Isotopic Analysis to Study Hydrological Processes in Mongolia

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1. Understanding of water/mass cycle processes using isotopes

The objectives of Isotope Group (IG) of *RAISE* project are to elucidate not only fluxes of hydrological cycle but also hydrological flow path and residence time by using isotopes including ^{2}H, ^{3}H, and ^{18}O. In particular, integrated measurements of isotopic compositions in precipitation, surface water, subsurface water and atmospheric water vapor are carried out. The strategy and concept of the IG are shown in Fig. 1. Based on these approaches, the origin of precipitation, surface water, subsurface water and atmospheric water vapor should be determined, and also interrelationship among each kind of water would be clarified. Also, soil and surface runoff (abrasion) are observed, and the discharged soil is sampled for ^{137}Cs analysis to investigate the source of the soil runoff. The sampling and measurement items of IG are summarized in Fig. 2.

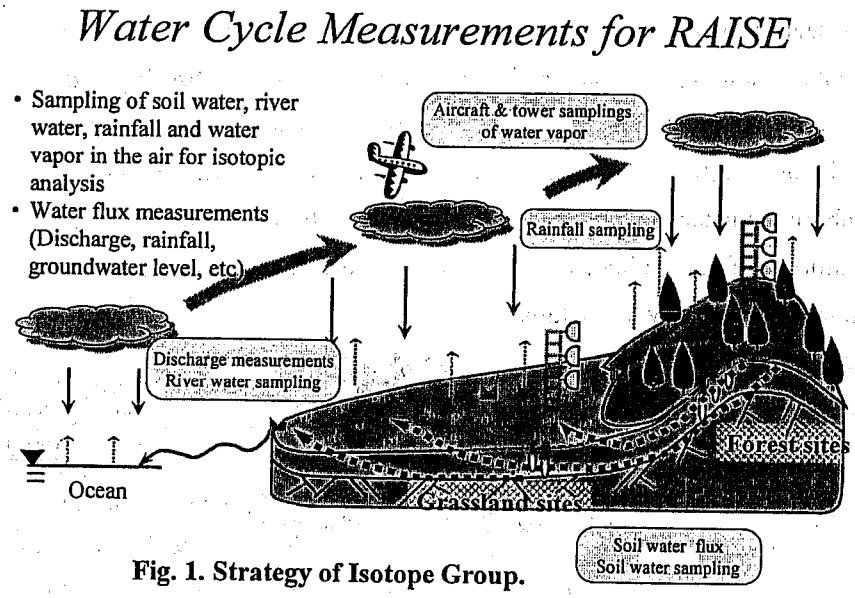

Fig. 1. Strategy of Isotope Group.

Stable isotope of water has been used as effective tracer for hydrological cycle study for recent 20 years. However, the variation of stable isotope itself in the water along with hydrological cycle has not been enough investigated previously. Especially, there are not enough information on the isotopic compositions in soil water and atmospheric vapor. We are also focusing the formation processes of isotopic compositions in precipitation, soil, ground,

stream and vapor waters in the *RAISE* project.

