Prof. Dr. Jakob Runge

Curriculum Vitae





contact positions

Prof. Dr. Jakob Runge		
Chair of Climate Informatics Technische Universität Berlin Einsteinufer 17 10587 Berlin	from 06/2024	Technische Universität Dresden, Center for Interdisciplinary Digital Sciences (CIDS), ScaDS.AI, and Faculty of Computer Science Dresden, Germany Full Professor of <i>Data Science</i> (W3 research professorship with reduced teaching)
German Aerospace	2021-2026	Technische Universität Berlin, Institute of Computer Engineering and Microelectronics Berlin Germany
Institute of Data Science Mälzerstraße 3-5 07745 Jena		Chair of <i>Climate Informatics</i> (W2-equivalent guest professor during period of ERC grant 2021-2026). Leading 13 group members (3+2 post-docs, 5+1 PhD students, 2+0 student assistants) jointly at DLR + TU Berlin.
jakob.runge@dlr.de runge@tu-berlin.de	2017-2024	German Aerospace Center (DLR), Institute of Data Science Jena, Germany Permanent position as research group leader <i>Causal Inference</i> in <i>Depart-</i> <i>ment of Data Analysis and Intelligence</i> .
personal website group website	2016-2017	Imperial College, Grantham Institute - Climate Change and the Environment
google scholar research gate ORCID		James S. McDonnell Foundation Postdoctoral Fellow (independent re- search grant, \$200.000).
	2014-2015	Potsdam Institute for Climate Impact Research Potsdam, Germany Postdoctoral Researcher for causal discovery and network theory.

education

2014	Ph.D. in Physics (summa cum laude)
	Potsdam Institute for Climate Impact Research & Humboldt-Universität zu Berlin, Ger-
	many Detection and Quantificing Quantific from Time Quies of Quantific Qua
	tems
	Supervised by Prof. Jürgen Kurths. This thesis explored multivariate statistical measures of causal association and investigated tropical climate mechanisms.
2010	Diploma in Physics (excellent)
	Potsdam Institute for Climate Impact Research & Humboldt-Universität zu Berlin, Ger-
	many
	Coupling in the Climate System
	Supervised by Prof. Jürgen Kurths. Specialization in mathematics and nonlinear dynamics. Studies abroad at University of California, Santa Cruz.

funding

Total third-party funding aquired: €2.8M

2022-2023	Host for Alexander von Humboldt Fellow Alexander von Humboldt Foundation Hosting Prof. Dr. Alexandra Jahn via Alexander von Humboldt Fellow- ship for experienced researchers; €4k for host.
2021-2024	Helmholtz AI project with UFZ Leipzig Helmholtz 2020 Research proposal <i>Identifying causal flood drivers (CausalFlood)</i> ; total budget ca. €400k, €200k for PI. (100k DLR internal contribution).
2021-2024	Consortium member in H2020 Advancing climate services proposal LC-CLA-12-2020 Research proposal eXtreme events : Artificial Intelligence for Detection and Attribution (XAIDA); total budget ca. €6M, €0.4M for PI.
2021-2026	ERC Starting Grant ERC-2020-STG Research proposal Advanced spatio-temporal causal inference for cli- mate research (CausalEarth); total budget €1.5M.
2020-2024	Innovative Training Networks (ITN) H2020-MSCA-ITN-2019 Joint research proposal <i>"innovative MachIne leaRning to constrain</i> <i>Aerosol-cloud CLimate Impacts" (iMIRACLI)</i> ; 2 PhD students; total bud- get ca. €4M, €0.5M for PI.
2016-2017	Postdoctoral Fellowship Award in Studying Complex Systems James S. McDonnell Foundation Postdoctoral grant for pursuing independent research at a research in- stitution of the awardee's choice (grant amount \$200.000, max. 10 fel- lows worldwide per year).

awards

2023	Outstanding Reviewer Award Nature Communications Physics
	sightful remarks.
2022	DLR Science Prize (Wissenschaftspreis)
	German Aerospace Center In recognition of outstanding scientific and technical achievements DLR awards the annual Science Prize.
2021	NeurIPS spotlight paper award
	35th Conference on Neural Information Processing Systems NeurIPS is the top conference for machine learning. Only the top 3% of submissions receive this award.
2020	ERC Starting Grant
	European Research Council Awarded for research proposal Advanced spatio-temporal causal infer- ence for climate research (CausalEarth).
2019	NeurIPS top 10%-reviewer
	33rd Conference on Neural Information Processing Systems NeurIPS is the top conference for machine learning.
2019	ELLIS scholar
	European Laboratory for Learning and Intelligent Systems ELLIS supports the very best European academics in Artificial Intelli- gence, I am scholar in the "ML for Earth and Climate Sciences" program.
2016-2017	Postdoctoral Fellowship Award in Studying Complex Systems
	James S. McDonnell Foundation Postdoctoral grant for pursuing independent research at a research in- stitution of the awardee's choice (grant amount \$200.000, max. 10 fel- lows worldwide per year).
2015	Carl-Ramsauer doctoral thesis prize
	Berlin Physical Society The Carl-Ramsauer prize is awarded each year to the four best doctoral theses in physics among all Berlin universities.
2007	Fulbright study award
	Fulbright Association US travel scholarship with financial and idealistic support.
2004-2014	Studienstiftung study and Ph.D. scholarship
	German National Academic Foundation (Studienstiftung) Full Ph.D. scholarship with financial and idealistic support (grant amount ca. € 30.000).

