2.5.10 Laboratory: Irrigation, Drainage and Hydrological Environment Engineering

| Member: | Professor | Kawashima, Shigeto, Dr. Agric. Sci. |
|---------|---------------------|-------------------------------------|
| | Senior Lecturer | Nakamura, Kimihito, Dr. Agric. Sci. |
| | Assistant Professor | Hama, Takehide, Dr. Agric. Sci. |
| | Doctor's program | 3 |
| | Master's Program | 9 |
| | Undergraduate | 8 |
| | Researcher | 1 |
| | | |

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Early detection and prediction of climate warming based on the long-term monitoring of alpine ecosystems on the Tibetan Plateau

The global warming observation system was constructed in the center part and the northern part of the Tibet plateau for the early detection of effects of global warming on ecosystem using the extremely high plateau and we started the long-term monitoring. The continuous meteorological observation at multi points in special high region with holding wide range in observation altitudes like this research is the first attempt in the Tibet plateau which is called the third pole of the earth. The meteorological data obtained by our observation network offers information on the reality how the status of global warming and the influence appear. b) Development of the methodology for forecasting the hybridization mating rate of wind pollination crops

In order to promote the development and the popularization of GMO products, the establishment of a scientific technique to evaluate the influence of GMO on conventional crops is indispensable. The forecasting model of the pollen dispersal and the hybridization mating for wind pollination crops such as corn and rice plants is constructed based on the atmospheric diffusion equation and the ecological information of crops. The result of this research quantifies the cultivation conditions of GMO and conventional crops, and contributes to the establishment of the policy criterion to coexist of both.

c) Development of an automatic measurement method for airborne pollen

The environmental impact and safety of genetically modified organisms have become to a social problem. Especially in the wind pollination crops, the pollen diffuses distantly, and there is a possibility to generate the hybridization mating in wide area. It is important to develop the technique for measuring the amount of airborne pollen correctly and speedily in order to assess the environmental effect problems of pollen that causes the hybridization mating. However, conventional measurement method for airborne pollen in the past require much labour and long amount of time. Then, we develop the technique for automatically measuring the amount of airborne pollen. This method is able not only to decrease the amount of labor but also to catch a detailed change in the concentration of airborne pollen.

forest area

Evaluation of flood control of a basin (Oshinohara, Shiga). Evaluation of hydrological and meteorological characteristics in forested catchments (Oshinohara, Shiga and Kamigamo, Kyoto). Evaluation of purification function of air pollution by a forest basin and measurement of pH and EC of rainfall and stem flow (Oshinohara, Shiga).

e) Hydro-geological environment management in agricultural area.

Physical and chemical consideration of cyclic irrigation system in paddy field district for the reduction of nitrogen and phosphorous load, Nitrogen and Phosphorous transport in the drainage canal in paddy field district (Konohama, Shiga and Takashima, Shiga). Water management in paddy fields harmonized with ecological system (Hikone, Shiga). Agricultural land accumulation is necessary for sustainable agriculture. Merits of plot-to-plot irrigation system are investigated from standpoints of farming, water use amount and water quality (Takashima, Shiga). Development of methane fermentation manure liquid application design for sustainable paddy agriculture (Nantan, Kyoto)

f) Modeling of mass transport of various substances in soil

Effect of infiltration rate on nitrogen transformation characteristics, Model of nitrogen transport in paddy soil. Model of heavy metals transport in vadose zone. Measurement of continuous air content in soil and air conductivity using acoustic wave.

g) Evaluation of effect of cyclic irrigation on reducing nutrients effluent loads and characterization of nutrients dynamics in a agricultural drainage canal

Cyclic irrigation system, in which drainage water from paddy-field district is reused as irrigation water, can reduce effluent loads of nutrients from the district. Our laboratory has researched the effect of cyclic irrigation system on nutrients effluent loads. However, cyclic irrigation may also cause nutrients accumulation in the agricultural drainage canal because the drainage canal functions as a water reservoir. Our laboratory has regularly sampled the bottom sediment and quantified seasonal variation of nutrients in the sediment.

