James A. Franke

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Professional experience

2023 – | **Toyota Technological Institute at Chicago** | Intelligence Community Postdoctoral Fellow

2018 – 2023 | **University of Chicago** | Data Science for Energy and Environmental Research Fellow

2017 – 2022 | **Center for Robust Decision Making on Climate and Energy Policy** | Research Associate

2013 – 2017 | **ESD Global** | Mechanical Engineer, Energy Systems - Professional Engineer, State of Illinois

Education

2017 – 2023 | **University of Chicago – Chicago, IL** | PhD – Department of the Geophysical Sciences

2009 – 2012 | **Milwaukee School of Engineering – Milwaukee, WI** | B.S. Mechanical Engineering
Fachhochschule Lübeck – Lübeck, Germany | B.S. Mechanical Engineering

Peer-reviewed publications

in prep.

19. **Franke, J.**, Smyth, M., Brandy, J., Shakhnarovich, G., Data-driven cloud forecasting from geostationary satellite observations. github

2024

18. Nelson, G., Cheung, W., Bezner Kerr, R., **Franke, J.**, Meza, F., Oyinlola, M., Thornton, P., Zabel, F., Adaptation to climate change and limits in food production systems: Physics, the chemistry of biology, and human behavior. *Global Change Biology*. publisher

17. **Franke, J.**, Kurihana, T., Foster, I., Moyer, E., Controls on stratocumulus texture diagnosed by deep learning. *Under revision*. ms

16. Müller, C., Jägermeyr, J., **Franke, J.** Ruane, A., Balkovič, J., Ciais, P., Dury, M., Falloon, P., Folberth, C., Hank, T., Hoffmann, M., Izaurralde, R., Jacquemin, I., Khabarov, N., Liu, W., Olin, S., Pugh, T., Xuhui Wang, X., Williams, K., Zabel, F., Elliott, J., Substantial differences in crop yield sensitivities between models call for functionality-based model evaluation. *Earth's Future*. publisher

15. Kahiluoto, H., Sakieh, Y., Kaseva, J., Kersebaum, K., Minoli, S., **Franke, J.**, Rötter, R.P., & Müller, C. Redistribution of nitrogen for people and the planet. *PNAS NEXUS*. publisher

14. Filho, W. L., Totin, E., Dlamini, L., Roncoli, C., **Franke, J.**, Mucova, S., North, M., Zoundji, G., Trisos, C., Food production and climate change in Africa: What do we know about impacts and responses? *STOTEN*. *Under revision.*

13. Filho, W. L., Stojanov, R., Matsoukas, C., Ingrosso, R., **Franke, J.**, Pausata, F., Grassi, T., Landa, J., Harrouni, C. An Assessment of Climate Change Impacts to Oases in Northern Africa. *Ecological Indicators*. publisher

2023

12. North, M.*, **Franke, J.***, Ouweneel, B., Trisos., C., Global risk of heat stress to cattle under climate change. *Environmental Research Letters*, 18 094027 (2023). ***co-first authors**. publisher

11. Liu, W., Ye, T., Müller, C., Jägermeyr, J., **Franke, J.**, Stephens, H., Chen, S., The statistical emulators of GGCMI phase 2: responses of year-to-year variation of crop yield to CO_2, temperature, water and nitrogen perturbations. *Geoscientific Model Development* (2023). *In press.* publisher

Peer-reviewed publications (cont.)

2022

10. Kurihana, T., **Franke, J.**, Foster, I. Wang, Z., Moyer, E., Insight into cloud processes from unsupervised classification with a rotationally invariant autoencoder. *Conference on Neural Information Processing - Machine Learning for Physical Science* (2022). arxiv

9. Filho, W., Totin, E., **Franke, J.**, Nunn, P., Andrew, S., Abubakar, I., Azadi, H., Ouweneel, B., Williams, P., Simpson, N., Understanding responses to climate-related water scarcity in Africa. *Science of the Total Environment*, 806, 1, 150420 (2022). publisher

2021

8. **Franke, J.**, Müller, C., Minoli, S., Elliott, J., Folberth, C., Gardner, C., Hank, T., Izaurralde, R., Jägermeyr, J., Jones, C., Liu, W., Olin, S., Pugh, T. A., Ruane, A., Stephens, H., Zabel, F., Moyer, E., Agricultural breadbaskets shift poleward given adaptive farmer behavior under climate change. *Global Change Biology*, 00:1–15 (2021). publisher

7. Jägermeyr, J., Müller, C., Ruane, A. C., Elliott, J., Balkovic, J., Castillo, O., Faye, B., Faye, B., Foster, I., Folberth, C., **Franke, J.**, Fuchs, K., GZuari, J., Heinke, J., Hoogenboom, G., Iizumi, T., Jain, A., Kelly, D., Khabarov, N., Lange, S., Lin, T., Liu, W., Minoli, S., Moyer, E., Okada, M., Phillips, M., Porter, C., Rabin, S., Scheer, C., Schneider, J., Schyns, J., Skalsky, R., Smerald, A., Stella, T., Stephens, H., Webber, H., Zabel, F., Rosenzweig, C., Climate change signal in agriculture emerges earlier in new generation of projections. *Nature Food*, 2, 873–885 (2021). publisher

