UPDATED PROPOSAL

Cover Page

1. **Project Leader:** **Dr. Ichirow Kaihotsu, Professor (Hiroshima University)**

2. **Project Reference:** **CBA2010-14NMY-kaihotsu**

3. **Project Title:**

   Drought monitoring system development by integrating in-situ data, satellite data and numerical model output

Part One: Project Summary (13 columns: 2 pages)

COLUMN 1

Title of proposed project:

Drought monitoring system development by integrating in-situ data, satellite data and numerical model output

COLUMN 2

Proponent's Name and Title: Ichirow Kaihotsu Professor/Dr.

Name of Organisation: Graduate School of Integrated Arts and Sciences, Hiroshima University

Address: 1-7-1 Kagamiyama、Higashihiroshima, 739-8521, Japan

Telephone: +81-82-424-6497

Fax: +81-82-424-0758

Email: kaihotu@hiroshima-u.ac.jp

COLUMN3

Briefly describe the proposed activity and its relevance to the APN Science and/or Policy Agenda(s), capacity building and sustainable development.

Droughts have happened unexpectedly and been creeping into us in Asia and world wide. Drought has directly an influence on agriculture, energy production, transportation, tourism and recreation, forest and wild land fires, urban water supply, environment and human health. In order to take precaution against a drought, we have to urgently establish and develop of a integrating system of in-situ data, satellite ones and numerical model outputs. The integrating system brings us to greatly improve the techniques and knowledge of drought study. Drought, related to the water issue in AWCI(Asian Water Cycle Initiative)/GEOSS implementing plan, is getting more and more concern from the publics and policy maker.

COLUMN 5

List the member & approved countries involved with a brief description of their role(s).

Project Leader

·Ichirow Kaihotsu, Graduate School of Integrated Arts and Sciences, Hiroshima University, email:kaihotu@hiroshima-u.ac.jp < Super vision of this project, Drought analysis in East Asia>

Co-Leaders and Ccollaborators

·Rasul Ghulam (Co-Leader), Pakistan Meteorological Department (PMD), Islamabad, Pakistan, email:rasulpmd@gmail.com <Meteorological data analysis and drought studies in Pakistan>

·Ailikun (Co-Leader), Institute of Atmospheric Physics(IAP), China, email:aili@mairs-essp.org <Definition analysis of drought, Drought analysis in China>

·Davaa Gombo (Co-Leader), Institute of Meteorology and Hydrology, Mongolia, email:watersect@yahoo.com <Hydrological analysis under the drought condition in Mongolia>

·Toshio Koike (Co-Leader, AWCI scientific leader), Department of Civil Engineering, University of Tokyo, email:tkoike@hydra.t.u-tokyo.ac.jp <Numerical model products in Asia>

·Mafizur Rahman (collaborator), Bangladesh University of Engineering and Technology, Bangladesh, email:mafiz@agni.com <Soil moisture/meteorological data analysis in Bangladesh>

·Shiv Sharma (collaborator), Department of Water Induced Disaster Prevention, Nepal, email:shiv1301@gmail.com <Drought analysis in Nepal>

·Flaviana DeLeon Hilario(collaborator), Philippine Atmospheric, Geophysical and Astronomical Services Administration, Philippine, email: fhilario@pagasa.dost.gov.ph <Drought analysis in Philippine>

·Thada Sukhapunnaphan(collaborator), Royal Irrigation Department, Thailand, email:thada999@yahoo.com <Hydrological analysis under the drought condition in Thailand>

·Duong Van Khanh (collaborator), Central Hydro-meteorological Forecasting Center of HMS (National Hydro & Meteorological Service) of Vietnam, Vietnam, email:khanhnhms@yahoo.com <Drought analysis in Vietnam>
·Hiroyuki Iwasaki (collaborator), Faculty of Education, Gunma University, email: iwasaki@edu.gunma-u.ac.jp <Prediction model of vegetation condition under drought in Arid and Semi-arid lands in Asia>
·Osamu Ochiai (collaborator), JAXA, email: ochiai.iosamu.@jaxa.jp <Satellite data analysis>
·Akihiko Kondoh(collaborator), Chiba University, email: kondoh@faculty.chiba-u.jp <Satellite data analysis >

COLUMN 6

Is the project a local, national or regional activity?

