

APN Project Report (Drought/CAPaBLE):

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

PL: Ichirow Kaihotsu (Hiroshima University)

Purposes

- To share and improve the drought monitoring capability in various Asian countries, such as Bangladesh, China, Nepal, Mongolia, Philippines, Pakistan, Thailand, and Vietnam.
- To set up a drought monitoring and research network in Asian countries.
- To assist development of early warning systems of drought hazards in the countries.

Co-workers

Rasul Ghulam: Pakistan Meteorological Department (PMD), Islamabad, Pakistan,
rasulpmd@gmail.com

Ailikun: Institute of Atmospheric Physics(IAP), China, ailli@mairs-essp.org

Davaa Gombo: Institute of Meteorology and Hydrology, Mongolia,
watersect@yahoo.com

Toshio Koike: Department of Civil Engineering, University of Tokyo,
tkoike@hydra.t.u-tokyo.ac.jp

Mafizur Rahman: Bangladesh University of Engineering and Technology,
Bangladesh, mafiz@agni.com

Shiv Sharma: Department of Water Induced Disaster Prevention, Nepal,
shiv1301@gmail.com

Flaviana DeLeon Hilario: Philippine Atmospheric, Geophysical and Astronomical
Services Administration, Philippine, fhilario@pagasa.dost.gov.ph

Thada Sukhapunphan: Royal Irrigation Department, Thailand,
thada999@yahoo.com

Duong Van Khanh: Central Hydro-meteorological Forecasting Center of HMS of
Vietnam, Vietnam, khanhnhms@yahoo.com

Hiroyuki Iwasaki: Faculty of Education, Gunma University,
iwasaki@edu.gunma-u.ac.jp

Osamu Ochiai: JAXA, ochiai.iosamu.@jaxa.jp

Akihiko Kondoh: Chiba University, kondoh@faculty.chiba-u.jp

What and how did we do?

- 1) Drought definition study
- 2) Building a data bank and data analysis for sharing and improving drought monitoring capabilities with Exchanging the data and information
- 3) Setting up monitoring and research network of drought
- 4) Developing an early warning system of drought hazard
- 5) Holding a workshop and training courses for Asian scientists and operators

Results

1) Drought definition

Various definitions using in Asian countries

China: Using/studying drought indices Standardized Precipitation Index (SPI), Palmer Drought Severity Index (PDSI), Crop Moisture Index (CMI), Surface Water Supply Index (SWSI) and Drought Frequency Index (DFI).

Vietnam: Two ways to estimate drought index:

- a) Estimate a drought year as one with rainfall deficit > 20%;
- b) Estimate a drought year with water balance K (Dry index – the ratio of evaporation to rainfall).

$$K(n) = E(n)/R(n)$$

En: amount of Piche evaporation in calculated period (n),

Rn: rainfall amount in calculated period (n).

K index	$K < 0.5$	$0.5 \leq K < 1.0$	$1.0 \leq K < 2.0$	$2.0 \leq K < 4.0$	$K \geq 4.0$
Drought level	Very humid	humid	slightly dry	moderate dry	very dry

2) Data sharing

Data bank

Folder name of data	Period	Target country/area	Others
SM MON	2006–2011	Mongolia	4 AWS
SM NAMHEM	2006–2011	Mongolia	More than 30 stations
SM SHANXI	2006–2009	China	More than 100 stations
SM PAKISTAN	2002–2009	Pakistan	4 stations
SM BD	2007	Bangladesh	9 stations
MET VEIT	2008–2009	Vietnam	3 stations
MET MON	2006–2011	Mongolia	4 AWS