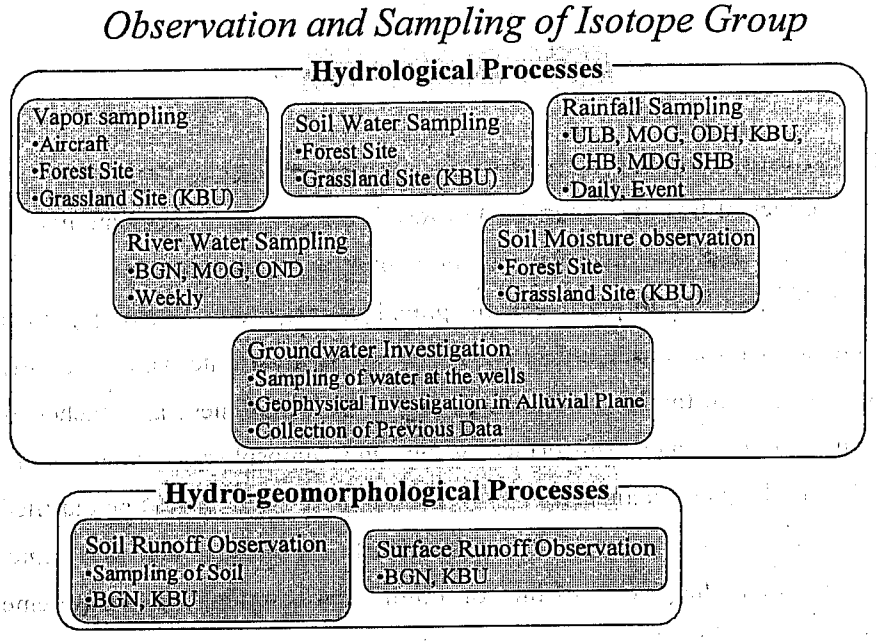

Fig. 2. Observation and sampling items of Isotope Group.

2. Understanding of hydrological cycle in the East Asia semi-arid region

Collection of precipitation samples is done over the whole study area (the locations of precipitation sampling are shown in Fig. 3). River water, subsurface water and atmospheric water vapor samples are collected at both grassland area (Kherlenbayan-Ulaan) and mountainous forest area (Mongonmorit). Multi-level water vapor sampling within the atmospheric boundary layer and free atmosphere will be conducted using an airplane. Isotopic compositions of the collected water samples are determined by mass spectrometer in a laboratory in University of Tsukuba.

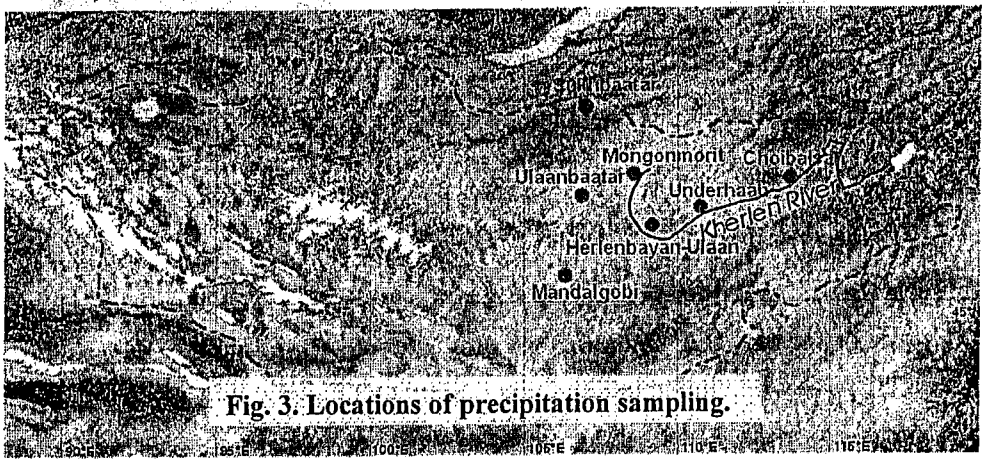

Fig. 3. Locations of precipitation sampling.

In addition to the isotopic measurements, surface runoff and subsurface water flow are

investigated by means of physical methods at Baganuur and Kherlenbayan-Ulaan. This hydro-geomorphological approach is performed in the hillslope. A protected areas from the animals are set in the hillslope and comparison of abrasion from the protected area and un-protected area is conducted.

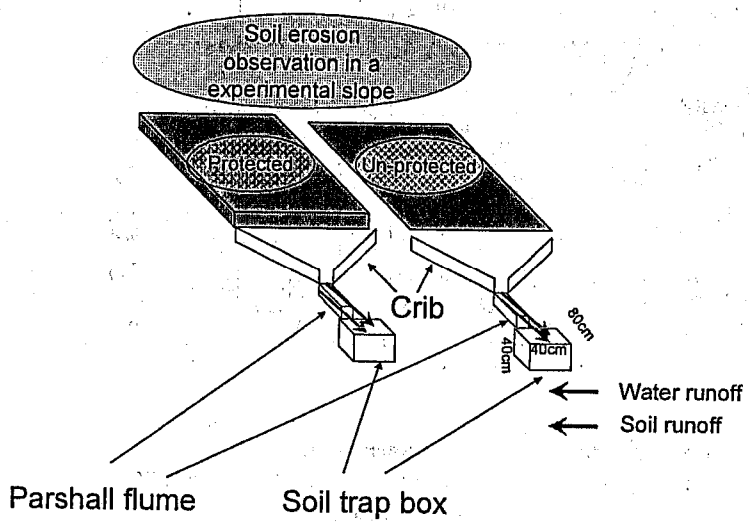

Fig. 4. Concept of soil and water runoff (abrasion) observations.

