

# Research Topics 2014



January 2016



National Agriculture and Food Research Organization  
National Institute for Rural Engineering (NIRE)

## Preface

The National Institute for Rural Engineering (NIRE) is one of several institutes belonging to the National Agriculture and Food Research Organization, an incorporated administrative agency. Scientists at NIRE perform engineering research to support measures to promote rural areas from the technical side, and have developed technology that meets the demands of the times.

Our recent research focuses on the development of technology that contributes to strategic renewal and management of agricultural irrigation facilities, disaster prevention and reduction in rural areas, preservation of regional resources for agricultural production, advanced paddy field management, biomass utilization, measures against the effects of climate change on farmland and water resources, and sophisticated environmental control of agricultural structures as well as many other areas.

This pamphlet outlines the main results of NIRE research in 2014. We greatly hope this pamphlet will be used by engineers of rural engineering.

Takeshi Koizumi

Director General

National Institute for Rural Engineering

January 2016

## Research Topics 2014

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## (Irrigation and drainage facilities )

### 1. Method for generation of short-term heavy rainfall data to utilize in flood risk assessment of agricultural facilities

[Keywords]

Heavy rainfall pattern, Rainfall generation, Internal pattern, Autocorrelation, Flood risk assessment

[Abstract]

We developed a diurnal rainfall pattern generator that can provide heavy rainfall data. Generated data are obtained as hourly data, and have characteristics similar to observed rainfall data in target areas. By using this method, we can prepare many patterns of heavy rainfall in various regions including areas lacking observed data. Generated heavy rainfall data can be used for any analysis such as flood simulations, and to assess flood risks associated with rainfall patterns.

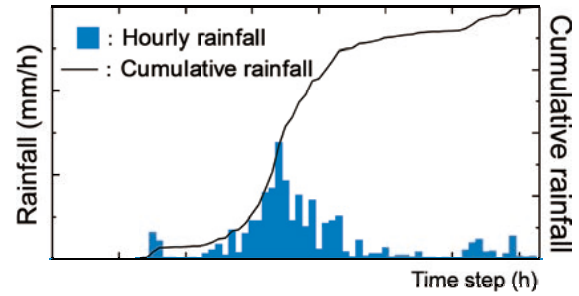


Fig. An example of a heavy rainfall pattern generated by the diurnal rainfall pattern generator

### 2. Effect of the direction of seismic waves on dam behavior during an earthquake

[Keywords]

Fill dam, Safety control, Lifetime improvement, Seismic observation, Seismic response

[Abstract]

The point above the deepest part of a dam's valley is suitable for observations on the maximum seismic response value of a fill dam under ordinary safety control. However, attention must be paid that no response happens at that point, which is the center of the crest and above the deepest part of the dam's valley, when the dominant direction of the seismic wave coincides with the dam axis.

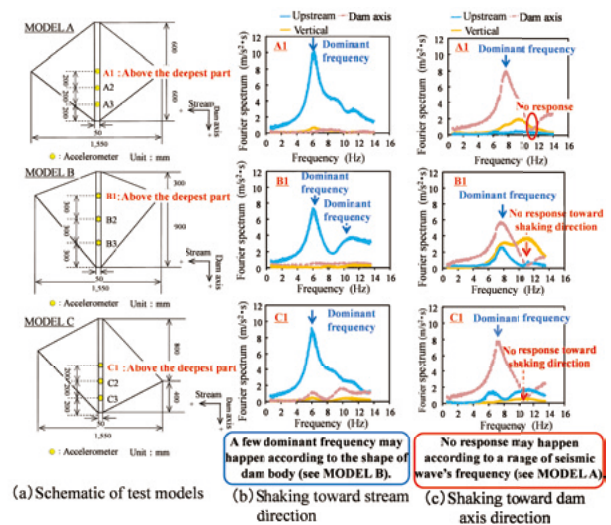


Fig. Comparison of seismic responses according to differences in dam shape and seismic wave direction



### 3. Method for prevention of scouring in downstream diversion weirs with connected riprap blocks and geotextile layers

[Keywords]

Diversion weir, Riprap, Riverbed drop, Scouring, Hydraulic model experiment with movable bed

[Abstract]

Many diversion weirs have risks of piping, structural unstableness by their downstream scouring from downstream riverbed drop. The drop occurs by downstream excavations to protect downstream city areas from large floods. For the scouring problem, we have developed the prevention method with connected riprap blocks and geotextile layer. The method perfectly prevent exposure of sheet piles in the condition of the supposed worst hydrograph in a standard diversion weir in Japan.

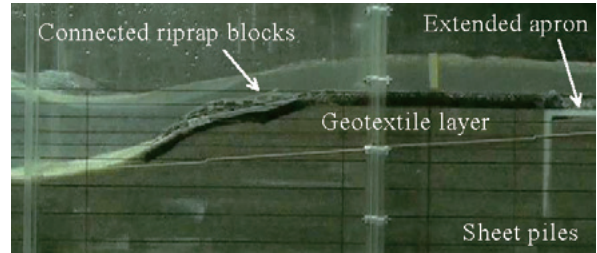
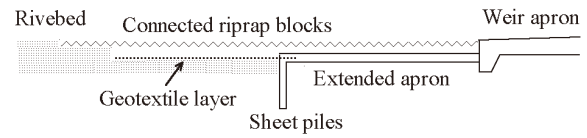


Fig. Sectional shape and hydraulic model test of the method.

### 4. Method for irrigation system hierarchical ordering based on irrigation canal order

[Keywords]

irrigation canal, canal network, hierarchical gap, water distribution

[Abstract]

In this study, we proposed expression of the hierarchical structure of irrigation systems with a new order (irrigation canal order).

A canal network can be expressed by a link and node. Irrigation canals are ascendingly ordered from downstream of the canal network to upstream by irrigation areas. A hierarchical gap occurs where hierarchical ordering doesn't continue. The hierarchical gap is regarded as the main cause that disturbs the equity of water distribution.

The method described in this study is effective in detecting hierarchical gaps and planning solutions.

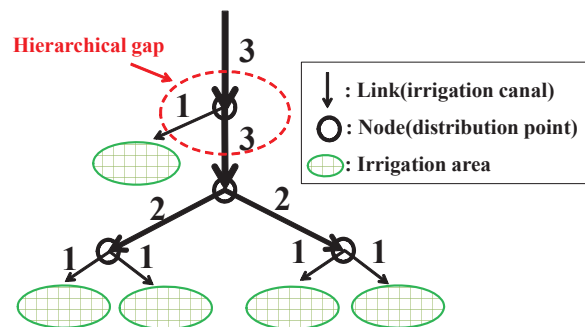


Fig. Irrigation canal order and hierarchical gap

**( Functional diagnosis )**

**5. Erosion monitoring system with a laser displacement meter for agricultural canals repaired by a cementitious surface coating method**

[Keywords]

Cementitious surface coating method, Agricultural canals, Erosion monitoring system, Laser displacement

[Abstract]

This is an erosion monitoring system with a laser displacement meter for agricultural canals repaired by a cementitious surface coating method. Erosion can be measured quantitatively and an average depth of the surface coating canals determined simply. Measurement accuracy is approximately  $\pm 0.1$  mm.