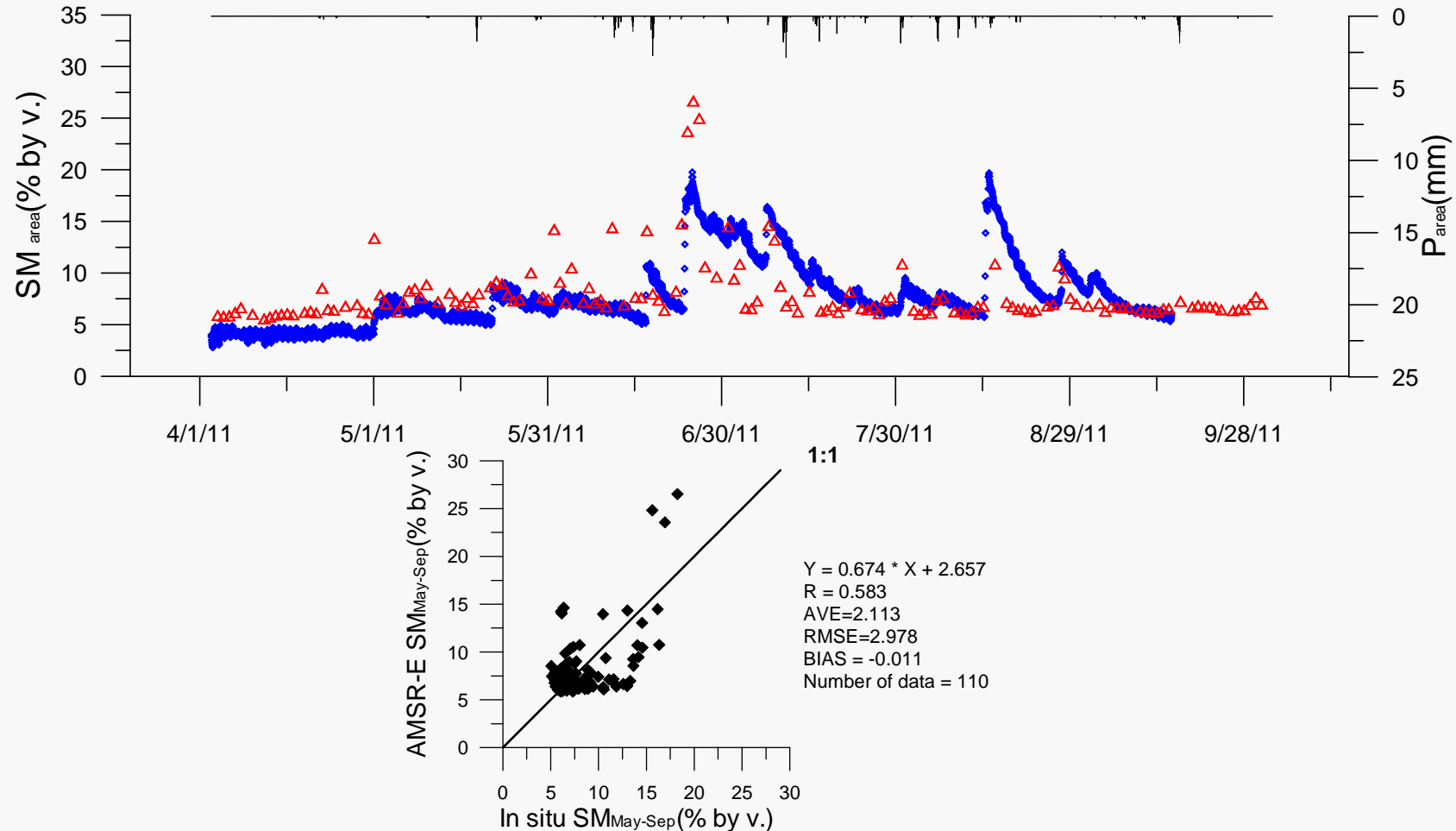
(Contact: kaihotu@hiroshima-u.ac.jp).

Satellite data (AMSR-E SM data):

