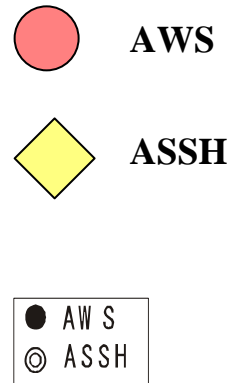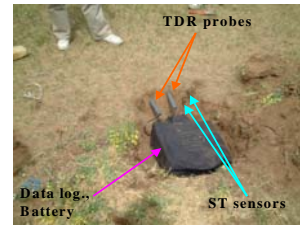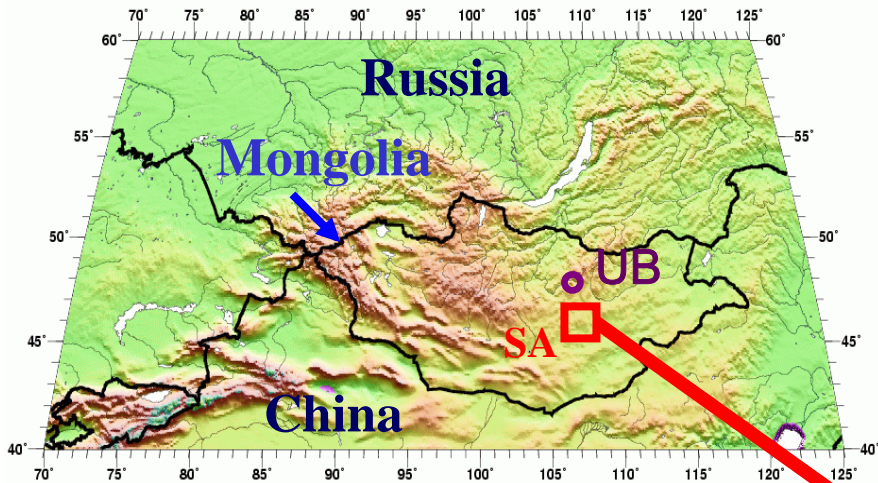# Current Status of Soil Moisture Monitoring by AWS/ASSH in Mongolia and Its Data Analysis

Ichirow Kaihotsu (Hiroshima University)

1. Current monitoring results by AWS and ASSH

2. Calibration and checking the soil moisture measurement accuracy

3. Soil physical parameter analysis

4. Available data for AMSR-E validation

5. Summary and research plans in FY 2007

AWS

ASSH

Aerovane
Thermometer
Hygrometer
Infrared thermometer
Data logger
Barometer
Three cup wind anemometer
TDR probes
ST sensors in the soil
Rain gauge
Net radiometer

TDR probes
Data log.,
Battery
ST sensors

AWS in BTS

ASSH

● AWS
◎ ASSH

Working stations in the MAVEX (Mongol AMSR/AMSR-E/ALOS Validation Experiment) study area in June, 2006（ ）:AWS （ Automatic Weather Station), : ASSH （ Automatic Station for Soil Hydrology) , SA ： Study area of MAVEX (AMPEX), UB: Ulaanbaatar)

DRS

DGS

BTS

TDS (NASA USDA)