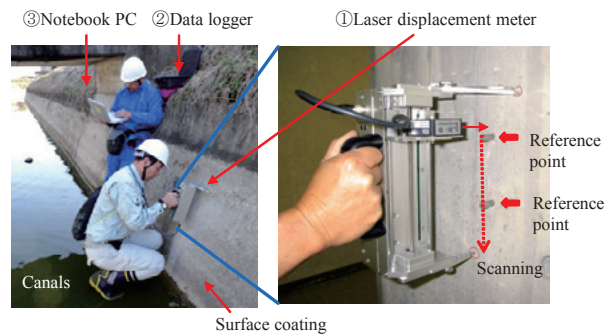


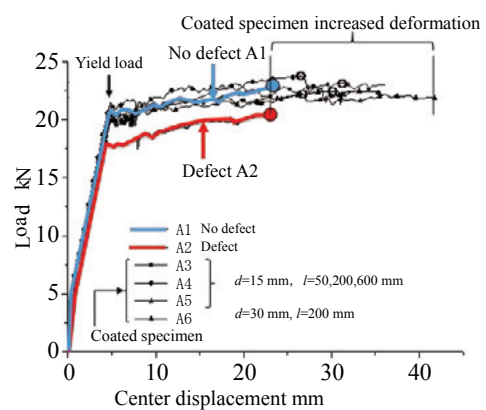
Fig. Outline of an erosion monitoring system

**6. Strength recovery effects of the cementitious surface coating method for agricultural canals**

[Keywords] Cementitious surface coating method, Agricultural canals, Strength, Reinforced concrete

[Abstract]

Flexural loading test of reinforced concrete beams repaired with cementitious surface coating was carried out. As a result, the strength of the specimens was recovered to almost the same level as healthy specimens. From these results, we conclude that cementitious surface coating repair restores the strength of the concrete open channel.



RC beam specimen

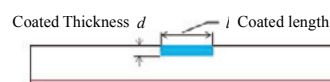


Fig. Relationships of Load-displacements

## 7. New functional diagnosis system for pump facilities by analysis of lubricating oil

[Keywords]

Pump facilities, Function diagnosis, Deterioration, Lubricating oil, Primary diagnosis, Secondary diagnosis

[Abstract]

The figure presents a technique to diagnose the deterioration of pump facilities, based on information from the analysis of lubricating oil. This new functional diagnosis system finds when the disassemble-check and repair are appropriate by a primary diagnosis with portable measuring equipment and a secondary diagnosis by the analysis organization. When a new functional diagnosis system is adopted, the disassemble-check and repair can be done more effectively than existing methods to regularly disassemble pump facilities.

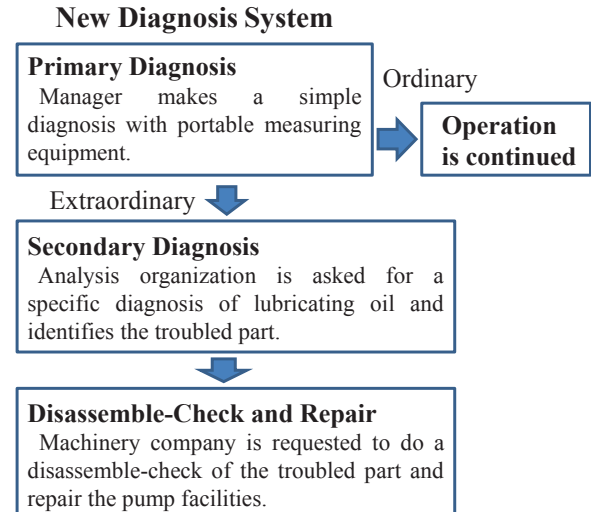


Fig. Flowchart of a new functional diagnosis system

## 8. Information management system with a functional diagnosis of small-scale irrigation-drainage facilities based on a mobile device and the internet

[Keywords]

Mobile device, simple function diagnosis investigation, life-cycle cost (LCC) evaluation, direct payment for multi-functionality

[Abstract]

This research has developed a system that evaluates the life cycle cost of irrigation-drainage facilities and can be used for information management using a functional diagnosis and field photographs. In order to use this system on site, the server-client operation method via the internet and mobile devices were constructed. The functional diagnosis and evaluation of small-scale facilities were done by a paper based method, but this system can conduct such activities more easily with mobile devices. Furthermore, this system can be used by residents who are not familiar with the irrigation-drainage facilities, where direct payment for multi-functionality is provided.

[Reference]

Kunimitsu., Nakata. (2015) JSRIDE , 295 : 59-67

Kunimitsu, Nakata. (2015) JSRIDE , printing

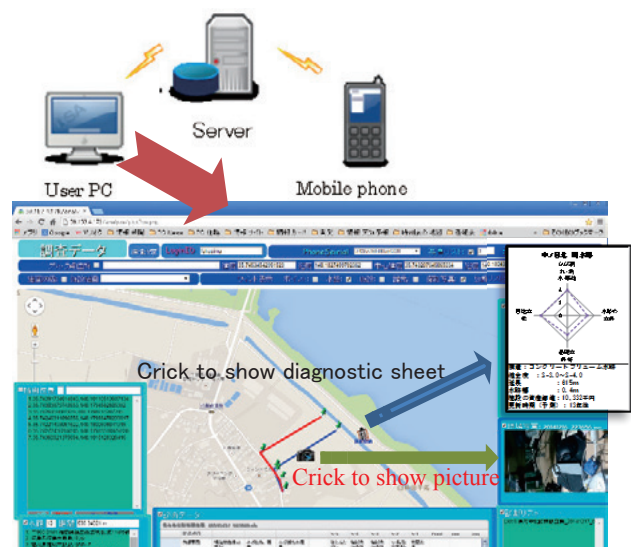


Fig. Outline of a system that evaluates the life cycle cost of irrigation-drainage facilities.



## ( Water quality )

### 9. Turbidity and water quality remote monitoring system that enables water sampling at an arbitrary time

[Keywords]

remote monitoring, turbidity, hydrological observation, ICT

[Abstract]

A turbidity and water quality remote observation system that enables water sampling at an arbitrary time was developed. Water samples can be taken based on orders or conditions of sensor output while remotely observing the water quality data. This enables low-cost water quality investigation in the entry limitation area or a remote area from the irrigation facilities.