Regional activity in Asia, including the scientists from Bangladesh, Japan, China, Mongolia, Thailand, Vietnam, Pakistan. Nepal and Philippines

COLUMN 7

Main Objectives:

GEOSS/AWCI is collaborating among the 18 Asian countries in sharing the ground observational data, and trying to support the information exchange and improve the technology of drought monitoring and studying among these Asian countries.

The main objectives of this project are:

1 To share and improve the drought monitoring capability in various Asian countries such as Bangladesh, China, Nepal, Mongolia, Philippines, Pakistan, Thailand, and Vietnam.

2 To try setting up a drought monitoring and research network in related Asian countries.

3 To try and help developing the early warning system of drought hazard in related countries.

COLUMN 8

Summary of Proposed Project in 100 words:

The ground-based routine data in each country, satellite products and numerical model ones for drought studies have not been widely used since lack of capacity building in many Asian countries. The retrieved soil moisture dataset from satellite remote sensing (RS) products has been gradually providing for the AWCI drought working group, and the related countries collaborators will validate this data set by using the in-situ observation data. Furthermore, we are preparing to provide numerical model products to the related countries for drought studies. Scientists and operators in the related countries will be able to learn and acquire the analysis techniques of satellite data and numerical products and methods of monitoring and an early warning system of drought.

COLUMN 9

Expected Outcomes:

1 An international workshop on drought and/or soil moisture monitoring, assessment and studying in Asia

2 A training course for the young scientists on monitoring water cycle elements and using the integrated monitoring data, numerical model products and an early warning system of drought in operational drought forecast and drought research

3 An activity report

COLUMN 10

Provide a summary of the project methodologies:

We have been successfully collecting the in-situ monitoring of water cycle elements from a few countries in Asia since 2008. On the other hand, the use of satellite RS products in conjunction with the in-situ monitoring data has been on trial proposed in monitoring, mapping and studying drought in some of Asian countries. Many drought related satellite products such like NDVI (Normalized Difference Vegetation Index) and SMI (Soil Moisture Index) etc. are being released, but validation is still a big problem in many countries. Fortunately, the scientists from various Asian countries can help validation of the RS products by using the in-situ observation in their own countries. In this project, JAXA (Japan

Aerospace Exploration Agency) will be a strong support engine, leading the scientists and users obtain and share the experiences and techniques of using the satellite RS products in Asian developing countries. Furthermore, setting up the data exchange network of ground-based monitoring and numerical model studies are very effective and important for the drought assessment and forecasting. As a result, the related countries to drought will be able to learn the latest knowledge and techniques of in-situ monitoring, satellite data analysis and the use of numerical model products for the drought study. That is, by establishing a drought monitoring system based on this activities, the scientists from Asian countries could share their experiences and information on drought monitoring and research.

COLUMN 11

Proposed Mode of Operation of the Project Team:

Under the leadership of GEOSS/AWCI, drought working group was set up 3 year ago. There were 22 members from 13 countries that joined the meeting and discussion in Bangkok 2006, in Beppu 2007, in Beijing 2008, in Bangkok May 2009, and in Chiang Mai August 2009, respectively.

COLUMN 12

Provide a concise literature review:

Ichirow Kaihotsu have been actively studying sub-surface hydrological cycle since 1981 and recently trying to make clear a mechanism of water interaction between soils and atmosphere using the data of ground-based and satellite observations[1),2),3)]. Kaihotsu who is familiar with soil moisture behaviours has a good skill to observe hydrological and meteorological elements in dry land [4)] and is good at analysis of the satellite soil moisture data [1),2)].

Recent papers:

1) Kaihotsu, I. et al. : Soil moisture observations in CEOP, GEOSS and earth observation satellite missions, J. of Jap. Soc. of Soil Physics, 111, 5-8, 2009

2) Kaihotsu, I. et al.: Validation of soil moisture estimation by AMSR-E in the Mongolian plateau, Jour. of the Remote Sensing Society of Japan, 29(1), 271-281, 2009.

3) Iwasaki, H., Sato, T., Nii, T., Kimura, F., Nakagawa, K., Kaihotsu, I., and Koike, T.: Diurnal variation of convective activity and precipitable water around Ulaanbaator, Mongolia, and impact of soil moisture on convective activity during night time, Monthly Weather Review,136(April), 1401-1415 doi:10.1175/2007MWR2062.1, 2008.