MGS(Mandalgobi station)
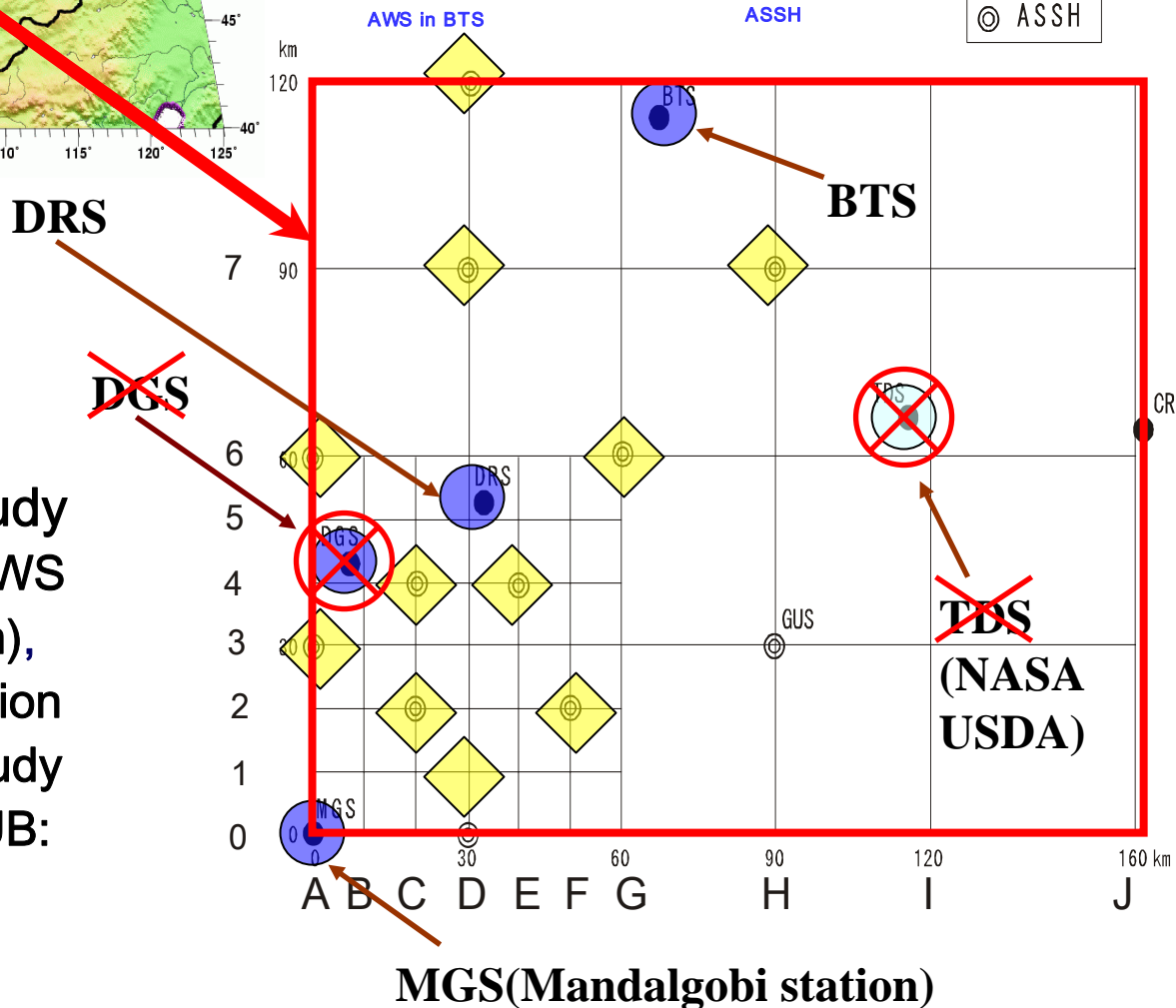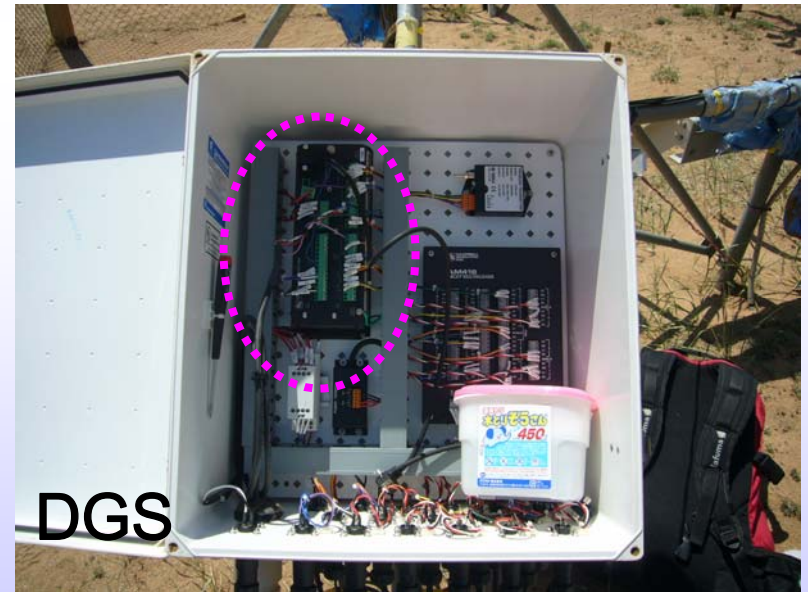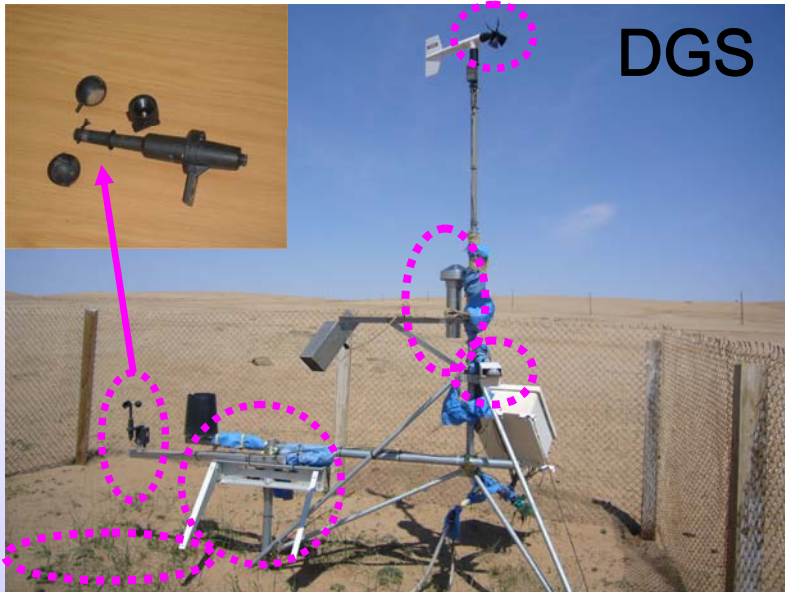