

# Emily C. Hector

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## **PROFESSIONAL APPOINTMENTS**

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Assistant Professor, Department of Statistics North Carolina State University	2020-present
Graduate Student Research Assistant, Department of Biostatistics University of Michigan	2015-2020

## **EDUCATION**

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PhD Biostatistics University of Michigan Thesis: “Distributed estimation and inference for the analysis of big biomedical data” Advisor: Peter X.-K. Song, PhD	2020
MSc Biostatistics University of Michigan	2016
BSc Honors Probability and Statistics McGill University	2014

## **RESEARCH INTERESTS**

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### *Theory/Methods*

Correlated data, Divide-and-conquer, Distributed estimation and inference, Estimating equations, Generalized method of moments, Heterogeneous data integration, Parallel computing.

### *Applications*

Brain imaging analysis, Metabolomics, Spatial data, Wearable devices.

## AWARDS & HONORS

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1. *Dennis Boos Citizenship Faculty Award*, Department of Statistics, North Carolina State University ('24)
2. *LeRoy and Elva Martin Award for Teaching Excellence*, College of Sciences, North Carolina State University ('24)
3. *Thank-An-Advisor note*, submitted by a student to the Academic Advising Programs and Services, North Carolina State University ('23)
4. *Internationalization Seed Grant award*, Office of Global Engagement, North Carolina State University ('23)
5. *Thank-A-Teacher note*, submitted by a student to the Office for Faculty Excellence, North Carolina State University ('22)
6. *Faculty Research and Professional Development award*, North Carolina State University ('21)
7. *Excellence in Research Award*, awarded annually to one student in recognition of research excellence. Department of Biostatistics, University of Michigan ('19)
8. *Gertrude M. Cox Scholarship, Honorable Mention*, sponsored by the American Statistical Association (ASA) Committee on Women in Statistics and the Caucus for Women in Statistics (CWS) ('19)
9. *John Van Ryzin Award* for most outstanding paper submitted to the International Biometric Society (IBS) Eastern North American Region's (ENAR) Distinguished Student Paper Award Competition ('18)
10. *Rackham Conference Travel Grant*, University of Michigan ('16, '17, '18, '19)
11. *Outstanding First-Year Masters Student*, Department of Biostatistics, University of Michigan ('15)
12. *First Class Honors*, McGill University ('14)
13. *Natural Sciences and Engineering Research Council of Canada (NSERC) Undergraduate Student Research Award (USRA)*, McGill University ('13)
14. *J W McConnell Scholarship* (major award), McGill University ('11-'13)

## FUNDING

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### *Current*

1. NSF DMS 2337943 (2024-2029). CAREER: New data integration approaches for efficient and robust meta-estimation, model fusion and transfer learning (PI Hector). Role: PI.
2. NSF DMS 2152887 (2022-2025). Projecting flood frequency curves under a changing climate using spatial extreme value analysis (PI Reich). Role: co-PI.
3. NIH R01GM087964 (2022-2026). Development and Application of New Ionization Methods for Biological Mass Spectrometry (PI Muddiman). Role: co-I.

### Past

1. North Carolina State University Office of Global Engagement (2023-2024). Scalable statistical approaches for robust and resilient extreme weather adaptation: a new approach to climate science (PI Hector). Role: PI.
2. NIH U24AR071113 Subcontract (2023). Molecular Transducers of Physical Activity Consortium Coordinating Center (MPI Miller, Pahor, Rejeski, Tracy). Role: Subcontract PI.
3. North Carolina State University Faculty Research and Professional Development award (2021 - 2022). Functional regression for intensive longitudinal data: a new lens through data partitioning (PI Hector). Role: PI.

