# Long-term monitoring results by water cycle stations in the study area of AMPEX-AMSR/AMSR-E

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## Introduction

To obtain the match up data for validation of new satellite sensors (AMSR and GLI) of ADEOS II and AQUA and to grasp the real conditions of water cycle in the Mongolian plateau, long-term monitoring by many water cycle stations started in 2000 in the study area where is located in 250 km southwest of Ulaanbaatar as shown in Fig.1.

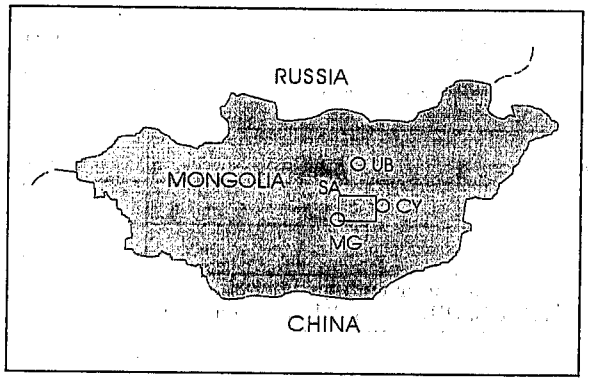


Fig. 1 Study area : SA (UB:Ulaanbaatar, MG:Mandalgobi, CY:Choyr)

## Method

The size of the study area is 120 km by 160km. The soil surface is almost covered with grass and small shrubs. The study area was in the inner drainage basin[1)] in Mongolia and some lakes and ponds are seen at random. According Geomorphologic maps, the range of altitude in the study area is approximately from 1300s m to 1500s m. The annual precipitation is between 100 mm and 200 mm[2)].

Fundamental meteorological and hydrological elements by four AWS (Automatic Weather Stations) and twelve ASSHs (Automatic Stations of Soil Hydrology) have been monitoring since summer in 2000 and June in 2001, respectively. Tables 1 and 2 present measurement elements of AWS and ASSH, respectively. The four AWS were installed in Mandalgobi site (MGS), Delgetsogt site (DGS), Deren site (DRS), and Bayantsaagan site (BTS) and ASSHs were perfectly set in the soil at measurement points with the density of the 20 km-30km intervals.

## Results and discussion

Figure 3 presents the AWS monitoring results at MGS from August in 2000 to September in 2001 as an example. Same seasonally changes in the monitoring results were seen in the other sites.

The monitoring results at all AWS sites from August in 2000 to September in 2001 showed that the mean value of annual precipitation was about 104 mm, air temperature varied widely from 36.3 ℃ to - 37.2 ℃, the mean annual air temperature was 1.2 ℃, and the mean annual volumetric water content of soil at the 3 cm depth was 4.7 %. There occurred highly relative humidity in winter and the lowest one in May. The snow fell a little in winter. The commencement of freezing and melting of soil at all AWS sites were seen in March and November, respectively.

Figure 4 suggests that neither of spatial distributions of soil moisture at the 3 cm and the

Table 1 Measurement elements of AWS

| Component | Instrument | Measurement point(m) | | | | |
|---|---|---|---|---|---|---|
| | | MGS | DRS | DGS | BTS | TDS |
| Air temperature | Ventilated platinum resistance thermometer | 1.6 | 1.5 | 1.5 | 1.5 | 2.0 |
| Relative humidity | Ventilated capacitance humidity sensor | 1.6 | 1.5 | 1.5 | 1.5 | 2.0 |
| Wind speed 1 | Propeller anemometer with wind vane | 3.2 | 3.1 | 3.2 | 3.15 | 3.2 |
| Wind speed 2 | 3 cups | 1 | 1 | 1 | 1.2 | - |
| Wind direction | Wind vane | 2.5 | 2.4 | 2.45 | 2.4 | 3.2 |
| Surface temperature | Infrared radiation thermometer | 1.5 | 1.4 | 1.45 | 1.45 | 1.8* |
| Net radiation | Net radiometer | 1.5 | 1.4 | 1.4 | 1.5 | 1.1 |
| Heat flux in the soil | Soil heat flux plate | -0.1 | -0.1 | -0.1 | -0.1 | -0.05 |
| Soil temperature 1 | Platinum resistance thermometer (TDS: thermistor) | -0 | -0 | -0 | -0 | -0.05 |
| " 2 | " | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |
| " 3 | " | -0.4 | -0.4 | -0.4 | -0.2 | -0.2 |
| " 4 | " | -1 | -1 | -1 | -0.4 | -0.5 |
| " 5 | " | - | - | - | - | -1 |
| Soil water content 1 | TDR sensor (TDS:ADR sensor) | -0 | -0 | -0 | -0 | -0.05 |
| " 2 | " | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |
| " 3 | " | -0.4 | -0.4 | -0.4 | -0.2 | -0.2 |
| " 4 | " | -1 | -1 | -1 | -0.4 | -0.5 |
| " 5 | " | - | - | - | - | -1 |
| Precipitation | Tipping bucket rain gauge | 1.15 | 1 | 1.05 | 1 | 3.0 |
| Air pressure | Barometer | 1.1 | 1 | 1.1 | 1.1 | 1.7 |
| Solar radiation | Pyranometer | - | - | - | - | 2.8* |
| | * installed points | Measurement time interval :10 min (MGS, DRS, DGS, BTS), 60 min TDS) | | | | |