4) Yamanaka, T., Kaihotsu, I., Oyunbaatar, D., and Ganbold, G.: Characteristics and controlling factors of regional scale variability in surface soil moisture within semi-arid grassland in Mongolia, Jour. of Meteorological Society of Japan, 85-A,261-270, 2007

Kaihotsu's study results about soil moisture are reported in many papers as shown later.

COLUMN 13

Provide any other relevant information (for example, has the proponent or collaborators received funding from the APN before or been involved in APN projects etc.)

Ichirow Kaihotsu has received the APN funding in 1997. Professor Toshio Koike and Dr. Ailinkun who are co-leaders of this project have also received the APN ARCP funding in 2006-2007 and in 2008-2009, respectively.

1. Project Title

Drought monitoring system development by integrating in-situ data, satellite data and numerical model output

2. Detailed Proposal

2-1. Background

AWCI (Asian Water Cycle Initiative) of GEOSS which has organized cooperation among the 18 Asian countries is focusing on convergence and harmonization of observation activities, interoperability arrangements for observed data and collected information, effective and comprehensive data management, and capacity building of the participating countries as the most functional elements. AWCI is trying to approach water issues in cooperation between global observations and local applications, between research communities and operational sectors, and/or among the different socio benefit area. We do believe that AWCI can solve various actual problems and lead GEO to realize societal benefits. Now, AWCI has four components for capacity building: flood, drought, water quality and climate change. This proposal is for the capacity building of drought monitoring and studying under the framework of AWCI of GEOSS.

As well known, drought is one of the most serious disasters in lots of Asian countries, such as Mongolia and China etc. In Mongolia, the economic loss affected by the drought hazard is huge. Mongol National Statistics[1)] show the sudden and great decrease of the livestock number in 2002. The pasture condition in the whole of Mongolia in 2002 became extremely worse than that in 2001 and 2003[2)]. As sever drought occurred in Mongolia in 2002, there is a possibility to have drought influences on the decrease and the pasture condition change. It is very difficult for us to predict drought because it is influenced by many factors, like rainfall, air temperature and water use. Drought which develops gradually and slowly is an unexpected creeping hazard and has a prolonged existence. Drought produces a complex web of impacts, which spans many sectors of the economy, especially agriculture, energy production, transportation, tourism and recreation, forest and wild land fires, urban water supply, environment and human health.

Recently, some scientists and a few countries have been challenging to monitor drought using the remote sensing technology and to build up an early warning system of drought disaster. Scientists and policy makers will be able to have a big chance to study and monitor drought, and to improve the drought management to reduce the social-economic losses. The state of art tools and techniques are not available operationally in most of the developing countries for inferring drought conditions. There is an urgent need to create greater development of a drought monitoring and assessment system. Release of satellite products provides a great chance for scientists to improve the techniques and knowledge of drought study. Furthermore, these days, numerical model simulation plays a important role in drought studies. We can doubtlessly expect that the numerical model outputs will be available and helpful for drought studying.

Drought, an important issue of water in GEOSS implementing plan, is getting more and more concern from the publics and policy maker.

2-2. Main objectives of the project

AWCI of GEOSS is collaborating among the 18 Asian countries in sharing the ground observational data, and trying to support the information exchange and improve the technology of drought monitoring and studying among these Asian countries. The main objectives of this project are:

❑To share and improve the drought monitoring capability in various Asian countries such as Bangladesh, China, Nepal, Mongolia, Philippines, Pakistan, Thailand, and Vietnam.

❑To try setting up a drought monitoring and research network in related Asian countries..

❑To try and help developing the early warning system of drought hazard in related countries.

2-3. Methodologies

The drought study is mainly based on the observation of precipitation, temperature and soil moisture by now, such as various drought index and moisture index. The satellite products has not been widely used in many Asian countries due to lack of capacity building. Under the support of Hiroshima University, JAXA (Japan Aerospace Exploration Agency) and the University of Tokyo, the retrieved soil moisture dataset from satellite remote sensing products and the numerical model products will be used in this project, and the related countries collaborators will validate this dataset by using the in-situ observation soil moisture, precipitation and temperature. The AWCI of GEOSS will be in charge of coordinate this regional activity, along with the flood, climate change and water quality groups.

For monitoring and studying drought, we need to study some kinds of drought indices such as Standardized Precipitation Index (SPI), Palmer Drought Severity Index (PDSI), Crop Moisture Index (CMI), Surface Water Supply Index (SWSI) and Drought Frequency Index (DFI)[3)]. These indices mainly based on the ground observations of precipitation, temperature and soil moisture. But the standards of definition of these indices are differed from countries and regions because of the spatial and temporal resolution of observation stations in different countries and regions.

