Mark D. Zelinka

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Research Interests

Climate sensitivity, cloud feedback, radiative forcing

Education

Ph.D., Atmospheric Sciences, University of Washington, Dec 2010

M.S., Atmospheric Sciences, University of Washington, Dec 2007

B.S., Meteorology, Pennsylvania State University, May 2004

Professional Experience

Research scientist, Lawrence Livermore National Laboratory, Apr 2013 - present.

Post-doctoral research scholar, Lawrence Livermore National Laboratory, Jan 2011 - Mar 2013.

Graduate research assistant, Dept. of Atmospheric Sciences, Univ. of Washington, Sep 2004 - Dec 2010.

Submitted Work

Ceppi, P., T. A. Myers, P. Nowack, C. J. Wall, and **M. D. Zelinka**, 2024: Implications of a pervasive climate model bias for low-cloud feedback, *Geophys. Res. Lett.*, submitted.

Lin, Y.-J., G. V. Cesana, C. Proistosescu , **M. D. Zelinka**, and K. C. Armour, 2024: The relative importance of forced and unforced temperature patterns in driving the time variation of low-cloud feedback, *J. Climate*, submitted.

Lee, J. et al. including **M. D. Zelinka**, 2024: Objective Evaluation of Earth System Models: PCMDI Metrics Package (PMP) version 3, *Geosci. Model Dev.*, submitted.

Cesana, G. V., et al. including **M. D. Zelinka**, 2024: Observational constraint on a feedback from supercooled clouds reduces projected warming uncertainty, *Commun. Earth Environ.*, submitted.

Published Work

83. Zhao, X. et al including **M. D. Zelinka**, 2024: Larger cloud liquid water enhances both aerosol indirect forcing and cloud radiative feedback in two Earth System Models, *Geophys. Res. Lett.*, 51, doi:10.1029/2023GL105529.

82. Chao, L.-W., **M. D. Zelinka**, and A. E. Dessler, 2024: Evaluating Cloud Feedback Components in Observations and Their Representation in Climate Models, *J. Geophys. Res.*, 129, doi:10.1029/2023JD039427.

81. Qin, Y., X. Zheng, S. A. Klein, **M. D. Zelinka**, P.-L. Ma, J.-C. Golaz, S. Xie, 2024: Causes of Reduced Climate Sensitivity in E3SM from Version 1 to Version 2, *J. Adv. Model. Earth Syst.*, 16, doi:10.1029/2023MS003875.

80. Rugenstein, M., **M. D. Zelinka**, K. Karnauskas, P. Ceppi, and T. Andrews, 2023: Patterns of Surface Warming Matter for Climate Sensitivity, *Eos*, 104, doi:10.1029/2023EO230411.

79. Samset, B., C. Zhou, J. S. Fuglestvedt, M. T. Lund, J. Marotzke, and **M. D. Zelinka**, 2023: Steady global surface warming from 1973 to 2022 but increased warming rate after 1990, *Commun. Earth Environ.*, 4, 400, doi:10.1038/s43247-023-01061-4.

78. Bonan, D. B., N. Feldl, **M. D. Zelinka**, and L. C. Hahn, 2023: Contributions to regional precipitation change and its polar-amplified pattern under warming, *Environ. Res.: Climate*, 2, 035010, doi:10.1088/2752-5295/ace27a.

77. **Zelinka, M. D.**, C. J. Smith, Y. Qin, and K. E. Taylor, 2023: Comparison of methods to estimate aerosol effective radiative forcings in climate models, *Atmos. Chem. Phys.*, 23, 8879-8898, doi:10.5194/acp-23-8879-2023.

76. Myers, T. A., **M. D. Zelinka**, and S. A. Klein, 2023: Observational Constraints on the Cloud Feedback Pattern Effect, *J. Climate*, doi:10.1175/JCLI-D-22-0862.1, in press.

75. Zhou, C., M. Wang, **M. D. Zelinka**, Y. Liu, Y. Dong, K. C. Armour, 2023: Explaining Forcing Efficacy with Pattern Effect and State Dependence, *Geophys. Res. Lett.*, doi:10.1029/2022GL101700.