Table 2 Measurement elements of ASSH

| Component | Instrument | Depth (m) | Time interval of measurement (min) |
|---|---|---|---|
| Soil temperature 1 | Platinum resistance thermometer | -0.03 | 60 |
| " 2 | " | -0.1 | 60 |
| Soil water content 1 | TDR sensor (TRIME ) | -0.03 | 60 |
| " 2 | " | -0.1 | 60 |

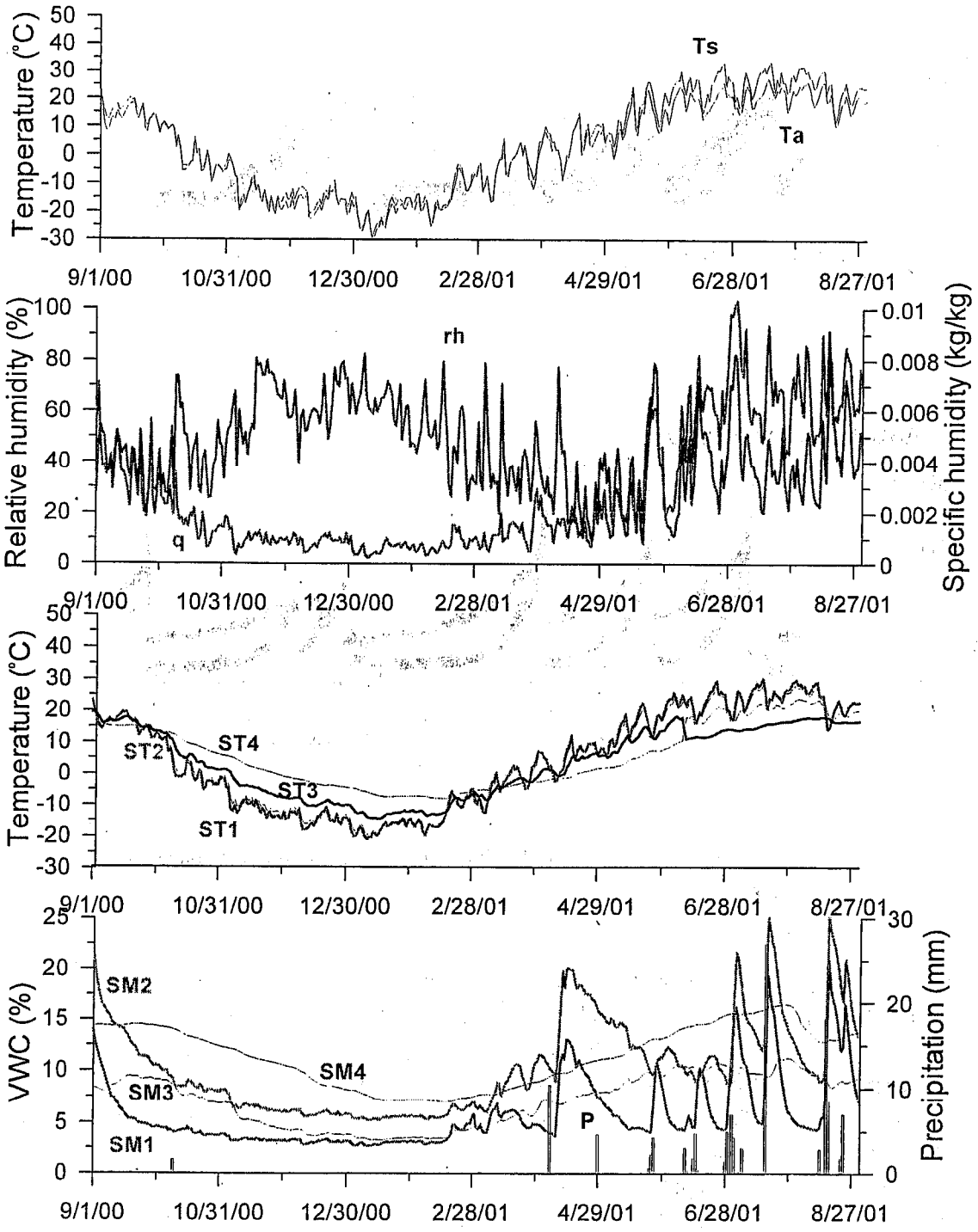


Fig. 3 Monitoring results at MGS (Mandalgobi site) (Ts: surface soil temperature, Ta: air temperature, rh: relative humidity, q: specific humidity, st: soil temperature, P: precipitation, sm: soil moisture in volumetric water content; VWC)