<<https://gcom-w1.jaxa.jp>>

Using the obtained data

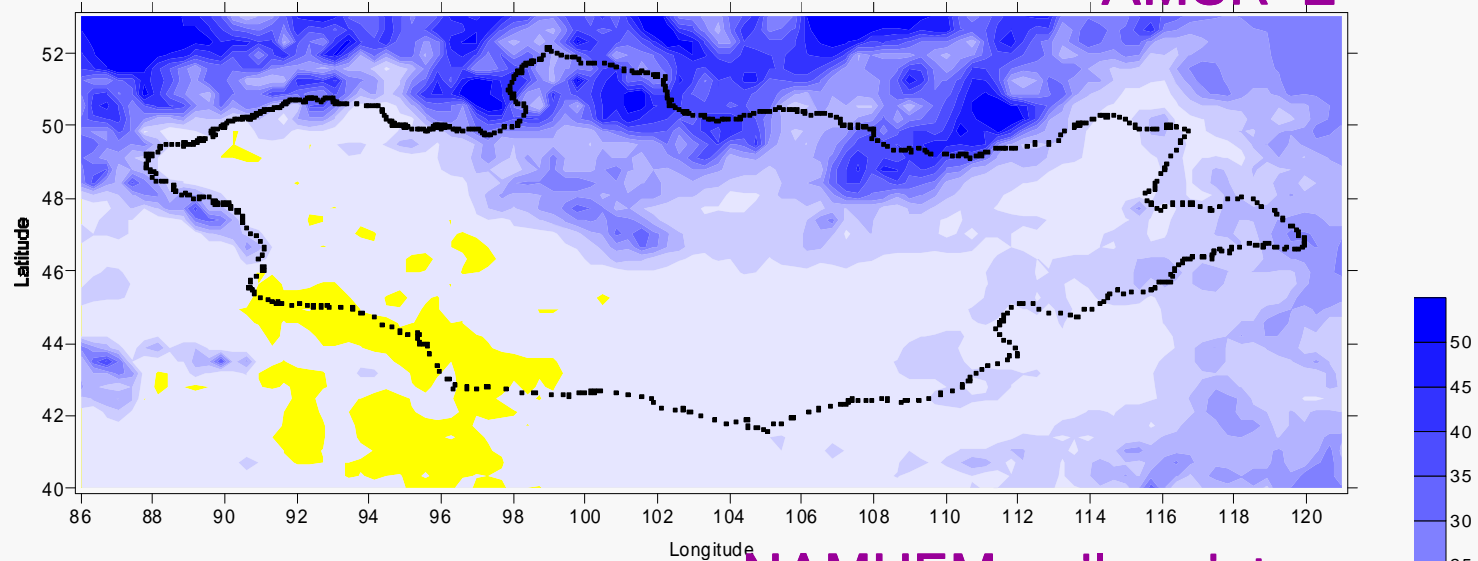
M1 - AMSR-E descending
- In situ 3:00



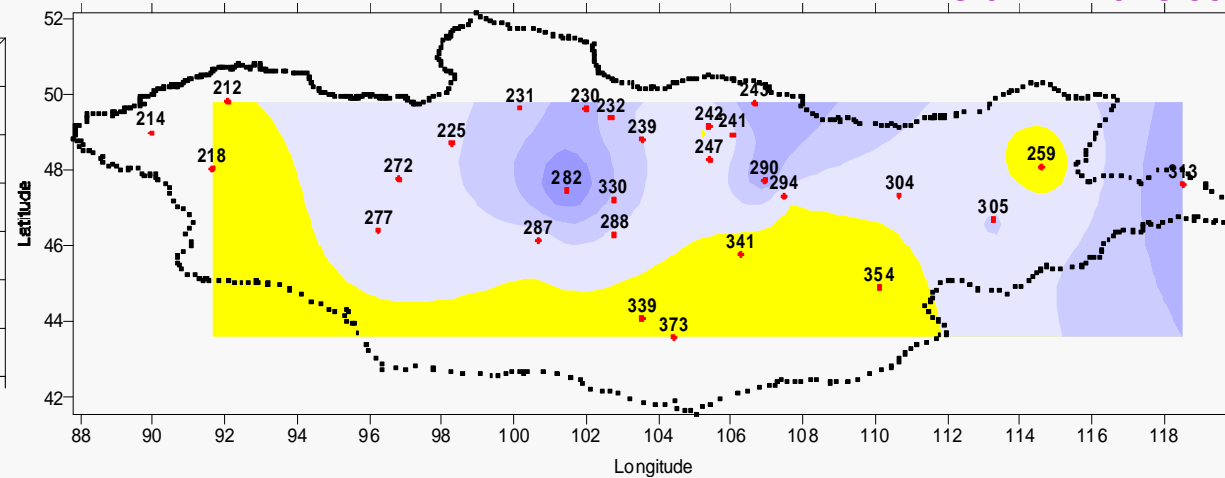
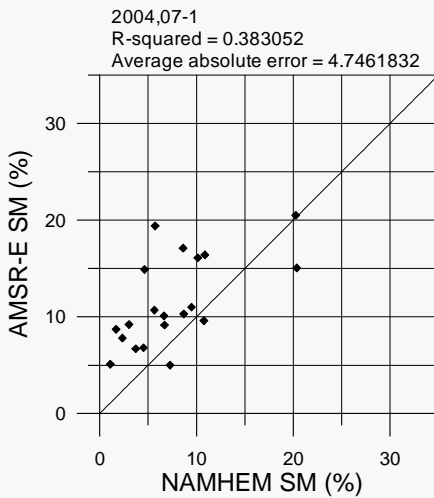
Comparison results of soil moisture of in situ (In-situ) with AMSR-E (Descending) in 2011