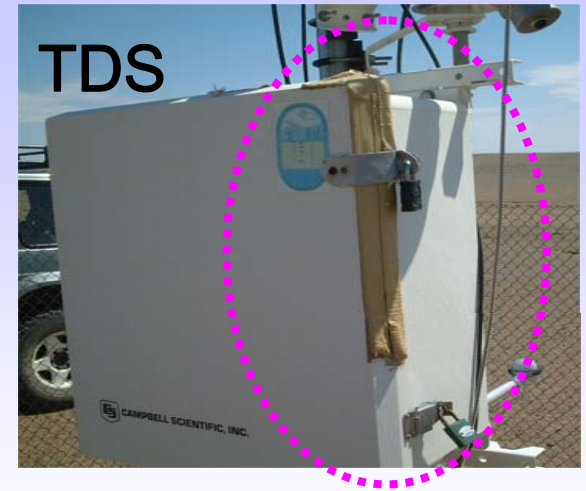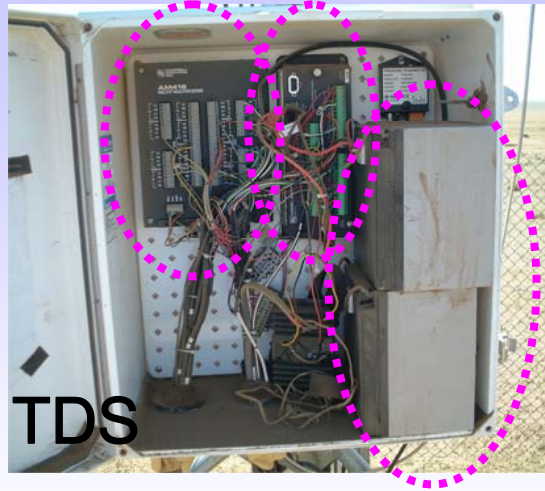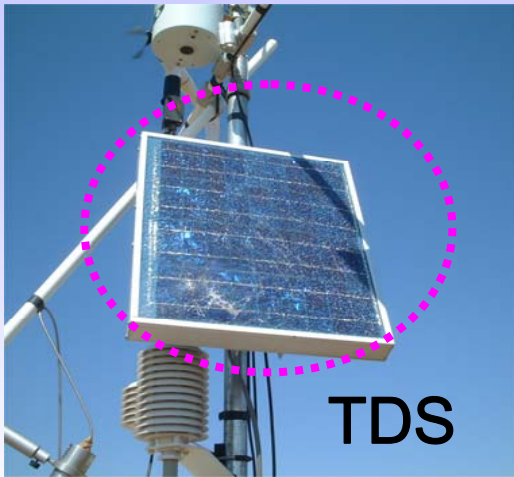
AWS at TDS and DGS in June 2006