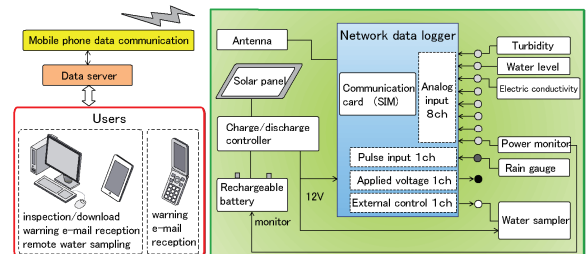


Fig. Remote water quality monitoring system

### 10. Vertical one-dimensional model for behavior of indicator microorganisms in dam reservoir

[Keywords]

Vertical water quality profile, Faecal coliforms, Soil-attached-type, Characteristic curve method

[Abstract]

A numerical model was developed to estimate the behavior of indicator microorganisms in a dam reservoir. Observed indicator microorganism concentrations showed a correlation with suspended solid concentrations in the river inflowing to the dam reservoir. An assumption that part of the indicator microorganisms move with suspended solids as solid-attached-type microorganisms can recreate the observed vertical indicator microorganism profiles at the deepest point of the dam reservoir.

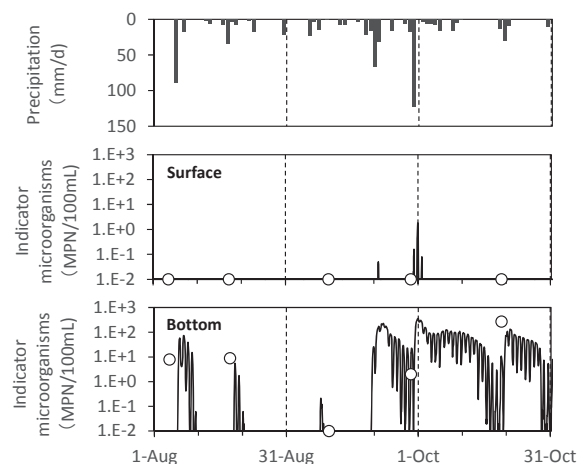


Fig. 1. Comparisons between observed and simulated concentrations (surface and the bottom of the dam reservoir)

[Reference]

Hamada *et al.* (2014): Technical Report of the National Institute for Rural Engineering, 216, 9-19.

## 11. Soil salinity assessment based on simultaneous monitoring of soil water content and electrical conductivity

[Keywords] Electromagnetic wave, Soil solution, Electrical conductivity, Solute concentration, non-destructive monitoring

[Abstract]

Simultaneous monitoring of soil water content and electrical conductivity in field soils contributes to better soil salinity assessment opportunities. By using a low-cost capacitance sensor, we developed a real-time monitoring system for soil salinity in the root zone of farmland covered with seawater during the 2011 Off the Pacific Coast of Tohoku Earthquake. The salinity monitoring system can also be applied for coastal farmlands to control and evaluate hazards of soil salinity.



[Reference]

Miyamoto et al. (2015) Japan Agricultural Research Quarterly, 49:261-267.  
Miyamoto et al. (2012) Technical Report of NIRE, 213:73-78. (In Japanese with English abstract)

Fig. Sensors for simultaneous measurement of soil water content and EC (upper part), installation of sensors (lower left), and monitoring soil salinity (lower, right).

## 12. Selection of suitable biochar as soil improvement materials for retardation of nitrate-nitrogen leaching in soils

[Keywords] Biochar, Soil amendment, Nitrate-nitrogen, Adsorption, Leaching, Retardation

[Abstract]

Biochar is produced from seven kinds of biomass feedstock (wood chips (Japanese cedar, Japanese cypress and moso bamboo), rice husks, sugarcane bagasse, poultry manure and domestic wastewater sludge) at three pyrolysis temperatures (400, 600 and 800°C) to select suitable biochar as soil improvement materials for the retardation of nitrate-nitrogen leaching in soils. Then, nitrate-nitrogen adsorption capacity of each biochar was measured.

Among the BC produced from each biomass feedstock at each pyrolysis temperature, BC produced from woodchips at a high temperature (800°C) had the greatest nitrate-nitrogen adsorption capacity.

[Reference]

Kameyama et al. (2012) J. Environ. Qual. 41(4): 1131-1137; Kameyama et al. (2014) Proc. of AGRO'2014. 2: 452-458

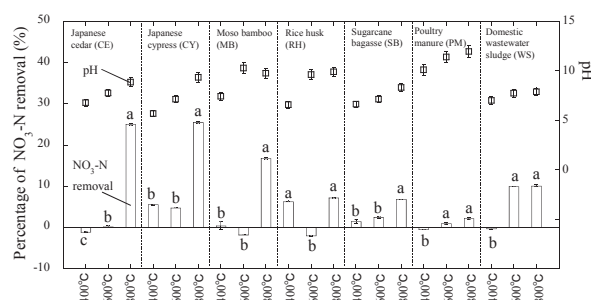


Fig. Percentage of nitrate-nitrogen removal by biochar samples and equilibrium solution pH (Error bars are standard error ( $n = 3$ ))

( Groundwater )

**13. Technique for pumping simultaneously from two depths in one well to prevent up-coning of saltwater**

[Keywords]

Groundwater, Water quality preservation, Pump, Pumping simultaneously from two depths, Well

[Abstract]

This technique pumps fresh groundwater and salty groundwater without mixing in coastal aquifers that have a freshwater layer and saltwater layer. The water cutoff partition, which consists of an air packer in an experimental device, is installed in one well and groundwater is pumped from the upper side and lower side of the partition at the same time. The freshwater is pumped from one pump and used, whereas the saltwater is pumped by the other pump and discarded. This technique enables efficient use of fresh groundwater in solitary islands and coastal regions.

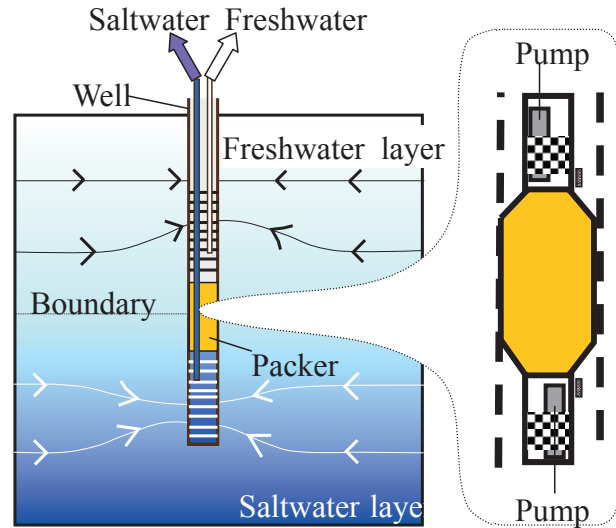


Fig. Conceptual diagram of this technique and experimental device

**14. Method for estimating aquifer diffusivity by analysis of groundwater-level tidal response**

[Keywords]

Groundwater level, Harmonic analysis, Tidal propagation, Aquifer diffusivity

[Abstract]

Presented is a method for estimating aquifer diffusivity, an aquifer hydraulic parameter, using only observation data of groundwater-level fluctuations induced by ocean-tide propagation. The estimation is achieved using 369-day-long data collected from two sites, at different distances from the shore. The aquifer diffusivity is a parameter equivalent to the ratio of transmissivity to storage coefficient of the aquifer, the transmissivity being the product of hydraulic conductivity and aquifer thickness.