professional activities

2023	Workshop co-organizer of a Dagstuhl Seminar on Causal Inference for Spatial Data Analytics
	Dagstuhl's mission is to further world-class research in computer science by facilitating communication and interaction between researchers.
2023	Main workshop organizer ``Causal inference for Time Series" at Con- ference on Uncertainty in Artificial Intelligence (UAI) UAI workshop UAI is among the top 5 conferences for machine learning.

2022, 2023	Area Chair for Conference on Uncertainty in Artificial Intelligence (UAI) UAI Area Chairs
	UAI is among the top 5 conferences for machine learning.
2018-2023	Steering committee member, Co-chair and co-PC chair Climate Infor- matics conference
	Cambridge 2023, North Carolina 2022, Oxford 2020, ENS Paris 2019, NCAR Boulder 2018 The Climate Informatics workshop series seeks to build collaborative re- lationships between researchers from statistics, machine learning and data mining and researchers in climate science.
2022	Member of appointment committee for tenure-track assistant profes- sorship at Universite Paris Saclay Assistant Professor CPJ IA-Physique Serving as external professor.
2021	Senior Programme Chair for Conference on Uncertainty in Artificial Intelligence (UAI) Senior Program Committee UAI is among the top 5 conferences for machine learning.
2021	Member of appointment committee for tenure-track assistant profes- sorship at Uni Bern Ass.Prof.tt in "Geodata and Earth Observation" Serving as external professor.
2021-Now	Editorial Board Member of Environmental Data Science (Cambridge University Press)
	Environmental Data Science is an interdisciplinary, open access journal dedicated to the potential of artificial intelligence and data science to enhance our understanding of the environment, and to address climate change.
2018	Guest editor, focus issue on Causation Inference and Information Flow in Dynamical Systems
	chaos. An interdisciplinary Journal of Nonlinear Science
2017	Workshop organizer Causality in complex systems Wageningen, NL
	Organization and scientific lead of workshop bringing together inter-



since 2012 Reviewer

NeurIPS 2019-2021, CLEAR 2021, UAI 2020-2022, Science, Science Advances, PNAS, Nature Comm., Physical Review Letters, Journal of Climate, Physical Review E, Chaos, Nature Human Behavior, Geophysical Research Letters, European Physics Journal, as well as European Research Council, DFG, among others.

national experts from statistics, machine learning, physics, climate re-

search, biology, ecology, and biogeochemistry (June 27-30).

publication metrics

(all publications shown at the end)

60+ publications (19 first-author, 6 single-author) totalling **4.500+ citations** (2.500+ on firstauthor papers), **h-index 29** approx. nine years after my PhD (Hirsch's m=3.2, all based on Google Scholar because other engines do not take into account the conference-publishing tradition in machine learning).

Among these a **Nature Reviews Earth and Environment Review article**, a single-author spotlight paper at **NeurIPS**, an invited **Nature Communications Perspective paper and Comment**, ML conference papers in **NeurIPS**, UAI, AISTATS, AAAI, ECCV, high-impact method papers in **Nature Communications and Science Advances**, pioneering causal discovery papers in **Physical Review Letters** and **Journal of Climate**, conference proceedings, and many application papers with collaborators in climate, biogeosciences, space physics, physiology, and other fields.

Furthermore, I am currently writing a book with **Cambridge University Press** on "Causal Inference for Time Series Data". I was also invited for upcoming review papers in **Nature Climate Change** and **Physics Reports**.

key publications

J Runge, A Gerhardus, G Varando, V Eyring, G Camps-Valls. "Causal inference for time series" *Nature Reviews Earth and Environment* 10:2553 (2023) in press; Invited review article.

J Runge. "Modern causal inference approaches to investigate biodiversity-ecosystem functioning relationships" *Nature Communications 1.14 (2023)* Pdf; 1 citations, Invited comment.

J Runge. "Necessary and sufficient graphical conditions for optimal adjustment sets in causal graphical models with hidden variables" *Advances in Neural Information Processing Systems 34 (NeurIPS 2021)*

Pdf; 4 citations, spotlight paper award (top 3% of submissions) for theoretical foundations of optimal causal effect estimation. DLR science prize was awarded for this paper.

J Runge at al.. "Detecting and quantifying causal associations in large nonlinear time series datasets" *Science Advances, eaau*4996 (2019)

Pdf. Method paper in high impact journal. 374 citations since 2019.

