

Research Focus

I use low-order mathematical models and complex numerical models to understand climate, paleoclimate, the cryosphere, planetary habitability, and exoplanets.

Positions

2015-Present	Associate Professor	Geophysical Sciences	University of Chicago
2011-2015	Assistant Professor	Geophysical Sciences	University of Chicago

Education

2009-2011	Postdoc	Geophysical Sciences	University of Chicago
2008-2009	Postdoc	Earth and Planet. Sci.	Harvard University
2008	Ph.D. (w/ Tziperman)	Applied Mathematics	Harvard University
2004	S.M.	Applied Mathematics	Harvard University
2004	A.B.	Physics	Harvard College

Science Family

PhD Students

Jade Checlair	ex. 2021	Exoplanet fun!
Predrag Popović	ex. 2019	Fractal behavior of melt ponds on sea ice
J. Bloch-Johnson	ex. 2018	Climate feedback temperature dependence and equilibrium climate sensitivity
Navah Farahat	ex. 2018	Assessing the role of seafloor weathering in carbon cycling and climate
David Plotkin	ex. 2018	Rare events in geophysical systems
Daniel Koll	2016	Dry atmospheric circulations of rocky exoplanets

MS Students

Nathan Baskin	2016	Investigating the effect of forced orbital evolution on planetary habitability using sophisticated global climate models
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Postdocs

Jun Yang	2012-2015	M-star planet habitability
Yi-Ping Ma	2011-2013	Mathematics of climate

Courses Taught

The Atmosphere (Undergraduate)
Fundamentals of Geophysical Fluid Dynamics (Graduate)
What makes a planet habitable? (Undergraduate+Graduate)
Mathematical Methods for Earth Science (Graduate)
Topics in Atmospheric Science (Graduate)

Publications

Bean, J.L., D.S. Abbot and E. M.-R. Kempton (2017), A Statistical Comparative Planetology Approach to the Hunt for Habitable Exoplanets and Life Beyond the Solar System, *Astrophysical Journal*, 841:L24.

