Jan Kazil, PhD

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Atmospheric scientist with 15+ years of experience in atmospheric research, atmospheric model development, and atmospheric model operation on high-performance computing systems (large-eddy simulations, regional models, and climate models), machine learning, analysis of in situ and remote sensing data, and operational forecasting.

Designed, secured funding for, and led research projects; supervised scientists. Led international model intercomparison projects and interdisciplinary teams supporting field campaigns (NOAA, NASA). Focused on advancing model capability, process representations, and translating research into actionable insights.

Professional Experience

Senior Research Scientist
University of Colorado (CIRES) & NOAA, Boulder, CO, USA
May 2024 – Mar 2025

Research Scientist III
University of Colorado (CIRES) & NOAA, Boulder, CO, USA
May 2015 – Apr 2024

Research Scientist II
University of Colorado (CIRES) & NOAA, Boulder, CO, USA
Dec 2008 – Apr 2015

Research Scientist
Max Planck Institute for Meteorology, Hamburg, Germany
Aug 2007 – Nov 2008

Research Scientist I
University of Colorado (CIRES) & NOAA, Boulder, CO, USA
Mar 2007 – Jul 2007

Education

PhD Atmospheric Science
University of Bern, Switzerland

MSc Theoretical Physics, Mathematics, and Astronomy
University of Bern, Switzerland

Research Experience

- **Boundary layer organization and climate response:** Identified and explained how organized circulation in trade-cumulus clouds modulates the cloud radiative effect under 21st-century climate change.
- **Stratocumulus dynamics:**
  - Demonstrated how mesoscale organization in stratocumulus alters entrainment rates and boundary layer thermodynamic structure.
  - Characterized the dynamical response of non-precipitating marine stratocumulus clouds to large-scale wind speed variations
- **Radiation-dynamics coupling:** Quantified the contributions of radiative processes on trade-wind boundary-layer stability using radiative-transfer modeling.
- **Aerosol-cloud interactions:** Investigated how cloud state transitions shape aerosol microphysics and feedbacks in the marine boundary layer.
- **Upper-tropospheric aerosol formation:** Studied new particle formation from the gas phase in cirrus clouds and its dependence on cirrus ice and aerosol properties.
- **Solar-cycle influence on climate:** Established an upper bound on solar-cycle modulation of Earth's cloud radiative effect via aerosol nucleation using a global climate model.
- **Aerosol nucleation and microphysics:** Developed and applied models of ion-mediated new particle formation and aerosol-cloud coupling in global and regional models.
- **Model numerics:** Developed an analytical solution to mitigate numerical artifacts in aerosol microphysics modules, improving stability and fidelity in the ECHAM-HAM climate model.
- **Environmental impact assessment:** Quantified U.S. deposition of a persistent fluorinated compound from vehicle air-conditioning emissions using a regional weather model.
- **Field observations:** Participated in field campaigns as a flight planner, meteorological analyst, and aircraft instrument operator.
- **Collaborative research:** Contributed domain expertise, model development, simulations, and interpretation to modeling and observational studies of aerosols, aerosol-cloud interactions, cloud transitions, chemistry-turbulence interactions, and model evaluation across institutions.

Key Competencies

- **Model development, simulation, analysis**:
  - Large-eddy and regional modeling (SAM, WRF/Chem): Developed and implemented process representations for surface gas and particulate emissions, aerosol microphysics with cloud coupling, gas- and aqueous-phase chemistry, and dry and wet deposition. Led and contributed to evaluation against in situ and remote-sensing observations.

