process in groundwater at the coastal area. My study area is located on a small island of Seto Inland Sea, Southern Japan. Seto Inland Sea is the biggest closed sea in Japan. Eutrophication of seawater and red tide is one of the critical environmental problems in here. So, it is important to confirm the nutrient transport from land to sea in this area.

Poster presentation on "Groundwater contamination in Bangkok" at IUGG2007

In the RIHN 2-4 FR Project Human Impacts on Urban Subsurface Environment, I am part of the Material subgroup. In this project, I study about the groundwater contamination by intensive urbanization and transport of contaminants from land to the sea at the Asian metropolitan area. I have participated in the field researches in South Korea and Bangkok, Thailand, in 2005 and 2006 respectively.

In South Korea, we collected samples of subsurface water and sediment to confirm the process of nutrient transport at the Kwang-hwa tidal flat located on the river mouth area of Han-river. The results suggest that the organic matter mineralization under the oxidative condition with seawater recirculation have large effect on discharge of nutrients such as Nitrogen (N) and Phosphorous (P) from the tidal flat to the sea.

In the metropolitan area of Bangkok, present groundwater potential is under the sea level because of excess water pumping at the urban area. Decline of groundwater potential at the urban area also has caused the change of contaminants (Mn, Zn and NO_3^--N) transport as well as seawater intrusion to the groundwater.

The future issue of our study is to confirm that the change of subsurface contaminants transport along with the stage of urbanization in past-current-future timescales at Asian cities.

ACKNOWLEDGMENT

We wish to thank all project members who have contributed to our newsletter. Your articles and reports are very valuable and informative. We hope for your continued support and cooperation in the succeeding issues of our newsletter.

ANNOUNCEMENTS

International Symposium

"Current Problems in Groundwater Management and Related Water Resources Issues"

RIHN Workshop

"Human Impacts on Urban Subsurface Environments"

Venue: Ramada Bintang Hotel, Kuta, Bali, Indonesia

Date: December 4-5 , 2007 International Symposium

December 6, 2007 Field Trip

December 7-8 RIHN Workshop

COP 13 Side Event (Special Session)

"Impacts of Global Climate Change and Subsurface Environments"

HydroChange 2008 in Kyoto

"Hydrological changes and management from headwater to the ocean"

Kyoto Garden Palace Hotel, Kyoto, Japan

October 1-3, 2008

http://www.chikyu.ac.jp/HC_2008

Submission of abstracts is extended to Dec.1, 2007!

Call for Contributions

For the fifth volume (April 2008), we would like to request the following Groups/individuals to give their articles for the newsletter:

1. Prof. Yoshikoshi's Group
2. Prof. Fukuda's Group
3. Dr. Nakano's Group
4. Dr. Ichinose's Group
5. Dr. Somkid
6. Dr. Endo

To allow ample time for editing and layouting, we hope to receive your articles on or before March 31, 2008. For inquiries, please send email to:

makoto@chikyu.ac.jp

Inter-University Research Institute Corporation

National Institutes for Humanities, Japan

Research Institute for Humanity and Nature

Project 2-4 Human Impacts on Urban Subsurface Environments

http://www.chikyu.ac.jp/USE/

Contact:

457-4 Motoyama Kamigamo, Kita-Ku, Kyoto
603-8047 JAPAN
Phone: + 81– 75– 707-2261
Fax: +81-75-707-2506

Project Leader: Dr. Makoto Taniguchi
E-mail: makoto@chikyu.ac.jp

Newsletter Editor: Karen Ann Bianet Jago-on
Email: Karen@chikyu.ac.jp

Human Impacts on Urban Subsurface Environments

This project will assess the effects of human activities on the urban subsurface environment, an important aspect of human life in the present and future but not yet evaluated. This is especially true in Asian coastal cities where population and density have expanded rapidly and uses of subsurface environmental have increased. The primary goal of this project is to evaluate the relationships between the development stage of cities and various subsurface environmental problems, including extreme subsidence, groundwater contamination, and subsurface thermal anomalies. We will address the sustainable use of groundwater and subsurface environments to provide for better future development and human being.

RIHN Corner

Tomotoshi Ishitobi

Research Associate

I became a staff of RIHN through the recommendation of Dr. Makoto Taniguchi after I graduated from my master course program in Nara University of Education. Now, I am working in RIHN as a Research Associate.

I started to study about "Submarine Groundwater Discharge (SGD)" during my masters program under Dr. Taniguchi's guidance. The theme of my first study, which is also my graduation thesis is "Investigation of submarine groundwater discharge in the coastal zone of Suruga Bay, Japan" . The purpose of this study is to clarify the changing factors of groundwater discharge rates based on the field research in the coastal zone. In addition, the origin of groundwater from the seabed was also assumed based on the result of groundwater research in Shizuoka Plain. I also studied submarine groundwater discharge in the Yatsushiro Sea in Kumamoto, Japan as part of my master thesis. In this study, fresh-salt water interface under the coastal sea as well as submarine groundwater discharge were measured by resistivity measurement.

In RIHN I belong to the Urban Subsurface Environment Project as well as to the Yellow River Project. My study in Yellow River project is to clarify the distribution of freshwater and saltwater under the delta of Yellow River by resistivity measurement and groundwater research in this delta. As just described, my field research is mainly geophysical technique. My research objective as member of the material group is the evaluation of groundwater discharge rates from the land to the sea. I have been to each target city in this project to perform this study. There is limited monitoring data of groundwater discharge rates from the seabed in the world because the measurement is so difficult, though there are many monitoring data for river which is the discharge process of water from the land to the sea. Recently, I have deployed the device on the seabed for long-term measurement of groundwater discharge rates from the seabed on the coastal zone of Metro Manila. I am looking forward to getting this data soon.

Other than the field research, I participated recently in science meetings and gave some presentations of my study about this project. I had three presentations this year: (1) "Quantitative evaluation of submarine groundwater discharge in the coastal zone of Osaka Bay" and (2) "Evaluations of fresh-salt water interface in the coastal zone using resistivity method" in Japan Geoscience Union Meeting 2007, Chiba, Japan, and (3) "Investigation of submarine groundwater discharge using several methods in the inter-tidal zone" in IUGG 2007, Perugia, Italy. My presentation was also published in one of the proceedings and this is one of my achievements for the year.

In addition to my research study, I am also doing assistance work for Dr. Taniguchi and to the whole project. Generally, in this project I take charge in facilitating the sharing of information using technology such as home page, e-mail list and database. I hope for the success of this project in the future.