### PUBLICATIONS

\* co-first author; † corresponding author; + student author

#### Peer-reviewed journal articles

1. **Hector EC**<sup>†</sup>, Martin R. Turning the information-sharing dial: efficient inference from different data sources. *Electronic Journal of Statistics* (2024). 18(2):2974-3020.
2. Sohn AL<sup>\*</sup>, Kibbe RR<sup>\*</sup>, Dioli OE<sup>\*</sup>, **Hector EC**, Bai H, Garrard KP, Muddiman DC<sup>†</sup>. A statistical approach to system suitability testing (SST) for mass spectrometry imaging. *Rapid Communications in Mass Spectrometry* (2024). 38(9):e9725.
3. **Hector EC**<sup>†</sup>. Fused mean structure learning in data integration with dependence. *The Canadian Journal of Statistics* (2024). 52(3):939-961.
4. **Hector EC**<sup>†</sup>, Reich BJ. Distributed inference for spatial extremes modeling in high dimensions. *Journal of the American Statistical Association* (2023). 119(546):1297-1308.
5. Luo L, Wang J, **Hector EC**<sup>†</sup>. Rejoinder to Statistical inference for streamed longitudinal data. *Biometrika* (2023). 110(4):841-858.
6. Luo L, Wang J, **Hector EC**<sup>†</sup>. Statistical inference for streamed longitudinal data. *Biometrika* (2023). 110(4):841-858. Invited for discussion.
7. Shi L<sup>+</sup>, Wank M<sup>+</sup>, Chen Y<sup>+</sup>, Wang Y<sup>+</sup>, Liu Y, **Hector EC**, Song P XK<sup>†</sup>. Sleep Classification with Artificial Synthetic Imaging Data from Empatica E4 Wristband by Convolutional Neural Networks. *IEEE Journal of Biomedical and Health Informatics* (2023). 27(1):421-432.
8. Tagelsir AA<sup>†</sup>, **Hector EC**, Urena-Cirett JL, Mercado-Garcia A, Cantoral A, Hu H, Peterson KE, Téllez-Rojo MM, Martinez-Mier EA. Early lead exposure is associated with molar incisor hypomineralization. *Pediatric Dentistry* (2023). 45(5):427:433.
9. **Hector EC**<sup>\*</sup>, Luo L<sup>\*</sup>, Song P XK. Parallel-and-stream accelerator for computationally fast supervised learning. *Computational Statistics and Data Analysis* (2022). 177:107587.
10. **Hector EC**<sup>†</sup>, Song P XK. Joint integrative analysis of multiple data sources with correlated vector outcomes. *The Annals of Applied Statistics* (2022). 16(3):1700-1717.
11. Sohn AL<sup>†</sup>, Ping L, Glass JD, Seyfried NT, **Hector EC**, Muddiman DC. Interrogating the metabolomic profile of amyotrophic lateral sclerosis in the post-mortem human brain by

- Infrared Matrix-Assisted Laser Desorption Electrospray Ionization (IR-MALDESI) mass spectrometry imaging (MSI). *Metabolites* (2022). 12(11):1096.
12. Twiddy J, **Hector EC**, Dubljević V<sup>†</sup>. Perceived invasiveness and therapeutic acceptability of transcranial magnetic stimulation. *American Journal of Bioethics –Neuroscience* (2022). 14(1):17-20.
  13. Yin X<sup>†</sup>, Chan LS, Bose D, Jackson AU, VandeHaar P, Locke AE, Fuchsberger C, Stringham HM, Yu K, Fernandes Silva L, Zhang D, **Hector EC**, Young E, Ganel L, Das I, Abel HJ, Erdos MR, Bonnycastle LL, Kuusisto J, Stitzel NO, Hall I, Wagner GR, Kang J, Morrison J, Burant CF, Collins FS, Ripatti S, Palotie A, Freimer NB, Mohlke KL, Scott L, Wen X, Fauman E, Laakso M, Boehnke M. Genome-wide association studies of metabolites in Finnish men identify disease-relevant loci. *Nature Communications* (2022). 13(1):1644.
  14. **Hector EC**<sup>†</sup>, Song PXX<sup>†</sup>. A distributed and integrated method of moments for high-dimensional correlated data analysis. *Journal of the American Statistical Association* (2021). 116(534):805-818.
  15. **Hector EC**<sup>†</sup>, Song PXX. Doubly distributed supervised learning and inference with high-dimensional correlated outcomes. *Journal of Machine Learning Research* (2020). 21(173):1–35.
  16. Goodrich JM<sup>\*†</sup>, **Hector EC**<sup>\*</sup>, Tang L, Labarre JL, Dolinoy DC, Mercado-Garcia A, Cantoral A, Song PXX, Téllez Rojo MM, Peterson KE. Integrative analysis of gene-specific DNA methylation and untargeted metabolomics data from the ELEMENT cohort. *Epigenetic Insights* (2020). 13:1-10.
  17. Jansen EC<sup>†</sup>, **Hector EC**, Goodrich JM, Cantoral A, Téllez Rojo MM, Basu N, Song PXX, Torres Olascoaga L, Peterson KE. Mercury exposure in relation to sleep duration, timing, and fragmentation among adolescents in Mexico City. *Environmental Research* (2020). 191: 110216.
  18. Perng W<sup>†</sup>, **Hector EC**, Song PXX, Tellez Rojo MM, Raskind S, Kachman M, Cantoral A, Burant BF, Peterson KE. Metabolomic determinants of metabolic risk in Mexican adolescents. *Obesity* (2017). 25(9):1594-1602.

