OKI Taikan Lab.

[Global Hydrological Cycle]

Department of Human and Social System

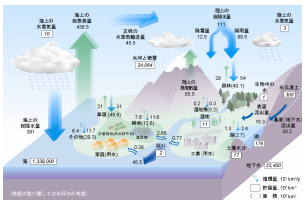
Global Hydrological System

Department of Civil Engineering

http://hydro.iis.u-tokyo.ac.jp/indexJ.html

Estimating Global Hydrological Cycle

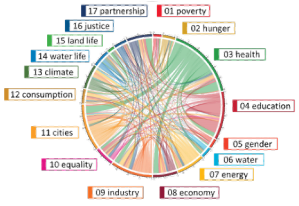
Water scarcity occurs around the world because of the temporal variation and spatial heterogeneity of water availability, rather than by the absolute shortage of water resources. The global simulation model predicting the fluctuation of hydrological cycles is useful to provide scientific basis to tackle 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 data, we're challenging to develop quasi-real-time simulation system, and also to estimate the hydrological variations on millennium scale.



Global Hydrological Cycle [Oki and Kanae (2006)]

Toward the Development of Sustainable Society

In order to achieve a sustainable development, it is necessary to solve social and natural problems in a combined manner. We are studying not only water issues, but also hunger, climate change, energy, and other social issues that are listed in the SDGs.

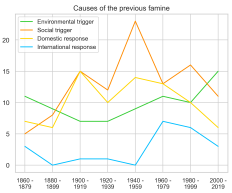


Hot topics

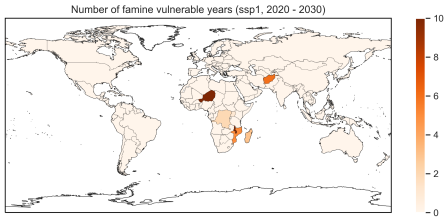
Assessment of Vulnerability to Famine in the Future

S. Funahashi

We conducted long-term quantitative assess the vulnerability to famine, which is still lasting in 21 century. We have compiled a database of information on famine from 1840 to the present, as well as the process of occurrence. We developed a decision tree model to assess vulnerability to famine using the urban population ratio, soil moisture, crop production, etc. Future projections show that, in the case of SSP1, no country will be vulnerable to famine by 2030.



Analysis on the trigger and response of famine. Green and orange lines show the number of environmental and social (conflict etc.) factors.
Yellow and blue line shows the number of domestic and international response led to famine

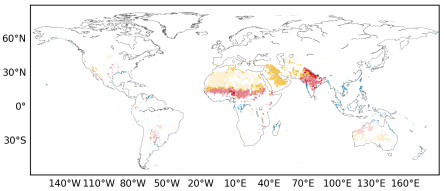


Number of years when the country is considered vulnerable to famine (by 2030 under SSP1)

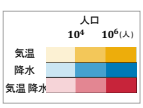
Estimation of Unprecedented Extreme Weather Risk

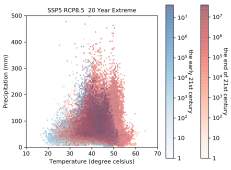
T. Sano

Using the results of future experiment of GCM, we identified populations and regions that will be exposed to extreme weather risks that no one has ever experienced (= unprecedented) due to climate change.We found that under RCP8.5 scenario, by the end of the 21st century, many regions will have unprecedented extreme temperatures and/or extreme precipitation potential, and totally Over 50 million people will be exposed to unprecedented extreme weather risk.



Yellow area will be exposed to unprecedented extreme temp. risk and blue to prcp. risk. Red to combination risk of both extreme temp. and prcp.



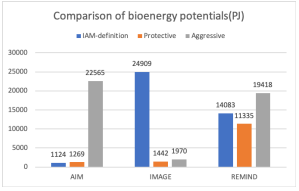


2-dimensional histograms of once-in-20-year temperature and precipitation weighted by population in each grid. The red represents extreme weather risk of 1980-2010 and the blue color represents 2070-2099.

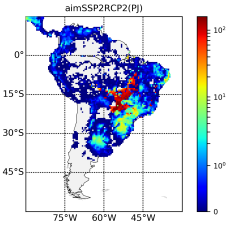
Assessment of Bioenergy Potential in Brazil in 2050

M. Shiozumi

Recently bioenergy has attracted much attention as a mitigation measure, but it can cause serious conflicts with food security and biodiversity over land use. We assessed future bioenergy potential without any trade-offs under SSPs and RCPs using integrated assessment models.
It is concluded that Brazil's bioenergy potential in the ideal scenario is around 36.7 EJ/yr, more than eight times larger than the estimated current potential.



Bioenergy potential from dedicated bioenergy crops. We assume protective and aggressive scenarios in addition to the original defined area by IAMs.



Bioenergy potential from utilizing agricultural residues and dedicated bioenergy crops. This shows the case where it has the largest potential, using AIM and aggressive scenario.