    - Climate modeling: Developed and implemented aerosol microphysics and aerosol-cloud coupling representations in ECHAM-HAM and contributed to model evaluation against observations.
    - Multi-scale modeling: Developed a Lagrangian downscaling framework coupling large-eddy simulations to realistic large-scale meteorology (ERA5, CESM1-WACCM) to investigate cloud-circulation interactions across scales.
    - Developed parallelized software for online (MPI) and offline (OpenMP) post-processing of atmospheric simulations on HPC systems, including computation of azimuthally averaged variance and covariance Fourier spectra.
    - Developed Python software that automates the evaluation of HRRR forecasts with surface observations (GitHub).
- **Machine learning**:
    - Designed and implemented torch-tk, an open-source PyTorch toolkit to streamline training, checkpoint management, and diagnostics of PyTorch models (GitHub).
    - Trained and applied a deep learning model for instance segmentation in satellite imagery.
    - Created a neural network emulator for an atmospheric radiative transfer model to improve host model efficiency.
- **Operational software deployment:** Built and deployed a Python system for near-real-time extraction and analysis of satellite and NWP data from AWS to support field-campaign forecasting.
- **Operations**: Aircraft mission planning, flight guidance, meteorological forecasting.
- **Programming**: Python, PyTorch, NumPy, Pandas/GeoPandas, Xarray, Jupyter, IDL, Fortran, MPI, OpenMP, netCDF, Bash, Csh, bash, Tcl/Tk, netCDF, NCO, CDO, Git.
- **Leadership, supervision, mentoring:** Led interdisciplinary and international projects; supervised research scientists; mentored undergraduate, graduate, and postdoctoral researchers.
- **External funding:** Secured $1.3M in competitive funding as Lead Investigator; designed and directed multi-year research projects (NOAA, DOE, NSF).

Leadership Roles

University of Colorado, CIRES Project Lead (2023-2025) – Served as Project Lead for the “Clouds, Aerosol, and Climate” project embedded at NOAA, supervising University scientists, managing hiring and evaluations, and coordinating delivery and reporting of project objectives.

International Collaboration Lead – Created and led the Cold Pool Model Intercomparison Project (CP-MIP). CP-MIP investigates the cloud and cold pool evolution in models including SAM, MicroHH, DALES, SCALE, and ICON, with a focus on cloud microphysics and boundary layer

dynamics. The objective is to understand the causes of inter-model divergence and deviation from observations to enable process representation improvements.

NOAA Modeling Strategy (2024) – Served as a subject-matter expert on the NOAA Modeling Strategy Working Group and co-authored the *NOAA Modeling Strategy Strategic Plan 2024–2033*.

Forecast Team Lead – NOAA/NASA AEROMMA Field Campaign (2023): Developed the forecast methodology and led the team that produced the 24-hour forecasts and nowcasts using the HRRR model and satellite analysis to support flight planning and real-time flight operation decisions.

Flight Scientist – NOAA ATOMIC Field Campaign (2020): Directed research flight science operations based on real-time meteorological analysis, aligned with mission objectives.

Project Lead – Supervised scientists working on research projects.

Grants (Lead Investigator)

Secured $1.3M in funding.

2019 – 2024: Shallow cumulus convection and climate variability (NOAA) – $498,479

2016 – 2017: Cloud radiative effect emulator (NOAA) – $103,259

2012 – 2015: Aerosol-cloud-precipitation interactions in the SE Pacific (DOE) – $344,000

2009 – 2011: Gas phase emissions and cloud properties (NOAA/NSF) – $345,000

Honors and Awards

American Meteorological Society (AMS) Committee on Cloud Physics (elected member, 2019-2025)

NASA Group Achievement Award for "Outstanding Achievements in Advancing and Enabling NASA’s Global Systems" during the AEROMMA field campaign (2025)

CIRES Bronze Medal for scientific achievement – ATOMIC campaign (2023)

Service

Review Panels:

- U.S. Department of Energy (DOE)
- U.S. National Science Foundation (NSF)
- U.S. National Oceanic and Atmospheric Administration (NOAA)
- Swiss National Science Foundation (SNSF)
- Israel Science Foundation (ISF)
- European Co-operation in Science and Technology (COST)

Publications

ResearcherID: B-7652-2013 | ORCID | Web of Science | 44 publications total, including 43 peer-reviewed publications | 1600+ citations | h-index: 23