74. **Zelinka, M. D.**, I. Tan, L. Oreopoulos, G. Tselioudis, 2023: Detailing Cloud Property Feedbacks with a Regime-Based Decomposition, *Clim Dyn.*, 60, 2983–3003, doi:10.1007/s00382-022-06488-7.

73. Santer, B. D, et al. including **M. D. Zelinka**, 2022: Robust anthropogenic signal identified in the seasonal cycle of tropospheric temperature, *J. Climate*, 35(18), 6075–6100, doi:10.1175/JCLI-D-21-0766.1.

72. Hausfather, Z., K. Marvel, G. A. Schmidt, J. W. Nielsen-Gammon, and **M. D. Zelinka**, 2022: Climate simulations: recognize the "hot model" problem, *Nature*, doi:10.1038/d41586-022-01192-2.

71. Samset, B., C. Zhou, J. Fuglestvedt, M. Lund, J. Marotzke, **M. D. Zelinka**, 2022: Earlier emergence of a temperature response to mitigation by filtering annual variability, *Nat Commun.*, 13, 1578, doi:10.1038/s41467-022-29247-y.

70. McCoy, D. M. et al. including **M. D. Zelinka**, 2022: Extratropical shortwave cloud feedbacks in the context of the global circulation and hydrological cycle, *Geophys. Res. Lett.*, 49, doi:10.1029/2021GL097154.

69. Ma, P.-L., et al. including **M. D. Zelinka**, 2022: Better calibration of cloud parameterizations and subgrid effects increases the fidelity of E3SM Atmosphere Model version 1, *Geosci. Model Dev.*, 15, 2881–2916, doi:10.5194/gmd-15-2881-2022.

68. Qin, Y., **M. D. Zelinka**, and S. A. Klein, 2022: On the Correspondence between Atmosphere-Only and Coupled Simulations for Radiative Feedbacks and Forcing from CO_2, *J. Geophys. Res.*, 127, doi:10.1029/2021JD035460.

67. **Zelinka, M. D.**, S. A. Klein, Y. Qin, and T. A. Myers, 2022: Evaluating climate models' cloud feedbacks against expert judgment, *J. Geophys. Res.*, 127, doi:10.1029/2021JD035198.

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63. Myers, T. A., R. C. Scott, **M. D. Zelinka**, S. A. Klein, J. R. Norris, and P. M. Caldwell, 2021: Observational Constraints on Low Cloud Feedback Reduce Uncertainty of Climate Sensitivity, *Nature Clim. Change*, doi:10.1038/s41558-021-01039-0.

62. Thackeray, C. W., A. Hall, **M. D. Zelinka**, and C. G. Fletcher, 2021: Assessing prior emergent constraints on surface albedo feedback in CMIP6, *J. Climate*, 34(10), 3889–3905, doi:10.1175/JCLI-D-20-0703.1.

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59. Zhou, C., **M. D. Zelinka**, A. E. Dessler, and M. Wang, 2021: Greater committed warming after accounting for the SST pattern effect, *Nature Clim. Change*, 11, 132–136, doi:10.1038/s41558-020-00955-x.

58. Ma, H.-Y., et al. including **M. D. Zelinka**, 2021: A multi-year short-range hindcast experiment with CESM1 for evaluating climate model moist processes from diurnal to interannual timescales, *Geosci. Model Dev.*, 14, 73–90, doi:10.5194/gmd-14-73-2021.

57. McCoy, D. M., P. Field, A. Bodas-Salcedo, G. S. Elsaesser, and **M. D. Zelinka**, 2020: A regime-oriented approach to observationally constraining extratropical shortwave cloud feedbacks, *J. Climate*, doi:10.1175/JCLI-D-19-0987.1.

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53. **Zelinka, M. D.**, T. A. Myers, D. T. McCoy, S. Po-Chedley, P. M. Caldwell, P. Ceppi, S. A. Klein, and K. E. Taylor, 2020: Causes of higher climate sensitivity in CMIP6 models, *Geophys. Res. Lett.*, 47, doi:10.1029/2019GL085782.

52. Zhou, C., Y. Hu, J. Lu, and **M. D. Zelinka**, 2020: Responses of the Hadley Circulation to regional sea surface temperature changes, *J. Climate*, 33, 429–441, doi:10.1175/JCLI-D-19-0315.1.

