T. Yoshikane LAB.

[AI Regional Earth system]

Large-Scale Experiment and Advanced-Analysis Platform

AI for Civil Engineering

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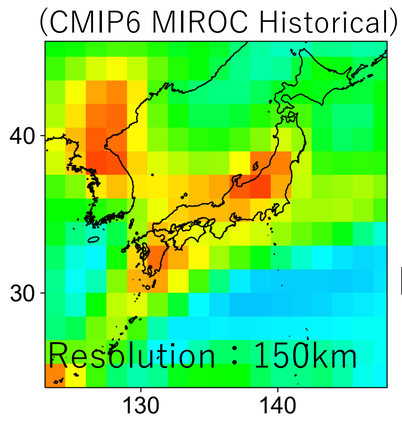
Background

Climate model simulations, which have developed rapidly in recent years, have revealed a variety of factors that contribute to global climate change. On the other hand, the mechanisms of localized disasters and environments caused by climate change are not easy to understand because they involve various factors such as topography. In addition, detailed regional studies of climate change require high-resolution simulations, **which require enormous computing resources**.

We are developing a method **to estimate regional detailed climate change characteristics** by recognizing the relationship between the phenomena reproduced in climate model simulations and observed values using **machine learning**. For example, this method is a statistical method, but estimates the time variation of hourly precipitation as if it were a dynamical method. In addition, this method is **computationally inexpensive and allows for higher resolution and bias correctio**n. This approach is expected to enable more accurate estimates of various climate change risks, including **water-related disasters**, **water resources, agriculture, and health impacts**

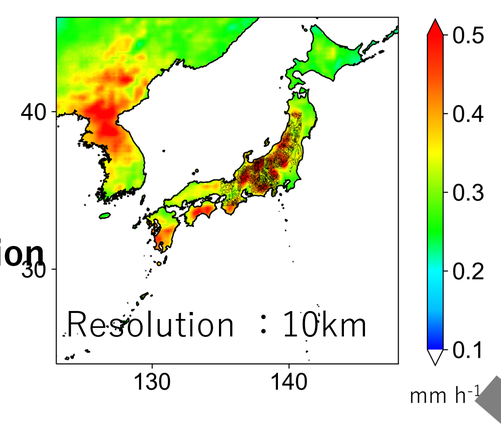
Summary

Climate model simulation
(CMIP6 MIROC Historical)



high resolution

Estimation by our method



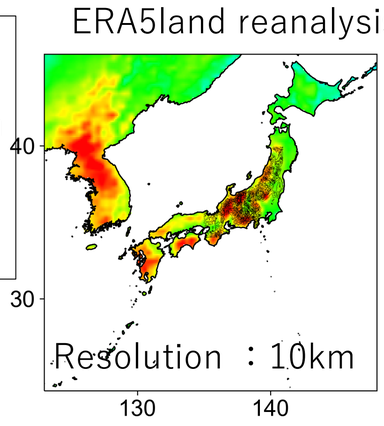
Apply to various phenomena in the atmosphere, land and ocean

Climate Change Risk Estimation

Water hazards, water resources
Agriculture
Health Impact
Urban functions
Infrastructure, logistics
Natural Energy

Higher resolution
⇩
The spatial distribution of hourly precipitation frequency can be estimated.
⇩
Available for Flood risk assessment

ERA5land reanalysis



Interpretability

Understanding the mechanism of climate change

Hypothesis testing based on theory and observed facts
Sensitivity experiments using machine learning
Improved method reliability

High-resolution 30-year average precipitation using machine learning methods and understanding climate change mechanisms

Future Prospects

By combining numerical simulation with machine learning methods (reinforcement learning), it is expected to be possible to take effective measures to minimize damage and promptly recover. Our laboratory is further developing AI forecasting research and working toward the realization of a **disaster-resilient society** (Less damage and faster recovery even in extreme events) while understanding the regional-global system.