OKI Taikan Lab.

[Global Hydrological Cycle: Monitoring and Prediction]

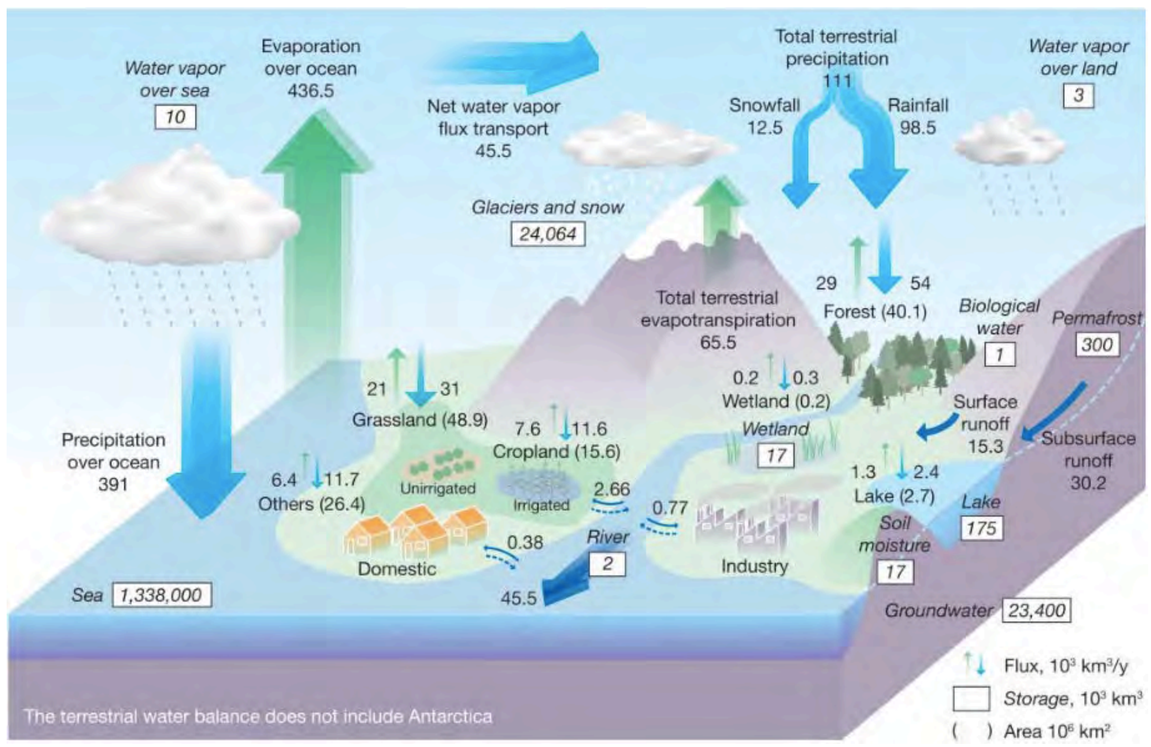
Department of Human and Social System

Global Hydrological System

Department of Civil Engineering http://hydro.iis.u-tokyo.ac.jp/indexJ.html

Estimating Global Hydrological Cycles

Water scarcity occurs around the world because of the temporal variation and spatial heterogeneity of water availability, rather than by the absolute shortage of water resources. The global simulation model predicting the fluctuation of hydrological cycles is useful to provide scientific basis to tackle with water issues, and also contribute to predict how climate change influences the water risks such as floods and droughts. Utilizing big data, such as high resolution boundary conditions from satellite information, we're challenging to develop quasi-real-time simulation system, and also to estimate the hydrological variations on millennium scale.



Water Cycles on the earth
[Oki and Kanae (*Science*, 2006)]

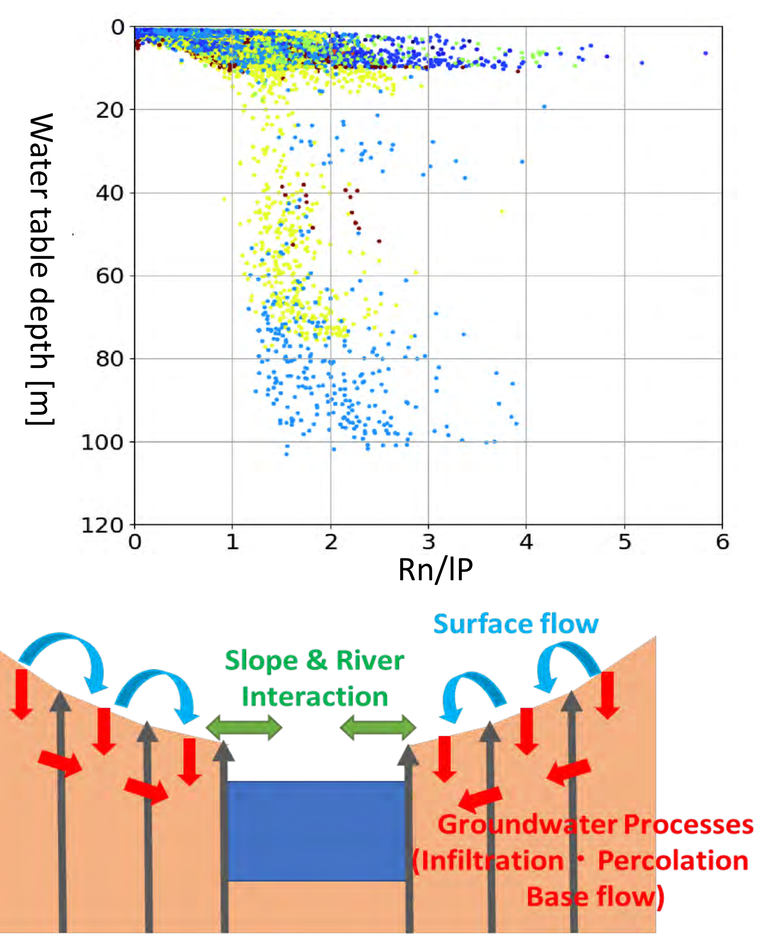
Terrestrial Model in the Next Generation：from "Natural" to "Real"

In order to provide more *realistic* information for decision-makers, we include anthropogenic interventions on hydrological cycles, such as reservoir operation and water withdrawals ("real" system), in our terrestrial model, when we improve the biogeophysical processes ("natural" system) of the model. Further, we dedicate ourselves to develop better boundary conditions crucial for terrestrial models, such as water surface & glacier areas, and topography, by reducing errors in high resolution global dataset estimated based on earth observation from space. The datasets are shared and widely used.

The Hot Topic：Development of Global Groundwater Dynamics Model

Hydrological cycle is influenced not only by surface water such as precipitation or river discharge, but also by groundwater. Global simulation for more than 1000 years have indicated that groundwater depth is regulated by energy and water balance above the ground. The result will contribute to the settings of initial groundwater depth for hydrological simulations.

Moreover, we've developed global groundwater dynamics model, which can explicitly represent groundwater dynamics with highly-efficient calculation cost. Through further validation of the model, detailed dynamics of surface & underground water will be obtained globally.



(up) Relationship between water table depth and Budyko aridity index [Yoshida (2018)]
(down) Global hydrological model considering lateral flow [Tozawa (2017)]