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50. Santer, B. D., et al. including **M. D. Zelinka**, 2019: Quantifying stochastic uncertainty in detection time of human-caused climate signals, *Proc. Natl. Acad. Sci.*, 116 (40) 19821–19827, doi:10.1073/pnas.1904586116.

49. Chen, Y.-J., Y.-T. Hwang, **M. D. Zelinka**, and C. Zhou, 2019: Distinct patterns of cloud changes associated with decadal variability and their contribution to observed cloud cover trends, *J. Climate*, 32, 7281–7301, doi:10.1175/JCLI-D-18-0443.1.

48. Zhang, Y., et al. including **M. D. Zelinka**, 2019: Evaluation of Clouds in Version 1 of the E3SM Atmosphere Model with Satellite Simulators, *J. Adv. Model. Earth Syst.*, 11, 1253–1268, doi:10.1029/2018MS001562.

47. Golaz, J.-C., et al. including **M. D. Zelinka**, 2019: The DOE E3SM coupled model version 1: Overview and evaluation at standard resolution, *J. Adv. Model. Earth Syst.*, 11, doi:10.1029/2018MS001603.

46. Santer, B. D., et al. including **M. D. Zelinka**, 2019: Celebrating the anniversary of three key events in climate change science, *Nature Clim. Change*, 9, 180–182, doi:10.1038/s41558-019-0424-x.

45. Terai, C. R., Y. Zhang, S. A. Klein, **M. D. Zelinka**, J. C. Chiu, and Q. Min, 2019: Mechanisms behind the extratropical stratiform low-cloud optical depth response to temperature in ARM site observations, *J. Geophys. Res.*, 124, doi:10.1029/2018JD029359.

44. McCoy, D. T., et al. including **M. D. Zelinka**, 2019: Cloud feedbacks in extratropical cyclones: insight from long-term satellite data and high-resolution global simulations, *Atmos. Chem. Phys.*, 19, 1147–1172, doi:10.5194/acp-19-1147-2019.

43. Colman, R., J. R. Brown, C. Franklin, L. Hanson, H. Ye, and **M. D. Zelinka**, 2019: Evaluating cloud feedbacks and rapid responses in the ACCESS model, *J. Geophys. Res.*, 124, doi:10.1029/2018JD029189.

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41. Santer, B. D., et al. including **M. D. Zelinka**, 2018: Human influence on the seasonal cycle of tropospheric temperature, *Science*, 361, doi:10.1126/science.aas8806.

40. Caldwell, P. M., **M. D. Zelinka**, and S. A. Klein, 2018: Evaluating Emergent Constraints on Equilibrium Climate Sensitivity, *J. Climate*, 31, 3921–3942, doi:10.1175/JCLI-D-17-0631.1.

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38. Qu, X., A. Hall, A. M. DeAngelis, **M. D. Zelinka**, S. A. Klein, H. Su, B. Tian, and C. Zhai, 2018: On proposed emergent constraints of climate sensitivity, *J. Climate*, 31, 863–875, doi:10.1175/JCLI-D-17-0482.1.

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34. C. Bonfils, et al. including **M. D. Zelinka**, 2017: Competing influences of anthropogenic warming, ENSO, and plant physiology on future terrestrial aridity, *J. Climate*, 30, 6883–6904, doi:10.1175/JCLI-D-17-0005.1.

33. Ceppi, P., F. Brient, **M. D. Zelinka**, and D. L. Hartmann, 2017: Cloud feedback mechanisms and their representation in global climate models, *WIREs Climate Change*, e465, doi:10.1002/wcc.465.

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27. Tan, I., T. Storelvmo, and **M. D. Zelinka**, 2016: Observational constrains on mixed-phase clouds imply higher climate sensitivity, *Science*, 352, 6282, 224–227, doi:10.1126/science.aad5300.

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23. Zhou, C., **M. D. Zelinka**, A. E. Dessler, S. A. Klein, 2015, The relationship between inter-annual and long-term cloud feedbacks, *Geophys. Res. Lett.*, 42, 10,463–10,469, doi:10.1002/2015GL066698.

22. DeAngelis, A. M., X. Qu, **M. D. Zelinka**, and A. Hall, 2015: An observational radiative constraint on hydrologic cycle intensification, *Nature*, 528, 249–253, doi:10.1038/nature15770.