Early-July 2004

AMSR-E



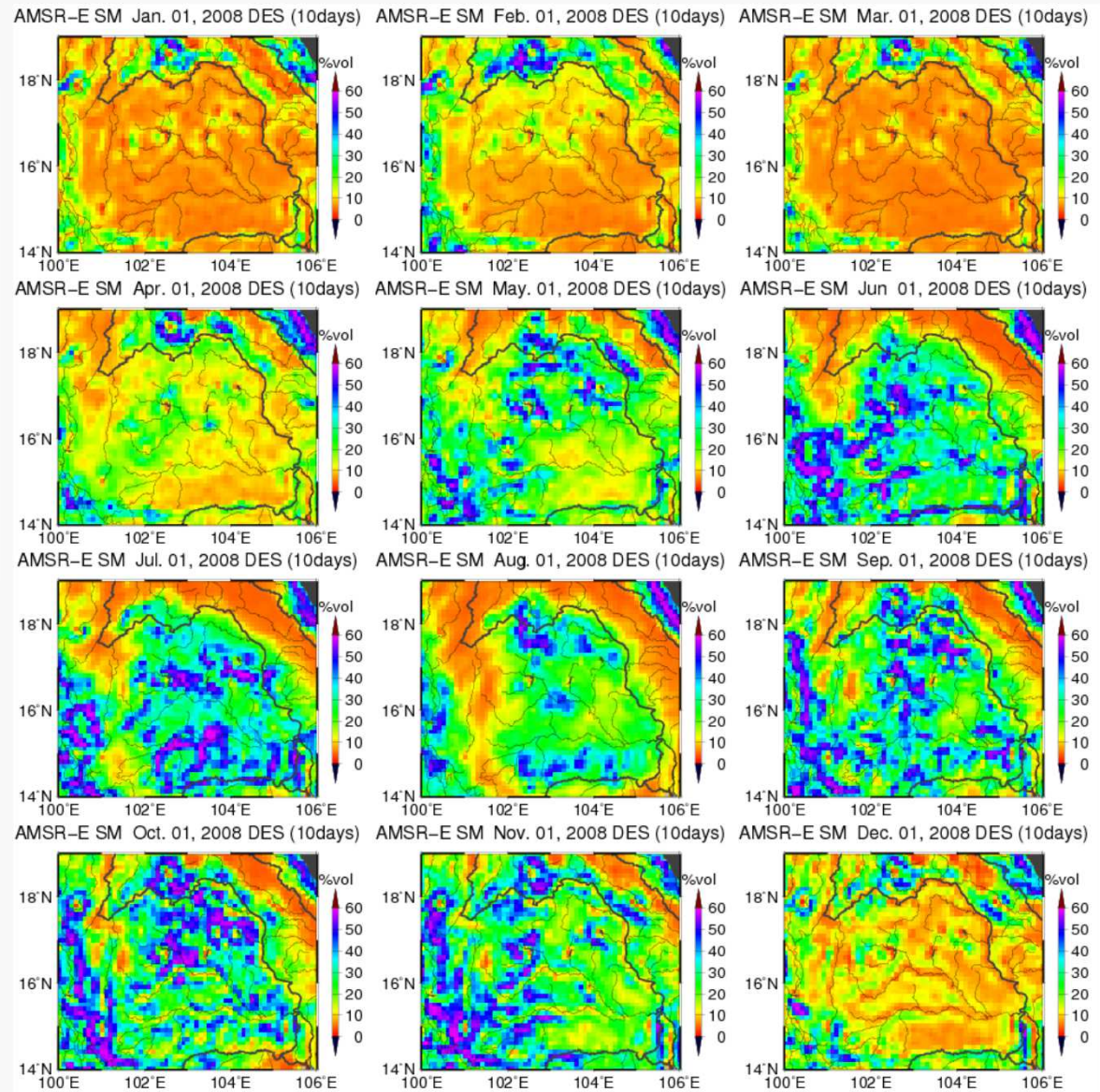
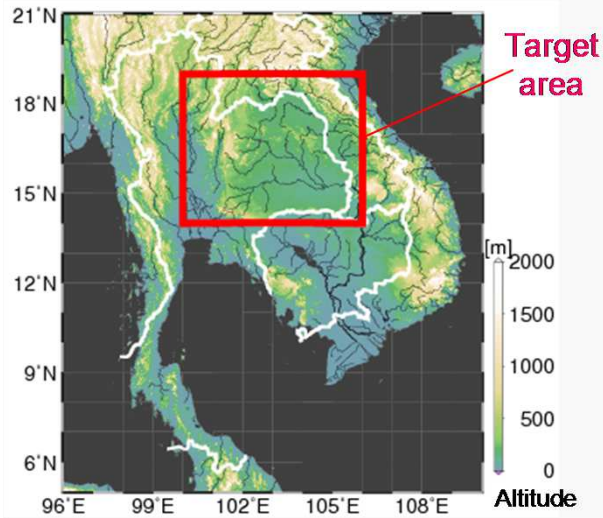
NAMHEM soil moisture



