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# Josh Jacobson

## Research Interests

Spatial ecology • Spatiotemporal statistics • Bayesian hierarchical modeling • Joint species distribution modeling • Forest ecology, dynamics, and biodiversity • Animal movement • Approximate Bayesian computation • Extreme-value theory • Ecosystem responses to environmental change

## Education

2020–present **Ph.D., Applied Statistics**
University of Wollongong — Wollongong, NSW
Thesis: Statistical Methods for the Joint Prediction of Environmental Processes from Remote Sensing Data
Advisors: Noel Cressie and Andrew Zammit Mangion

2018–2020 **M.S., Applied Mathematics**
University of Colorado — Boulder, CO
Thesis: Verification of Spatial Structure in Ensembles of Forecast Fields
Advisors: Will Kleiber and Michael Scheuerer

2015–2019 **B.S., Applied Mathematics**
University of Colorado — Boulder, CO
Minors: Computer Science, Atmospheric & Oceanic Sciences

## Experience

2021–present **Graduate Research Assistant**
Centre for Environmental Informatics, University of Wollongong — Wollongong, NSW
Updated the group's $CO_2$ flux-inversion framework for compatibility with different atmospheric transport models; translated technical research articles into public-facing content.

2021–2023 **Data Science Consultant**
Jupiter Intelligence — Boulder, CO
Developed a non-stationary Bayesian copula model for analysis of multivariate extreme events; identified and implemented an approximate Bayesian computation algorithm suitable for non-stationary data; collaborated as a core developer of a proprietary Python package for statistical modeling.

2019–2020 **Data Science Consultant**
Jupiter Intelligence — Boulder, CO
Contributed to development of a statistical emulator for hydrologic model output using boundary-condition inputs; evaluated the computational efficiency of Julia and Python for vectorized calculation and numerical optimization in distributed, parallel frameworks.

2019 **Data Science Intern**
Jupiter Intelligence — Boulder, CO
Developed a stochastic generator of physically realistic, multi-decadal sea level rise projections and quantified the model's variability in a Monte Carlo experiment.

2017-2019 **Undergraduate Research Assistant**
Department of Environmental Engineering, University of Colorado — Boulder, CO
Developed `Parasol`, a JavaScript library for interactive visualization of tradeoff sets in multi-objective optimization problems, e.g., water resources planning and decision making.

2017 **Data Engineering Intern**
VictorOps — Boulder, CO
Developed a proprietary R package to streamline database queries and common data-wrangling operations.

## Publications

### In Preparation

- Harr, P., **J. Jacobson**, and S. Sain (n.d.). A fully-Bayesian spatial copula model for joint-frequency analysis of extreme events.
- **Jacobson, J.**, N. Cressie, and A. Zammit-Mangion (n.d.). Spatial statistical prediction of solar-induced chlorophyll fluorescence (SIF) from multivariate OCO-2 data.

### Published

4. Cressie, N., A. Zammit-Mangion, **J. Jacobson**, and M. Bertolacci (2023). Earth's CO2 battle: a view from space. *Significance*, 20, 1, pp. 14–19.
3. Vu, Q., Y. Cao, **J. Jacobson**, A. R. Pearse, and A. Zammit-Mangion (2021). Discussion on "Competition on Spatial Statistics for Large Datasets". *Journal of Agricultural, Biological and Environmental Statistics*.
2. **Jacobson, J.**, W. Kleiber, M. Scheuerer, and J. Bellier (2020). Beyond univariate calibration: verifying spatial structure in ensembles of forecast fields. *Nonlinear Processes in Geophysics*, 27, 3, pp. 411–427.
1. Raseman, W. J., **J. Jacobson**, and J. R. Kasprzyk (2019). Parasol: an open source, interactive parallel coordinates library for multi-objective decision making. *Environmental Modelling & Software*, 116, pp. 153–163.

## Presentations

### Conferences & Workshops

2023-01 A fully-Bayesian spatial copula model for joint-frequency analysis of extreme events
American Meteorological Society (AMS) 103rd Annual Meeting, Denver, CO, USA

2021-07 Multivariate spatial prediction of column-averaged carbon dioxide over North America
Australian Mathematical Sciences Institute (AMSI) Winter School, Virtual

2021-07 Spatial prediction of column-averaged carbon dioxide over the globe
Australian and New Zealand Statistical Conference (ANZSC), Virtual

2019-12 Improving interpretability of multi-objective tradeoff sets for environmental systems
American Geophysical Union (AGU) Fall Meeting, San Francisco, CA, USA

