

Japan Academy Prize to:

Toshisuke MARUYAMA

President,
Ishikawa Prefectural Universityfor “Water Demand-Supply Analysis in Large
Spatial Areas Based on Evapotranspiration
and Runoff”*Outline of the work:*

Irrigation and drainage science based on hydrological cycles of the Earth is important for the management of water shortages or excesses to promote agricultural productivity. Understanding the material circulation of water, its input, and change in storage and output in a given hydrologic region is essential for solving the environmental problems in various sectors of society. Research on the hydrological cycle is fundamental not only to irrigation and drainage but also to the environmental problems as it affects various types of materials distributed throughout a river basin.

Dr. Toshisuke Maruyama's pioneering work in the field of water demand-supply analysis has been most valuable. He has conducted extensive research in large spatial areas based on evapotranspiration and runoff, with a primary focus on rice fields in Japan and elsewhere.

Understanding the evapotranspiration process is important in establishing standards for water resource planning, irrigation, and drainage. As a pioneer in establishing the “short-period water-balance method,” which estimates seasonal evapotranspiration on a basin scale, he was able to clarify the extent of evaporation and transpiration in several hydrologic basins in Japan. In addition, Dr. Maruyama introduced the “complimentary relationship” theory, which postulates that the summation of potential evaporation and actual evapotranspiration remains constant. The reliability of this theory is proven by a heat balance method. Basin scale evapotranspiration can be estimated by this short-period water-balance method without using seasonal evapotranspiration coefficients.

Research on basin runoff phenomena, the relationship between rainfall and discharge, have been major issues in the planning of water resources, irrigation, drainage and disaster prevention. Dr. Maruyama proposed the establishment of the “weighted-statistical unit hydrograph method” which can estimate long-term stream flow accurately under low water conditions. In addition to this, he has initiated research on comparative runoff analyses. This research was carried out by setting up a pair of test basins in Gojoyoshino, Nara Prefecture; one on reclaimed land, and the other in a natural mountainous area.

It was found that the flooding discharge that occurred in the reclaimed land was significantly greater than that found in natural mountainous areas. In addition, the equivalent roughness for various plant covers was investigated using a lysimeter test and applied to runoff calculations hydraulically. The validity of this method was verified by applying it to the reclaimed land test basin. Moreover, it was discovered that during dry weather conditions, discharge from mountainous areas is sometimes smaller than that of reclaimed lands. It was also concluded that there are cases when forests do not contribute to an increase in discharge during dry periods in arid regions.

Irrigation water accounts for about 66% of the total managed water resources in Japan. A key

feature of irrigation water is that it can be recycled and repeatedly used over large spatial areas, which differs from that of the one-time use of industrial and drinking waters. However, an accurate way of accounting for irrigation water was not been discovered until just recently. A leader in analyzing the repeated use of agricultural water, Dr. Maruyama established the pioneering method of what he calls the “composite reservoir model.” This model has contributed greatly to the analysis of demand-supply of irrigation water in the Yodo River Basin as well as in other main river basins in Japan.

Dr. Maruyama’s innovative research on water demand-supply analysis in large spatial areas based on evapotranspiration and runoff has not only made a significant contribution to obtaining new knowledge and advancing irrigation and drainage science but has also contributed other academic fields associated with the water environment and wise management of water resources. This has additionally contributed to irrigation and drainage planning and water environment science in monsoon-affected areas throughout Asia.

Dr. Maruyama has been honored with several academic awards by The Society of Irrigation, Drainage and Reclamation Engineering (1992), Japan Society of Agriculture (1999), Yomiuri Agriculture Science (1999), and International Society of Paddy and Water Environment Engineering (2003). He has also received other high academic appraisal and recognition in Japan as well as abroad.