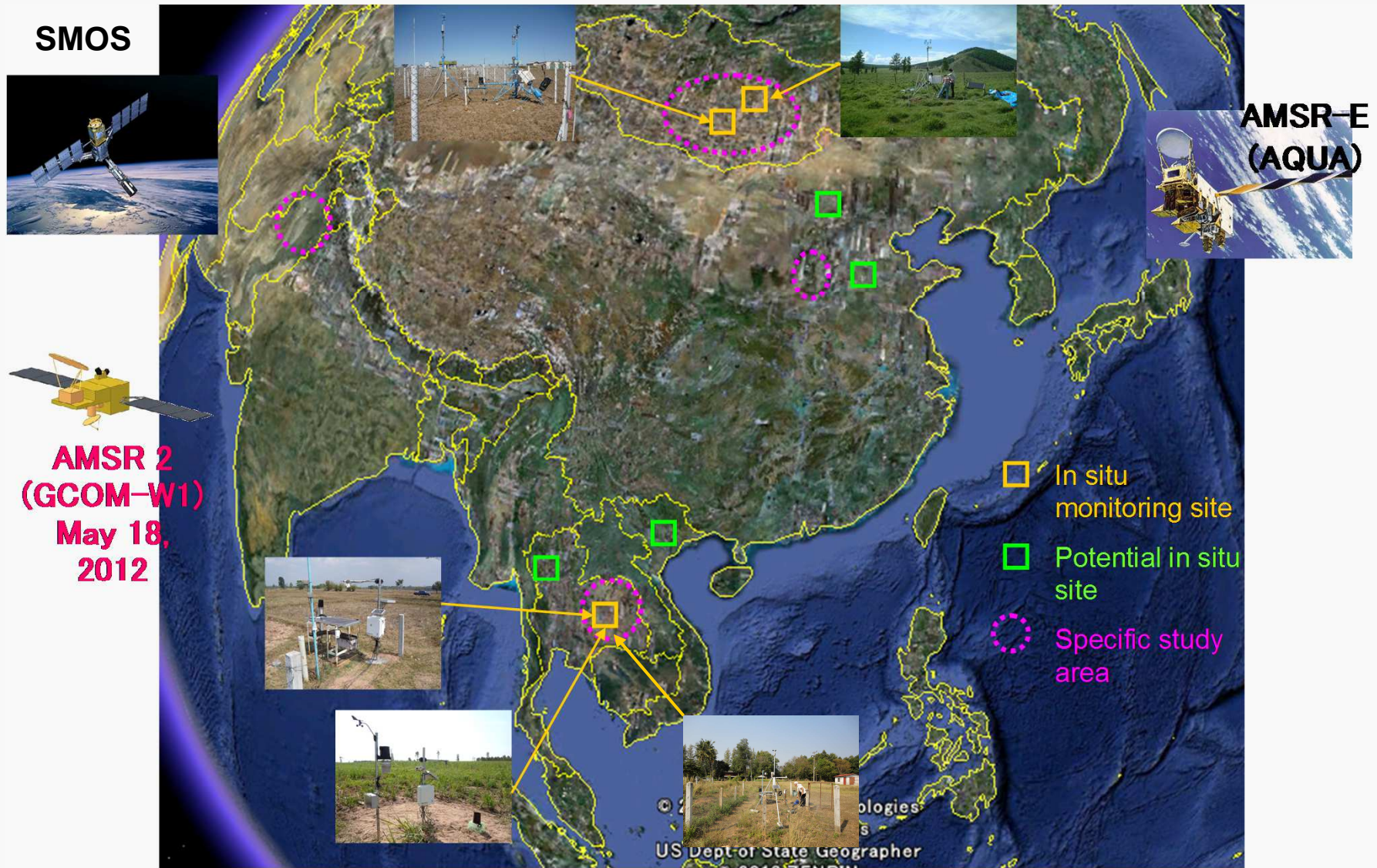
SM(%)