Mandalgobi Site   Sep 2005~June 2006

Latest data of AWS at MGS (Sep.2005-June 2006)

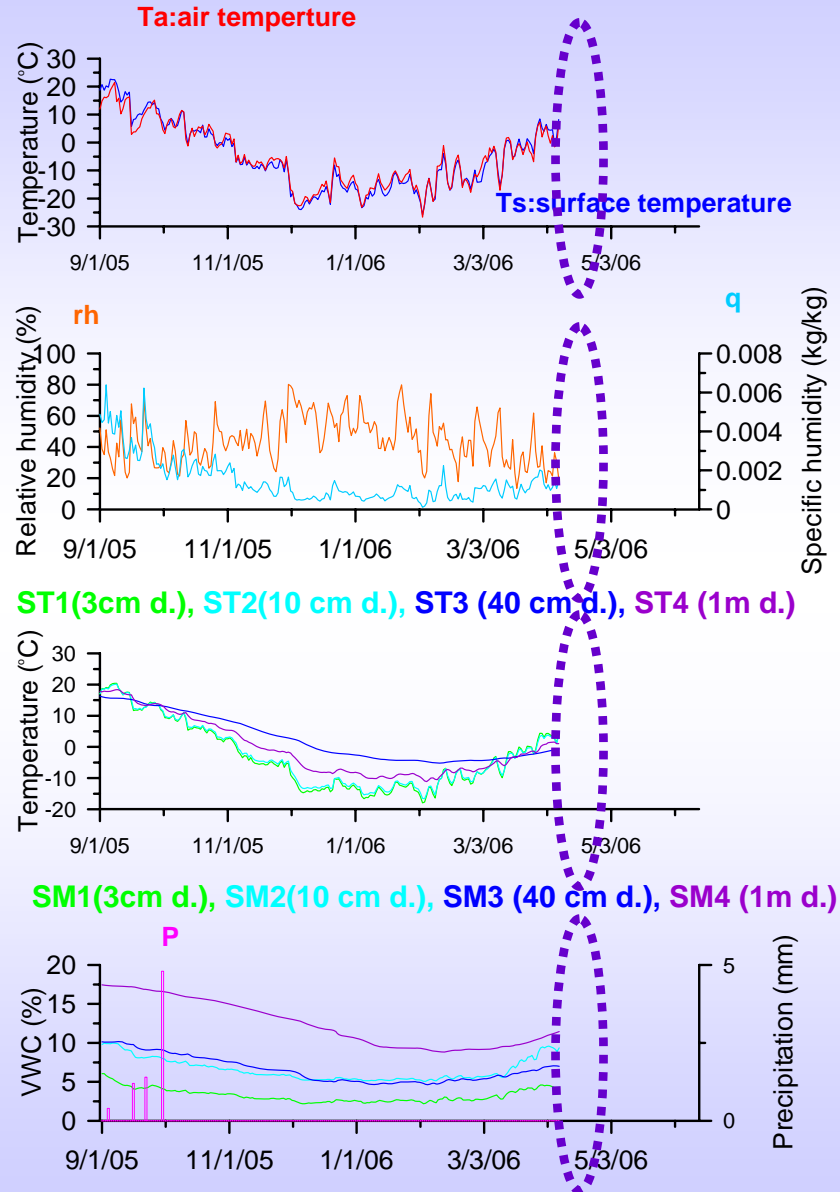# Calibration and error test of TDR probes

(GWC/SSM:gravimetric water content, ITSM:water content measured by TDR-IT)

Before installation of probes

Basic calibration in glass beads column

↓

Probe error test in glass beads column

↓

Probe error test using site soils in laboratory

During monitoring with replacement of probes

2000

(Upper plot: AWS TRIME-TDR volumetric water content (%) vs GWC(%))