*Peer-reviewed book chapters*

19. **Hector EC**<sup>†</sup>, Tang L, Zhou L, Song PXX. Data integration and model fusion in the Bayesian and Frequentist frameworks. *Handbook on Bayesian, Fiducial and Frequentist Inference* (2024). Chapman and Hall/CRC Press.

*Invited comments*

20. Wrobel J<sup>†</sup>, **Hector EC**, Crawford L, D’Agostino McGowan L, da Silva N, Goldsmith J, Hicks S, Kane M, Lee Y, Mayrink V, Paciorek CJ, Usher T, Wolfson J<sup>a</sup>. Partnering with authors to enhance reproducibility at JASA. *Journal of the American Statistical Association* (2024), Invited comment. 119(546):795–797.

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<sup>a</sup> Authors after Hector are listed in alphabetical order to reflect equal contribution.

### *Preprints*

21. **Hector EC**<sup>†</sup>, Reich BJ, Eloyan A (2024+). Distributed model building and recursive integration for big spatial data modeling. arXiv:2305.15951.
22. Hickey J<sup>†</sup>, Williams JP, **Hector EC** (2022+). Transfer learning with uncertainty quantification: Random Effect Calibration of Source to Target (RECaST). arXiv:2211.16557.
23. Huang W<sup>+</sup>, **Hector EC**, Cape J, McKennan C<sup>†</sup> (2023+). A statistical framework for GWAS of high dimensional phenotypes using summary statistics, with application to metabolite GWAS. arXiv: 2303.10221.
24. Kim H<sup>†</sup>, Ghosh S, Di Martino A, **Hector EC** (2023+). Bayesian estimation of clustered dependence structures in functional neuroconnectivity. arXiv:2305.18044.
25. Manschot C<sup>+</sup>, **Hector EC**<sup>†</sup> (2022+). Functional regression with intensively measured longitudinal outcomes: a new lens through data partitioning. arXiv:2207.13014.
26. Manschot C<sup>†</sup>, **Hector EC** (2024+). Modeling massive physical activity monitor data through distributed inference. Preprint coming soon.
27. Maceda E<sup>†</sup>, **Hector EC**, Lenzi A, Reich BJ (2024+). A variational neural Bayes framework for inference on intractable posterior distributions. arXiv:2404.10899.

## **SOFTWARE**

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GitHub page: [github.com/ehector/](https://github.com/ehector/)

C++; R

**ISED** R Package: Estimates mean regression parameters by borrowing information from a prior analysis on another dataset.

**SLA** R Package: Performs streaming inference of intensively measured longitudinal data.

**BRdac** R Package: Divide-and-conquer estimation and inference for max-stable spatial process modeling.

**DIQIF** R Package: Performs joint integrative regression analysis of multiple data sources with correlated vector outcomes using quadratic inference functions.

**DDIMM** R Package: Performs doubly distributed and integrated method of moments regression for high-dimensional correlated responses.

**DIMM** R Package: Performs singly distributed and integrated method of moments regression for high-dimensional correlated responses.

## **TEACHING**

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\*new course I developed

**North Carolina State University, Department of Statistics**

ST422: Introduction to Mathematical Statistics II (Fall '21, '22, '23, '24)

ST502: Fundamentals of Statistical Inference II (Spring '21, '22, '23, Fall '23)

ST790\*: Statistical Methods for Data Integration (Spring '24)  
Guest lecture for NCSU Libraries Statistics Power Half Hour (Spring '22)  
Guest lecture for Summer Institute in Biostatistics (Summer '22, '23, '24)

### **Duke University, Department of Statistics**

Guest lecture for STA561: Probability for Machine Learning (Spring '22)

## **ADVISING & MENTORING**

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### **Current PhD students**

1. Liz Davis (NCSU, Statistics, expected Spring '27)
2. Rishav Chakrabarti (co-advised with Nate Josephs) (NCSU, Statistics, expected Spring '27)
3. Ryan Li (co-advised with Brian Reich) (NCSU, Statistics, expected Spring '26)
4. Wei Zhao (co-advised with Brian Reich) (NCSU, Statistics, expected Spring '26)
5. Jimmy Hickey (co-advised with Jonathan Williams) (NCSU, Statistics, expected Fall '24)
6. Hyoshin Kim (co-advised with Sujit Ghosh) (NCSU, Statistics, expected Spring '25)