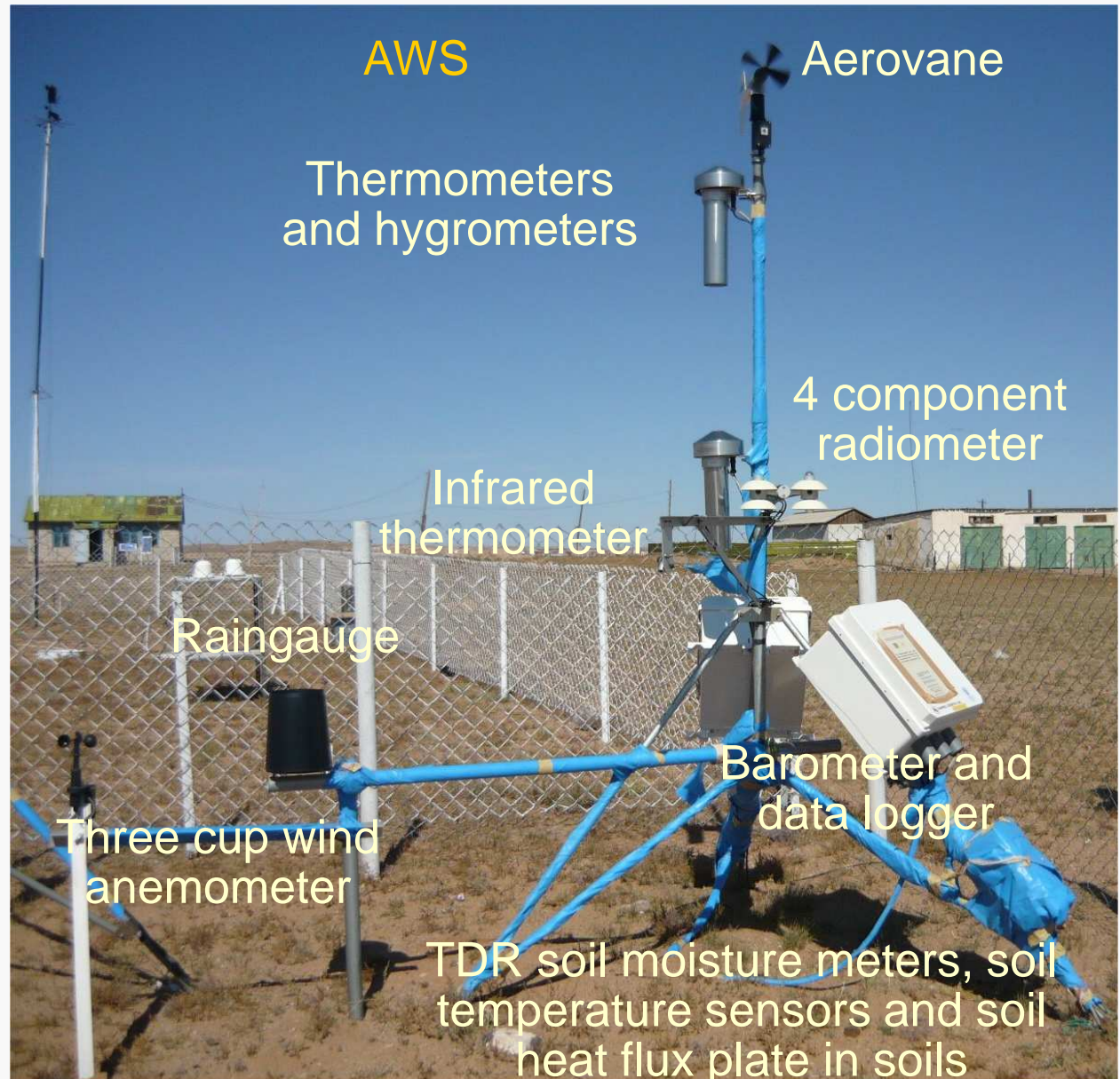
Comparison of AMSR-E estimation with NAMHEM soil moisture at the 0-5 cm depth in early-July in 2004

3) Data analysis (AMSR-E SM analysis)

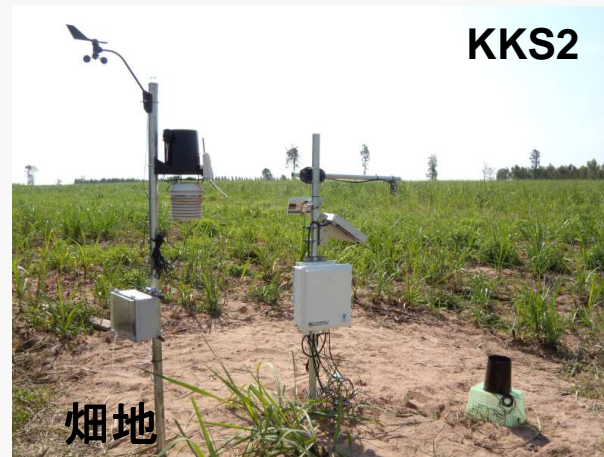
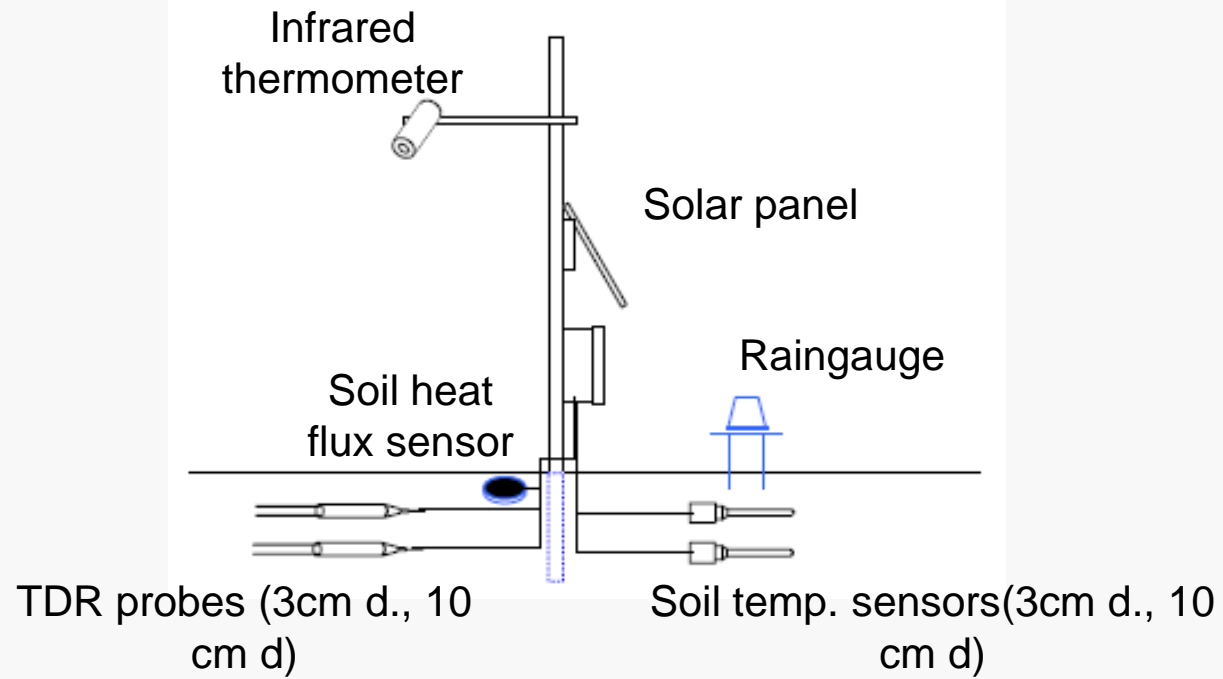