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20. Marvel, K. et al. including **M. D. Zelinka**, 2014: External influences on modeled and observed cloud trends, *J. Climate*, 28, 4820–4840, doi:10.1175/JCLI-D-14-00734.1.

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17. Johnston, M. S., et al. including **M. D. Zelinka**, 2014: Diagnosing the average spatio-temporal impact of convective systems - Part 2: A model intercomparison using satellite data, *Atmos. Chem. Phys.*, 14, 8701–8721, doi:10.5194/acp-14-8701-2014.

16. **Zelinka, M. D.**, T. Andrews, P. M. Forster, and K. E. Taylor, 2014: Quantifying Components of Aerosol-Cloud-Radiation Interactions in Climate Models, *J. Geophys. Res.*, 119, 7599–7615, doi:10.1002x/2014JD021710.

15. Ceppi, P., **M. D. Zelinka**, and D. L. Hartmann, 2014: The Response of the Southern Hemispheric Eddy-Driven Jet to Future Changes in Shortwave Radiation in CMIP5, *Geophys. Res. Lett.*, 41, 3244–3250, doi:10.1002/2014GL060043.

14. Caldwell, P. M., et al. including **M. D. Zelinka**, 2014: Statistical Significance of Climate Sensitivity Predictors Obtained by Data Mining, *Geophys. Res. Lett.*, 41, 1803–1808, doi:10.1002/2014GL059205.

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12. Johnston, M. S., et al. including **M. D. Zelinka**, 2013: Diagnosing the average spatio-temporal impact of convective systems - Part 1: A methodology for evaluating climate models, *Atmos. Chem. Phys.*, **13**, 12043–12058, doi:10.5194/acp-13-12043-2013.

11. Grise, K.M., L.M. Polvani, G. Tselioudis, Y. Wu, and **M.D. Zelinka**, 2013: The ozone hole indirect effect: Cloud-radiative anomalies accompanying the poleward shift of the eddy-driven jet in the Southern Hemisphere. *Geophys. Res. Lett.*, **40**, 1–5, doi:10.1002/grl.50675.

10. **Zelinka, M.D.**, S.A. Klein, K.E. Taylor, T. Andrews, M.J. Webb, J.M. Gregory, and P.M. Forster, 2013: Contributions of Different Cloud Types to Feedbacks and Rapid Adjustments in CMIP5. *J. Climate*. **26**, 5007–5027. doi: 10.1175/JCLI-D-12-00555.1.

9. Zhou, C., **M.D. Zelinka**, A.E. Dessler, P. Yang, 2013: An analysis of the short-term cloud feedback using MODIS data. *J. Climate*. **26**, 4803–4815. doi: 10.1175/JCLI-D-12-00547.1.

8. Klein, S.A., et al. including **M. D. Zelinka**, 2013: Are climate model simulations of clouds improving? An evaluation using the ISCCP simulator. *J. Geophys. Res*. **118**, 1329–1342. doi: 10.1002/jgrd.50141.

7. Forster, P.M., et al. including **M. D. Zelinka**, 2013: Evaluating adjusted forcing and model spread for historical and future scenarios in the CMIP5 generation of climate models. *J. Geophys. Res*. **118**, 1139–1150. doi: 10.1002/jgrd.50174.

6. **Zelinka, M.D.**, S.A. Klein, and D.L. Hartmann, 2012: Computing and Partitioning Cloud Feedbacks Using Cloud Property Histograms. Part I: Cloud Radiative Kernels. *J. Climate*, **25**, 3715–3735. doi:10.1175/JCLI-D-11-00248.1.

5. **Zelinka, M.D.**, S.A. Klein, and D.L. Hartmann, 2012: Computing and Partitioning Cloud Feedbacks Using Cloud Property Histograms. Part II: Attribution to Changes in Cloud Amount, Altitude, and Optical Depth. *J. Climate*, **25**, 3736–3754. doi:10.1175/JCLI-D-11-00249.1.

4. **Zelinka, M.D.** and D.L. Hartmann, 2012: Climate Feedbacks and their Implications for Poleward Energy Flux Changes in a Warming Climate. *J. Climate*, **25**, 608–624, doi:10.1175/JCLI-D-11-00096.1.