[Reference]

Ferris JG (1951) Cyclic fluctuations of water level as a basis for determining aquifer transmissibility. International Association of Scientific Hydrology, Publication 33:148-155

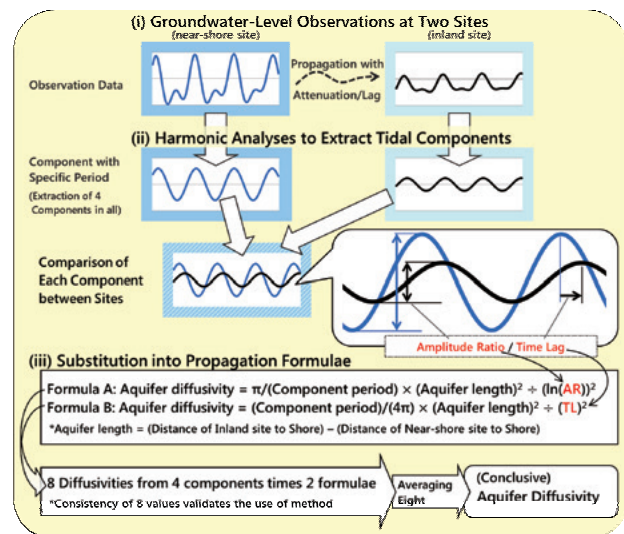


Fig. Procedure for estimating aquifer diffusivity by groundwater-level observations, harmonic analyses and application of propagation formulae.

## 15. Factors for prolongation of salt-water intrusion after the Great East Japan Earthquake

[Keywords] shallow ground water, salt-water intrusion, coastal low land areas, irrigation and drainage, one-dimensional density driven flow analysis

[Abstract]

Salt-water intrusion is concerned in the areas affected by the Tsunami caused by the Great East Japan Earthquake. This is because the fresh water supply to ground water decreases when irrigated paddy fields are decreased. A decrease in irrigation water is one factor that generates salt-water intrusion. This study examined the impacts of irrigation and drainage on salt-water intrusion with a one-dimensional density driven flow analysis.

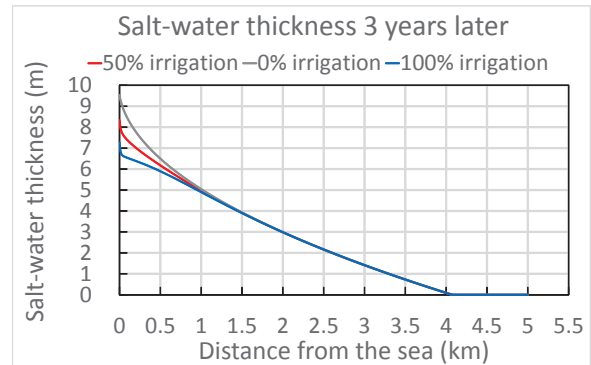


Fig. 1. Calculation of the salt-water thickness 3 years after the tsunami in the coastal aquifer

## 16. Controlled Source Magneto Telluric method survey system with multi-channel receiver for high efficiency deep groundwater investigation

[Keywords]

Groundwater trouble, Alternative water source, Geophysical prospecting, Resistivity, Low cost

[Abstract]

This resistivity prospecting system rapidly improves the signal-to-noise ratio with synchronized sending and receiving electromagnetic waves using the time signal of GPS. In addition, multipoint simultaneous measurements using two or more multi-channel receivers improve working efficiency. This system can be applied to an efficient groundwater investigation in the coastal zone such as prompt discrimination of the distribution of good quality deep groundwater.

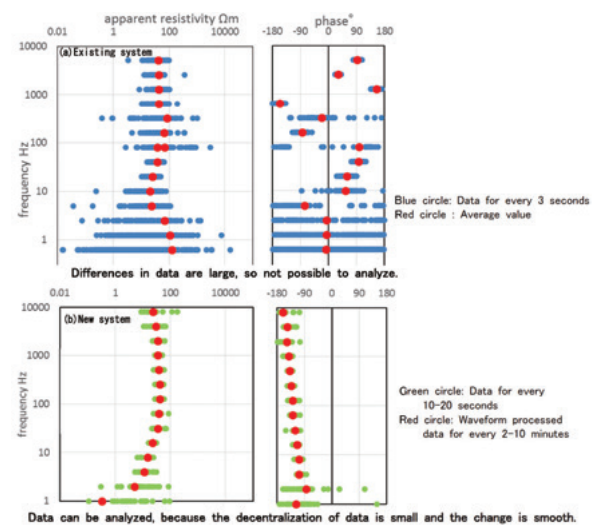


Fig. Comparison of inquiry results between existing system and new system in urban areas where noise levels are high.

## 17. Age dating for groundwater in slopes of hilly and mountainous areas using sulfur hexafluoride

[Keywords]

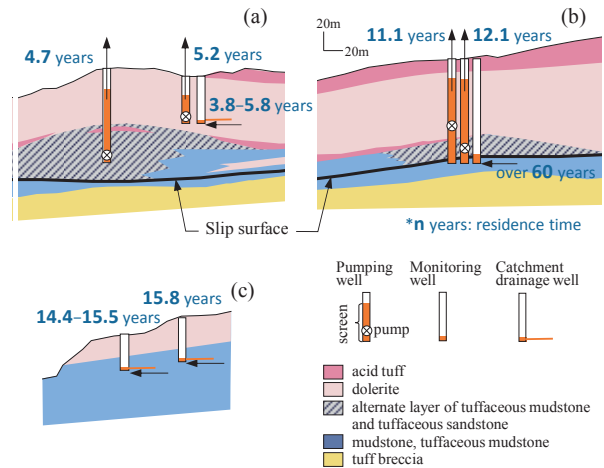
Sulfur hexafluoride, hilly and mountainous areas, groundwater, recharge age, residence time

[Abstract]

The sulfur hexafluoride (SF<sub>6</sub>) - based age dating method for groundwater in slopes of hilly and mountainous areas was developed. After industrial production of SF<sub>6</sub>, concentrations in the air have continuously increased. These increases in SF<sub>6</sub> have become particularly useful for age dating of relatively young groundwater in the past several years. The SF<sub>6</sub>-based method can be used to determine groundwater flow with different residence times in hilly and mountainous areas. The estimated residence time of groundwater can be used for classifying groundwater and predicting arrival of contaminants from the source area.

[Reference]

Tsuchihara, T. et al. (2014) *TRANSACTIONS of the JSIDRE*, 294, 65-74 (in Japanese with English abstract)



Central area (a), northern area (b) and southern area (c) in the landslide block

Fig. Groundwater with different residence times in a landslide block

## ( Disaster prevention and reduction )

## 18. Method to detect damaged zones on ground that are difficult to judge by sight

[Keywords]

Resistivity monitoring, rainfall, damage, slope

[Abstract]

A 2-D resistivity survey during rain-fall on a ground that is difficult to judge the damaged zone by sight provides resistivity changes according to changes in water content. Changes in water content depend on the soil density. These results show the possibility to estimate damaged parts by monitoring the infiltration of rain-fall.