IT12474
SSM = 0.9918 * (ITSM) - 0.2835
R^2 = 0.986993

+ 0.4 %

+ 1.6 %

IT12472
SSM = 0.9902 * (ITSM)- 1.4962
R^2 = 0.981135

(Lower plot: SSM (in volume:%) vs ITSM (in volume:%))
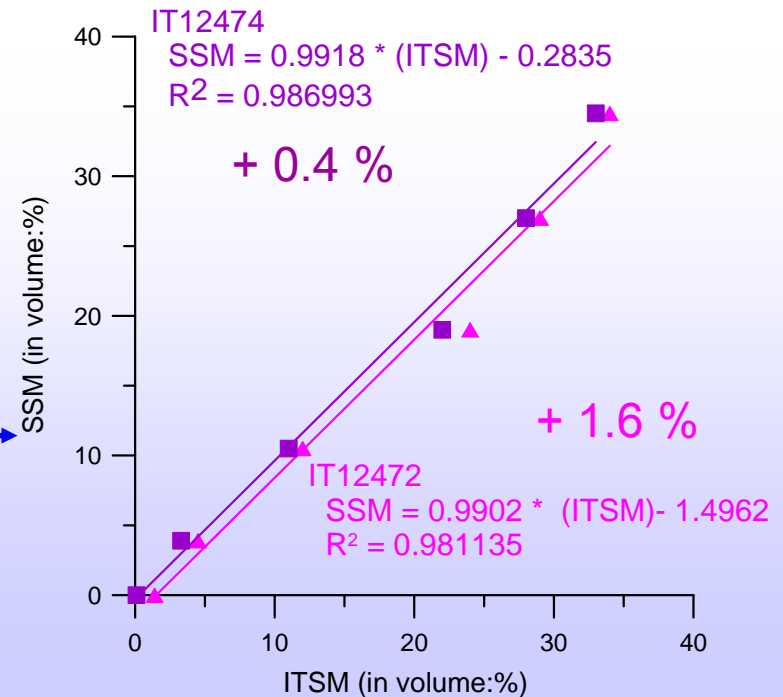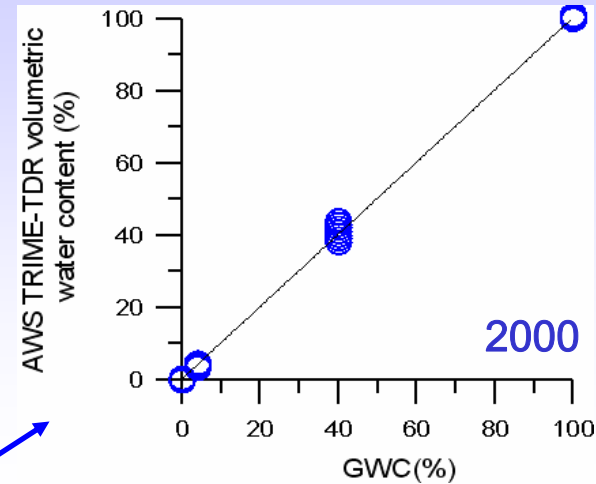
Water Budget method

Comparison of soil moisture change ΔS with rainfall amount ΔR during rainfall infiltration in the early stage with no surface runoff and evapotranspiration

→ checking the accuracy of TDR soil moisture measurement at the 3 cm depth
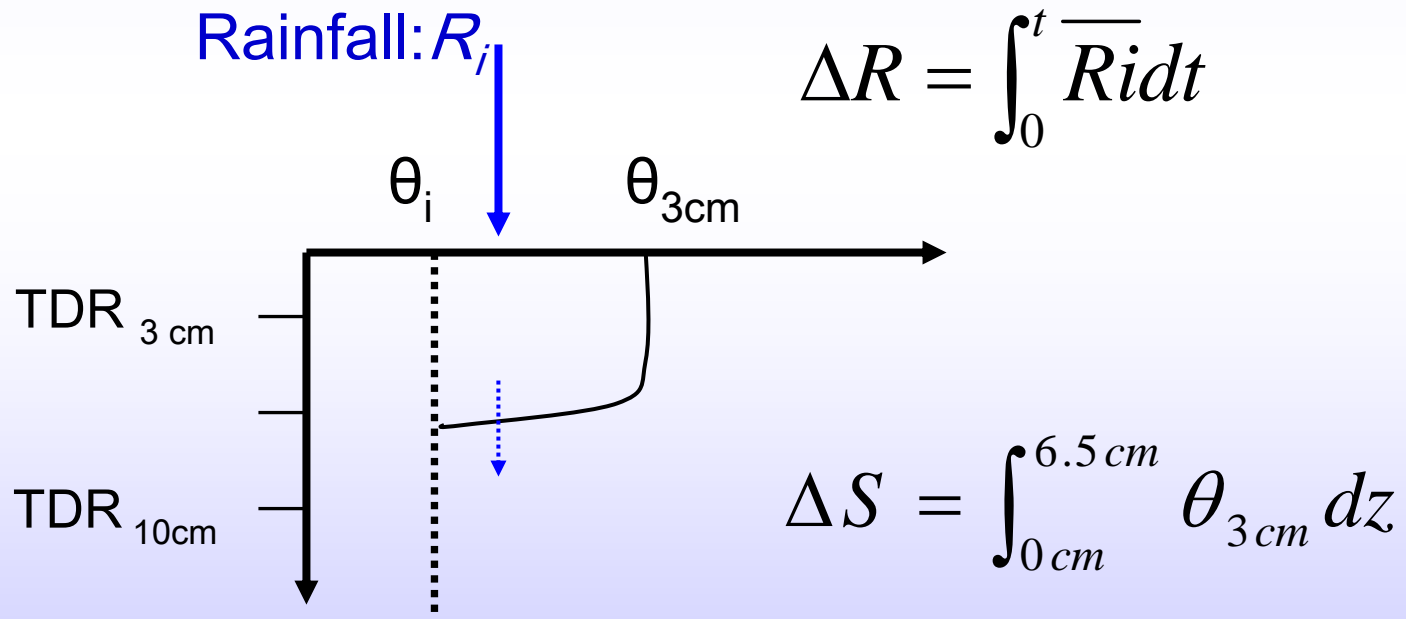
$$\Delta R \cong \Delta S$$