Research on soil moisture remote sensing has been conducted several decades, especially the early tuck-based and airborne remote sensing retrievals, the estimates of soil moisture from the satellite microwave remote sensing data have gained great achievement in recent years. However, as there is still a remarkable difference between the satellite microwave remote sensing data and the ground-based ones, we need more challenge for satellite remote sensing estimated soil moisture validation under the complicated land surface. Because of the complex of soil type, ground water deposit. irrigation and vegetation type in the area, soil moisture will be a key indicator of drought monitoring besides precipitation and temperature in this project. JAXA and University of Tokyo will help developing a set of soil moisture dataset in specific region we are interested in for related countries. Optical and microwave remote sensing datasets will be used in this project. In many studies, microwave products have many advantages in the bare and pasture surface at least. Optical products, such as NDVI and LAI are usually used for full cover vegetation area to understand the vegetation and soil processes. For partly vegetation cover area, optical and microwave products will be both used in getting the high resolution soil moisture data. The validation of remote sensing products in each typical area in related countries will be done by the network of AWCI drought group. Kaihotsu and a few collaborators have been leading in validation and retrieving the remote sensing data in cooperation with JAXA.

Doctors Ailikun and Kaihotsu are trying to show a rational and reasonable index of drought in Arid and Semi-Arid lands and to make a drought map using the data of ground-based monitoring and satellite observation. Professor Iwasaki has been studying the prediction model of vegetation change in the pasture area in Mongolia since 2007 and is successfully showing a prototype model of the prediction considering the meteorological data and the soil moisture products of AMSR-E. This model will be available and useful for the early waning system study of drought. We will study intensively the drought condition in some specific countries and regions such as Mongolia, China, Pakistan, Vietnam, Thailand and Nepal.

Furthermore, the numerical model simulation has been carrying out by Prof. Koike's group to make clear mechanism of water cycle change in Asia using GCM (Global Climate Model) for a long time. The products of the simulation will be available and useful for our drought studies and contribute making an early waning system of drought. Concretely, we will be probably able to get the simulated data of soil moisture, soil temperature, etc.

An international workshop on drought and soil moisture will be prepared not only for AWCI Asian related participants, but also for the expert in drought monitoring all over the world, such like Africa, America and Australia. After the discussion on all the analyzed results and numerical model products, we will have a training course (for young scientists/operators) among the related Asian countries to share the techniques and experiences in monitoring, understanding and prediction of drought.

2-4. Main proponents and collaborators

Project Leader

·Ichirow Kaihotsu, Graduate School of Integrated Arts and Sciences, Hiroshima University, email:kaihotu@hiroshima-u.ac.jp

Co-leaders and collaborators

· Rasul Ghulam (Co-Leader), Pakistan Meteorological Department (PMD), Islamabad, Pakistan, email: rasulpmd@gmail.com

·Ailikun (Co-Leader), Institute of Atmospheric Physics (IAP), China, email:aili@mairs-essp.org

·Davaa Gombo (Co-Leader), Institute of Meteorology and Hydrology, Mongolia, email: watersect@yahoo.com

·Toshio Koike (Co-Leader, AWCI scientific leader), Department of Civil Engineering, University of Tokyo, email: tkoike@hydra.t.u-tokyo.ac.jp

· Mafizur Rahman(collaborator), Bangladesh University of Engineering and Technology, Bangladesh, email: mafiz@agni.com

·Shiv Sharma(collaborator), Department of Water Induced Disaster Prevention, Nepal, email:shiv1301@gmail.com

·Flaviana DeLeon Hilario(collaborator), Philippine Atmospheric, Geophysical and Astronomical Services Administration, Philippine, email: fhilario@pagasa.dost.gov.ph

·Thada Sukhapunnaphan(collaborator), Royal Irrigation Department, Thailand, email: thada999@yahoo.com

· Sap Van Tran(collaborator), National Hydro & Meteorological Service (NHMS) of Vietnam, Vietnam, email: tvsap@yahoo.com

·Hiroyuki Iwasaki (collaborator), Faculty of Education, Gunma University, email: tvsap@yahoo.com

·Osamu Ochiai (collaborator), JAXA, email: ochiai.iosamu.@jaxa.jp

·Akihiko Kondoh(collaborator), Chiba University, email: kondoh@faculty.chiba-u.jp