J Runge at al.. "Inferring causation from time series in earth system sciences" *Nature Communications*, 10(1): 2553 (2019)

Pdf.Invited Perspective Paper. 389 citations since 2019.

research stays

Dec 2022	Visiting scientist at Columbia University Causality Lab Department of Computer Science, New York, USA Invited talks and scientific exchange with Elias Bareinboim (former PhD student of Judea Pearl).
June 2022	Invited participant at Aspen AGCI workshop "Machine Learning and Climate" Aspen Institute for Global Change, Aspen, Colorado, USA Invited talks and scientific exchange.
Nov 2021	Invited participant at KITP workshop "Machine Learning and the Physics of Climate" Kavli Institute for Theoretical Physics, Santa Barbara Invited talks and scientific exchange.
Sept 2018	1-month research trip to US Carnegie Mellon University, NCAR Boulder, Caltech Invited talks and scientific exchange.
Mar–April 2017	Carnegie Mellon University Pittsburgh, US Invited as a guest scientist working with Kun Zhang, Clark Glymour, and others in causality group and Department of Machine Learning.

Feb 2017	California Institute of Technology
	Pasadena, US One-week exchange with Frederick Eberhardt working on deep learning methods for reconstructing causal states.
Jan-Feb 2017	Santa Fe Institute Santa Fe, US Invited as a guest scientist. The Santa Fe Institute is dedicated to the multidisciplinary study of the fundamental principles of complex adap- tive systems.
May-June 2014	Max Planck Institute for the Physics of Complex Systems Dresden, Germany Invited as a guest scientist and lecturer for a two-month international seminar on <i>Causality, Information transfer and Dynamical networks (CID-</i> <i>NET14).</i>

selected invited presentations

2023	TU Munich Institute for Mathematical Statistics Invited seminar (May 23)
2023	Keynote at workshop on Foundations of Causal Inference at Grenoble Univ. Invited in-person lecture (May 10)
2023	Seminar talk at Netherlands eScience Center Invited online talk (March 2)
2022	Columbia University LEAP seminar Invited in-person lecture (Dec 8)
2022	Banff workshop Combining Causal Inference and Extreme Value Theory in the Study of Climate Extremes and their Causes Invited online lecture (July 1)
2022	AGCI workshop on Machine Learning and Climate research Invited in-person workshop (June 5)
2022	Villa Garbald Causality workshop Invited in-person talk (May 3)
2022	Madrid Causality conference Invited online talk (May 5)
2022	Carnegie Mellon University Statistics STAMPS webinar series Invited online talk (April 22)
2022	ITU AI4Good webinar series Invited online talk (Jan 19)
2021	NOAA Center for Artificial Intelligence (NCAI) Invited online talk (Sept 9)
2020	SCAI Sorbonne Invited online talk (Dec 4)
2020	Alphabet and Google X Invited online talk (Feb 18)
2020	Machine Learning for Earth and Climate Sciences (ELLIS workshop), Mathema- tisches Forschungsinstitut Oberwolfach, Germany Invited participant (March 1-4)
2019	NeurIPS competition "Causality 4 Climate", Vancouver, Canada Competition track presentation (Dec 13)
2019	NYU Courant Institute Invited seminar talk (Nov 27)

- 2019 Foundations and New Horizons for Causal Inference, Mathematisches Forschungsinstitut Oberwolfach, Germany Invited participant (May 26-June 1) 2018 Climate group, California Institute of Technology, Pasadena, US Seminar presentation (Sept 27) 2018 21st International Conference on Artificial Intelligence and Statistics, Lanzarote, Spain Poster presentation (April 12) 2017 Brest Data Science and Environment workshop, Brest, France Invited lecture presentation (July 4) 2017 International Conference on Computational and Methodological Statistics, London, UK Invited oral presentation (Dec 17) 2017 Brest Data Science and Environment workshop, Brest, France Lecture presentation (July 4) 2017 DALI Data Learning and Inference (invitation-only conference), Tenerife, Spain Oral presentation (April 20) 2017 Machine learning seminar, Toyota Technological Institute, Chicago, US Invited seminar talk (March 31) 2017 Google Inc., Pittsburgh, US Invited seminar talk (March 17) 2017 Machine Learning Department, Carnegie Mellon University, US Invited seminar talk (March 6) 2017 National Center for Atmospheric Research (NCAR), Boulder, US Invited seminar talk (Feb 15) 2017 Los Alamos National Laboratory, US Invited seminar talk (Feb 1) 2017 Santa Fe Institute, US Invited seminar talk (Jan 24) 2016 Image Processing Laboratory, Universitat de València, Spain Invited seminar talk (Dec 1) 2016 Department of Meteorology, University of Reading, UK Invited seminar talk (Nov 7) 2016 Laboratoire de météorologie dynamique, École normale supérieure, France Invited seminar talk (June 1) 2015 Institute for Atmospheric and Climate Science, ETH Zurich, Switzerland Invited seminar talk (July 2) Department of Physics, University of Oxford, UK 2015 Invited seminar talk May 29) 2014 Moscow State University, Russia Invited lectures (Nov. 15-21) 2014 AIMS Conference on Dynamical Systems, Differential Equations and Applications, Madrid, Spain Invited talk (July 8)
 - 2013 Department of Machine Learning, Massachussets Institute of Technology, US Invited seminar talk (Nov 25)