A-2.Publications and presentations

a) Publications

Original Papers

- Nakamura, K., A. Fukami, H. Horino, T. Nakagiri, and S. Sakata : Irrigation and drainage components in a paddy plot with fush ladder. Trans. JSIDRE 264; 9-16, 2009

- Hama, T., K. Nakamura and S. Kawashima : Effectiveness of cyclic irrigation in reducing suspended solids load from a paddy-field district. Agricultural Water Management 97; 483-489, 2010

<u>Reviews</u>

- Shigeto Kawashima, Pollen dispersal and hybridization model and simulation, Japanese Journal of Palynology, 55, 2, 2009

- Nakamura, K., H. Higashioka, Y. Hirose, Y. Nakajima, and T. Hama : The effect of plot-to-plot irrigation on irrigation and drainage components in low-lying paddy field. Applied Hydrology 22; 21-30, 2010

Reports

- Nakamura, K. and S. Sakata: Annual report of "Research for revise of design criteria for irrigation and drainage water and land reclamation in Nanki district"; 37p., 2010 (in Japanese)

- Nakamura, K. and S. Sakata: Annual report of "Research for revise of design criteria for irrigation and drainage water and land reclamation in Hino river district"; 29p., 2010 (in Japanese)

Sato, K, S. Kawashima, K. Nakamura, T. Hama : Effect of the lake water temperature increase by global warming on air temperature and wind system around Lake Biwa.
22-28, Annual report of "Research for water conservation function of a forest"; 114p., 2010 (in Japanese)

- Seto, S., S. Kawashima, K. Nakamura, and T. Hama : Effect of tree thinning on runoff in a small forest cathment. 31-38, Annual report of "Research for water conservation function of a forest"; 114p., 2010 (in Japanese)

- Nakamura, K., T. Hama, and S. Setp : Temporal changes in water quality of mountain stream in the case of rainfall events in Oshinohara forest catchment. 77-84, Annual report of "Research for water conservation function of a forest"; 114p., 2010 (in Japanese)

Patents

- Method and instrument for measuring soil water content (patent application number; 2010-058378)

b) Conference and seminar papers presented

- Annual Meeting of the Japanese Society of Irrigation, Drainage and Rural Engineering in 2009 (5 presentations)

- The 49th Annual Meeting of the Palynological Society of Japan in 2009 (2 presentations)

- Annual Meeting of the Japanese Society of Soil Science and Plant Nutrition in 2009 (1 presentation)

- The 66th Annual Meeting of the Japanese Society of Irrigation, Drainage and Rural Engineering Kyoto Branch (5 presentations)

- Annual Meeting of The National University Corporation Arid Land Research Center, Tottori University in 2009 (1 presentation)

A-3.Off-campus activities

Membership in academic societies

- Kawashima, Shigeto, Dr. Agric. Sci. : Palynological Society of Japan, Japanese Society of Allergology, Meteorological Society of Japan, The Society of Agricultural Meteorology of Japan, Japanese Society of Irrigation, Drainage and Rural Engineering

- Nakamura, Kimihito, Dr. Agric. Sci. : Japanese Society of Soil Physics (Member of Editorial Board), Japanese Assiciation of Groundwater Hydrology (Member of Editorial Board), Japanese Society of Irrigation, Drainage and Rural Engineering (Member of research council, Member of the subcommittee of strategically research, Member of subcommittee of annual meeting organization, Member of the committee of international technical training of agricultural engineers in irrigation and drainage)

- Hama, Takehide : Japanese Society of Irrigation, Drainage, and Rural Engineering, Japan Society of Hydrology and Water Resources

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Young Scientists (Start-up) : Hama, Takehide : Management of Agricultural Drainage Canals for Reducing Outflow Load

2. Other Research Grants

- Research fund of Shiga Prefecture : Kawashima, Shigeto, Dr. Agric. Sci. : Research on

functions of forest for water environmental conservation.

- Mitsui & Co., Ltd. Environment Fund: Kawashima, Shigeto, Dr. Agric. Sci.: Research on strategy for introducing various functions in water circulation of forest into valley management plan.