1. ***Increased dynamic efficiency in mesoscale organized trade wind cumulus clouds***
   I. L. McCoy, S. Baidar, P. Zuidema, J. Kazil, W. A. Brewer, W. M. Angevine, and G. Feingold, Atmos. Chem. Phys., 25, 16233–16261, doi:10.5194/acp-25-16233-2025, 2025
2. ***Flower-type organized trade-wind cumulus: A multi-day Lagrangian large eddy simulation intercomparison study***
   G. N. Raghunathan, P. Blossey, S. Boeing, L. Denby, S. Ghazayel, T. Heus, J. Kazil, and R. Neggers, JAMES, 17, e2024MS004864, doi:10.1029/2024MS004864, 2025
3. ***Magnitude and timescale of liquid water path adjustments to cloud droplet number concentration perturbations for nocturnal non-precipitating marine stratocumulus***
   Y.-S. Chen, P. Prabhakaran, F. Hoffmann, J. Kazil, T. Yamaguchi, and G. Feingold, Atmos. Chem. Phys., 25, 6141–6159, doi:10.5194/acp-25-6141-2025, 2025
4. ***On Climate Change and Trade Cumulus Organization***
   J. Kazil, P. Narenpitak, T. Yamaguchi, and G. Feingold, JAMES, 16, e2023MS004057, doi:10.1029/2023MS004057, 2024
5. ***NOAA Modeling Strategy: strategic plan 2024–2033***
   M. Morgan, D. Koch, B. Gross, D. Carlis, P. Burke, H. Tolman, J. Vogt, J. Mahoney, J. Kazil, J. Dunne, C. Kongragunta, J. Carmen, M. Huang, K. Garrett, J. Pica, Y.-J. Kim, C. Stawitz, H. Townsend, D. Barrie, Y. Jung, S. Gopalakrishnan, H.-S. Kim, C. Zhang, M. Poti, A. Mariotti, M. Supernaw, M. Brooks, M. Srinivasan, and R. Dempsey, United States National Oceanic and Atmospheric Administration, doi:10.25923/qggz-jb43, 2024
6. ***Segregation of fast-reactive species in atmospheric turbulent flow***
   G. P. Brasseur, M. Barth, J. Kazil, E. G. Patton, and Y. Wang, Atmosphere, 14, 1136–1151, doi:10.3390/atmos14071136, 2023
7. ***The sugar-to-flower shallow cumulus transition under the influences of diel cycle and free-tropospheric mineral dust***
   P. Narenpitak, J. Kazil, T. Yamaguchi, P. K. Quinn, and G. Feingold, JAMES, 15, e2022MS003228, doi:10.1029/2022MS003228, 2023
8. ***Projecting stratocumulus transitions on the albedo-cloud fraction relationship reveals linearity of albedo to droplet concentrations***
   T. Goren, G. Feingold, E. Gryspeerdt, J. Kazil, J. Kretzschmar, H. L. Jia, and J. Quaas, Geophys. Res. Lett., 49, e2022GL101169, doi:10.1029/2022GL101169, 2022
9. ***Cloud adjustments from large-scale smoke-circulation interactions strongly modulate the southeastern Atlantic stratocumulus-to-cumulus transition***
   M. S. Diamond, P. E. Saide, P. Zuidema, A. S. Ackerman, S. J. Doherty, A. M. Fridlind, H. Gordon, C. Howes, J. Kazil, T. Yamaguchi, J-H. Zhang, G. Feingold, and R. Wood, Atmos. Chem. Phys., 22, 12113–12151, doi:10.5194/acp-22-12113-2022, 2022
10. ***Segmentation-based multi-pixel cloud optical thickness retrieval using a convolutional neural network***
    V. Nataraja, S. Schmidt, H. Chen, T. Yamaguchi, J. Kazil, G. Feingold, K. Wolf, and H. Iwabuchi, Atm. Meas. Tech., 15, 5181–5205, doi:10.5194/amt-15-5181-2022, 2022