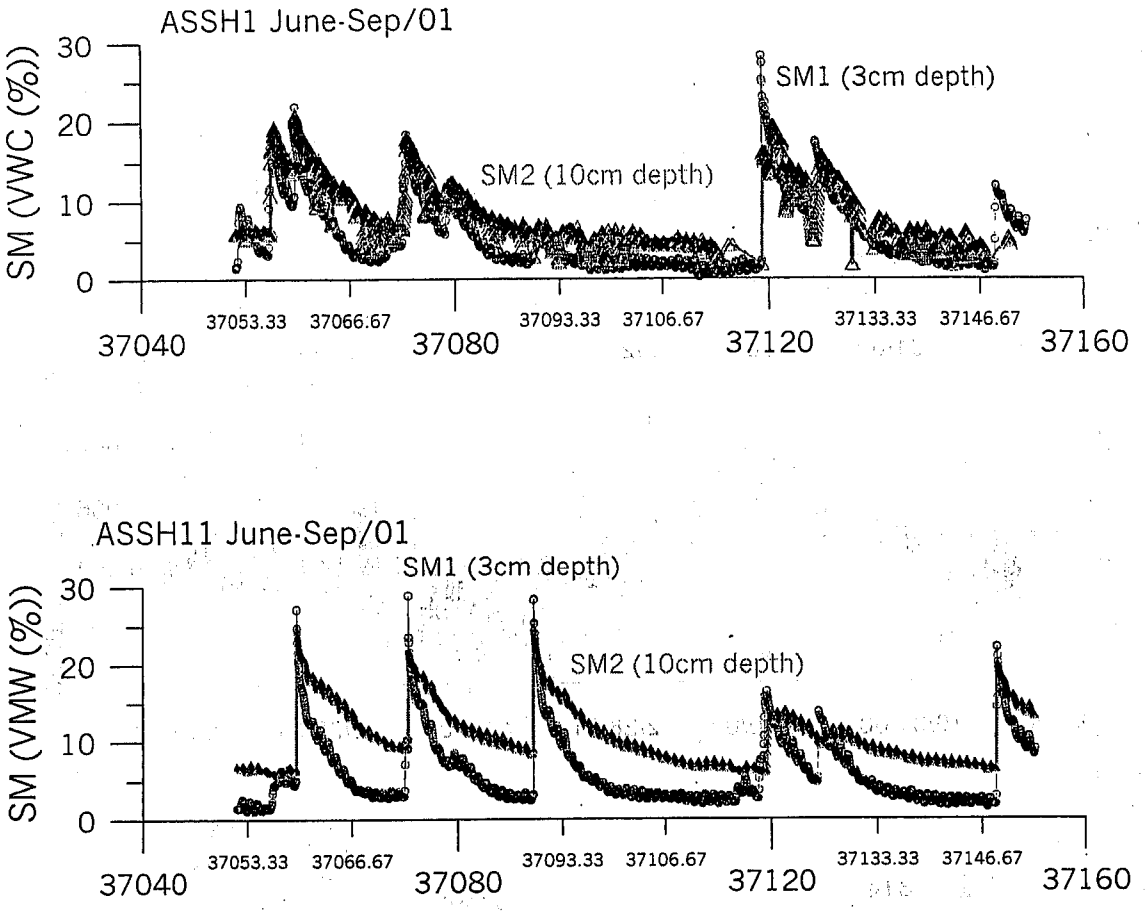


Fig. 4 Monitoring results at ASSH 1 and 11 from mid-June to mid-September in 2001.

10 cm depths in the study area was monotonous and homogeneous. This figures show two examples of the ASSH monitoring results. Although there are a few rapid increases of soil moisture at the 3 cm depth in both figures of Fig. 4, they can be considered to be response to rainfall.

The appearance pattern of the rapid increase was a little different by ASSH (Fig. 4). This fact suggests that there were some local circulations of water in the study area.

A trial calculation of the annual evapotranspiration from mid-June to mid-September in 2001 by a water balance method showed to be less than 90 % of the mean annual precipitation except BTS result.

**References**

1) Batima Punsalmaa and Dagvadorj Damdin: Climate changes and its impacts in Mongolia, JEMR Pub., 227p., 2000.

2) National Statistical Office of Mongolia: Mongolian Statistical Yearbook, 301p., 2001.

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