Rainfall: R_i

$$\Delta R = \int_0^t \overline{Ri} \, dt$$

θ_i θ_{3cm}

TDR $_{3\,cm}$

TDR $_{10cm}$

$$\Delta S = \int_{0\,cm}^{6.5\,cm} \theta_{3\,cm} \, dz$$
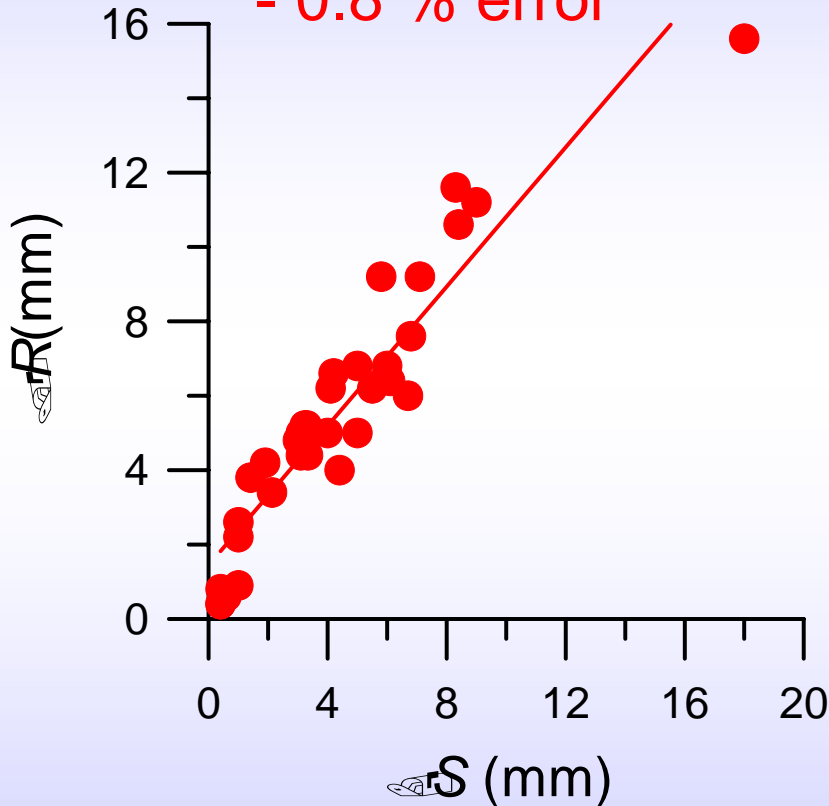
t: time