11. ***Realism of Lagrangian large eddy simulations driven by reanalysis meteorology: tracking a pocket of open cells under a biomass burning aerosol layer***
    J. Kazil, M. W. Christensen, S. J. Abel, T. Yamaguchi, and G. Feingold, JAMES, 13, e2021MS002664, doi:10.1029/2021MS002664, 2021
12. ***From sugar to flowers: a transition of shallow cumulus organization during ATOMIC***
    P. Narenpitak, J. Kazil, T. Yamaguchi, P. Quinn, and G. Feingold, JAMES, 13, e2021MS002619, doi:10.1029/2021MS002619, 2021
13. ***EUREC^{4}A***
    B. Stevens, S. Bony, D. Farrell, F. Ament, A. Blyth, C. Fairall, et al., Earth Syst. Sci. Data, 13, 4067–4119, doi:10.5194/essd-13-4067-2021, 2021
14. ***Observations from the NOAA P-3 aircraft during ATOMIC***
    R. Pincus, C. W. Fairall, A. Bailey, H. N. Chen, P. Y. Chuang, G. de Boer, G. Feingold, D. Henze, Q. T. Kalen, J. Kazil, M. Leandro, A. Lundry, K. Moran, D. A. Naeher, D. Noone, A. J. Patel, S. Pezoa, I. PopStefanija, E. J. Thompson, J. Warnecke, and P. Zuidema, Earth Syst. Sci. Data, 13, 3281–3296, doi:10.5194/essd-13-3281-2021, 2021
15. ***Large hemispheric difference in nucleation mode aerosol concentrations in the lowermost stratosphere at mid- and high latitudes***
    A. Kupc, C. J. Williamson, A. L. Hodshire, J. Kazil, E. Ray, T. P. Bui, M. Dollner, K. D. Froyd, K. McKain, A. Rollins, G. P. Schill, A. Thames, B. B. Weinzierl, J. R. Pierce, and C. A. Brock, Atmos. Chem. Phys., 21, 9065–9088, doi:10.5194/acp-21-9065-2021, 2021
16. ***The potential role of organics in new particle formation and initial growth in the remote tropical upper troposphere***
    A. Kupc, C. J. Williamson, A. L. Hodshire, J. Kazil, E. Ray, T. P. Bui, M. Dollner, K. D. Froyd, K. McKain, A. Rollins, G. P. Schill, A. Thames, B. B. Weinzierl, J. R. Pierce, and C. A. Brock, Atmos. Chem. Phys., 20, 15037–15060, doi:10.5194/acp-20-15037-2020, 2020
17. ***Anthropogenic air pollution delays marine stratocumulus breakup to open cells***
    T. Goren, J. Kazil, F. Hoffmann, T. Yamaguchi, and G. Feingold, Geophys. Res. Lett., 46, 14135–14144, doi:10.1029/2019GL085412, 2019
18. ***Aerosol-cloud interactions in trade wind cumulus clouds and the role of vertical wind shear***
    T. Yamaguchi, G. Feingold, and J. Kazil, J. Geophys. Res., 124, 12244–12261, doi:10.1029/2019JD031073, 2019
19. ***Analysis of albedo versus cloud fraction relationships in liquid water clouds using heuristic models and large eddy simulation***
    G. Feingold, J. Balsells, F. Glassmeier, T. Yamaguchi, J. Kazil, and A. McComiskey, J. Geophys. Res., 122, 7086–7102, doi:10.1002/2017JD026467, 2017
20. ***Stratocumulus to cumulus transition by drizzle***
    T. Yamaguchi, G. Feingold, and J. Kazil, JAMES, 9, 2333–2349, doi:10.1002/2017MS001104, 2017
21. ***Mesoscale organization, entrainment, and the properties of a closed-cell stratocumulus cloud***
    J. Kazil, T. Yamaguchi, and G. Feingold, JAMES, 9, 2214–2229, doi:10.1002/2017MS001072, 2017
22. ***Wind speed response of marine non-precipitating stratocumulus clouds over a diurnal cycle in cloud-system resolving simulations***
    J. Kazil, G. Feingold, and T. Yamaguchi, Atmos. Chem. Phys., 16, 5811–5839, doi:10.5194/acp-16-5811-2016, 2016