### **Current PhD Student committees**

1. Abbey Collins (NCSU, Psychology, expected Summer '27)
2. Kevin Collins (NCSU, Statistics, expected Spring '26)
3. Nate Wiecha (NCSU, Statistics, expected Spring '26)
4. Matt Shisler (NCSU, Statistics, expected Spring '25)
5. Hongjian Yang (NCSU, Statistics, expected Spring '25)
6. Zhen Chen (NCSU, Statistics, expect Summer '24)

### **Former PhD students**

1. Cole Manschot (co-advised with Eric Laber) (NCSU, Statistics, Spring '23)
2. Joe Zhao (co-advised with Shu Yang) (NCSU, Statistics, Summer '23)

### **Former PhD Student committees**

1. Akshay Bharadwaj (NCSU, Industrial and Systems Engineering, Spring '23)
2. Sanghyun Choo (NCSU, Industrial and Systems Engineering, Spring '22)
3. Mohamed Abdelkader Abba (NCSU, Statistics, Summer '24)

### **Former Masters students**

1. Annabel Settle (NCSU, Statistics, Spring '23)

### **Former undergraduate students**

1. Vrishank Ghosh (NCSU, Statistics, Spring '24)
2. Livia Poppa (NCSU, Statistics, Spring '22)

*Invited Seminar Talks*

1. University of Edinburgh School of Mathematics and Statistics Seminar, May '24. Edinburgh, Scotland.
2. Emory University Department of Biostatistics and Bioinformatics Seminar, Mar '24. Atlanta, GA.
3. Statistical Sciences Applied Research and Education Seminar, Mar '24. York University, Canada.
4. Washington University in St. Louis Statistics and Data Science Seminar, Oct '23. St. Louis, MO.
5. NYU Langone DPH Biostatistics Seminar Series, Sep '23. Virtual.
6. Colloquium of the Department of Statistics and Actuarial Science of the University of Iowa, Apr '23. Virtual.
7. Seminar of the Wake Forest Biostatistics and Data Science Department, Feb '23. Wake Forest, NC.
8. Seminar of Columbia University's Department of Biostatistics, Dec '22. New York, NY.
9. University of North Carolina at Chapel Hill Colloquium of the Department of Statistics and Operations Research, Nov '22. Chapel Hill, NC.
10. KAUST Statistics Workshop, Nov '22. King Abdullah University of Science and Technology, Saudi Arabia.
11. Seminar of the University of California – Berkeley Division of Biostatistics, Apr '22. Berkeley, CA.
12. Seminar of the University of Pittsburgh Department of Statistics, Oct '21. Held virtually.
13. Seminar of the North Carolina State University Department of Statistics, Feb '21. Held virtually.
14. Joint seminar of the HEC Département de sciences de la décision and the McGill University Department of Statistics, Feb '21. Held virtually.
15. Seminar of the North Carolina State University Department of Statistics, Nov '19. Raleigh, NC.

*Invited Conference Talks*

16. \*'24 IMS International Conference on Statistics and Data Science, Dec '24. Nice, France.
17. Conference on Innovative Statistics and Machine Learning, Aug '24. Bend, OR.
18. Joint Statistical Meetings (JSM), Aug '24. Portland, OR.
19. Fifth International Workshop on Statistical Analyses of Multi-Outcome Data, Jul '24. Salzburg, Austria.
20. CMStatistics, Dec '23. Berlin, Germany.
21. Joint Statistical Meetings (JSM), Aug '23. Toronto, Canada.
22. EcoSta, Aug '23. Virtual.
23. International Statistical Institute World Statistics Congress, July '23. Ottawa, Canada.
24. New England Statistics Symposium, Jun '23. Virtual.

25. 2023 Clemson Climate Extremes Workshop, May '23. Clemson, SC.
26. ENAR Spring Meeting, Mar '23. Nashville, TN.
27. '22 IMS International Conference on Statistics and Data Science, Dec '22. Florence, Italy.
28. AISC, Oct '22. Greensboro, NC.
29. COMPSTAT '22, Aug '22. Bologna, Italy. Participating virtually.
30. Joint Statistical Meetings (JSM), Aug '22. Washington, DC.
31. ICSA Canada Chapter Symposium, Jul '22. Banff, Canada.
32. ICSA Applied Statistics Symposium, June '22. Gainesville, FL.
33. EcoSta, June '22. Virtual.
34. AAAS Annual Meeting Symposium, Feb '22. Held virtually.
35. CMStatistics, Dec '21. Held virtually.
36. Statistical Methods in Imaging Conference, May '21. Held virtually.
37. ENAR Spring Meeting, Mar '21. Held virtually.
38. BFF6.5 Virtual Workshop on Bayesian, Fiducial and Frequentist Statistical Inference, Feb '21. Held virtually.
39. Workshop on Recent Developments in Statistical Theory and Methods Based on Distributed Computing, May '18. Casa Matemática Oaxaca (CMO), Banff International Research Station for Mathematical Innovation and Discovery. Oaxaca, Mexico. Recording available at <http://www.birs.ca/events/2018/5-day-workshops/18w5089/videos>.