4) Drought monitoring and research network



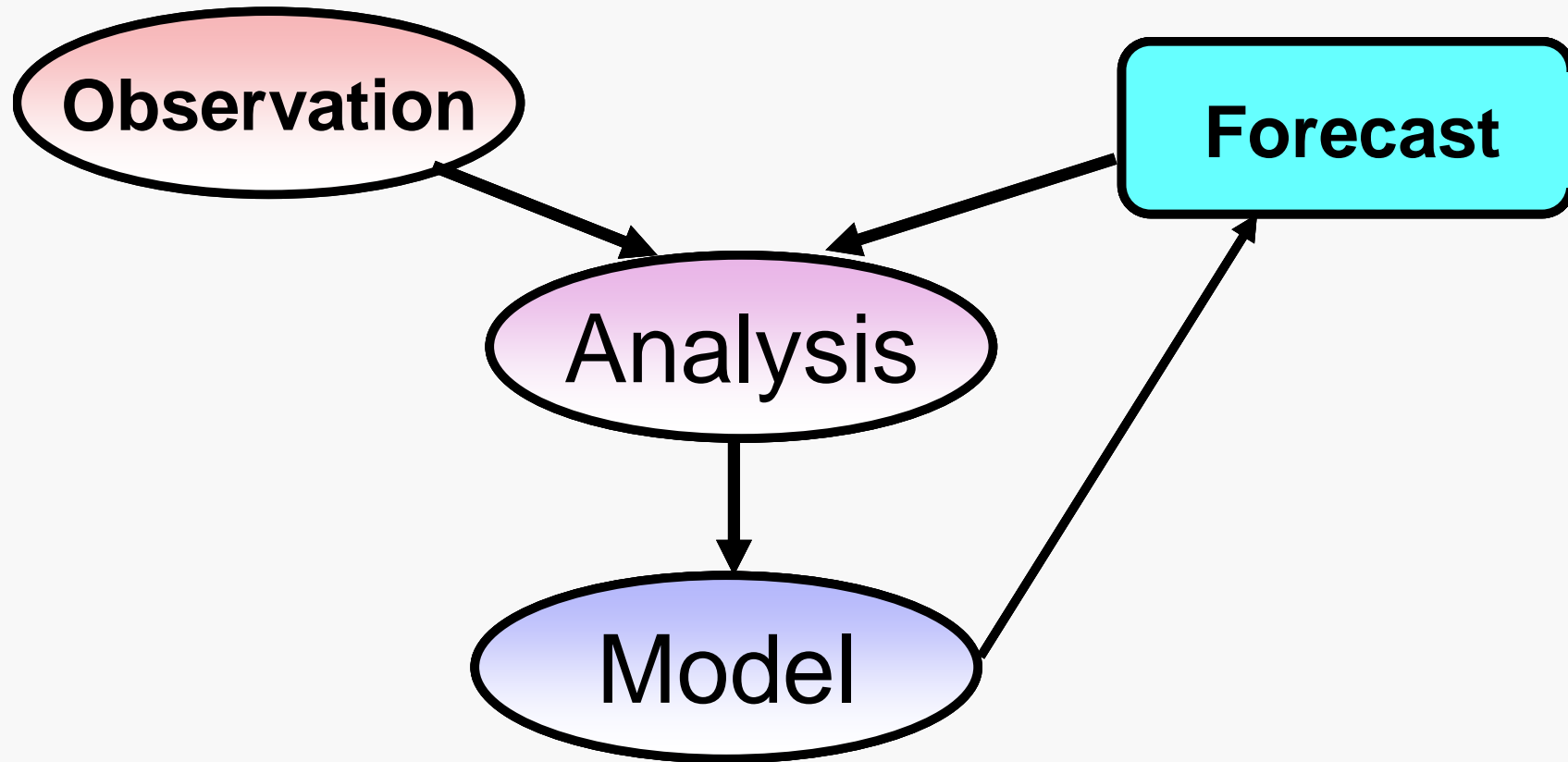


In situ monitoring of water cycle in the MAVEX study area in Mongolia

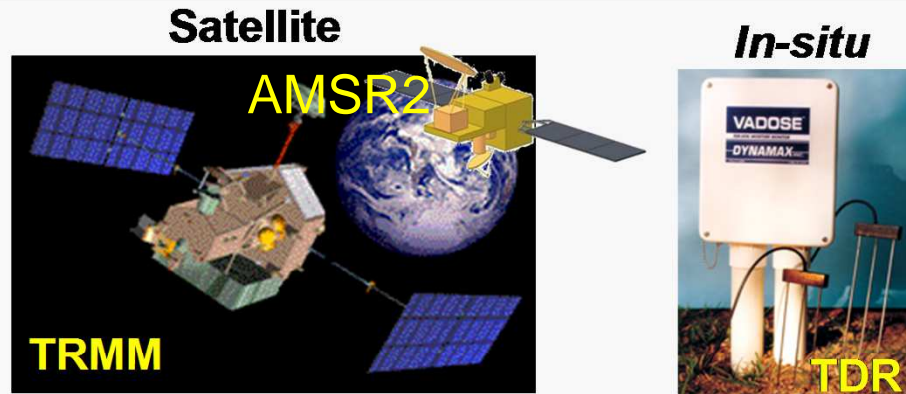


地上検証用土壌水文ステーション (ASSH-T)

5) Developing an early warning system of drought hazard

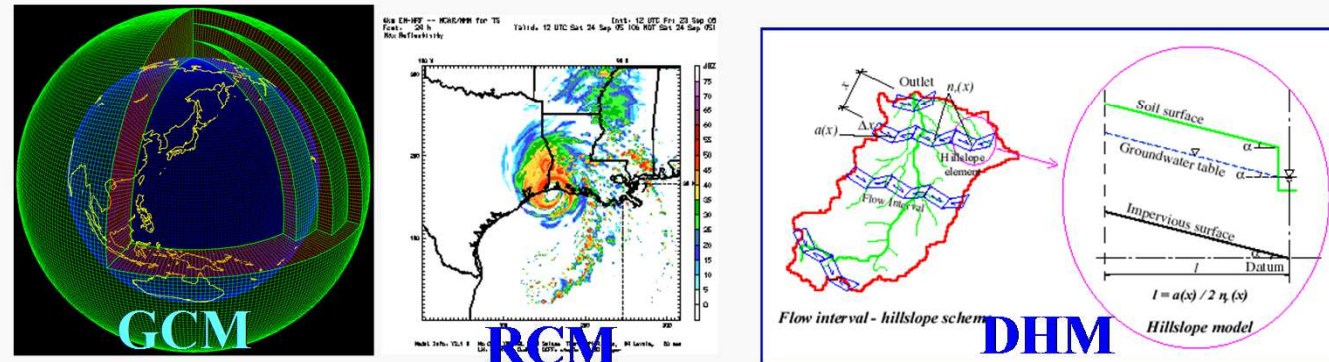


Observation



+

Modeling



6) Workshop and training courses

Asia Drought Workshop 2011 (For APN CAPaBLE project (CBA2010-14NMY-Kaihotsu)) Tokyo Office of Hiroshima University (Room 408#, Campus Innovation Center, Shibaura, Tokyo: Jan. 20, 2011

Training courses

- The GEOSS Asian Water Cycle Initiative (AWCI) Training Course for the Climate Change Assessment and Adaptation (CCAA) Study, The University of Tokyo, Hongo Campus, Tokyo, Japan 11 – 12 March 2011
- A Training Course on Analysis Techniques for APN/AWCI Drought Studies, Tokyo Office of Hiroshima University Jan. 11 – 12, 2012

Workshop

Asia Drought Workshop 2011 (For APN CAPaBLE project
(CBA2010-14NMY-Kaihotsu)) Tokyo Office of Hiroshima University
(Room 408#, Campus Innovation Center, Shibaura, Tokyo: Jan. 20,
2011



**•A Training Course on Analysis Techniques for APN/AWCI
Drought Studies, Tokyo Office of Hiroshima University Jan. 11 – 12, 2012**



Data books of WS and Training Course

Data book of Asia Drought Workshop 2011 sponsored by APN

Asia Drought Workshop 2011

Edited by the Executive Committee of Asia Drought
Workshop 2011

January, 2011



Conclusions

- Data bank
- In situ - satellite monitoring and research network of drought
- An early warning system of drought hazards in the countries
- Workshop and training courses for learning the results studied in this project

□ Dr. Rasul Ghulam's APN CAPaBLE project (2 years: FY 2012-2013) :

“Impact of Climate Change on Glacier Melting and Water Cycle Variability in Asian River Basins”