- Checlair, J., K. Menou, and D.S. Abbot (2017), No snowball on habitable tidally locked planets, *Astrophysical Journal*, 845:132.
- Koll, D.D.B., and D.S. Abbot (2017), Entropy budget constrains general circulation of dry atmospheres, *Astrophysical Journal*, in prep.
- Farahat, N.X., D. Archer, and D.S. Abbot (2017), Using the BASALT model to simulate off-axis hydrothermal circulation in oceanic crust, *Journal of Geophysical Research*, DOI: 10.1002/2016JB013758.
- Popović, P. and D.S. Abbot (2017), A simple model for the evolution of melt pond coverage on permeable Arctic sea ice, *The Cryosphere*, 11, 1149-1172.
- Yang, J., M.F. Jansen, F.A. MacDonald, and D.S. Abbot (2017), Persistence of A Surface Freshwater Ocean After A Snowball Earth, *Geology*, 45(7), 615–618.
- P.F. Hoffman, D.S. Abbot, Y. Ashkenazy, D.I. Benn, P.A. Cohen, G.M. Cox, J.R. Creveling, Y. Donnadieu, D.H. Erwin, I.J. Fairchild, D. Ferreira, J.C. Goodman, G.P. Halverson, M.F. Jansen, G. Le Hir, G.D. Love, F.A. Macdonald, A.C. Maloof, C.A. Partin, G. Ramstein, B.E.J. Rose, C.V. Rose, P.M. Sadler, E. Tziperman, A. Voigt, and S.G. Warren (2017), Climate dynamics of Snowball Earth and Cryogenian geologygeobiology, *Science Advances*, accepted.
- Komacek, T.D. and D.S. Abbot (2016), Effect of surface-mantle water exchange parameterizations on exoplanet ocean depths, *Astrophysical Journal*, 832, 54.
- Abbot, D.S. (2016), Analytical investigation of the decrease in the size of the habitable zone due to limited CO₂ outgassing rate, *Astrophysical Journal*, 827, 117.
- Yang, J., J. Leconte, E.T. Wolf, C. Goldblatt, N. Feldl, T. Merlis, Y. Wang, D.D.B. Koll, F. Ding, F. Forget, and D.S. Abbot (2016), Differences in water vapor radiative transfer among 1D models can significantly affect the inner edge of the habitable zone, *Astrophysical Journal*, 826, 222.
- Koll, D.D.B., and D.S. Abbot (2016), Temperature Structure and Atmospheric Circulation Strength of Tidally Locked Rocky Exoplanets, *Astrophysical Journal*, 825, 99.
- Hill, K., D.S. Abbot, and M. Silber (2016), Analysis of an Arctic sea ice loss model in the limit of a discontinuous albedo, *SIAM Journal on Applied Dynamical Systems*, 15(2), 1163-1192.
- Abbot, D.S. (2015), A proposal for climate stability on H₂-greenhouse planets, *Astrophysical Journal Letters*, 815, L3.
- Bloch-Johnson, J., R.T. Pierrehumbert, and D.S. Abbot (2015), Feedback Temperature Dependence Determines the Risk of High Warming, *Geophysical Research Letters*, 43(12), 4973–4980.
- Koll, D.D.B. and D.S. Abbot (2015), Deciphering Thermal Phase Curves of Dry, Tidally Locked Terrestrial Planets, *Astrophysical Journal*, 802, 21, doi: 10.1088/0004-637X/802/1/21.
- Yang, J., Y. Liu, Y. Hu, and D.S. Abbot (2014), Water Trapping on Tidally Locked Terrestrial Planets Requires Special Conditions, *Astrophysical Journal Letters*, 796, L22, doi:10.1088/2041-8205/796/2/L22.
- Plotkin, D.A., J. Weare, and D.S. Abbot (2014), Distinguishing meanders of the Kuroshio using machine learning, *Journal of Geophysical Research*, 119, 6593–6604, doi:10.1002/2014JC010128.
- Arnold, N.P., M. Branson, M.A. Burt, D.S. Abbot, Z. Kuang, D.A. Randall, E. Tziperman (2014), The effects of explicit atmospheric convection at high CO₂, *Proceedings of the National Academy of Sciences*, 111(30), 10943–10948, doi:10.1073/pnas.1407175111.

