

【Grant-in-Aid for Scientific Research(S)】

Integrated Science and Innovative Science (New multidisciplinary fields)



Title of Project : Changes in hydrological cycle in East Asia during the Holocene and their implication for Global Monsoon

Ryuji Tada

(The University of Tokyo, Graduate School of Science,
Professor)

Research Area : Earth System Dynamics, Environmental Change Analysis

Keyword : East Asia, hydrological cycle, monsoon, Holocene, Yangtze River, Lake Suigetsu,
East China Sea, flood, ESR

【Purpose and Background of the Research】

This project aims to reconstruct temporal changes in intensity and spatial pattern of East Asian Summer Monsoon [EASM] since the middle Holocene (last 5,000 years) and clarify the ultimate driving forces of such changes. It will also explore the temporal and spatial relationships between flood events associated with tropical cyclones and EASM precipitation. The project is composed of three sub-projects, i) reconstruction of spatio-temporal variations of EASM precipitation and flood events in the Yangtze River drainage, ii) investigation of the linkage between EASM precipitation and the Kuroshio intensity, and iii) reconstruction of spatio-temporal variations of the position of the westerly jet axis over East Asia and EASM precipitation over the Japan Sea side of Honshu. Based on the synthesis of these results and exploration of the relationships with behaviors of other monsoon systems on different continents, we hope to understand the dynamics of the global monsoon system and properly evaluate changes in EASM precipitation pattern with in the global monsoon context.

【Research Methods】

- 1) We plan to collect sediments, suspended particles, and water samples from major tributaries of the Yangtze River to characterize the provenance and understand water and sediment budgets in the modern Yangtze River.
- 2) We also plan to drill Yangtze delta and Dongting Lake to recover the continuous Holocene record of sediment discharge from the Yangtze River. We will reconstruct provenance changes in response to changes in area of heavy EASM precipitation using ESR signal intensity of detrital quartz based on the result of 1).
- 3) We reconstruct changes in the Yangtze River discharge during the summer based on SST and SSS estimations in the northern East China Sea [ECS] using Mg/Ca ratio and $\delta^{18}\text{O}$ of planktonic foraminifera from cores.
- 4) We also plan to take cores from E-W transect in the central Okinawa Trough to reconstruct changes in Kuroshio intensity based on changes

in the thermocline gradient along the transect using two planktonic foraminifera species with different depth habitat.

5) We plan to drill Lake Suigetsu to reconstruct changes in the westerly jet axis position using ESR signal intensity of eolian quartz within the sediments.

【Expected Research Achievements and Scientific Significance】

From this project, we hope to reconstruct spatio-temporal changes in patterns, speeds, and magnitudes of EASM precipitation during the middle to late Holocene in millennial to decadal time-scales. We also hope to clarify their relationships with tropical storm tracks and frequency, westerly jet axis position, and Kuroshio strength. Ultimately, we hope to understand the relationship between EASM and global climate with special emphasis on the global monsoon.

【Publications Relevant to the Project】

- 1) Tada, R., Onset and evolution of millennial-scale variability in Asian monsoon and its impact on paleoceanography of the Japan Sea, in Clift, P. et al. (eds.) Continent-ocean interactions within east Asian marginal seas, AGU Monograph Series 149, 283-298, 2004.
- 2) Kubota, Y., Kimoto, K., Tada, R., Oda, H., Yokoyama, Y., Matsuzaki, H., Variations of East Asian summer monsoon since the last deglaciation based on Mg/Ca and oxygen isotope of planktic foraminifera in the northern East China Sea, *Paleoceanography*, 25, PA4205, doi:10.1029/2009PA001891, 2010.
- 3) Nagashima K., Tada R., Tani A., Sun Y., Isozaki, Y., Toyoda, S., Hasegawa, H. Millennial-scale oscillations of the westerly jet path during the last glacial period, *Journal of Asian Earth Sciences*, 40, 1214-1220, 2011.

【Term of Project】

FY2011-2015

【Budget Allocation】

166,300 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www-sys.eps.s.u-tokyo.ac.jp/~tada/ryuji@eps.s.u-tokyo.ac.jp>