3. **Zelinka, M.D.** and D.L. Hartmann, 2011: The Observed Sensitivity of High Clouds to Mean Surface Temperature Anomalies in the Tropics. *J. Geophys. Res.*, **116**, D23103, doi:10.1029/2011JD016459.

2. **Zelinka, M.D.** and D.L. Hartmann, 2010: Why is Longwave Cloud Feedback Positive? *J. Geophys. Res.*, **115**, D16117, doi:10.1029/2010JD013817.

1. **Zelinka, M.D.** and D.L. Hartmann, 2009: Response of Humidity and Clouds to Tropical Deep Convection. *J. Climate*, **22**, 2389–2404. doi:10.1175/2008JCLI2452.1.

Book Chapters

McCoy, D. T., M. E. Frazer, J. Muelmenstaedt, I. Tan, C. R. Terai, and **M. D. Zelinka**, 2024: Extratropical Cloud Feedbacks, in *Clouds and their Climatic Impacts: Radiation, Circulation, and Precipitation*, S. C. Sullivan (Ed) and C. Hoose (Ed), American Geophysical Union.

Contributing author to Forster et al. 2021: The Earth's Energy Budget, Climate Feedbacks, and Climate Sensitivity, in *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Masson-Delmotte et al. (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 923-1054, doi:10.1017/9781009157896.009.

McCoy, D.T., D. L. Hartmann, and **M. D. Zelinka**, 2017: Mixed-Phase Cloud Feedbacks, in *Mixed-phase Clouds: Observations and Modeling*, Andronache, C. (Ed.), Elsevier.

Tan, I., T. Storelvmo, and **M. D. Zelinka**, 2017: The climatic impact of thermodynamic phase partitioning in mixed-phase clouds, in *Mixed-phase Clouds: Observations and Modeling*, Andronache, C. (Ed.), Elsevier.

Dessler, A.E. and **M. D. Zelinka**, 2015: Climate Feedbacks, in *Encyclopedia of Atmospheric Sciences, 2nd edition*, Vol 2, pp. 18-25, G. R. North (editor-in-chief), J. Pyle and F. Zhang (editors).

Recent Honors & Awards

American Meteorological Society Henry G. Houghton Award, 2022

Eos Research Spotlight for Zelinka et al. (2022)

Editors' Citation for Excellence in Refereeing - *Geophysical Research Letters*, 2021

LLNL Deputy Director's Science & Technology Excellence in Publication Award [Zelinka et al. 2020]

Sherwood et al. (2020) named runner-up for *Science Magazine*'s 2020 Breakthrough of the Year

LLNL Deputy Director's Science & Technology Excellence in Publication Award [Sherwood et al. 2020]

Nature Climate Change Research Highlight for Dong et al. (2020)

LLNL Physical and Life Sciences Directorate Award for Excellence in Publications [Sherwood et al. 2020]

US CLIVAR Research Highlight for Zelinka et al. (2020)

Eos Research Spotlight for Zelinka et al. (2020)

LLNL Outstanding Mentor Award, 2018

LLNL Early and Mid-Career Recognition Program Award, 2018

Eos Research Spotlights for Zhou et al. [2017], Zelinka et al. [2016], and McCoy et al. [2016]

Diablo Magazine 40 Under 40, 2017

LLNL Spot Award for "Excellence in Publications", 2017

Professional Activities, Service, & Leadership Roles

External Peer Reviewer, NASA Langley Research Center Science Directorate, Nov 2023

Programme Advisory Group, Uncertainty in Climate Sensitivity due to Clouds (CloudSense) Research Programme, Sep 2023–present

CFMIP Scientific Steering Committee, Jul 2023–present

Discussion Leader, 2023 Gordon Research Conference on Radiation & Climate

AGU Global Environmental Change Fellows Committee, 2022–present

Contributing Author for IPCC 6th Assessment Report, 2019–2021

Convener, Extratropical Cloud Feedbacks Session, 2020 CFMIP Meeting

Discussion Leader, 2019 Gordon Research Conference on Radiation & Climate

LLNL Physical and Life Sciences Postdoc Committee, 2017–2020

Section Editor for *Current Climate Change Reports* Topical Collection on Climate Feedbacks, 2014–2017