The Ministry of Agriculture, Forestry and Fisheries, Research fund : Kawashima, Shigeto, Dr. Agric. Sci. : Integrated research on the safety of genetically modified organism crops.
The Ministry of Agriculture, Forestry and Fisheries Entrust Research (Kinki Regional Agricultural Administration Office) : Nakamura, Kimihito, Dr. Agric. Sci. : Research for revise of design criteria for irrigation and drainage water and land reclamation in Nanki district
The Ministry of Agriculture, Forestry and Fisheries Entrust Research (Kinki Regional Agricultural Administration Office) : Nakamura, Kimihito, Dr. Agric. Sci. : Research for revise of design criteria for irrigation and drainage water and land reclamation in Nanki district
The Ministry of Agriculture, Forestry and Fisheries Entrust Research (Kinki Regional Agricultural Administration Office) : Nakamura, Kimihito, Dr. Agric. Sci. : Research for revise of design criteria for irrigation and drainage water and land reclamation in Hino river district
Ishikawa Prefectural University : Nakamura, Kimihito, Dr. Agric. Sci. : Research for groundwater flow analysis in Tedori river fan in the research project of "Studies on sound hydrological cycle based on agricultural water"

- The Agricultural Upland Development Association: Nakamura, Kimihito, Dr. Agric. Sci.: Quantitative estimation of prevention of red clay outflow in Okinawa Prefecture using vetiver grass

- Joint Research with Arid Land Research Center, Tottori University: Nakamura, Kimihito, Dr. Agric. Sci.: Development of measurement technique of continuous air content and air conductivity in soil using sound resonance

- Sponsorship for research groups (the Japanese Society of Irrigation, Drainage and Rural Engineering): Sakata Satoshi(Researcher): Approach for prevention of red clay outflow in Okinawa Prefecture to utilize the vetiver grass

A-4.International cooperation and overseas activities

Membership in academic societies

- Nakamura, Kimihito, Dr. Agric. Sci.: Paddy and Water Environment (Member of Editorial Board)

International joint research, overseas research surveys

- Kawashima, S.: A joint research on development of automatic measurement technique of airborne biological particles, with Meteo Swiss and Neuchatel University (Switzerland).

- Kawashima, S.: Early detection and prediction of climate warming based on the long-term monitoring of alpine ecosystems on the Tibetan Plateau, with Chinese Academy of Science (The People's Republic of China).

- Kawashima, S.: Investigation on the coexistence system of genetically modified organisms in EU and the technological development situation, with IPTS (Institute for Prospective Technological Studies) of the European Union.

B.Educational Activities(2009.4-2010.3)

B-1.On-campus teaching

a) Courses given

| - Undergraduate level: | Environmental Hydrology (Kawashima), Irrigation and Drainage |
|------------------------|---|
| | Engineering (Kawashima), Practice in Irrigation and Drainage |
| | Planning (Nakamura), Soil Physics (Nakamura), Laboratory Course |
| | in Soil Physics and Hydrological Environment Engineering |
| | (Nakamura), Seminar in Agricultural and Environmental |
| | Engineering (Kawashima, Nakamura, and Hama), Practice in Data |
| | Processing I (Nakamura and Hama) |
| - Graduate level: | Seminar in Irrigation, Drainage and Hydrological Environment |
| | Engineering I (Nakamura and Kawashima), Seminar in Irrigation, |
| | Drainage and Hydrological Environment Engineering II |
| | (Kawashima, Nakamura, and Hama), Laboratory Course in |
| | Irrigation, Drainage and Hydrological Environment Engineering |
| | (Kawashima, Nakamura, and Hama) |

B-2.Off-campus teaching etc.

Open lectures, etc.

 Nakamura, Kimihito, Dr. Agric. Sci.: Lecure of "Environmental-Friendly Water Management", Seminar for Young Scientists in the Japanese Society of Soil Science and Plant Nutrition, Lecturer

- Nakamura, Kimihito, Dr. Agric. Sci.: Lecture of "Cyclic irrigation and lake water quality" in Integrated Basin Management for Lake Environment Course, International Lake Environment Committee and JICA, Lecturer

C.Other Remarks

- Kawashima, Shigeto, Dr. Agric. Sci.: Ministry of the Environment, Committee member of the research committee concerning pollen dispersal., Kyoto prefecture, Committee member of

the assessment group for river reclamation in water shed of Kizu river, Katsura river and Uji river.

- Nakamura, Kimihito, Dr. Agric. Sci.: Vice chairman of the committee of water environmental conservation (Division of water quality) (Shiga Prefecture)