6. Wang, Z., **Franke, J.**, Luo, Z., Moyer, E., Reanalyses and a high-resolution model fail to capture the 'high tail' of CAPE distributions. *Journal of Climate*, 34, 8699–8715 (2021). publisher

5. Müller, C., **Franke, J.**, Jägermeyr, J., Ruane, A., Elliott, J., Moyer, E., Heinke, J., Falloon, P., Folberth, C., Francois, L., Hank, T., Izaurralde, R., Jacquemin, I., Liu, W., Olin, S., Pugh, T., Williams, K., Zable F., Exploring uncertainties of the full range of climate scenarios from CMIP5 and CMIP6 for global crop yields. *Environmental Research Letters*, 16 034040 (2021). publisher

4. Zabel, F., Müller, C., Elliott, J., Minoli, S., Jägermeyr, J., Schneider, J. M., **Franke, J.**, Moyer, J., Dury, M., Francois, L., Folberth, C., Liu, W., Pugh, T., Olin, S., Rabin, S., Mauser, W., Hank, T., Ruane, A., Asseng, S., Large potential for crop production adaptation depends on available future varieties. *Global Change Biology*, 27:3870–3882 (2021). publisher

2020

3. **Franke, J.**, Müller, C., Elliott, J., Ruane, A. C., Jägermeyr, J., Balkovic, J., Ciais, P., Dury, M., Falloon, P. D., Folberth, C., Francois, L., Hank, T., Hoffmann, M., Izaurralde, R. C., Jacquemim, I., Jones, C., Khabarov, N., Koch, M., Li, M., Liu, W., Olin, S., Phillips, M., Pugh, T., Reddy, A., Wang, X., Williams, K., Zabel, F., Moyer, E., The GGCMI Phase 2 experiment: simulating and emulating global crop yield responses to changes in CO_2, temperature, water, and nitrogen levels. *Geoscientific Model Development*, 13, 2315–2336 (2020). publisher

2. **Franke, J.**, Müller, C., Elliott, J., Ruane, A. C., Jägermeyr, J., Snyder, A., Dury, M., Falloon, P. D., Folberth, C., Francois, L., Hank, T., Izaurralde, R. C., Jacquemin, I., Jones, C., Li, M., Liu W., Olin, S., Phillips M., Pugh, T., Reddy, A., Williams, K., Wang, Z., Zabel, F., Moyer, E., The GGCMI Phase 2 emulators: global gridded crop model responses to changes in CO_2, temperature, water, and nitrogen. *Geoscientific Model Development*, 13, 3995–4018 (2020). publisher

1. Jägermeyr, J., Robock, A., Elliott, J., Müller, C., Xia, L., Khabarov, N., Folberth, C., Schmid, E., Liu, W., Zabel, F., Rabin, S., Puma, M. J., Heslin, A. C., **Franke, J.**, Foster, I., Asseng S., Bardeen, C., Toon, O., Rosenzweig, C. A regional nuclear conflict would compromise global food security., *Proceedings of the National Academy of Sciences*, 117, (13),7071-7081 (2020). publisher

Awards

2023 | Intelligence Community Postdoctoral Fellowship

2022 | Foster and Coco Stanback Postdoctoral Fellowship - Caltech - *Declined*

2019 | NSF Graduate Research Fellowship

2017 | McCormick Fellowship - University of Chicago

2012 | Valedictorian - Milwaukee School of Engineering

Conference presentations

2024 | **Intelligence Community Tech Symposium – Washington, D.C.**
Data-driven cloud forecasting ***(Invited)***
NRO First – Washington, D.C.
Data-driven cloud forecasting ***(Invited)***

2023 | **Pritzker Conference on AI & Science – Chicago, IL**
Cloud classification via unsupervised deep learning highlights the drivers of stratocumulus texture
Argonne National Lab, LANS Seminar – Lemont, IL
Insight into cloud dynamics from unsupervised classification with a rot-invariant autoencoder ***(Invited)***

2022 | **American Geophysical Union Annual Meeting – Chicago, IL**
Boundary layer controls on subtropical stratocumulus morphology revealed with deep learning
Machine Learning for Climate and Weather Applications Workshop - Institute for Mathematical and Statistical Innovation - Chicago
Unsupervised classification of full-disk geostationary satellite images for tropical cyclone analysis

2021 | **American Geophysical Union Annual Meeting – New Orleans**
Regional marine cloud brightening for heat wave attenuation
US Department of Energy Artificial Intelligence for Earth System Predictability – Washington, D.C.
Land Surface modeling 2.0 ***(Invited)***
The Inter-Sectoral Impact Model Intercomparison Project Annual Meeting – Berlin, Germany
Will agriculture regions shift poleward under warming? ***(Invited)***