Teaching

WS 2021/22,	Technische Universität Berlin
2022/23,	Berlin, Germany
2023/24	Regular Master course on Causal inference at Faculty of Computer Sci-
	ence. The course teaches the modern statistical framework of "causal
	inference". This framework formalizes the notions of cause and effect

ence. The course teaches the modern statistical framework of "causal inference". This framework formalizes the notions of cause and effect in mathematical terms, delineates the distinction between mere statistical relationships on the one hand and causal relationships on the other hand, and provides methods that allow to learn and reason about causal relationships in a data-driven way. The focus of this course in on conveying the framework's conceptual basics and central concepts. A particular emphasis lies on the application of causal inference to time series data, which is ubiquitous in many applied fields.

WS 2018/19, Friedrich Schiller University

SS 2020 Jena, Germany

Regular MSc course on *Causal inference with applications to time series* at Faculty of Mathematics and Computer Science. See description above.

- 2016, 2017 **European Geoscience Union** Vienna, Austria Short course on *Causal inference in the geosciences*.
- 2014 **Max Planck Institute for the Physics of Complex Systems** Dresden, Germany Lecture series within workshop Causality, Information transfer and Dynamical networks (CIDNET14).

2012 **Department of Physics, Humboldt University** Berlin, Germany Teaching assistant of graduate course *Linear and nonlinear methods of data analysis.*

(co-)supervision

2024-	Alexandrine Lanson
Now	PhD student at Technische Universität Berlin
2022-	Simon Bing
Now	PhD student at Technische Universität Berlin
2022-	Oana Popescu
Now	PhD student at DLR and Technische Universität Berlin
2021-	Sagar Simha
22	Co-supervised Master student at Universität Weimar
2022-	Tom Hochsprung
Now	PhD student at DLR and Technische Universität Berlin
2022-	Wiebke Günther
Now	PhD student at DLR and Technische Universität Berlin
2021-	Nicolas Reiter
Now	PhD student at DLR and Technische Universität Berlin
2020-	Rafael Westenberger
Now	PhD student at DLR and Technische Universität Berlin
2020-	Carla Roesch
Now	Co-supervised PhD student at University of Edinburgh
2020-	Emilie Fons
Now	Co-supervised PhD student at ETH Zürich
2020-	Peter Manshausen
Now	Co-supervised PhD student at University of Oxford

- 2020- Lucile Ricard
- Now Co-supervised PhD student at EPFL Lausanne
- 2018- Xavier Tibau
- 2022 PhD student at DLR and Friedrich Schiller Universität Jena
- 2018- Chris Requena
- 2021 Co-supervised PhD student at Friedrich Schiller Universität Jena
- 2018- Violeta Trifunov
- 2021 Co-supervised PhD student at Friedrich Schiller Universität Jena
- 2018- Christian Reimers
- 2021 Co-supervised PhD student at Friedrich Schiller Universität Jena
- 2018- Michael Niebisch
- 2021 Co-supervised PhD student at Friedrich Schiller Universität Jena
- 2019- Kevin Debeire
- Now Co-supervised PhD student at DLR Oberpfaffenhofen and Friedrich Schiller Universität Jena
- 2013- Marlene Kretschmer
- 2016 Co-supervised PhD student at Potsdam-Institute for Climate Impact Research
- 2016- Verena Schenzinger
- 2019 Co-supervised PhD student at Oxford University
- 2014 Pascal Klamser Co-supervised Master student at Humboldt Universität Berlin
- 2014 Lara Neureither Co-supervised Master student at Humboldt Universität Berlin

web projects and software

Tigramite causal inference for time series (https://github.com/jakobrunge/tigramite) **Causeme** causal inference benchmarking platform (http://www.causeme.net) **Pyunicorn** complex networks tools (https://github.com/pik-copan/pyunicorn)

public outreach and engagement

2023	Public video-interview for Causal Inference-series Federal Ministry of Education and Research (BMBF) within the research program "Digitale Hochschulbildung" Lead by Julia M. Rohrer.
2022	Invited speaker at science policy symposium on German-British science collaborations Symposium on future of German-British science collaborations (June 30) Held together with British Embassy Berlin.
2021	News articles on Künstliche Intelligenz sucht Kipppunkte im Klimasys- tem Heise Online (Oct 4) Part of MIT Technology Review.
2015	Organization of workshop on income and wealth inequality in Ger- many Wirkcamp Heidelberg (Aug 6–9) Part of nationwide initiative "Synagieren".

2011-Now Founding member of "Kunst schafft Wissen e.V." for artistically proliferating science

www.kunst-schafft-wissen.org

Production and performance of theater plays for communicating climate science: play "Die kleine Klimaprinzessin" staged at the "Lange Nacht der Wissenschaften" in Potsdam, "Odyssee:Klima" in Bremerhaven, and for educating young students in Potsdam on climate change.