- Yang, J., G. Boué, D.C. Fabrycky, and D.S. Abbot (2014), Strong Dependence of the Inner Edge of the Habitable Zone on Planetary Rotation Rate, *Astrophysical Journal Letters*, 787, L2, doi:10.1088/2041-8205/787/1/L2.
- Abbot, D.S. (2014), Resolved Snowball Earth Clouds, *Journal of Climate*, 27(12), 4391–4402, doi: 10.1175/JCLI-D-13-00738.1.
- Yang, J. and D.S. Abbot (2014), A Low-order Model of Water Vapor, Clouds, and Thermal Emission of Tidally Locked Terrestrial Planets, *Astrophysical Journal*, 784, 155, doi:10.1088/0004-637X/784/2/155.
- Cowan, N.B. and D.S. Abbot (2014), Water cycling between ocean and mantle: super-Earths need not be waterworlds, *Astrophysical Journal*, 781, 27, doi:10.1088/0004-637X/781/1/27.
- Cathles, L.M., D.S. Abbot, and D.R. MacAyeal (2014), Intra-surface radiative transfer limits the geographic extent of snow penitentes on horizontal snow fields, *Journal of Glaciology*, 60, 147–154, doi: 10.3189/2014JoG13J124.
- Rodehacke, C.B., A. Voigt, F. Ziemer, and D.S. Abbot (2013), An open ocean region in Neoproterozoic glaciations would have to be narrow to allow equatorial ice sheets, *Geophysical Research Letters*, 40, 5503–5507, doi:10.1002/2013GL057582.
- Mills, S.M. and D.S. Abbot (2013), Utility of the Weak Temperature Gradient Approximation for Earth-like Tidally Locked Exoplanets, *Astrophysical Journal Letters*, 774, L17, doi:10.1088/2041-8205/774/2/L17.
- Koll, D.D.B. and D.S. Abbot (2013), Why Tropical Sea Surface Temperature is Insensitive to Ocean Heat Transport Changes, *Journal of Climate*, 26, 6742–6749, doi:10.1175/JCLI-D-13-00192.1.
- Yang, J., N.B. Cowan, and D.S. Abbot (2013), Stabilizing Cloud Feedback Dramatically Expands the Habitable Zone of Tidally Locked Planets, *Astrophysical Journal Letters*, 771, L45, doi:10.1088/2041-8205/771/2/L45.
- Abbot, D.S., A. Voigt, D. Li, G. Le Hir, R.T. Pierrehumbert, M. Branson, D. Pollard, and D.D.B. Koll (2013), Robust elements of Snowball Earth atmospheric circulation and oases for life, *Journal of Geophysical Research*, 118, 6017–6027, doi:10.1002/jgrd.50540.
- Voigt, A. and D.S. Abbot (2012), Sea-ice dynamics strongly promote Snowball Earth initiation and destabilize tropical sea-ice margins, *Climate of the Past*, 8, 2079–2092, doi:10.5194/cp-8-2079-2012.
- Farrell, B.F. and D.S. Abbot (2012), A Mechanism for Dust-Induced Destabilization of Glacial Climates, *Climate of the Past*, 8, 2061–2067, doi:10.5194/cp-8-2061-2012.
- Abbot, D.S., A. Voigt, M. Branson, R.T. Pierrehumbert, D. Pollard, G. Le Hir, D.D.B. Koll (2012), Clouds and Snowball Earth Deglaciation, *Geophysical Research Letters*, 39, L20711, doi:10.1029/2012GL052861.
- Cowan, N.B., A. Voigt, and D.S. Abbot (2012), Thermal phases of exoplanets: Disentangling eccentricity, obliquity, and climate, *Astrophysical Journal*, 757, 80, doi:10.1088/0004-637X/757/1/80.
- Abbot, D.S., N.B. Cowan, and F.J. Ciesla (2012), Indication of insensitivity of planetary weathering behavior and habitable zone to surface land fraction, *Astrophysical Journal*, 756, 178, doi:10.1088/0004-637X/756/2/178.
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- positive winter convective cloud feedback, *Journal of Advances in Modeling Earth Systems*, 4, M07002, doi:10.1029/2012MS000153.
- Cowan, N.B., D.S. Abbot, and A. Voigt (2012), A false positive for ocean glint on exoplanets: the latitude-albedo effect, *Astrophysical Journal Letters*, 752, L3, doi:10.1088/2041-8205/752/1/L3.
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- Abbot, D.S., M. Silber, and R.T. Pierrehumbert (2011), Bifurcations Leading to Summer Arctic Sea Ice Loss, *Journal of Geophysical Research*, 116, D19120, doi:10.1029/2011JD015653.
- Abbot, D.S., A. Voigt, and D. Koll (2011), The Jormungand Global Climate State and Implications for Neoproterozoic Glaciations, *Journal of Geophysical Research*, 116, D18103, doi:10.1029/2011JD015927.
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- Abbot, D.S. and E.R. Switzer (2011), The Steppenwolf: A proposal for a habitable planet in interstellar space, *Astrophysical Journal*, 735:L27, doi:10.1088/2041-8205/735/2/L27.
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- Voigt, A., D.S. Abbot, R.T. Pierrehumbert, and J. Marotzke (2011), Initiation of a Marinoan Snowball Earth in a state-of-the-art atmosphere-ocean general circulation model, *Climate of the Past*, 7, 249–263, doi:10.5194/cp-7-249-2011.
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- Abbot, D.S. and I. Halevy (2010), Dust Aerosol Important for Snowball Earth Deglaciation, *Journal of Climate*, 23(15), 4121–4132, doi: 10.1175/2010JCLI3378.1.
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