θ : volumetric water content

θ_i : initial volumetric water content before rainfall after several fine da

MGS
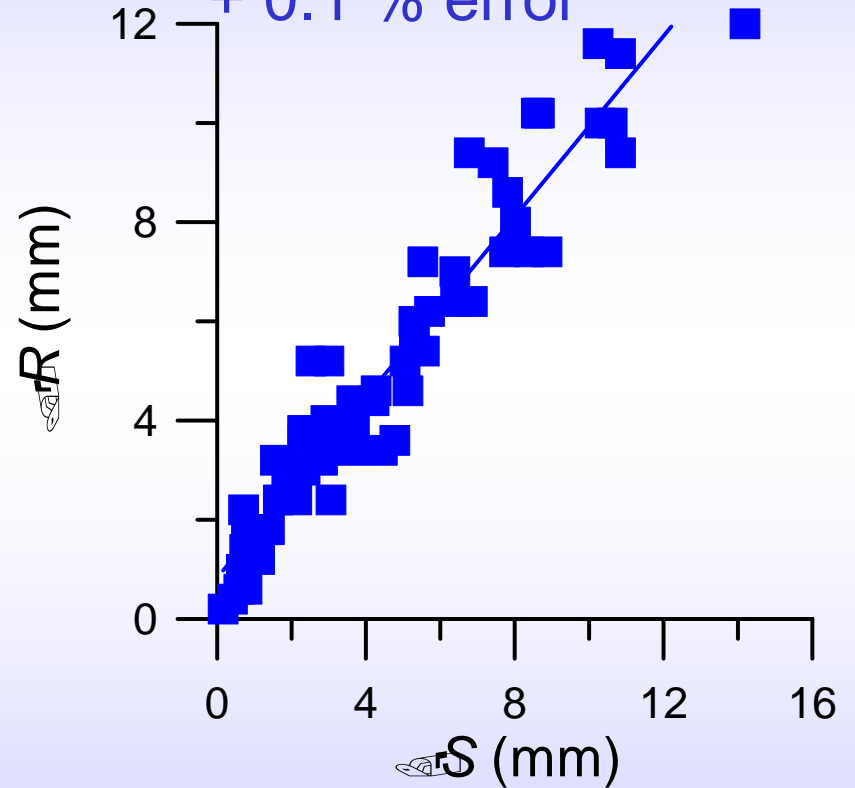
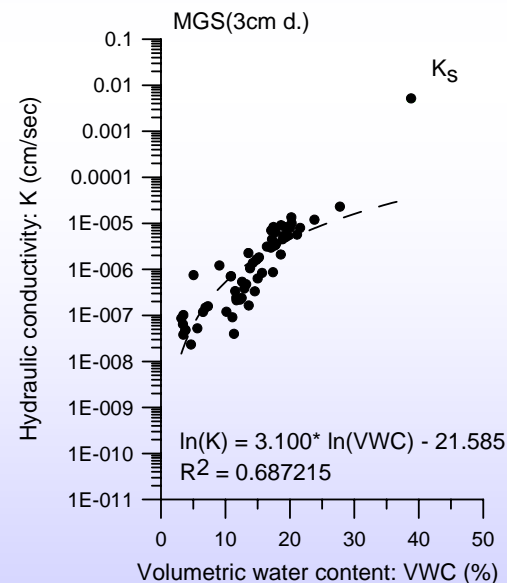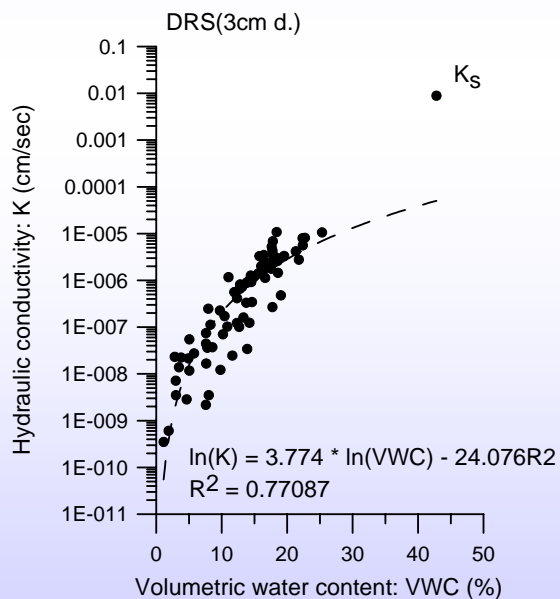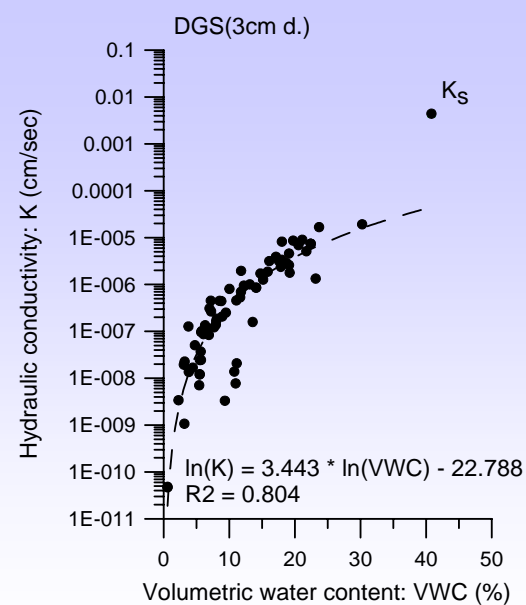$\Delta R = 0.9362 * (\Delta S) + 1.4473$

