

2009 ITP Project Report
Research at Department of Water Resource Engineering,
Lund University, Sweden



(Picture: Lund University Engineering Department V-huset)

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Program institute: Department of Water Resources Engineering, Lund University

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Research theme: “Fundamental investigation for water extraction from freshwater lens”

Based on International Training Program (ITP) supported by Japan Society for the Promotion of Science (JSPS), I had attended International Internship Training Program within 2 months (21th August 2009 ~ 2nd November 2009) in Lund University, Lund city, where is located in the southern edge of Sweden. In this report, research activities, circumstances in Lund and training on the project are reported as follows.

■ Life in Lund

Lund City is located south part of Sweden in the province of Scania region and easily accessible from Copenhagen international airport by train with approximately 50 minutes. Lund University is one of Scandinavia’s largest institutions for education and research. I studied in Department of Water Resource Engineering (in Swedish, Teknisk Vattenresurslara; TVRL) as a visitor research student and supervised by Professor Ronny Berndtsson on the program period. I studied at the research room shown in Picture-1 that are for Ph.D students and staffs. Every weekday, “coffee break” is held at 9:40 am and 2:40 pm at the rest room in the building of department. I communicated with other staffs and students through the coffee break. This break is also sometimes for giving a presentation about research.



Picture1 Research room in Lund University

■ Reserch activities

1. Paper submission for international symposium

At first, I wrote a paper for international symposium held on December 8th to 9th. The abstract was already submitted. But it was my first experience to write a paper in English and was difficult to express the words appropriately. My paper was corrected proofs by Edanz Editing. I received my paper corrected in a week and checked the correction points. I felt my unskilled English writing and understood the importance of appropriately expression.

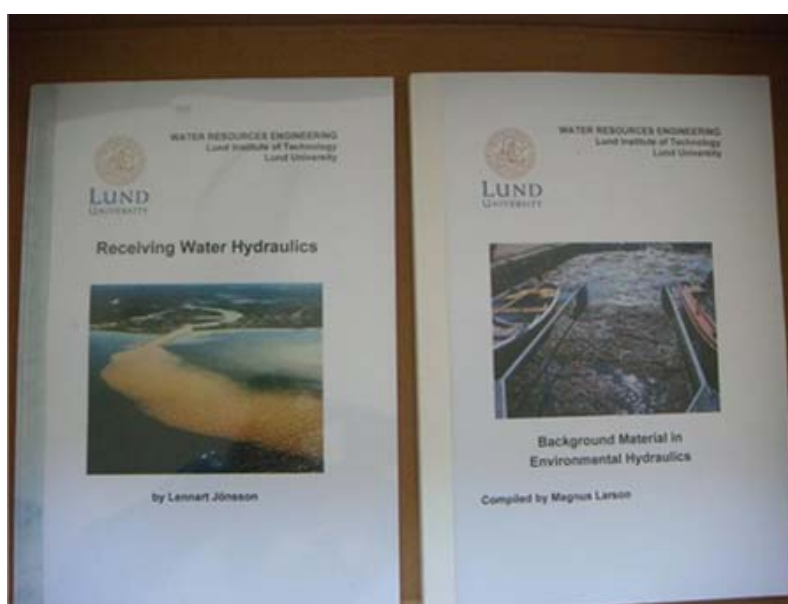
2. Lecture Environmental Hydraulics

I took part in the Ph.D and master level course, “Environmental Hydraulics” from 31th August to 22th October, conducted by Prof. Magnus Larson. I wasn’t exchange student and consulted with Prof. Magnus about registration and I could take a course. Picture2 shows the text of Environmental Hydraulics. The contents of the course were part of Hydraulics and Environmental engineering.

The contents of lecture are shown as follows

- Receiving water types. Transport process and spreading of pollutants. Balance equation for water and pollutants.
- Basic mechanisms for mixing. The general transport equation (advection-diffusion equation) – formulation and application to special cases (river flows, coastal areas; point sources, distributed sources)
- Turbulent jets; basic theory and models
- Buoyant jets and plumes; basic theory and models
- Stratified receiving waters. Case studies of pollution discharge and environmental impact. Diffusers and other technical solutions for pollution discharge
- Heat transport; basic equations and applications
- Oxygen transport; basic equations and applications
- Mechanisms for water exchange (wind, waves, tide, seiching)
- Density currents and stratification
- Field studies on receiving water quality
- Basic sediment transport and boundary layer theory
- Bed load and suspended load. Commonly used sediment transport formulas
- Interaction between structures and natural flows

The score is determined by several reports and periodical exam. It need third of two attendance to get a unit in case of Japanese university but in case of the course, it doesn't need if students understand the contents of this lecture. The lecture that includes ordinal lecture, tutorial as solving practical problems and assignment as a class teacher reply the questions about assignment for students achieve the assignment. It was careful and it was impressive for me that there is a class for assignment. I attended all lectures and submitted three assignments and passed a periodical exam on October 22th.