#### *Contributed Conference Talks*

40. ENAR Spring Meeting, Mar '22. Houston, TX.
41. Joint Statistical Meetings (JSM), Aug '21. Held virtually.
42. Joint Statistical Meetings (JSM), Jul '19. Denver, CO.
43. ENAR Spring Meeting, Mar '18. John Van Ryzin Award winner. Atlanta, GA.
44. University of Michigan Data Science Research Forum, '17. Michigan Institute for Data Science (MIDAS). Ann Arbor, MI. Recording available at <https://www.youtube.com/watch?v=SGPPfX2T4dI>.

#### *Poster Presentations*

45. Joint Statistical Meetings (JSM), '24. Portland, OR. (invited)
46. Joint Statistical Meetings (JSM), '20. Held virtually.
47. Joint Statistical Meetings (JSM), '18. Vancouver, Canada.
48. Spatial Statistics Conference, '17. University of Lancaster. Lancaster, England.
49. ENAR Spring Meeting, '16. Austin, TX.

#### *Other*

50. University of Michigan Biostatistics Alumni Spotlight, Sep '23 (invited). Virtual.
51. Panel Discussant. SAMSI workshop on Data-driven Mathematical & Statistical Modeling: Careers in Academia. '21. Virtual.
52. Panel Discussant. Fifth Bayesian, Fiducial and Frequentist (BFF5) Conference: Foundations of Data Science, '18. Ann Arbor, MI.



## PROFESSIONAL SERVICE

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### American Statistical Association

- Associate Editor for Reproducibility ('22-present), Journal of the American Statistical Association
- Co-organizer and chair of Topic-Contributed Session at the Joint Statistical Meetings: “*Recent Advances in High-Dimensional Estimation and Inference Methods*” ('22)
- Organizer and Chair of Topic-Contributed Session at the Joint Statistical Meetings: “*Integrative inference with data from multiple sources: challenges and new developments*” ('21)
- ASA Section on Statistical Learning and Data Science Student Paper Award judge ('21)

### Institute of Mathematical Statistics

- IMS contributed session chair for the 2024 Joint Statistical Meetings ('23-'24)

### International Biometric Society

- Chair of Contributed Papers Session at ENAR: “*Clustered Data Methods*” ('22)

### International Chinese Statistical Association

- Organizer and chair of Invited Sessions at the 2023 ICSA Applied Statistics Symposium:
  - “*Statistical methods for wearable devices*”
  - “*New developments in spatial extremes modelling*”

### International Statistical Institute

- Organizer and Chair of Invited Session at the 64th World Statistics Congress: “*Integrative inference with data from multiple sources: challenges and new developments*” ('23)

### Referee

Annals of Applied Statistics, Bernoulli, Biometrics, Biostatistics, Computational Statistics and Data Analysis, Electronical Journal of Statistics, Journal of the American Statistical Association, Journal of Applied Statistics, Journal of Business & Economic Statistics, Journal of Computational and Graphical Statistics, Journal of Data Science, Journal of Mathematical Imaging and Vision, Journal of the Royal Statistical Society (Series B), Journal of Statistical Computation and Simulation, Proceedings of the National Academy of Sciences of the United States of America, Scandinavian Journal of Statistics, Science Advances, Statistics in Biosciences, Statistics in Medicine, Statistical Methods in Medical Research

### Review Panel Member

National Science Foundation ('24)

## **DEPARTMENTAL SERVICE**

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### **North Carolina State University**

1. Search Committee, Member ('24-'25)
2. Seminar Committee, Member ('21-'22, '23-'24), Chair ('22-'23)
3. Climate Committee, Member ('21-'23)
4. Qualifying Exam Committee, Member ('22, '24, '25)
5. Beach Trip Committee, Member ('22)
6. Professional Strategies Working Group, Member ('20-present)