Contributor to climatefeedback.org, 2017–present

Chair, 2011 Gordon Research Seminar on Radiation and Climate

Proposal reviewer for DOE, European Research Council, NASA, and NSF

Reviewer for:
Atmosphere | *Atmos. Ocean* | *Atmos. Chem. Phys.* | *Atmos. Meas. Tech.* | *Atmos. Sci. Lett.*
B Am Meteorol Soc | *Clim. Dynam.* | *Climatic Change* | *Earth System Dynamics* | *Earth System Science Data*
Environ. Res. Lett. | *Geophys. Res. Lett.* | *Geosci. Model Dev.* | *J. Adv. Model. Earth Syst.*
J. Appl. Meteorol. Clim. | *J. Atmos. Oceanic Technol.* | *J. Atmos. Sci.* | *J. Climate* | *J. Geophys. Res*
J. Meteorol. Soc. Jpn. | *Nature* | *Nat. Clim. Change*| *Nat. Commun.* | *Nat. Geosci.*
npj Climate and Atmospheric Science | *P. Natl. Acad. Sci.* | *Sci. Rep.* | *Surv. Geophys.*

Advisees

Post-Docs

Li-Wei Chao

Yi Qin (Post-doc, PNNL)

Timothy Myers (Research Scientist, NOAA/CIRES)

Chen Zhou (Associate Professor, Nanjing University)

Graduate Students

Zac Espinosa (University of Washington)

Undergraduate Students

Russell Hunter (Duke Univesity / Second Lieutenant, US Space Force)

Thea Moellerstedt (UC Berkeley)

Scott Feldman (Meteorologist, Verisk Weather Solutions)

Recent Invited Presentations

AGU Fall Meeting: The Flows of Energy Through the Climate System Session, 12 Dec 2023

AGU Fall Meeting: Climate Sensitivity and Feedbacks Session, 11 Dec 2023

University of Cambridge Centre for Atmospheric Science, Department of Chemistry, 24 Oct 2023

Yale University School of the Environment, ENV 630, 27 Apr 2023

AGU Fall Meeting: Atmospheric Physics, Radiation, Clouds, and Aerosols Session, 15 Dec 2022

"Moving the field forward" Panel, Pattern Effect Workshop, 12 May 2022

Yale University, School of the Environment, ENV 630, 21 Apr 2022

Aerosol and Cloud, Convection and Precipitation Webinar Series, 19 Apr 2021

University of Maryland Baltimore County Department of Physics Colloquium, 24 Feb 2021

University of Toronto Physics Colloquium, 28 Jan 2021

AGU Fall Meeting: CMIP6 Climate Model Evaluation Session, 8 Dec 2020

The National Academies of Sciences, Engineering, and Medicine Workshop "Data in Motion: New Approaches to Advancing Scientific, Engineering and Medical Progress", 14-15 October 2020

2020 Princeton AOS Summer Workshop, 17-21 Aug 2020

2020 CESM Workshop (Plenary talk), 15 June 2020

ECS & Cloud Feedback Symposia, 28 May 2020

Imperial College London, Atmospheric Physics Group Webinar, 12 May 2020

Global Model Cloud-Aerosol Research Webinar Series, 2 April 2020

UC Davis Department of Land, Air and Water Resources, 16 October 2019

Geophysical Fluid Dynamics Laboratory, 23 May 2019

Outreach Activities

LLNL Technical Lightning Talk: Community Cohorts program for new hires, 24 Aug 2023.

LLNL - Las Positas College Science and Engineering Seminar Series, 20 Apr 2023.

Science on Saturday, The Future in Focus: Predicting Climate Change through Observations, Modeling, and Artificial Intelligence, 4 Mar 2023.

Castro Valley Rotary Club, 13 Sep 2022.

Science on Saturday, The Future in Focus: Predicting Climate Change through Observations, Modeling, and Artificial Intelligence, 26 Feb 2022.

San Joaquin County Office of Education Climate Change Summit, 26 Sep 2020

Panel Discussant, Wild and Scenic Film Festival, Bankhead Theater, Livermore, CA, Jan 2020

Univ. of Washington Dept. of Atmospheric Sciences and Program on Climate Change Outreach Teams, Sep 2004 – Dec 2010

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