Picture2 Text of Environmental Hydraulics

3. Research activities for master thesis

In my ITP period, as my research activity for accomplishing master thesis, I developed a model of saltwater intrusion in groundwater flow due to water extraction and injection through the VISUAL FORTRAN. As a development step, my purpose was that simulating laboratory experiments through numerical simulation for investigating the validity of numerical model and efficacy of the water extraction method. The numerical model without the part of water extraction and injection had developed almost before the study program. In this period, I developed the part of reading the data after the steady state of no extraction for continuous calculation and the part of water extraction that including the location of extraction pipe, extracting pressure and the condition of velocity. The model conducted the saltwater intrusion due to the water extraction, but the condition of

the extraction pressure has problem. There wasn't enough accuracy between experimental results and numerical results and it needs improvements continuously.

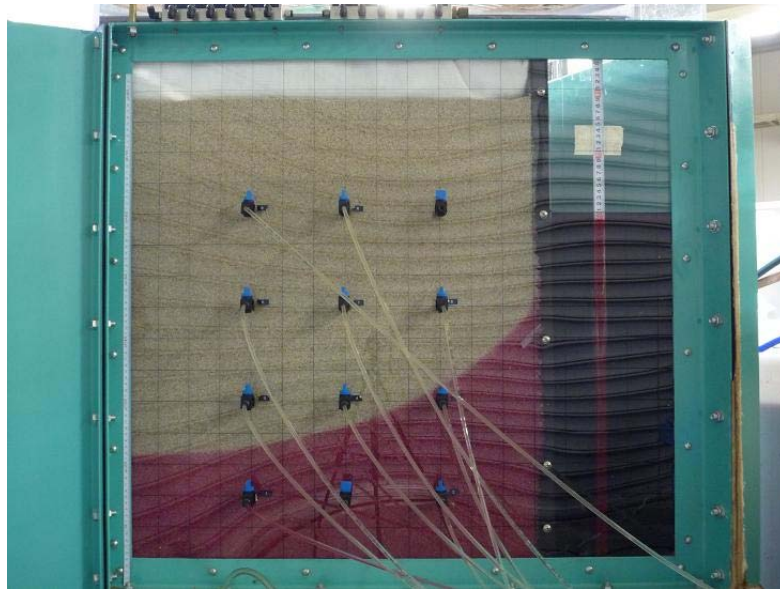


Figure1 Laboratory experiment
(steady state without water extraction)

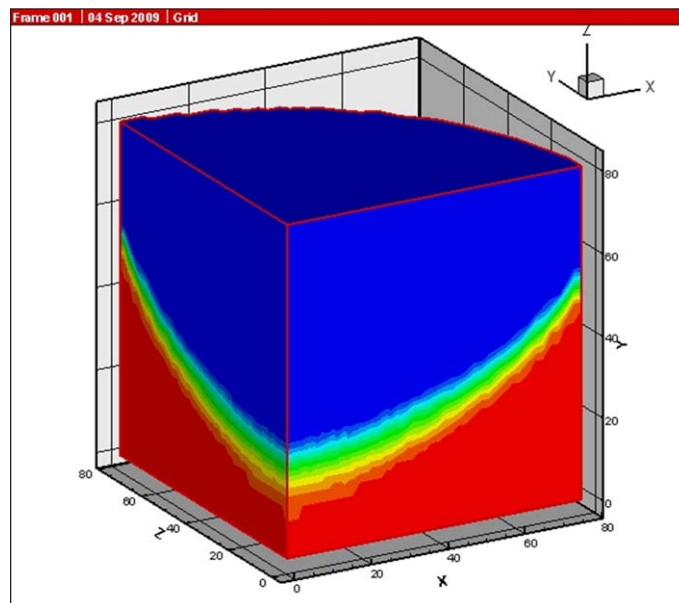


Figure2 3-dimensional density distribution

(steady state without water extraction)