2009–2014 Website on fair trade certificates www.fair-zieht-an.de Part of nationwide student initiative "Synagieren". Website gives an overview over ecological and social criteria in the textile industry.

all publications

Reviews and Perspectives

- Runge, Jakob (2023). "Modern causal inference approaches to investigate biodiversity-ecosystem functioning relationships". In: *Nature Communications* 14.1, p. 1917.
- Runge, Jakob, Andreas Gerhardus, Gherardo Varando, Veronika Eyring, and Gustau Camps-Valls (2023). "Causal inference for time series". In: *Nature Reviews Earth & Environment* 10, p. 2553.
- Ludescher, Josef, Maria Martin, Niklas Boers, Armin Bunde, Catrin Ciemer, Jingfang Fan, Shlomo Havlin, Marlene Kretschmer, Jürgen Kurths, Jakob Runge, Veronika Stolbova, Elena Surovyatkina, and Hans J. Schellnhuber (2021). "Network-based forecasting of climate phenomena". In: *Proceedings of the National Academy of Sciences* 118.47, e1922872118.
- Camps-Valls, Gustau, Dino Sejdinovic, Jakob Runge, and Markus Reichstein (2019). "A perspective on gaussian processes for earth observation". In: *National Science Review* 6.4, pp. 616–618.
- Runge, Jakob, Sebastian Bathiany, Erik Bollt, Gustau Camps-Valls, Dim Coumou, Ethan Deyle, Clark Glymour, Marlene Kretschmer, Miguel D Mahecha, Jordi Muñoz-Marí, Egbert H van Nes, Jonas Peters, Rick Quax, Markus Reichstein, Marten Scheffer, Bernhard Schölkopf, Peter Spirtes, George Sugihara, Jie Sun, Kun Zhang, and Jakob Zscheischler (2019). "Inferring causation from time series in earth system sciences". In: *Nature Communications* 10.1, p. 2553.
- Runge, Jakob (2018a). "Causal network reconstruction from time series: From theoretical assumptions to practical estimation". In: *Chaos An Interdiscip. J. Nonlinear Sci.* 28.7, p. 075310.
- Balasis, Georgios, Reik V. Donner, Stelios M. Potirakis, Jakob Runge, Constantinos Papadimitriou, Ioannis A. Daglis, Konstantinos Eftaxias, and Jürgen Kurths (Nov. 2013). "Statistical Mechanics and Information-Theoretic Perspectives on Complexity in the Earth System". In: *Entropy* 15.11, pp. 4844–4888. ISSN: 10994300. DOI: 10.3390/e15114844.
- Schellnhuber, Hans Joachim, Bill Hare, Olivia Serdeczny, Michiel Schaeffer, Sophie Adams, Florent Baarsch, Susanne Schwan, Dim Coumou, Alexander Robinson, Marion Vieweg, et al. (2013). "Turn down the heat: climate extremes, regional impacts, and the case for resilience." In: *Turn down the heat: climate extremes, regional impacts, and the case for resilience*.

Proceedings

- Brajard, Julien, Chen Chen, Jakob Runge, and Anastase Charantonis, eds. (2020). *Cl2020: Proceedings of the 10th International Conference on Climate Informatics.* virtual, United Kingdom: Association for Computing Machinery. ISBN: 9781450388481.
- Chen, C., A. Charantonis, J. Runge, and J. Brajard, eds. (2019). *Proceedings of the 9th International Workshop on Climate Informatics: Cl 2019.* Vol. 561+PROC. Technical Reports. NCAR. DOI: 10.5065/y82j-f154.
- Bollt, Erik M., Jie Sun, and Jakob Runge (July 2018). "Introduction to Focus Issue: Causation inference and information flow in dynamical systems: Theory and applications". In: *Chaos An Interdiscip. J. Nonlinear Sci.* 28.7, p. 075201. ISSN: 1054-1500. DOI: 10.1063/1.5046848.

Chen, C., D. Cooley, J. Runge, and E. Szekely, eds. (2018). *Proceedings of the 8th International-Workshop on Climate Informatics (CI2018)*. NCAR/TN-550+PROC. NCAR. NCAR Technical Note.

