

# Takuya Kurihana

## RESEARCH INTERESTS

Takuya's research focuses on the development of advanced deep learning algorithms and their applications in climate, weather, and remote sensing domains. Specializing in cutting-edge techniques such as self-supervised learning and generative AI, Takuya also applies clustering algorithms to address complex problems in the natural sciences (climate, clouds, and hydrology). In addition to these technical specialties, Takuya is adept at scaling applications on high-performance computing (HPC) systems, improving their efficiency and effectiveness for large-scale implementations.

## EDUCATION

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**University of Chicago** PhD in Computer Science: 2018–2024  
Advisor: Ian Foster  
Thesis: Democratizing access to extensive climate dataset via deep learning-powered techniques

**University of Chicago** MS in Computer Science: 2018–2021  
Advisor: Ian Foster  
Thesis: A data-driven novel cloud classification framework based on an efficient cloud representation via rotational and non-rotational invariant autoencoder

**University of Tsukuba** MS in Meteorology: 2017–2021  
Advisor: Hiroshi Tanaka  
Thesis: Development of fast super-observation algorithm for the Nonhydrostatic ICosahedral Atmospheric Model (NICAM)

**University of Tsukuba** BS in Meteorology: 2013–2017  
Advisor: Hiroshi Tanaka  
Thesis: Comparison of data assimilation performance between Kalman filter, 4DVar, and the Hybrid method on S-Model

## PROFESSIONAL EXPERIENCE

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**Oak Ridge National Laboratory** May 2024 – Present  
Postdoctoral Research Associate

**University of Chicago** August 2018 – March 2024  
Graduate Research Associate & Teaching Assistant

\*Intern experience during working in University of Chicago as follows:

- IBM Research, Researcher: June. 2023–Sep. 2023
- Frontier Development Laboratory, Researcher: June 2022 – Aug. 2022
- Woven Planet, Software engineer: July 2021–Oct. 2021

## PEER REVIEWED PUBLICATION

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- Aurelien Meray, Lijing Wang, Takuya Kurihana, Ilijana Mastilovic, Satyarth Praveen, Zexuan Xu, Milad Memarzadeh, Alexander Lavin, Haruko Wainwright, 2024: "Physics-Informed Surrogate Modeling for Supporting Climate Resilience at Groundwater Contamination Sites"; *Computational Geosciences*, 183, 105508.

- Takuya Kurihana, Kyongmin Yeo, Daniela Szwarcman, Bruce Elmegeen, Karthik Mukkavilli, Johannes Schmude, Levente Klein, 2023: "A 3D super-resolution of wind fields via physics-informed pixel-wise self-attention generative adversarial network", *Workshop at the 37th conference on Neural Information Processing Systems (NeurIPS)*.
- Lijing Wang, Takuya Kurihana, Aurelien Meray, Ilijana Mastilovic, Satyarth Praveen, Zexuan Xu, Milad Memarzadeh, Alexander Lavin, Haruko Wainwright, 2022; "Multi-scale Digital Twin: Developing a fast and physics-infused surrogate model for groundwater contamination with uncertain climate models", *Workshop at the 36th conference on Neural Information Processing Systems (NeurIPS)*.
- Takuya Kurihana, James Franke, Elisabeth Moyer, Ziwei Wang, and Ian Foster, 2022; "Insight into cloud processes from unsupervised classification with a rotationally invariant autoencoder", *Workshop at the 36th conference on Neural Information Processing Systems (NeurIPS)*.
- Takuya Kurihana, Elisabeth Moyer, and Ian Foster, 2022; "AICCA: AI-driven Cloud Classification Atlas", *Remote Sens.*, 2022, 14(22), 5690, doi: 10.3390/rs14225690.
- Takuya Kurihana, James A Franke, Elisabeth Moyer, Ziwei Wang, Tatsu Monkman, Jacob Kuntzleman, Adam Chaikin-Lifshitz, and Ian Foster, 2022; "Global-scale unsupervised cloud classification to construct a novel AI-driven Cloud Classification Atlas (AICCA)", *AGU Fall meeting 2022*, \*Selected to oral presentation.
- Takuya Kurihana, Elisabeth Moyer, Rebecca Willett, Davis Gilton and Ian Foster, 2021; "Data-driven Cloud Clustering via a Rotationally Invariant Autoencoder", *IEEE Transactions on Geoscience and Remote Sensing*, doi: 10.1109/TGRS.2021.3098008.
- Takuya Kurihana, Ian Foster, Rebecca Willett, Sydney Jenkins, Kathryn Koeing, Ruby Werman, Ricardo Barros Lourenco, Casper Neo, and Elisabeth Moyer, 2019; "Cloud classification with unsupervised deep learning", *Proceedings of the 9th International Workshop on Climate Informatics: CI 2019*.

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#### PEER REVIEWING PUBLICATION UNDER REVIEW/PREP

- Identifying Climate Patterns using Clustering Autoencoder Techniques, 2023; Takuya Kurihana, Ilijana Mastilovic, Aurelien Meray, Lijing Wang, Satyarth Praveen, Zexuan Xu, Milad Memarzadeh, Alexander Lavin, Haruko Wainwright, *Artificial Intelligence for the Earth Systems (under review)*.
- Meteorological tendencies of subtropical stratocumulus mesoscale morphology, 2023; James A. Franke, Takuya Kurihana, Ian T. Foster, Elisabeth J. Moyer, *The Proceedings of the National Academy of Sciences (under review)*.

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#### CONFERENCE PRESENTATIONS

- Valentine Anantharaj, Takuya Kurihana, Gabriele Padovani, Ankur Kumar, Aristeidis Tsaris, Udaysankar Nair, Sandro Fiore, Ian Foster; "Pretraining a foundation model using MODIS observations of the earths atmosphere", *EGU 2024*.

- Takuya Kurihana, James Franke, Elizabeth Moyer, Ian Foster 2023; "SCuBA: Self-supervised Cloud Bias Assessment for evaluating cloud representations from high-resolution climate models against MODIS cloud images", *AGU Fall Meeting 2023*.
- Takuya Kurihana, Kyongmin Yeo, Daniela Szwarcman, Bruce Elmegreen, Surya Karthik Mukkavill, 2023; "A 3D spatial self-attention module on a non-uniform vertical coordinate for super-resolution wind fields", *AGU Fall Meeting 2023*.
- Takuya Kurihana, James Franke, Ziwei Wang, Elizabeth Moyer, Ian Foster 2022; "Global-scale unsupervised cloud classification to construct a novel AI-driven Cloud Classification Atlas (AICCA)", *AGU Fall Meeting 2022*.
- Takuya Kurihana, Ian Foster, Rebecca Willett, Sydney Jenkins, Kathryn Koeing, Ruby Wer-  
man, and Elisabeth Moyer, 2019; "Cloud classification with deep learning II", *AGU Fall Meeting 2019*.
- Takuya Kurihana, and Hiroshi Tanaka, 2018; "Analysis of cloud formation processes for arctic cyclone in the non-hydrostatic icosahedral grid model", *Fifth International Symposium on Arctic Research*.