Climate change actions with **CO**-creation powered by **R**egional weather information and **E**-technology

Our Future
with Reanalysis

Knowing the past leads to understanding the present,
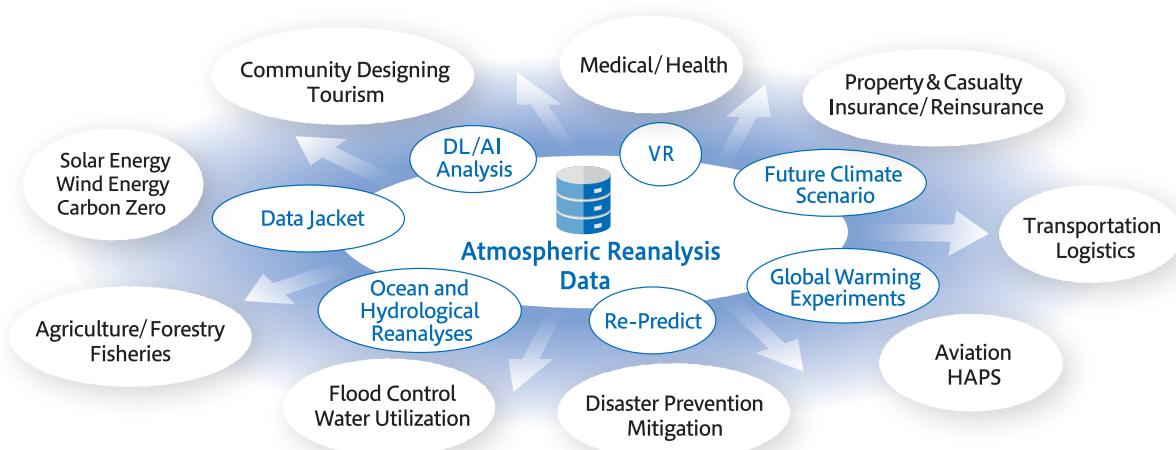helping us cocreate our future

ClimCORE

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In the context of ongoing global warming, weather-related disasters are becoming increasingly severe worldwide. In Japan, torrential rain and typhoons have caused extensive damage in recent years. To prepare for greater risks in the future, we must promote measures to mitigate and adapt to global warming based on local climatic characteristics. For this purpose, we need data that can reproduce Japan's atmospheric conditions from the past to the present at high spatiotemporal resolution.

ClimCORE can conduct regional atmospheric reanalysis over Japan by combining the latest weather modeling techniques with observational technologies, such as satellite and radar.

Thus, we can generate high-quality 4D meteorological data with high spatiotemporal resolution from the past to the present for Japan and its surrounding maritime areas.

This new weather dataset can be used to assess climate change across Japan, analyze the impact of past weather-related disasters, and realize the benefit of our endeavor in social and economic fields. Using this regional meteorological dataset, we will establish a "co-creation platform" to strategically and organically utilize or apply such weather data.

Project Goals

- Construction of a co-creation platform
- Comprehensive development Maintenance of weather big data
- Promotion of social application and emergence research

Expanded Use of Meteorological Data from Reanalysis Data

ClimCORE's atmospheric reanalysis efforts are not limited to weather forecasting. Depending on your business strategy and situation, ClimCORE's meteorological reanalysis data can be further leveraged through combination with existing data.

Atmospheric Reanalysis Data

- Community Designing Tourism
- Medical / Health
- Property & Casualty Insurance / Reinsurance
- Solar Energy Wind Energy Carbon Zero
- DL / AI Analysis
- VR
- Future Climate Scenario
- Data Jacket
- Transportation Logistics
- Ocean and Hydrological Reanalyses
- Global Warming Experiments
- Agriculture / Forestry Fisheries
- Re-Predict
- Aviation HAPS
- Flood Control Water Utilization
- Disaster Prevention Mitigation

The ClimCORE Initiative

Learning from Past Weather Data to Prepare for Future Disasters

Kumamoto Prefecture, which suffered extensive damage from the 2016 Kumamoto Earthquake and the July 2020 heavy rain event, is committed to creative reconstruction and to building a disaster-resilient community.

With these goals in mind, ClimCORE utilizes reanalysis data to reproduce Kumamoto's past heavy rainfall events and to predict future rainfall. We aim to enhance the disaster prevention awareness and response capabilities of Kumamoto Prefectural Government employees through disaster training.

We are also collaborating with the Prefectural University of Kumamoto and Kumamoto Prefecture on initiatives such as the "Catchment-based Flood Management" project.

## Energy Storage and Hydrogen Energy System Using Solar Power Generation

As an early social implementation of industry–academia–government collaboration, a photovoltaic power generation system with 60 kW output and the world's lowest-reflectance antiglare solar panels has been installed on the roof of the 14th Building of RCAST, the University of Tokyo.

The aim is to achieve zero emissions, with 100% of the building's electricity demand supplied by renewable energy. Currently, with batteries and solar systems already installed, an integrated system of solar power, storage batteries, and hydrogen energy is being developed with the aim of establishing weather forecasting, monitoring, and control technology using meteorological data in the future.