Causal inference

- Wahl, Jonas, Urmi Ninad, and Jakob Runge (2023). "Vector causal inference between two groups of variables". In: *Proceedings of the Thirty-Seventh AAAI Conference on Artificial Intelligence*. Ed. by Yiling Chen and Jennifer Neville. AAAI.
- Günther, Wiebke, Urmi Ninad, Jonas Wahl, and Jakob Runge (2022). "Conditional Independence Testing with Heteroskedastic Data and Applications to Causal Discovery". In: *Advances in Neural Information Processing Systems*. Ed. by Alice H. Oh, Alekh Agarwal, Danielle Belgrave, and Kyunghyun Cho.
- Runge, Jakob (2021). "Necessary and sufficient graphical conditions for optimal adjustment sets in causal graphical models with hidden variables". In: *Advances in Neural Information Processing Systems 34 (NeurIPS 2021)*. Ed. by M. Ranzato, A. Beygelzimer, Y. Dauphin, P.S. Liang, and J. Wortman Vaughan.
- Gerhardus, Andreas and Jakob Runge (2020). "High-recall causal discovery for autocorrelated time series with latent confounders". In: *Advances in Neural Information Processing Systems* 33.
- Runge, Jakob (2020). "Discovering contemporaneous and lagged causal relations in autocorrelated nonlinear time series datasets". In: *Proceedings of the 36th Conference on Uncertainty in Artificial Intelligence, UAI 2020, Toronto, Canada, 2019.* Ed. by David Sontag and Jonas Peters. AUAI Press.
- Saggioro, Elena, Jana de Wiljes, Marlene Kretschmer, and Jakob Runge (2020). "Reconstructing regime-dependent causal relationships from observational time series". In: *Chaos: An Interdisciplinary Journal of Nonlinear Science* 30.11, p. 113115.
- Runge, Jakob, Peer Nowack, Marlene Kretschmer, Seth Flaxman, and Dino Sejdinovic (2019). "Detecting and quantifying causal associations in large nonlinear time series datasets". In: Science Advances eaau4996.5.
- Runge, Jakob (2018b). "Conditional independence testing based on a nearest-neighbor estimator of conditional mutual information". In: *Proc. 21st Int. Conf. Artif. Intell. Stat.* Ed. by F. Storkey A. & Perez-Cruz. Playa Blanca, Lanzarote, Canary Islands: PMLR.
- (2015). "Quantifying information transfer and mediation along causal pathways in complex systems". In: *Physical Review E* 92.6, p. 062829. ISSN: 1539-3755. DOI: 10.1103/ PhysRevE.92.062829.
- Runge, Jakob, Reik V. Donner, and Jürgen Kurths (2015). "Optimal model-free prediction from multivariate time series". In: *Physical Review E* 91.5, p. 052909. ISSN: 1539-3755. DOI: 10. 1103/PhysRevE.91.052909.
- Runge, Jakob, Vladimir Petoukhov, Jonathan F. Donges, Jaroslav Hlinka, Nikola Jajcay, Martin Vejmelka, David Hartman, Norbert Marwan, Milan Paluš, and Jürgen Kurths (2015).
 "Identifying causal gateways and mediators in complex spatio-temporal systems". In: *Nature Communications* 6, p. 8502. ISSN: 2041-1723. DOI: 10.1038/ncomms9502.
- Runge, Jakob, Jobst Heitzig, Norbert Marwan, and Jürgen Kurths (2012). "Quantifying causal coupling strength: A lag-specific measure for multivariate time series related to transfer entropy". In: *Physical Review E* 86.6, p. 061121. ISSN: 1539-3755. DOI: 10.1103/PhysRevE. 86.061121. arXiv: 1210.2748.
- Runge, Jakob, Jobst Heitzig, Vladimir Petoukhov, and Jürgen Kurths (2012). "Escaping the Curse of Dimensionality in Estimating Multivariate Transfer Entropy". In: *Phys. Rev. Lett.* 108.25, p. 258701. ISSN: 0031-9007. DOI: 10.1103/PhysRevLett.108.258701.
- Pompe, Bernd and Jakob Runge (May 2011). "Momentary information transfer as a coupling measure of time series". In: *Physical Review E* 83.5, pp. 1–12. ISSN: 15393755. DOI: 10. 1103/PhysRevE.83.051122.

Deep learning

Reimers, Christian, Paul Bodesheim, Jakob Runge, and Joachim Denzler (2021). "Conditional adversarial debiasing: Towards learning unbiased classifiers from biased data". In: *DAGM German Conference on Pattern Recognition*. Springer, pp. 48–62.

- Reimers, Christian, Niklas Penzel, Paul Bodesheim, Jakob Runge, and Joachim Denzler (2021). "Conditional dependence tests reveal the usage of ABCD rule features and bias variables in automatic skin lesion classification". In: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pp. 1810–1819.
- Trifunov, Violeta Teodora, Maha Shadaydeh, Jakob Runge, Markus Reichstein, and Joachim Denzler (2021). "A Data-Driven Approach to Partitioning Net Ecosystem Exchange Using a Deep State Space Model". In: *IEEE Access* 9, pp. 107873–107883.
- Reimers, Christian, Jakob Runge, and Joachim Denzler (2020). "Determining the Relevance of Features for Deep Neural Networks". In: European Conference on Computer Vision (ECCV).
- (2019). "Using Causal Inference to Globally Understand Black Box Predictors Beyond Saliency Maps". In: 9th Int. Work. Clim. Informatics, pp. 1–4.
- Trifunov, Violeta Teodora, Maha Shadaydeh, Jakob Runge, Veronika Eyring, Markus Reichstein, and Joachim Denzler (2019a). "Causal Link Estimation under Hidden Confounding in Ecological Time Series". In: 9th Int. Work. Clim. Informatics, pp. 1–4.
- (2019b). "Nonlinear Causal Link Estimation under Hidden Confounding with an Application to Time-Series Anomaly Detection". In: *German Conference on Pattern Recognition (GCPR)*, pp. 1–4.
- Tibau, Xavier-andoni, Christian Requena-Mesa, Christian Reimers, Joachim Denzler, Veronika Eyring, Markus Reichstein, and Jakob Runge (2018). "SupernoVAE : VAE based kernel PCA for analysis of spatio-temporal Earth data". In: 8th Int. Work. Clim. Informatics, pp. 1–4.