2-5. Detailed workplan

Although we have successfully been collecting the ground-based data (soil moisture and fundamental elements of water cycle from 2006 to 2008) in a few related countries, we have been still asking them in other member countries. In the Kick-off plenary meeting (joint meeting with AWCI drought working group) in Tokyo in October 2010, the detailed concrete work plans (the method, algorism of getting and exchanging the soil moisture data set from the remote sensing products and numerical model products, a drought monitoring and research network, etc.) of this project will be discussed by all the participants. The scientists from the related countries agreed to provide the ground surface and soil observing data in a particular region in their countries. By January in 2011, we will collect whole set of dataset for drought monitoring (ground and satellite RS). Of course, we have been challenging to build up a drought monitoring and research network by January in 2011.

The satellite data (*e.g.* AMSR-E data) from 2007 to 2008 (if possible , to 2009) by Hiroshima University will be analysed in cooperation with JAXA focus on the specific area in each country by the end of summer in 2011. The University of Tokyo has been trying to obtain various kinds of the numerical model products since 2008 and will be able to show them by summer in 2011 using GCM (Global Climate Model).

Sharing the results of the analysis of the obtained ground-based data and estimation of soil moisture from the satellite data (AMSR-E data) in an international workshop on drought and soil moisture in December in 2011 in Tokyo. We will challenge to make a drought map in Asia using the ground-based data, satellite soil moisture estimation data and numerical model products and then a trial model of the early warning and/or prediction system of drought hazard based on numerical simulations (also considering the ground-based and satellite data analysis) and a few empirical models by late spring in 2012.

We will hold a training course supported by this proposal in an international workshop and drought and soil moisture in March in 2012 (Tokyo) in conjunction with a training course of drought studies of AWCI. Young scientists will be able to learn and acquire the analysis techniques of the obtained ground-based data, estimation of soil moisture from the satellite

data, the numerical model products, the ground-based monitoring method of soil moisture, how to use the data and products, and a few prototype models of the early warning and /or prediction system of drought hazard.

Finally, in September of 2012, we will publish an activity report of this project in cooperation with the AWCI drought working group.

References

1) National Statistical Office of Mongolia: "Mongolian Statistical Yearbook", Ulaanbaatar, Mongolia, 2004, 418p.
2) Munkhzul, D. and Ramesh, R.: Relationship between vegetation index, temperature and precipitation in droughted and non-droughted years over Mongolia, Papers in Meteorology and Hydrology, 61-72, 2007.
3) Gonzalez, J. eta al.: New drought frequency index: Definition and comparative performance analysis, Water Resour. Res., 42. W11421, 2006.

3. Relationship to Research under CAPaBLE

This project is for a regional research and capacity building through the network of AWCI of GEOSS. The capability of drought monitoring and studying is much low in Asian countries compared to it in the developed countries such as US, Japan, China and EU. By using the remote sensing and numerical model products, ground-based monitoring and sharing the techniques and the data, Asian countries will get various kinds of benefits in drought mitigation.

4. Capacity Building and Awareness Raising

As mentioned above, drought monitoring in developing and undeveloped countries is not matured comparing some developed countries in northern America, China and Japan. Sharing the data, techniques and experiences of the in-situ monitoring, the development of satellite RS technology and numerical model products can be considered to help the developing and undeveloped countries monitor and predict precisely drought. International workshops and the training course will be opened to the related countries to raise the capability of using the exchanged in-situ monitoring data, the satellite RS data and the numerical model products and international collaboration.

5. Contribution of Each Participating Country and Organisational Arrangements

The related countries, organizations and scientists are all involved in GEOSS/AWCI activities. Japan will be the key player in this project, Hiroshima University, JAXA and the University of Tokyo will be in charge of coordinating and provide scientific support of using of remote sensing products and numerical model products in drought monitoring. China, Mongolia, Thailand and Pakistan will be the main implementing countries. The local government of meteorological and hydrology in each country joined this project.

6. Links to Sustainable Development

Drought produces a large number of impacts that affects the social, environmental, and economical standard of living. Its affects spread far beyond the physical effects of drought itself. Water is integral to produce goods and provide certain services. Some direct impacts of drought are reduced crop, rangeland, and forest productivity; reduced water resources; increased fire hazard; increased livestock and wildlife death rates; damage to wildlife and fish habitat; and biodiversity change. A reduction in crop productivity usually results in less income for farmers, increased prices for food, unemployment, and migration.