$R^2 = 0.8809$

- 0.8 % error

DRS

$\Delta R = 0.9097 * (\Delta S) + 0.8307$

$R^2 = 0.9167$

+ 0.1 % error

Relationship between soil moisture change ΔS and rainfall amount ΔR

BTS(3cm d.)

Hydraulic conductivity: K (cm/sec)

K_S

$\ln(K) = 2.203 * \ln(VWC) - 19.665$
$R2 = 0.639$

Volumetric water content: VWC(%)

DGS(3cm d.)

Hydraulic conductivity: K (cm/sec)

K_S

$\ln(K) = 3.443 * \ln(VWC) - 22.788$
$R2 = 0.804$

Volumetric water content: VWC (%)

DRS(3cm d.)

Hydraulic conductivity: K (cm/sec)

K_S

$\ln(K) = 3.774 * \ln(VWC) - 24.076 R2$
$R^2 = 0.77087$

Volumetric water content: VWC (%)

MGS(3cm d.)

Hydraulic conductivity: K (cm/sec)

K_S

$\ln(K) = 3.100 * \ln(VWC) - 21.585$
$R^2 = 0.687215$

Volumetric water content: VWC (%)
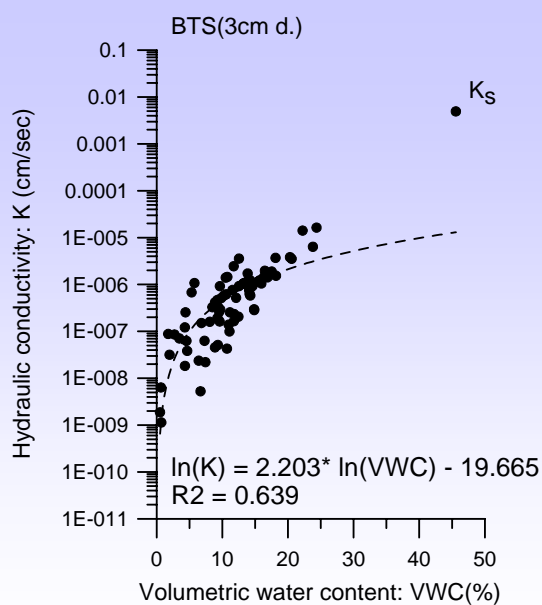
Unsaturated hydraulic conductivities of AWS site soils
(3 cm depth), Ks: saturate hydraulic conductivity

Available ground truth data in 2005/2006

> Processed monitoring data of AWS/ASSH

・ AWS and ASSH data from June 2001 to June 2006

(We have been opening all processed/revised data from October 2003 to December 2004 at the CEOP web site [www.ceop.net] as CEOP I data.)

> Unsaturated hydraulic conductivities of AWS site soils

> Vegetation data at MGS in 2005（April to September)

・ plant cover and plant water content, type of emerged plant

> Routine data of soil moisture by stations of NAMHEM (Natural Agency for Meteorology, Hydrology and Environment monitoring in Mongolia) in 2002 and 2004

Summary and research plans in FY 2007

- Good monitoring by AWS and ASSH in 2005-2006
- Finish of monitoring at two AWS sites (DGS and TDS)
- High accuracy data of ground-based soil moisture measurement
- Unsaturated hydraulic conductivities of AWS site soils
- Vegetation data at MGS in 2005 and routine data of soil moisture by NAMHEM stations
- Continuing monitoring by AWS and ASSH
- Revised data set (CD/DVD) of all the data obtained
- Making efforts for replacement of data loggers and other instruments with new ones
- More accuracy check tests (in laboratory and field tests)