Applications

- Karmouche, Soufiane, Evgenia Galytska, Jakob Runge, Gerald A Meehl, Adam S Phillips, Katja Weigel, and Veronika Eyring (2022). "Regime-oriented causal model evaluation of Atlantic-Pacific teleconnections in CMIP6". In: *EGUsphere*, pp. 1–42.
- Krich, Christopher, Miguel D Mahecha, Mirco Migliavacca, Martin G De Kauwe, Anne Griebel, Jakob Runge, and Diego G Miralles (2022). "Decoupling between ecosystem photosynthesis and transpiration: a last resort against overheating". In: *Environmental Research Letters* 17.4, p. 044013.
- Krich, Christopher, Mirco Migliavacca, Diego G Miralles, Guido Kraemer, Tarek S El-Madany, Markus Reichstein, Jakob Runge, and Miguel D Mahecha (2021). "Functional convergence of biosphere–atmosphere interactions in response to meteorological conditions". In: *Biogeosciences* 18.7, pp. 2379–2404.
- Tibau, Xavier-Andoni, Christian Reimers, Christian Requena-Mesa, and Jakob Runge (2021). "Spatio-temporal Autoencoders in Weather and Climate Research". In: *Deep Learning for the Earth Sciences: A Comprehensive Approach to Remote Sensing, Climate Science, and Geosciences*, pp. 186–203.
- Di Capua, Giorgia, Jakob Runge, Reik V Donner, Bart van den Hurk, Andrew G Turner, Ramesh Vellore, Raghavan Krishnan, and Dim Coumou (2020). "Dominant patterns of interaction between the tropics and mid-latitudes in boreal summer: causal relationships and the role of timescales". In: *Weather and Climate Dynamics* 1.2, pp. 519–539.
- Krich, Christopher, Mirco Migliavacca, Diego G Miralles, Guido Kraemer, Tarek S El-Madany, Markus Reichstein, Jakob Runge, and Miguel D Mahecha (2020). "Functional convergence of biosphere–atmosphere interactions in response to meteorology". In: *Biogeosciences Discussions*, pp. 1–35.
- Krich, Christopher, Jakob Runge, Diego Miralles, Mirco Migliavacca, Oscar Perez-Priego, Tarek El-Madany, Arnaud Carrara, and Miguel D Mahecha (2020). "Estimating causal networks in biosphere–atmosphere interaction with the PCMCI approach". In: *Biogeosciences*, pp. 1033– 1061.
- Nowack, Peer, Jakob Runge, Veronika Eyring, and Joanna D Haigh (2020). "Causal networks for climate model evaluation and constrained projections". In: *Nature Communications* 11.1, pp. 1–11.
- Di Capua, G, M Kretschmer, J Runge, A Alessandri, RV Donner, B van den Hurk, R Vellore, R Krishnan, and D Coumou (2019). "Long-Lead Statistical Forecasts of the Indian Summer Monsoon Rainfall Based on Causal Precursors". In: *Weather and Forecasting* 34.5, pp. 1377–1394.
- Kretschmer, Marlene, Judah Cohen, Vivien Matthias, Jakob Runge, and Dim Coumou (Dec. 2018). "The different stratospheric influence on cold-extremes in Eurasia and North America". In: *npj Climate and Atmospheric Sciences* 1.1, p. 44. ISSN: 2397-3722. DOI: 10.1038/ s41612-018-0054-4.