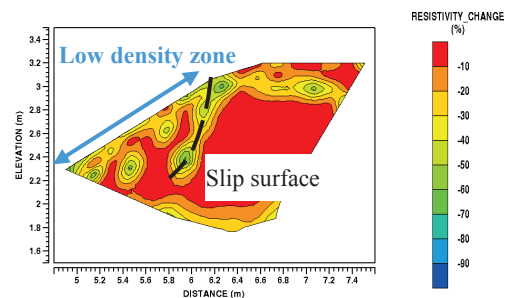


Fig. Changes in resistivities during rainfall compared to that before rainfall in a slope with damaged zones.



## 19. Evaluation of areas inundated with failure of a small earthfill dam by numerical analysis

[Keywords]

Dam for irrigation, Outflow, Analysis of inundation

[Abstract]

In Japan, small earthfill dams used for irrigation are particularly prone to damage, since some of them were built over 400 years ago. Dam failures are caused by concentrated heavy rain or large earthquakes. Potential inundation areas are displayed on municipal "Hazard Maps" to reduce the risk of damage to downstream sites. In this study, the accuracy of inundation analysis for a small earthfill dam that has failed due to heavy rain was verified through comparisons with field surveys.

[Reference]

Daisuke SHODA et al. (2015) Prediction of Inundation Areas Due to Failure in Small Earthfill Dam Using Numerical Analysis, JARQ, 49(2), 97-102.

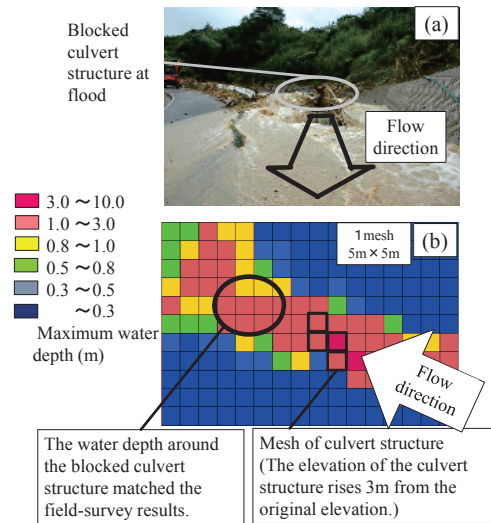


Fig. (a) Photo of culvert structure blocked during flood (b) Maximum water depth around culvert structure with change in elevation

## 20. Effect of water discharge tank on the reduction of tsunami damage of drainage pump stations in coastal areas

[Keywords]

Tsunami, Pump station, Water discharge tank, Disaster reduction

[Abstract]

Most drainage pump stations in coastal areas suffered great damage by the 2011 Tohoku Pacific Ocean Tsunami, but water discharge tanks greatly reduced the level of damage. Existence of a water discharge tank at the front of a pump house can reduce the wave force in the direction of movement of the tsunami wave.

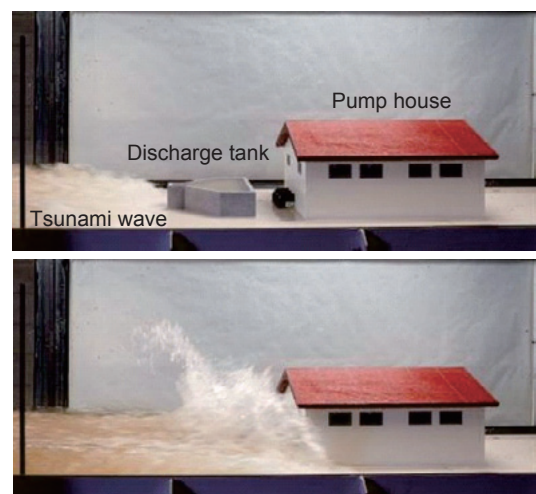


Fig. Time series variation of the Tsunami energy dissipating effect of a water discharge tank by hydraulic model experiment

## 21. New dikes resistant to earthquakes and tsunamis because of geosynthetic reinforcement technology

[Keywords]

Enhancement of capacity to cope with a large-scale disaster

[Abstract]

The National Institute for Rural Engineering of the National Agricultural and Food Research Organization has developed a dike structure capable of persistently resisting overflowing waves of gigantic tsunami and earthquakes. The dike structure was successfully developed by integrating three surfaces and three kinds of material to enhance resistance to tsunamis and earthquakes.

This new technology is expected to improve the constructability and maintain steep slopes as well as meet demands for higher safety in topographically restricted locations of coastal areas.

[Reference]

Press release :

[https://www.naro.affrc.go.jp/publicity\\_report/press/laboratory/nkk/052569.html](https://www.naro.affrc.go.jp/publicity_report/press/laboratory/nkk/052569.html)

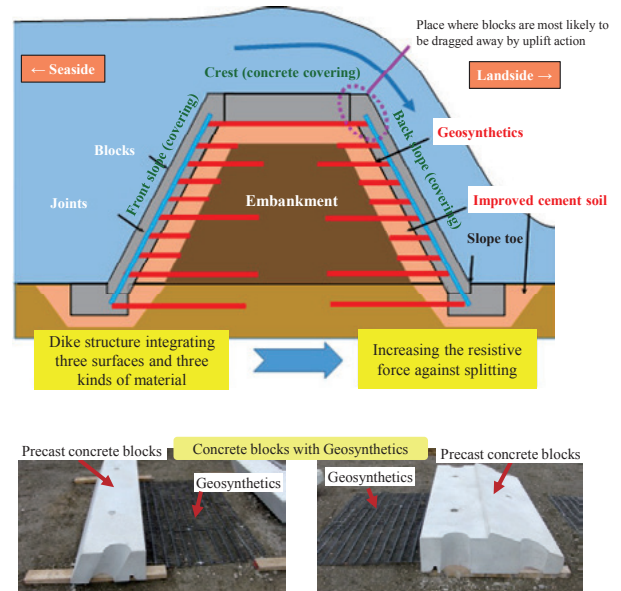


Fig. 1. Specific Structural Features of the New Dike

## 22. Reservoir water level prediction system for small earth dams during heavy rainfall

[Keywords]

Small embankment dam, Heavy rainfall, Breach, Water level, Disaster prevention measure

[Abstract]

Because most of the 200,000 small earth dams in Japan were constructed before the Edo era (150 years ago) and the spillways (a structure for discharge from a dam) are not effective, breaches of dams induced by heavy rainfalls frequently occur. MAFF recommends to make disaster prevention plans, for example prior discharge before heavy rainfall.