Drought is one of the most serious disasters in lots of Asian and Asian countries, such as Kenya, Pakistan, China and Mongolia etc. For example, in 2002, the sudden and great decrease of the livestock number occurred and the pasture condition in the whole of Mongolia became extremely worse than that in 2001 and 2003 because of severe drought in 2002.

Drought is also associated with increases in insect infestations, plant disease, and wind erosion. Droughts may cause problems with insects, diseases to forests and biodiversity. Forest fires increase dramatically during periods of droughts.

7. Policy-relevancy & Links to Policy & International Assessments/Conventions on Global Change

We have been continually faced by drought hazard for a long time. Needless to say, drought relates to the social economics and public concern directly. Policy makers in every country work hard in drought mitigation and more efficient water management. In this mitigation and adaptation processes, drought monitoring is the key bridge connected to the scientific research and decision making. This project, concretely our drought monitoring and research network will give great contribution not only to the research group, but also to the policy makes by improving the capability of drought monitoring techniques and studies through regional network of AWCI of GEOSS.

8. Publication and Dissemination

An activity or working paper on drought monitoring techniques and experiences in Asia is in our publication plan. It may be one of the series for GEOSS/AWCI publications.

9. Relationship to Global Change Research Programmes and Other Bodies

GEOSS/AWCI is an initiative under GEOSS, it matches the GEOSS social benefit areas, and it focus on the capacity building in Asian countries.

CEOP II is a water-energy research program under GEWEX/WCRP, CEOP II has 52 reference sites globally, and about 20 in Asia. CEOP also has a top-level data-management and quality check system that could be used by us.

Monsoon Asian Integrated Regional Study (MAIRS) is a ESSP integrated study program over monsoon Asia region. Water shortage over arid/semi-arid Asia is one of the key issues MAIRS interested in. AWCI will work with MAIRS on data exchange and drought studies.

Asian Monsoon Years (AMY) is new cross-cutting program of WCRP, AMY will promote a large-scale intensive experiment from 2008. AMY will support AWCI in data sharing and regional collaboration.

10. Related Work

Some countries need drought monitoring and early warning systems which mainly based on the drought index. There is no coordinated drought monitoring network in Asia by now. Our project tries to help and support one another for monitoring and studying the drought by ground-based and satellite observations and numerical model simulation, especially focus on the variability of soil moisture, through the network and regional collaboration of AWCI of GEOSS.

Appendix 1 **Timeline and Budget**

Project activities	Year 1 (2010/2011) From October 2010 to September 2011											
	1	2	3	4	5	6	7	8	9	10	11	12
Kick-off plenary meeting/GEOSS -AWCI meeting												
Data collection and building up the exchange network of Asian drought monitoring data												
Project meeting and scientific supporting team meeting of AWCI drought WG												
Ground-based data analysis												
GEOSS -AWCI meeting												
1st year progress report to APN												
Satellite data analysis and validation												
Numerical model simulation												
Report for Year 1												

Date/Venue	Event	Estimated No. of participants
5-6 October 2010: Tokyo (Japan)	Kick-off plenary meeting	20
January 2011: Chiang Mai (Thailand)	Project meeting and scientific supporting team meeting of AWCI drought WG	12
March 2011:Tokyo (Japan)	GEOSS AWCI meeting	50

Project activities	Year 2 (2011/2012) From October 2011 to September 2012											
	1	2	3	4	5	6	7	8	9	10	11	12
Plenary meeting/GEOSS -AWCI meeting												
Ground-based data analysis and building up monitoring and research network of drought												
Satellite data analysis and numerical model simulation products												
International workshop of drought/soil moisture												
Project meeting and scientific supporting team meeting of AWCI drought WG												
Preparation for training course												
GEOSS-AWCI meeting												
Training course in cooperation with AWCI drought WG												
1st year progress report to APN												
Drought mapping and early warning system analysis												
Summarizing results												
Final and financial report												

Date/Venue	Event	Estimated No. of participants
Late December 2011: Tokyo	International WS of drought/soil moisture	70
January 2012: Hiroshima (Japan)	Project meeting and scientific supporting team meeting of AWCI drought WG	10
March 2012: Tokyo (Japan)	Training course of AWCI drought WG	15
March 2012:Tokyo (Japan)	GEOSS AWCI meeting	50