3. Modeling of hydrological cycle and isotopic variation

A model to represent hydrological cycle and isotopic variation is developed. This model is incorporated in the meso-scale atmosphere model (Group 4) and distributed hydrological model (Group 5) and is utilized to estimate accurate residence time and to predict future hydrological changes.

4. Activities of IG in 2002

Main activities of IG in 2002 are summarized below.

- Determination of intensive observation sites.
- Groundwater and surface water investigation in Kherlen River basin.
- Test flight of aircraft sampling with Group 1.

The spatial distribution of sampling locations for groundwater, stream water and spring water is shown in Fig. 5. The depth of groundwater table ranges from 0.5 to 5 m, and electrical conductivity ranges from 200 μS/cm to 800 μS/cm with some exceptions. The stable isotopic analyses on the sampled water are on going, so the data would be presented at the workshop.

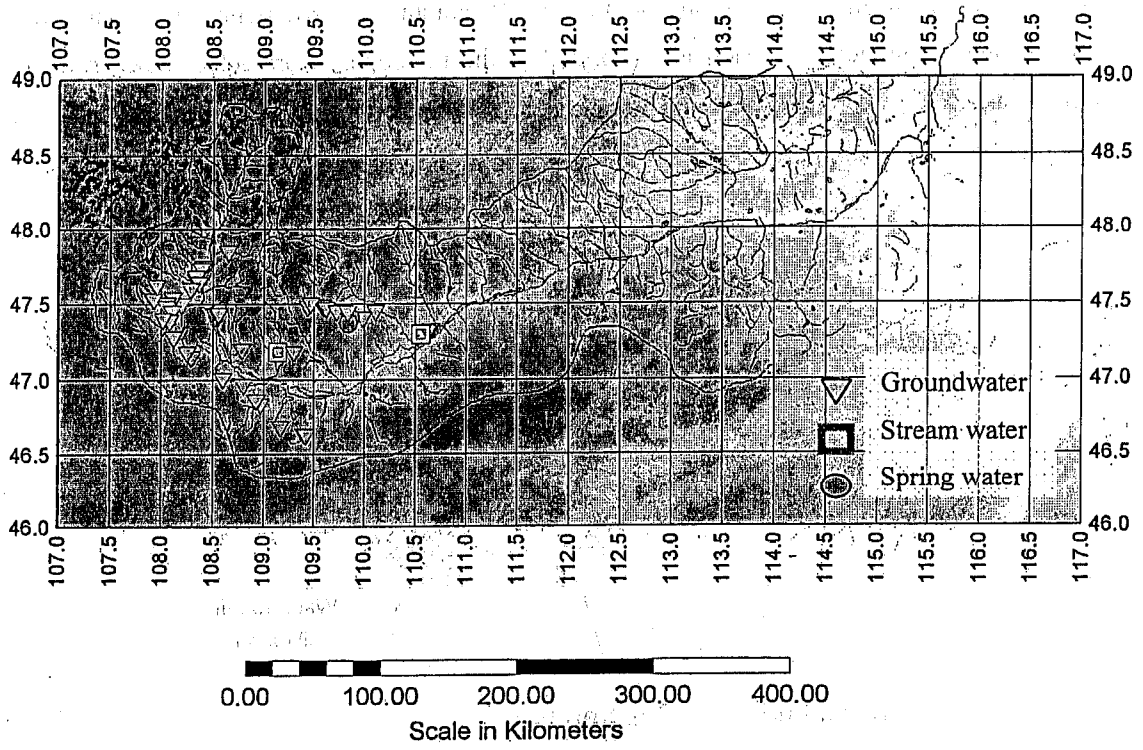

Fig. 5. Location of groundwater, stream water and spring water samplings (June – August, 2002).