Using the system we developed, a rise in reservoir water level during heavy rainfall and necessary controlled water level for emergency discharge can be predicted from rainfall radar data and weather forecasts. This system can support disaster prevention measures with emergency refuge and water control.

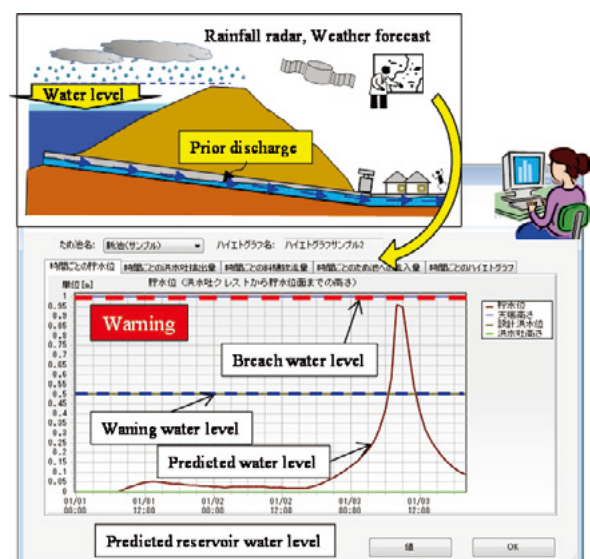


Fig. 1. Example of predicted reservoir water level during heavy rainfall

## 23. Compaction control for preventing liquefaction of soil containing fine fractions

[Keywords]

Liquefaction strength, Compaction degree, Fine fraction content

[Abstract]

With an increase in the compaction degree and fine fraction content, liquefaction strength becomes larger. To prevent liquefaction of soils with high fine fraction content by a level 1 earthquake, compacting soil so that the compaction degree becomes larger than 90% is effective.

In other soils, a compaction degree of more than 95% is effective to prevent liquefaction.

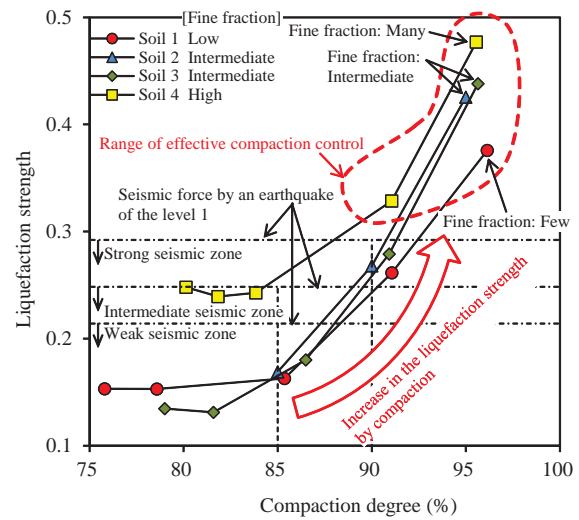


Fig. Relationships between liquefaction strength and degree of compaction

## 24. Monitoring for the effect of earthquakes on dams for irrigation based on seismic records

[Keywords]

Dams for irrigation, Seismometer, Seismic wave propagation, Huge earthquake, Seismic interferometry

[Abstract]

Application of seismic interferometry for seismic records of dams enables us to estimate seismic wave propagation property and to monitor the effect of huge earthquakes on dams.

[Reference]

Nakata, Snieder, Kuroda et al. (2013) Bul. Seis. Soc. Am, 103(3), pp.1662-1678

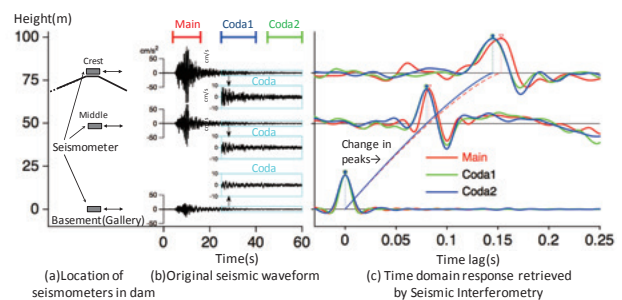


Fig. Observed seismic waveforms of a dam and its time domain response retrieved by seismic interferometry

## 25. Field Survey of Greenhouses Damaged by Heavy Snow in February 2014

[Keywords]

February 2014, Kanto-Ko-Shin Region, greenhouse structure, snow load, meteorological disaster, failure mode

[Abstract]

There are frequent failures of columns in greenhouses with insufficient bracing. For greenhouses without bracing, the connections between the column and beam, and column and foundation are the major causes of failure. In order to increase the strength of a greenhouse for snow loads, we propose the development of a new attachment that can be easily attached as a temporary bracing of the structure before a storm. We also propose a concrete modification of the connection between the column and foundation, and the addition of a covering film at the valley gutter.

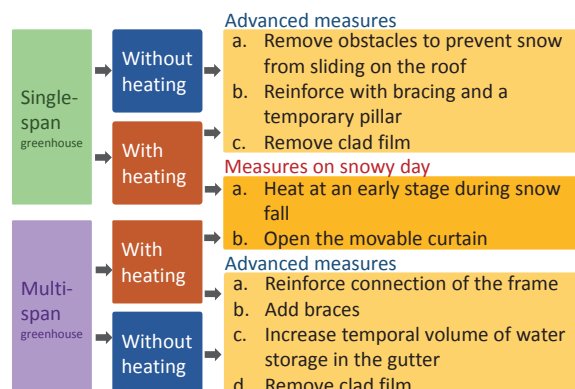


Fig. Flowchart of measures for heavy snow fall

[Reference]

Moriyama *et al.* (2014), J. SASJ, 45(3) : 108-120.

## ( Management of rural resources )

## 26. Web-application for benefit evaluation of life infrastructure and social capital

[Keywords] Degree of resident satisfaction, life infrastructure, social capital, national resilience plan

[Abstract]

This study examined application of the Web to measure the degree of resident satisfaction improved by life infrastructure and social capital based on the individual level as well as the regional level. This can be used in national resilience planning and revitalization planning for local towns. The causative factors in the degree of personal-level satisfaction are analyzed by an ordered probit estimation, and the causative factors at the regional-level are modeled by a structural equation analysis.

