2.8 Activities of Post Doctoral Researchers

(1) Dr. Hideki Araki

Summary of research

Evaluation of Hydraulic Properties in Cereal Crops

Hydraulic resistances to water flow in Soil-Plant-Atmosphere Continuum (SPAC) determine water use and acquisition of crop plants. A root system of the crop plant is one of the components that form the larger resistances in SPAC. However, changes and responses of the root hydraulic properties to stress environments are still poorly understood. My research objective was to establish the method that allows instantaneous measurements of the hydraulic properties in crop root systems. I employed High Pressure Flow Meter (HPFM) that was developed by Tyree et al. (1995). Though HPFM provided good performances in tree and dicotyledonous plants, reports that applied HPFM to cereal crops were scarce. I examined the availability of HPFM for the measurements of maize and sorghum in my term.

Publication:

1) Araki Hideki (2002), Water extraction pattern of crop root system. Root Research 11: 51-56. (in Japanese)

(2) Dr. Naru Takayama

Summary of research

A Relationship between Estimated 1-km-Mesh Nocturnal Minimum Temperature and Observed Points Temperature over Kyushu Region in Winter.

The 1-km-mesh nocturnal minimum temperatures were estimated by using variational analysis over whole of Kyushu region in winter. So, the method to convert the nocturnal minimum temperatures from 1-km-mesh to 50-m-mesh was examined. The estimated deviation for 1-km-mesh nocturnal minimum temperature ($DT_{r\text{-}m}$) was defined as the value subtracting 1-km-mesh nocturnal minimum temperature from observed nocturnal minimum temperature. Each day from December 1, 1997 to February 28, 1998 was classified into five kinds of weather condition days. The properties of $DT_{r\text{-}m}$ distribution under each of weather condition days were investigated by rank sum test and by using GIS with DEM (GTOPO30). The values of $DT_{r\text{-}m}$ tended to become nearly zero at rainy days, and large positive or negative quantity at fine days. But, in the plain area where flat topography spreads, the values of $DT_{r\text{-}m}$ were distributed around zero regardless of the weather conditions. In fine days, the values of $DT_{r\text{-}m}$ were large positive quantity in mountainous region, and were large negative quantity in West sea coastal area.

The difference of the degree of basin ($BD_{J\text{-}A}$) was calculated from 50-m-mesh elevation data at the JH weather stations and its nearest AMeDAS stations. The values of $BD_{J\text{-}A}$ have a negative relationship to the median of $DT_{r\text{-}m}$ frequency. These results show that 1-km-mesh temperature may be convertible for 50-m-mesh temperature by using $BD_{J\text{-}A}$.

Research Activities

The loess plateau in China is semi-arid area located at E100° to 115° and N34° to 40°. About 70% of the annual precipitation is concentrated in the summer and loess soil is very highly erodible, so a steep gully is formed in Loess Plateau. I examined the amount of soil loss from the erosion valley by using digital photogrammetry. As a result, it was clarified that it was difficult to estimate the amount of erosion by using

the remote sensing in a past method.

Publications:

Takayama Naru, Hayakawa Seiji, Onomoto Satoshi and Tsuji Tamon (2002), A Relationship between Estimated 1-km-Mesh Nocturnal Minimum Temperature and Observed Points Temperature over Kyushu Region in Winter. *J. Agric. Meteorol.,* 58, 79-92.

National work shops and meetings

Takayama Naru, Hayakawa Seiji, and Onomoto Satoshi (2002), Development of a Frost Damage Prediction Technique Using a Digital Elevation Model (DEM) in Air Temperature Estimation., *Abstracts of Annual Meeting of the Society of Agricultural Meteorology Japan* held in (Tokyo City), 58.

(3) Dr. Tomonori Fujikawa

Summary of research

Improvement of soil physical and chemical properties by porous glass materials

In arid land, it is very important to prevent the water loss after the irrigation procedures. To make the water retention of the soil better, the amount of water whose potential is suitable for the uptake of the plants may increase. The objective of the study is to improve the soil physical properties by mixing the other material into the soil. In this study we take note of the porous grass materials. This material is made by wasted grass and porous, so not only the retention of water also the dissolution of Ca^{2+} or Si^{4+} which may be fertilizer to the plant are expected. From the measurements of saturated hydraulic conductivity, it is found that soil hydraulic conductivity was able to control arbitrary to change the mixing ratio of porous grass materials. And from the immersing test, it is suggested that the dissolution from the porous grass materials changes pH and increase Na^{+}, Ca^{2+} and Si^{4+} concentration.

National symposium:

1. Fujikawa Tomonori, Miyazaki Tsuyoshi and Mizoguchi Masaru (2002), Simulations of CO_2 Gas Behavior in a Soil Column. The Japanese Society of Irrigation, Drainage and Reclamation Engineering. 2002 Annual meeting, pp 330-331 (in Japanese)
2. Fujikawa Tomonori and Miyazaki Tsuyoshi (2002), Effects of soil microorganisms on the behavior of CO_2 and O_2 gases in soil. 17th World Congress of Soil Science
3. Fujikawa Tomonori (2002), Behaviors of CO_2 and O_2 gases in a field soil with a hard pan. 44th Japanese Society of Soil Physics Symposium (in Japanese)

(4) Dr. Hidetoshi Mochizuki

Summary of research

Comparison of the methods measuring of soil thermal conductivity

Thermal conductivity is important to analyze the water-heat-solute movement in soils. Although many methods were proposed for measuring it, but the comparison of the methods was not studied. We measured thermal conductivity of Tottori dune sand and water using four methods, single heat probe (SPM), twin heat probe (TPM), dual heat probe (DPM), and Decagon probe (KDM). The measured values were compared. The thermal conductivity values measured with SPM and DPM are similar, and those with TPM and KDM are also similar. The thermal conductivity of water measured with KDM was as high as the value reported in literature, on the other hand the values obtained using SPM and DPM were higher than the reported data. As a result, KDM and TPM are recommended to measure soil thermal conductivity.

Improvement of soil physical and chemical properties by porous glass materials

The research on this subject was conducted with Dr. Fujikawa. The content, mentioned by him should be referred to.

Publications:

1. Mochizuki Hidetoshi, Mizoguchi Masaru, and Miyazaki Tsuyoshi (2002), Modeling of Thermal

Conductivity of Sand and Clay as a Function of Water Content and NaCl Concentration. The Japanese Society of Irrigation, Drainage and Reclamation Engineering. 2002 Annual meeting, pp 348-349 (in Japanese)

2. Mochizuki Hidetoshi, and Miyazaki Tsuyoshi (2002), The effect of NaCl on soil thermal conductivity. 17th World Congress of Soil Science, pp 1136
3. Mochizuki Hidetoshi, Sakaguchi Iwao, and Inoue Mitsuhiro (2002), Comparison of the Methods for Soil Thermal Conductivity Measurement. 44th Japanese Society of Soil Physics Symposium, pp 78-79 (in Japanese)
4. Mochizuki Hidetoshi, Mizoguchi Masaru, and Miyazaki Tsuyoshi (2002), Modeling of Saline Soil Thermal Conductivity. The 23rd Japan Symposium on Thermophysical Properties, pp 123-125 (in Japanese)