

The seawater temperature distribution in tropics causes the low amount of rainfall in East Asia

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Seaside near from Shimoda Marine Research Center

A wide swatch of Asia, from the tropics to the mid-latitudes, which has wet and dry seasons, is significantly affected by "Asian monsoons." The

amount of rainfall in particular has a close relationship to agriculture and damage from flooding. For this reason, understanding the mechanisms of changes in the Asian monsoon and being able to forecast such changes are vital to social and economic activities in the region. It is said that from the middle to the end of the 20th century, the amount of land-based rainfall from monsoons has declined globally. Looking at regions such as East Asia, major changes have been confirmed by region over a 10-year to multiple-decade period. The mechanisms of change in regional rainfall are extremely complex, and there remained great uncertainty in making future forecasts.

The research group led by Professor Hiroaki Ueda and Assistant Professor Youichi Kamae of the University of Tsukuba, Faculty of Life and Environmental Science, performed numerical simulations using climate models, and compared the results with observational data. They found that specific trends in seawater temperatures in distant tropical regions could explain changes in recent years in the Asian monsoon, a wide-area precipitation system extending across Asia from the tropics to the mid-latitudes.

The group used an atmospheric general circulation model that hypothesizes [sea surface temperature](#) distribution in experiments to reproduce observed anomalies in order to investigate the effects of specific water temperature distributions in the tropics in recent years. They also conducted idealized numerical experiments by setting seawater temperatures according to sea area. They succeeded in reproducing the summer [rainfall](#) trend in recent years—low rainfall across an east-west region extending about 4,000 km from northern China to the vicinity of Japan and high rainfall over the Pacific Ocean in the western tropics and western Indian Ocean. Taking into account the results of the numerical experiments, the group found that the low amount of rainfall in East Asia was clearly related to the seawater temperature distribution in the tropical Pacific Ocean (low in the central

and eastern regions and high in the western region). The research clarifies the influence of tropical oceans on mid-latitude climates located great distances away, across a far broader area than was previously known.

More information: Hiroaki Ueda et al. Combined effects of recent Pacific cooling and Indian Ocean warming on the Asian monsoon, *Nature Communications* (2015). [DOI: 10.1038/ncomms9854](https://doi.org/10.1038/ncomms9854)

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