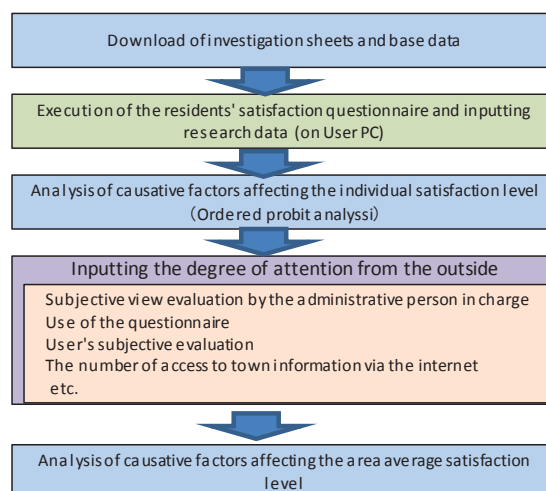


Fig. 1. Flowchart of analysis by users

[Reference] 1) Kunimitsu (2015) Social Indicators Research. 120:483-497, 2) Kunimitsu (2014) International Journal of Economic Policy Studies. 8:197-214

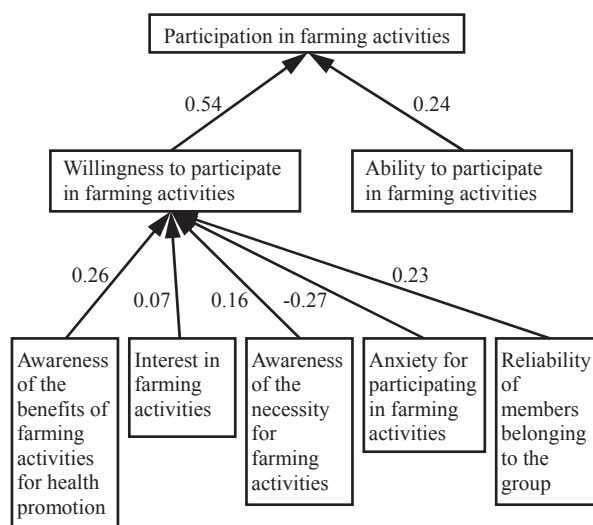
## 27. Structure of elderly non-farmers' participation in farming activities of urban areas

[Keywords]

Elderly persons, Health promotion, Participation in farming activities, Non-farmers, Path analysis

[Abstract]

This study analyzed the structure of elderly (persons aged 65 or older) non-farmers' participation (relationship between participation and influencing factors) in farming activities with a questionnaire given to 800 elderly non-farmers that lived in three major urban areas by path analysis. As a result, the following was determined: (1) participation in farming activities is influenced by both willingness to participate and ability to participate, and (2) willingness to participate is influenced by factors such as awareness of the benefits of farming activities for health promotion.



[Reference]

Onimaru, T., Ishida, K., Aizaki, H. and Katayama, C. (2015) Technical Report of NIRE, No.217, pp.63-74 [in Japanese with English abstract].

Fig. Model of the structure of elderly non-farmers' participation in farming activities of urban areas by path analysis (standardized solution)

## 28. "Residents' participatory survey on flowering grasses in paddy fields" contributes to discovery and countermeasures for the alien plant *Heteranthera reniformis*

[Keywords] Residents' participatory survey on flowering grasses in paddy fields, alien plants, High-risk weed in rice paddies, *Heteranthera reniformis*

[Abstract]

For the maintenance of good rice paddy ecosystems to ensure sustainable production, invasion of new alien plants with high risks as harmful weeds is a problem.

On the other hand, the "Residents' participatory survey on flowering grasses in paddy fields" program that we proposed as a tool for recognition of the environmental problems, has contributed to the improvement of the awareness of residents about the plant resources in the surrounding rice paddy fields.

This study showed that "Residents' participatory survey on flowering grasses in paddy fields" contributes to the discovery and development of measures against the new alien plant *Heteranthera reniformis* in Saitama Prefecture.

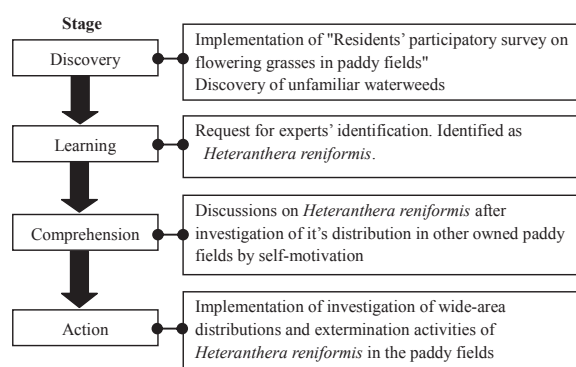


Fig. Farmers action towards for measures *Heteranthera reniformis* was triggered by the "Residents' participatory survey on flowering grasses in paddy fields"



## 29. Screening method of paddy fields targeted for field surveys of abandoned farmlands using multitemporal satellite data

[Keywords]

Abandoned farmlands, Screening, Remote sensing, RapidEye satellite data, NDVI

[Abstract]

We proposed a method to extract paddy fields that may be abandoned based on the parcel mean values of NDVI (Normalized Difference Vegetation Index) using multitemporal satellite data and paddy parcel boundary data. By screening paddy fields targeted for field surveys during investigations on the status of generation and elimination of abandoned farmlands with this method, we can save labor for field surveys because we do not have to survey all paddy fields.

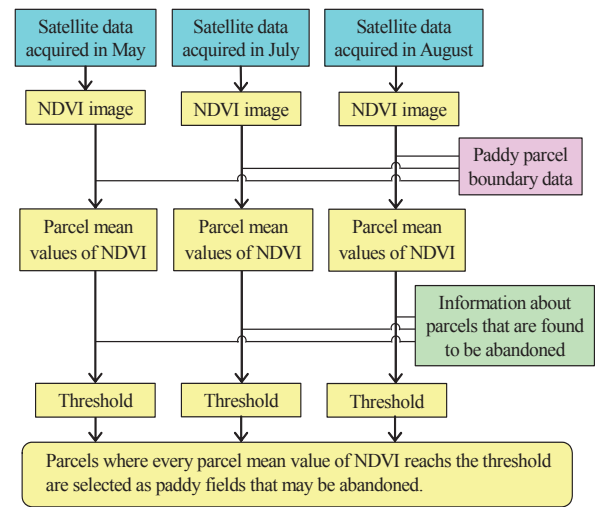


Fig. Method to extract paddy fields that may be abandoned

## 30. Protocol for extraction of eco-friendly canal sections to improve biodiversity

[Keywords]

Agricultural water facility, Biodiversity, Environmental conservation, Land improvement project

[Abstract]

When eco-friendly sections in agricultural canals do not sufficiently conserve biodiversity, the sections should be preferentially remediated. The protocol we have established can extract such sections based on the “scores” (0 to 1) from five evaluation indexes and the “total score” (0 to 5) of the indexes. Five indexes are the number of species, the total individuals, the number of indicator species, Morishita’s index  $\beta$  and Pielou’s evenness index  $J'$ , and are calculated from fish sampling data.