- Runge, Jakob, Georgios Balasis, Ioannis A. Daglis, Constantinos Papadimitriou, and Reik V. Donner (Dec. 2018). "Common solar wind drivers behind magnetic storm–magnetospheric substorm dependency". In: *Scientific Reports* 8.1, p. 16987. ISSN: 2045-2322. DOI: 10.1038/ s41598-018-35250-5.
- Kretschmer, Marlene, Jakob Runge, and Dim Coumou (2017). "Early prediction of weak stratospheric polar vortex states using causal precursors". In: *Geophysical Research Letters* 44.16, pp. 8592–8600.
- Kretschmer, Marlene, Dim Coumou, Jonathan F. Donges, and Jakob Runge (Mar. 2016). "Using causal effect networks to analyze different arctic drivers of midlatitude winter circulation". EN. In: *Journal of Climate* 29.11, pp. 4069–4081. ISSN: 08948755. DOI: 10.1175/ JCLI-D-15-0654.1.
- Runge, Jakob, Maik Riedl, Andreas Müller, Holger Stepan, Niels Wessel, and Jürgen Kurths (2015). "Quantifying the causal strength of multivariate cardiovascular couplings with momentary information transfer". In: *Physiol. Meas.* 36.4, pp. 813–825. ISSN: 0967-3334. DOI: 10.1109/ESGC0.2014.6847563.
- Runge, Jakob, Vladimir Petoukhov, and Jürgen Kurths (2014). "Quantifying the Strength and Delay of Climatic Interactions: The Ambiguities of Cross Correlation and a Novel Measure Based on Graphical Models". In: *Journal of Climate* 27.2, pp. 720–739. ISSN: 0894-8755. DOI: 10.1175/JCLI-D-13-00159.1.
- Runge, Jakob, Maik Riedl, Andreas Müller, Holger Stepan, Niels Wessel, and Jürgen Kurths (May 2014). "Quantifying the causal strength of multivariate cardiovascular couplings with momentary information transfer". In: *8th Conf. Eur. Study Gr. Cardiovasc. Oscil.* 1.Esgco, pp. 149–150. ISSN: 0967-3334. DOI: 10.1109/ESGC0.2014.6847563.
- Schleussner, Carl-Friedrich, Jakob Runge, Jascha Lehmann, and Anders Levermann (Sept. 2014). "The role of the North Atlantic overturning and deep ocean for multi-decadal global-mean-temperature variability". In: *Earth Syst. Dyn.* 5.1, pp. 103–115. ISSN: 2190-4987. DOI: 10.5194/esd-5-103-2014.
- Hlinka, Jaroslav, David Hartman, Martin Vejmelka, Jakob Runge, Norbert Marwan, Jürgen Kurths, and Milan Palůs (May 2013). "Reliability of inference of directed climate networks using conditional mutual information". In: *Entropy* 15.6, pp. 2023–2045. ISSN: 10994300. DOI: 10.3390/e15062023.
- Radebach, Alexander, Reik V. Donner, Jakob Runge, Jonathan F. Donges, and Jürgen Kurths (Nov. 2013). "Disentangling different types of El Niño episodes by evolving climate network analysis". In: *Physical Review E* 88.5, p. 052807. ISSN: 1539-3755. DOI: 10.1103/PhysRevE. 88.052807.
- Schleussner, C. F., J. Runge, J. Lehmann, and a. Levermann (Sept. 2013). "The role of the North Atlantic overturning and deep-ocean for multi-decadal global-mean-temperature variability". In: *Earth Syst. Dyn. Discuss.* 4.2, pp. 967–1003. ISSN: 2190-4995. DOI: 10.5194/ esdd-4-967-2013.

Benchmarks, software, and web platforms

- Tibau, Xavier-Andoni, Christian Reimers, Andreas Gerhardus, Joachim Denzler, Veronika Eyring, and Jakob Runge (2022). "A spatiotemporal stochastic climate model for benchmarking causal discovery methods for teleconnections". In: *Environmental Data Science* 1, e12.
- Requena-Mesa, Christian, Vitus Benson, Markus Reichstein, Jakob Runge, and Joachim Denzler (2021). "EarthNet2021: A large-scale dataset and challenge for Earth surface forecasting as a guided video prediction task." In: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pp. 1132–1142.
- Runge, Jakob, Xavier-Andoni Tibau, Matthias Bruhns, Jordi Muñoz-Marí, and Gustau Camps-Valls (2020). "The Causality for Climate Competition". In: *PMLR NeurIPS Competition & Demonstration Track Postproceedings*. Ed. by Hugo Jair Escalante and Raia Hadsell. Proceedings of Machine Learning Research. PMLR.
- Donges, Jonathan F., Jobst Heitzig, Boyan Beronov, Marc Wiedermann, Jakob Runge, Qing Yi Feng, Liubov Tupikina, Veronika Stolbova, Reik V. Donner, Norbert Marwan, Henk a. Dijkstra, and Jürgen Kurths (Nov. 2015). "Unified functional network and nonlinear time series analysis for complex systems science: The pyunicorn package". In: *Chaos An Interdiscip. J. Nonlinear Sci.* 25.11, pp. 1–28. ISSN: 1054-1500. DOI: 10.1063/1.4934554. arXiv: 1507.01571.

Theses

Runge, Jakob G. B. (2014). "Detecting and Quantifying Causal Interactions from Time Series of Complex Systems". PhD thesis. Humboldt University Berlin, p. 247.

Runge, Jakob (2010). "Coupling in the Climate System". Diploma Thesis. Humboldt University.

Others

Runge, Jakob and Grant Logan (2009). "Nonuniformity for rotated beam illumination in directly driven heavy-ion fusion". In: *Phys. Plasmas* 16.3, p. 033109. ISSN: 1070664X. DOI: 10.1063/1.3095561.