23. ***Stratocumulus to cumulus transition in the presence of elevated smoke layers***
    T. Yamaguchi, G. Feingold, J. Kazil, and A. McComiskey, Geophys. Res. Lett., 42, 10478–10485, doi:10.1002/2015GL066544, 2015

24. ***On the reversibility of transitions between closed and open cellular convection***
    G. Feingold, I. Koren, T. Yamaguchi, and J. Kazil, Atmos. Chem. Phys., 15, 7351–7367, doi:10.5194/acp-15-7351-2015, 2015

25. ***Deposition and rainwater concentrations of trifluoroacetic acid in the United States from the use of HFO-1234yf***
    J. Kazil, S. McKeen, S.-W. Kim, R. Ahmadov, G. A. Grell, R. K. Talukdar, and A. R. Ravishankara, J. Geophys. Res., 119, 14059–14079, doi:10.1002/2014jd022058, 2014

26. ***On the interaction between marine boundary layer cellular cloudiness and surface heat fluxes***
    J. Kazil, G. Feingold, H. Wang, and T. Yamaguchi, Atmos. Chem. Phys., 14, 61–79, doi:10.5194/acp-14-61-2014, 2014

27. ***Numerical issues associated with compensating and competing processes in climate models: an example from ECHAM-HAM***
    H. Wan, P. J. Rasch, K. Zhang, J. Kazil, and L. R. Leung, Geosci. Model Dev., 6, 861–874, doi:10.5194/gmd-6-861-2013, 2013

28. ***The present-day decadal solar cycle modulation of Earth's radiative forcing via charged H_2SO_4/H_2O aerosol nucleation***
    J. Kazil, K. Zhang, P. Stier, J. Feichter, U. Lohmann, and K. O'Brien, Geophys. Res. Lett., 39, L02805, doi:10.1029/2011GL050058, 2012

29. ***The regional aerosol-climate model REMO-HAM***
    J.-P. Pietikäinen, D. O'Donnell, C. Teichmann, U. Karstens, S. Pfeifer, J. Kazil, R. Podzun, S. Fiedler, H. Kokkola, W. Birmili, C. O'Dowd, U. Baltensperger, E. Weingartner, R. Gehrig, G. Spindler, M. Kulmala, J. Feichter, D. Jacob, and A. Laaksonen, Geosci. Model Dev., 5, 1323–1339, doi:10.5194/gmd-5-1323-2012, 2012

30. ***The global aerosol-climate model ECHAM-HAM, version 2: sensitivity to improvements in process representations***
    K. Zhang, D. O'Donnell, J. Kazil, P. Stier, S. Kinne, U. Lohmann, S. Ferrachat, B. Croft, J. Quaas, H. Wan, S. Rast, and J. Feichter, Atmos. Chem. Phys., 12, 8911–8949, doi:10.5194/acp-12-8911-2012, 2012

31. ***In situ observations of new particle formation in the tropical upper troposphere: the role of clouds and the nucleation mechanism***
    R. Weigel, S. Borrmann, J. Kazil, A. Minikin, A. Stohl, J. C. Wilson, J. M. Reeves, D. Kunkel, M. de Reus, W. Frey, E. R. Lovejoy, C. M. Volk, S. Viciani, F. D'Amato, C. Schiller, T. Peter, H. Schlager, F. Cairo, K. S. Law, G. N. Shur, G. V. Belyaev, and J. Curtius, Atmos. Chem. Phys., 11, 9983–10010, doi:10.5194/acp-11-9983-2011, 2011

32. ***Radon activity in the lower troposphere and its impact on ionization rate: a global estimate using different radon emissions***
    K. Zhang, J. Feichter, J. Kazil, H. Wan, W. Zhuo, A. D. Griffiths, H. Sartorius, W. Zahorowski, M. Ramonet, M. Schmidt, C. Yver, R. E. M. Neubert, E.-G. Brunke, Atmos. Chem. Phys., 11, 7817–7838, doi:10.5194/acp-11-7817-2011, 2011