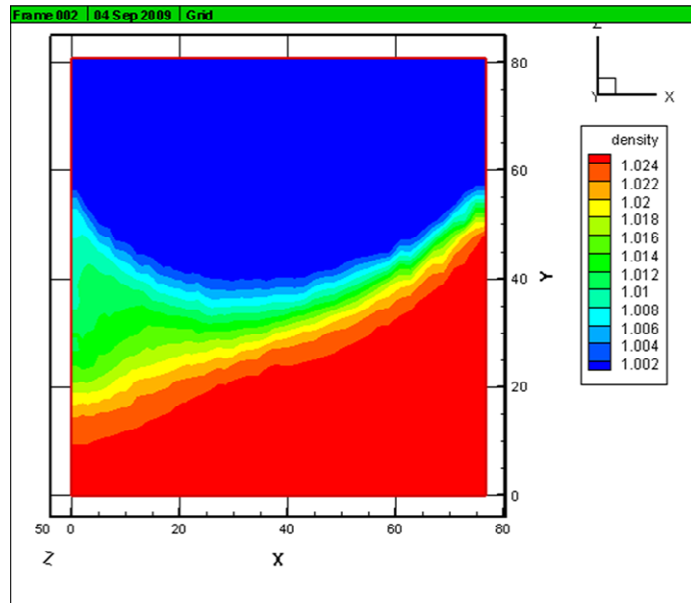


Figure3 Freshwater area shrink due to water extraction
Density distribution on vertical section

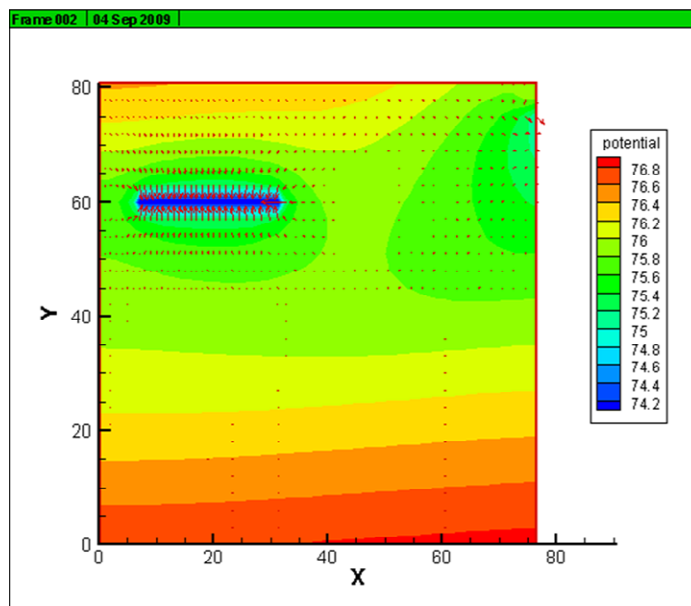


Figure4 Potential distribution during water extraction
and fluid velocity distribution on vertical section

4. Presentation

I had presentation about my research for department staff on November 7th. It was also first time to have presentation in English outside school. Workshop for English presentation in Kyushu-university supported by ITP office was helpful for this time. Ota who was also supported by ITP and I practiced the presentation each other for few days before the presentation. Also I sent my presentation slide to Prof. Ronny and got advices about expression.

Our presentation was held as seminar turn coffee break time to presentation time. We had 20minutes each for presentation and pic4 shows me having presentation and pic5 shows the department staff including Professors and PhD students. The contents of presentation were self-introduction, about ITP and abstract of my research and laboratory experiment that I conducted in Japan. It was most smooth presentation I had ever performed in English. But I had problem in question and answer. After presentation, I got many question about my research, especially laboratory experiment. I could answer the question about experiment and research data but couldn't reply the question about the reason of background logically. I should improve English speaking easy to understand.



Picture3 Presentation



Picture4 Department staff

■ Acknowledgements

This work was performed at the Department of Water Resources Engineering, Lund University. The author would like to thank Professor Ronny Berndtsson, Professor Kenji Jinno and Professor Kyuro Sasaki. The study was financed by the International Training Program (ITP) of Japan Society for the Promotion of Science (JSPS).