Creating Local Weather Data and Providing an Environment for Their Use

To create regional weather data through reanalysis, ClimCORE first assimilates the vast amount of atmospheric observational data collected in the past into a state-of-the-art forecast system. This requires an information infrastructure that includes high-speed networks, large-scale data storage, and high-performance supercomputer for transferring, accumulating, and analyzing data. In cooperation with the Japan Meteorological Agency (JMA), ClimCORE has implemented the latest version of the regional atmospheric forecast and assimilation system, used operationally for daily weather prediction by the JMA, in the innovative supercomputer at the Information Technology Center of the University of Tokyo. This system is used for processing historical weather observation data for the reanalysis. Hereafter, we will continue to develop a user-friendly data platform through discussions with potential data users of the "co-creation platform" set by ClimCORE.
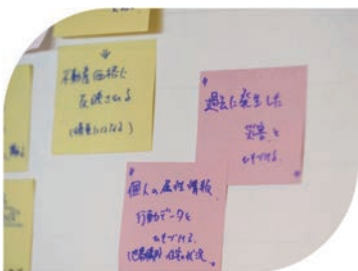
The "Co-creation Platform" to Promote Data Use

To ensure sustained creation and utilization of atmospheric reanalysis data for the region of Japan, there must be a platform where data creators/providers, including private meteorological companies and data users in industry, can engage in diversified discussions.

Through backcasting discussions and workshops, ClimCORE continuously discusses how weather data should be used through industry–academia–government collaboration.

We will provide a "co-creation platform" using the method of "data canal engineering" that abstracts information and knowledge using data to achieve our goals.
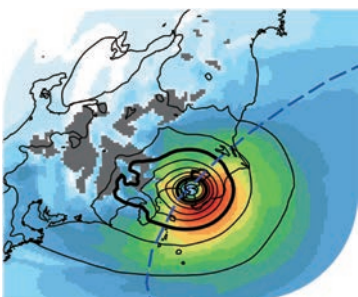
Regional Reanalysis over the Japan Area : RRJ-ClimCORE

RRJ-ClimCORE is a high-quality 4D meteorological reanalysis dataset for Japan, which reproduces regional atmospheric conditions with high spatiotemporal resolution. RRJ-ClimCORE can thus provide much more extensive training data for deep learning, over Japan and its surrounding oceans, compared with conventional regional meteorological observation data. Furthermore, ClimCORE uses not only satellite data but also long-term reprocessed hourly analyzed precipitation data with 1-km horizontal resolution, which combine radar and rain gauge observations. Use of these high-resolution data greatly improves the representation of extreme phenomena, such as typhoons and bands of organized convective systems. Thus, we will be a front-runner in the field of regional atmospheric reanalysis appropriate for the Asian monsoon region. We are in the process of calculating reanalysis data for the five most recent years.

ClimCORE's Regional Reanalysis over the Japan Area

A numerical weather forecast predicts future atmospheric conditions based upon current atmospheric conditions using observed data and supercomputer simulations based on physical laws.

Reanalysis data reproduce past atmospheric conditions (e.g., pressure, wind, temperature, humidity, sunshine, and precipitation) four-dimensionally in time and space with homogeneous quality. Reanalysis is made possible by assimilating stored observational data into the latest numerical weather forecast system used for daily weather forecasts. Japan is known for its complex coastlines and many mountainous areas that result in each region having its own local weather characteristics. To precisely reproduce the features of the weather of the different regions of Japan and the extreme weather phenomena that cause natural disasters (e.g., typhoons, heavy snowfall, and organized convective systems), reanalysis must be performed at finer grid intervals than used in global reanalysis.

To address these conditions, ClimCORE will produce high-quality reanalysis data for the past 20+ years for Japan and its surrounding maritime areas with high spatial resolution (5-km horizontal grid).

Research and Development

1 A
Maintaining 4D high-function meteorological data for the Japanese region for a safe and secure society
Leader : **Hisashi NAKAMURA**
Professor, RCAST, The University of Tokyo

1 B
Building an advanced data platform with the latest data analysis technologies
Leader : **Makoto IIDA**
Project Associate Professor, RCAST, The University of Tokyo

1 C
Constructing "Data Canal Engineering" using Data Jackets
Leader : **Yukio OHSAWA**
Professor, School of Engineering, The University of Tokyo

2
Emergent Research and Development to apply weather data to the society
Leader : **Makoto IIDA**
Project Associate Professor, RCAST, The University of Tokyo

3
Agricultural, forestry and fishing industries that can cope with drastic climate changes
Leader : **Motoki NISHIMORI**
Director, Institute for Agro-Environmental Sciences, National Agriculture and Food Research Organization

4
New energy technologies using meteorological data for social implementation
Leader : **Tatsuoki KONO**
Professor, RCAST, The University of Tokyo

5
Advanced weather data utilisation in the wind energy sector
Leader : **Makoto IIDA**
Project Associate Professor, RCAST, The University of Tokyo

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https://www.climcore.rcast.u-tokyo.ac.jp