33. ***Modeling chemical and aerosol processes in the transition from closed to open cells during VOCALS-Rex***

J. Kazil, H. Wang, G. Feingold, A. D. Clarke, J. R. Snider, and A. R. Bandy, Atmos. Chem. Phys., 11, 7491–7514, doi:10.5194/acp-11-7491-2011, 2011

34. ***Modelling microphysical and meteorological controls on precipitation and cloud cellular structures in Southeast Pacific stratocumulus***
    H. Wang, G. Feingold, R. Wood, and J. Kazil, Atmos. Chem. Phys., 10, 6347–6362, doi:10.5194/acp-10-6347-2010, 2010

35. ***Aerosol nucleation and its role for clouds and Earth's radiative forcing in the aerosol-climate model ECHAM5-HAM***
    J. Kazil, P. Stier, K. Zhang, J. Quaas, S. Kinne, D. O'Donnell, S. Rast, M. Esch, S. Ferrachat, U. Lohmann, and J. Feichter, Atmos. Chem. Phys., 10, 10733–10752, doi:10.5194/acp-10-10733-2010, 2010

36. ***Aerosol microphysics modules in the framework of the ECHAM5 climate model – intercomparison under stratospheric conditions***
    H. Kokkola, R. Hommel, J. Kazil, U. Niemeier, A.-I. Partanen, J. Feichter, and C. Timmreck, Geosci. Model Dev., 2, 97–112, doi:10.5194/gmd-2-97-2009, 2009

37. ***Tropospheric new particle formation and the role of ions***
    J. Kazil, R. G. Harrison, and E. R. Lovejoy, Space Sci. Rev., 137, 241–255, doi:10.1007/978-0-387-87664-1_15, 2008

38. ***Relevance of ion-induced nucleation of sulfuric acid and water in the lower troposphere over the boreal forest at northern latitudes***
    M. Boy, J. Kazil, E. R. Lovejoy, A. Guenther, and M. Kulmala, Atmos. Res., 90, 151–158, doi:10.1016/j.atmosres.2008.01.002, 2008

39. ***Hot-air balloon as a platform for boundary layer profile measurements during particle formation***
    L. Laakso, T. Grönholm, L. Kulmala, S. Haapanala, A. Hirsikko, E. R. Lovejoy, J. Kazil, T. Kurtén, M. Boy, E. D. Nilsson, A. Sogachev, I. Riipinen, F. Stratmann, and M. Kulmala, Boreal Env. Res., 12, 279–294, doi:10.60910/hy3b-xke7, 2007

40. ***A semi-analytical method for calculating rates of new sulfate aerosol formation from the gas phase***
    J. Kazil and E. R. Lovejoy, Atmos. Chem. Phys., 7, 3447–3459, doi:10.5194/acp-7-3447-2007, 2007

41. ***Is aerosol formation in cirrus clouds possible?***
    J. Kazil, E. R. Lovejoy, E. J. Jensen, and D. R. Hanson, Atmos. Chem. Phys., 7, 1407–1413, doi:10.5194/acp-7-1407-2007, 2007

42. ***Aerosol nucleation over oceans and the role of galactic cosmic rays***
    J. Kazil, E. R. Lovejoy, M. C. Barth, and K. O'Brien, Atmos. Chem. Phys., 6, 4905–4924, doi:10.5194/acp-6-4905-2006, 2006

43. ***Tropospheric ionization and aerosol production: A model study***
    J. Kazil and E. R. Lovejoy, J. Geophys. Res., 109, D19206, doi:10.1029/2004JD004852, 2004

44. ***The University of Bern Atmospheric Ion Model: Time-dependent modeling of the ions in the mesosphere and lower thermosphere***
    J. Kazil, E. Kopp, S. Chabrillat, and J. Bishop, J. Geophys. Res., 108, 4432, doi:10.1029/2002JD003024, 2003