[Reference]

Watabe et al. (2015): *Technical Report of the National Institute for Rural Engineering*, 217, 29-37 [in Japanese with English abstract]

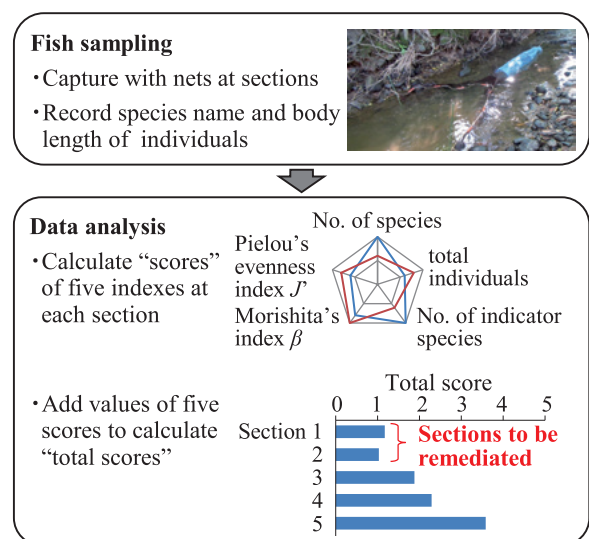


Fig. Protocol for extraction of eco-friendly canal sections

## ( Decontamination )

### 31. Gamma-ray counting system for radioactive cesium contained in bottom sediments of reservoirs

[Keywords]

CsI scintillation detector, GNSS receiver, Bottom sediment, Reservoir

[Abstract]

The system is composed of a measuring unit containing a commercial CsI scintillation detector in an acrylic waterproof container, a GNSS receiver, and a tablet PC as a control unit. The PC is connected to the CsI scintillation detector under water with a LAN cable and to the GNSS receiver via Bluetooth. This system is easy to handle and to visualize the planar distribution of gamma rays in real time by the software we developed.

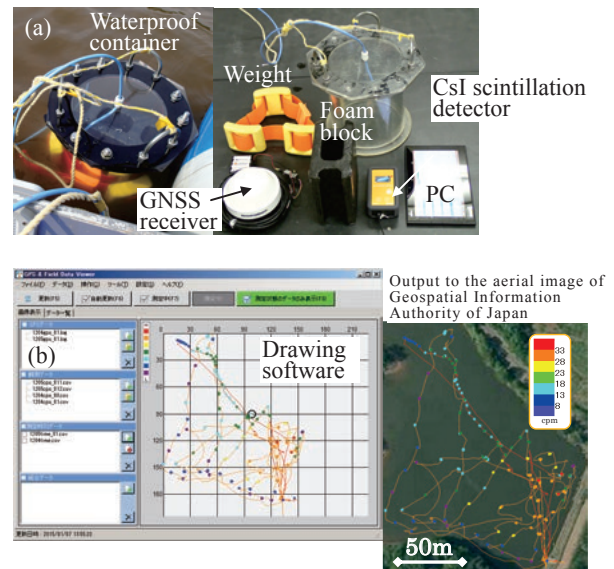


Fig. Gamma-ray counting system. (a) System appearance. (b) Sample of the drawing produced by the software we developed.

### 32. Method for Simulation of the Movement of Wash Load and Radioactive Substances by a Distributed Water Circulation Model Incorporating Substances Movement

[Keywords] Suspended solids, wash load, radioactive substances, a distributed water circulation model incorporating substances movement

[Abstract]

Radioactive substances spread widely by the accident at TEPCO's Fukushima Daiichi Nuclear Power Plant have been absorbed on the surface of clay and seen in runoff with suspended solids during rainfall. Therefore, the movement of the suspended solids and radioactive substances should be clarified both spatially and temporally. We built a distributed water circulation model incorporating substances movement. We also tried to simulate the movement of the wash load and radioactive substances adsorbed on the wash load.

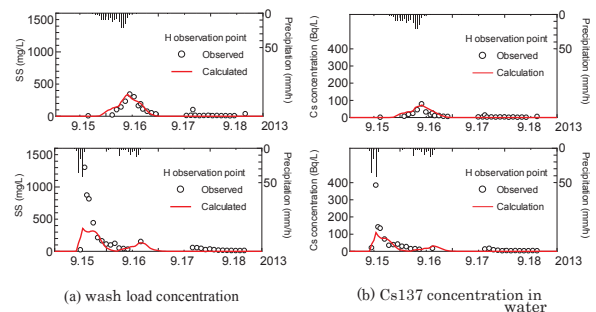


Fig. Simulation of the movements of a wash load and Cs137

### 33. Sedimentological properties of radioactive Cs in an irrigation canal system

[Keywords]

Irrigation canal, bottom sediment, radioactive Cs, canal decontamination

[Abstract]

Concentrations of radioactive Cs in the bottom sediments of an irrigation canal were studied for future management of bottom sediment in ruined areas. Concentrations of radioactive Cs of the bottom sediment of an irrigation canal system is comparatively high in the mud sediment of a branch canal with comparatively slow flow velocity. Concentrations of radioactive Cs in newly generated bottom sediment at a spillway greatly decrease after decontamination.

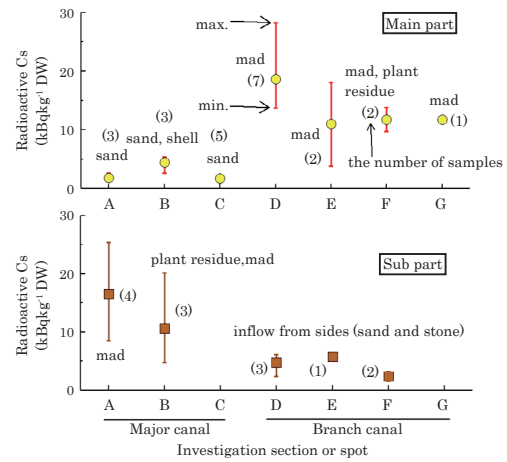


Fig. Radioactive Cs of bottom sediment in irrigation canal

### 34. Effect of extending the ponding period after puddling on reducing the discharge of radioactive cesium contained in puddled water from a paddy field

[Keywords]

Radioactive cesium, Paddy field, Puddled water

[Abstract]

A field examination was carried out to clarify the effects of water management for extending the ponding period after puddling to reduce the discharge of radioactive cesium contained in the puddled water of a paddy field. Application of water management reduced the surface drainage load of radioactive cesium by about 60 percent. This result suggests that extending the ponding period allowed the radioactive cesium that existed as suspended solids in the ponding water to effectively sediment.

The radioactive cesium concentrations of ponding water after final puddling increased more drastically than after first puddling, and decreased by 90 percent in 39 hours.

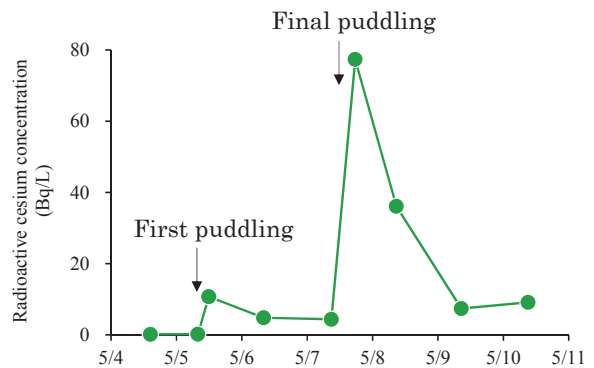


Fig. Fluctuations in the concentrations of radioactive cesium in ponding water during the puddling period.

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