2020 | **American Geophysical Union Annual Meeting – San Francisco**
Little poleward shift of peak agricultural regions under warming
Agricultural Model Intercomparison Project Annual Meeting – New York
Will agriculture regions shift poleward under warming? ***(Invited)***

2019 | **American Geophysical Union Annual Meeting – San Francisco**
Can shifting cropland offset agricultural losses under climate change?
Energy Policy Institute Seminar Series – University of Chicago
Shifting cropland under climate change
National Research Traineeship Annual Meeting, Northwestern University – Chicago, IL
Data Science for Energy and Environmental Research
3rd Agriculture and Climate Change Conference – Budapest, Hungary
The GGCMI Phase II experiment: simulating and emulating global crop yield responses

2018 **American Geophysical Union Annual Meeting – Washington D.C.**
The GGCMI Phase II experiment: global crop yield responses to change in carbon dioxide, temperature, water, and nitrogen levels
National Research Traineeship Annual Meeting –Washington, D.C.
Assessing food security under climate change with model emulation
Interdisciplinary PhD Workshop in Sustainable Development, Columbia University – New York
Integrated Model Emulation for Climate Change Impact Assessments
American Meteorological Society Annual Meeting – Austin, Texas
Long-range Dependence of Millennial Scale Climate Models

Outreach and press

2023 Livestock heat stress under climate change press

Poleward shift of agriculture under climate change press

UIC Summer Institute on Climate and the Environment Seminar *(50+ students)*

2019 Saturday Morning Physics Seminar – FermiLab, US Department of Energy, Batavia, IL *(100+ students)*

Professional service

2023 Convener - American Geophysical Union Annual Meeting
- Solar Radiation Modification for Climate Intervention
- Deep Learning in Climate, Weather, and Earth Sciences
- Implications of climate change, extreme events, and adaptation potentials for global agriculture

2022 Convener - American Geophysical Union Annual Meeting
- Advances in Solar Radiation Modification (SRM) Research
- Implications of climate change, extreme events, and adaptation potentials for global agriculture

2021 Convener - American Geophysical Union Annual Meeting
- Implications of climate change, extreme events, and adaptation potentials for global agriculture

2017 – Provided peer reviews for: *The Proceedings of the National Academy of Sciences, Nature Food, Agricultural and Forest Meteorology*, and *Journal of Climate and Development*

Reports and white papers

2020-2022 **IPCC AR6 Africa Food System Chapter** – Contributing Author

2021 **Land Surface Modeling 2.0.** Franke, J., ... Moyer, E., US Department of Energy - Artificial Intelligence for Earth System Predictability (AI4ESP). pdf

Data-Driven Exploration of Climate Attractor Manifolds for Long-term Predictability. Graziani, C., ... Franke, J., US Department of Energy - AI4ESP. pdf

New Understanding of Cloud Processes via Unsupervised Cloud Classification in Satellite Images. Moyer, JE, Foster I.,Franke, J., ... US Department of Energy - AI4ESP. pdf

Predictability and feedbacks of the ocean-soil-plant-atmosphere water cycle: deep learning water conductance in Earth System Model. Renchon A.,, ... Franke J.. AI4ESP. pdf

Teaching experience

2018-2022 | **Environmental Data Science Bootcamps - University of Chicago**
Instructor. Led organization, developed curriculum, and taught data science bootcamps to graduate students across the University. Oversaw continuing operation over 5 years.

2020 | **GEOS39650: Environmental Data Science Practicum - University of Chicago** – *TA*

2018 | **GEOS24705: Energy: Science, Technology and Human Usage - University of Chicago** – *TA*

Software

languages | **julia** - *Flux, Lux, MLJ, Makie, GeoMakie, GLMakie, DataFramesMeta, etc.*
python - *sklearn, tensorflow, pytorch, dask, opencv, xarray, altair, plotly, holoviews, pandas, etc.*
unix/bash/git

public tools | julia package - *MacroArrays.jl* high-level interface for loading and manipulating multi-dimensional labeled arrays with *Dagger.jl* compatibility.

Global crop model emulators.

Mentorship

2021-2024 | Carly KleinStern – Junior Graduate Student

2021-2023 | Samantha Lapp – Junior Graduate Student

2020-2021 | Charles Gardner – Undergraduate Intern
Lily Mansfield – Undergraduate Intern
Krista Sowkey – Undergraduate Intern

2018-2019 | Kareem El-Adle – Undergraduate Intern
Paul Alves – Undergraduate Intern

2017-2018 | Shree Mendota – Undergraduate Intern
Michelle Li – Undergraduate Intern
Briana Moore – Undergraduate Intern

2017 | Tab Dayani – Undergraduate Intern
Charles Homans – Undergraduate Intern
Giacomo Glotzer – High School Intern

2013-2016 | Tyler Buffkin – Junior Engineer
Colin Clark – Junior Engineer