2018-09 Interactive visualizations for multi-objective optimization problems
RMACC HPC Symposium, Boulder, CO, USA

### Seminars & Colloquia

2022-04 Approximate Bayesian computation for non-stationary processes
Jupiter Intelligence, Boulder, CO, USA

2019-11 Verification of spatial structure in ensembles of forecast fields
Department of Mathematics, University of Zurich, Zurich, Switzerland

2019-08 Uncertainty quantification for sea level rise
Jupiter Intelligence, Boulder, CO, USA

### Posters

2021-07 Multivariate spatial-dependence modelling with satellite data
Early Career & Student Statisticians Conference, Virtual

2020-12 Flexible methodology for hyperlocal flooding risk due to sea level rise
American Geophysical Union (AGU) Fall Meeting, Virtual

## Conferences

2023-01 American Meteorological Society (AMS) 103rd Annual Meeting. Denver, CO, USA.

2022-06 International Statistical Ecology Conference (ISEC). Virtual.

2021-07 Australian and New Zealand Statistical Conference (ANZSC). Virtual.

2019-07 Joint Statistical Meetings (JSM). Denver, CO, USA.

## Workshops

2021-07 "Winter School on Statistical Data Science." Australian Mathematical Sciences Institute (AMSI). Virtual.

## Teaching

Fall 2018 Teaching Assistant, APPM 4/5350: Fourier Series and Boundary Value Problems, Department of Applied Mathematics, University of Colorado

Fall 2016 Teaching Assistant, CSCI 1320: Introduction to Programming for Engineers, Department of Computer Science, University of Colorado

## Service, Leadership, & Synergistic Activities

2019 **Radio Show Host**
Department of Applied Mathematics, University of Colorado Boulder, CO
Probably Novel Radio Show and Podcast intends to bring research achievements of STEM undergraduates to the public sphere and make them more accessible to a broad audience.

2017–present **Open-Source Developer**
Projects with accepted pull-requests include ArviZ, Parasol, parcoords-es, and Mamba

2017–2018 **Resident Advisor**
University of Colorado Boulder, CO

2016–2018 **Engineering Honors Program Mentor**
College of Engineering & Applied Science, University of Colorado Boulder, CO

### Writing

2022-03 "Global CO2 Flux: Bayesian statistical inversion using the WOMBAT framework."
Centre for Environmental Informatics, University of Wollongong

## Honors, Awards, & Fellowships

2021 Allison Harcourt Poster Award: 1st, Early Career & Student Statisticians Conference

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| 2021 | ECSSC 2021 Scholarship, Early Career & Student Statisticians Conference |
| 2021 | Statistical Data Science Scholarship, Australian Mathematical Sciences Institute (AMSI) |
| 2020–2024 | University Postgraduate Award, University of Wollongong |
| 2020 | NPG Paper of the Month Award [2] chosen by Editors of Nonlinear Processes in Geophysics for paper of the month, October, 2020 |
| 2019 | Active Learning Award, College of Engineering and Applied Science, University of Colorado |
| 2017 | Global Seminar Funding, Engineering Honors Program, University of Colorado |
| 2016 | Honorable Mention, International Mathematical Contest in Modeling, Consortium for Mathematics and its Applications |
| 2015–2019 | Dean's List, University of Colorado |
| 2015–2019 | Engineering Merit Scholarship, University of Colorado |
| 2015–2019 | Hale Esteemed Scholar Award, University of Colorado |

## Professional Memberships

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|---|---|
| 2021–present | Statistical Society of Australia (SSA) |
| 2019–present | American Statistical Association (ASA) |
| 2019–present | Society for Industrial and Applied Mathematics (SIAM) |

## Computer Skills

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| Basic | JavaScript, Shell-scripting |
| Intermediate | Julia, LaTeX, Linux, Matlab |
| Advanced | Git, Python, R |

## Selected Coursework (* indicates graduate level)

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|---|---|
| Probability & Statistics | Spatial Statistics*, Statistical Modeling*, Statistical Learning, Mathematical Statistics*, Applied Probability, Markov Processes and Monte Carlo Simulations*, Time Series Analysis*, Experimental Design* |
| Applied Mathematics | Multivariable Calculus, Differential Equations, Linear Algebra, Numerical Analysis*, Real Analysis, Complex Analysis, Fourier Series and Boundary Value Problems, Data Assimilation* |
| Computer Science | Data Structures, Computer Systems, Algorithms, Introduction to Data Science |
| Climate Science | Climate Modeling, Physical Oceanography, Radiative Transfer and Remote Sensing*, Objective Data Analysis* |