

Curriculum Vitae

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Education Background

- University of Illinois at Urbana-Champaign 09/2000 – 05/2007
Ph.D. in Atmospheric Sciences 2007
- Nanjing University, China 09/1994 – 07/1998
B.S. in Atmospheric Sciences 1998

Employment History

- Professor Zhejiang University 04/2012 - Present
- Senior Research Associate Carnegie Institution 01/2010 - 03/2012
- Postdoctoral Research Fellow Carnegie Institution 04/2007 - 12/2009

Research Interest

- Earth system modeling
- Ocean carbon cycle and ocean acidification
- Climate engineering

Editorship

- Deputy Associate Editor *Climatic Change*
- Editor *Atmosphere and Oceanic Science Letters*
- Editor *Geoscience Letters*

Professional service

- **Lead author**, Chapter 4, *Future global climate: scenarios-based projections and near-term information*, Working Group I to the Six Assessment Report of the Intergovernmental Panel on Climate Change (To be released in 2021)

- **Contributing author**, *Chapter 6, Carbon and Other Biogeochemical Cycles*. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*
- **Contributing author**, *Chapter 30 The Ocean*. In: *Climate Change 2013: Impacts, Adaptation, and Vulnerability Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*
- **Reviewer**, *Nature Geoscience, Nature Climate Change, Journal of Geophysical Research, Geophysical Research Letters, Global Biogeochemical Cycles, Biogeosciences, Environmental Research Letters, Journal of Climate, Climate Dynamics, Geoscientific Model Development, Carbon Management, Mitigation and Adaptation of Strategies for Global Change, American Journal of Science, Earth System Dynamics, Earth Future*

Honors

- WMO (World Meteorological Organization) Norbert Gerbier-MUMM International Award (2014)

Peer-reviewed publications

Year 2019

Duan, L., Cao, L.*, & Caldeira, K. (2019). Estimating contributions of sea ice and land snow to climate feedback. *Journal of Geophysical Research: Atmospheres*, 124. <https://doi.org/10.1029/2018JD029093>

Year 2018

Duan, L., Cao, L.*, Bala, G., & Caldeira, K. (2018). Comparison of the fast and slow climate response to three radiation management geoengineering schemes. *Journal of Geophysical Research: Atmospheres*, 123. <https://doi.org/10.1029/2018JD029034>

Cao, L.*, (2018), The Effects of Solar Radiation Management on the Carbon Cycle, *Current Climate Change Reports*, 4: 41. <https://doi.org/10.1007/s40641-018-0088-z>

Jiang J, Zhang H, Cao L*. (2018), Simulated effect of sunshade solar geoengineering on the global carbon cycle. *Science China Earth Sciences*, 61, <https://doi.org/10.1007/s11430-017-9210-0>

Zhang H, Cao L*. (2018), Simulated effects of interactions between ocean acidification, marine organism calcification, and organic carbon export on ocean carbon and oxygen cycles. *Science China Earth Sciences*, 61, <https://doi.org/10.1007/s11430-017-9173-y>

Modak A, Bala G, Caldeira K, and **Cao. L** (2018), Does shortwave absorption by methane influence its effectiveness? *Climate Dynamics*, (D19):1-20, doi 10.1007/s00382-018-4102-x

Year 2017

Cao, L.*, Jiang, J. (2017), Simulated effect of carbon cycle feedback on climate response to solar geoengineering. *Geophysical Research Letters*, 44. <https://doi.org/10.1002/2017GL076546>

Cao, L*, L. Duan, G. Bala, and K. Caldeira (2017), Simultaneous stabilization of global temperature and precipitation through cocktail geoengineering, *Geophysical Research Letters*, 44, doi:10.1002/2017GL074281.

Cao L.*, and H. Zhang (2017), The role of biological rates in the simulated warming effect on oceanic CO₂ uptake, *Journal of Geophysical Research: Biogeosciences*, 122, doi:10.1002/2016JG003756.

Cheng W., J. Moore., **L. Cao.**, D. Ji., and L. Zhao. (2017), Simulated climate effects of desert irrigation geoengineering. *Scientific Reports*, 7, 46443; doi: 10.1038/srep46443

Year 2016

Cao L.*, M. Zheng, and K. Caldeira (2016), Simulated effect of deep-sea sedimentation and terrestrial weathering on projections of ocean acidification, *Journal of Geophysical Research: Oceans*. 121, doi:10.1002/2015JC011364.

Cao. L.*, L. Duan., G. Bala, and K. Caldeira (2016), Simulated long-term climate response to idealized solar geoengineering, *Geophysical Research Letters*, 43, doi:10.1002/2016GL068079.

Zhang H. and **L. Cao*** (2016), Simulated effect of calcification feedback on atmospheric CO₂ and ocean acidification, *Scientific Reports*, doi:10.1038/srep20284.

Modak A., G. Bala, **L. Cao**, and K. Caldeira (2016), Why must a solar forcing be large than a CO₂ forcing to cause the same global mean surface temperature change? *Environmental Research Letters*, 11, doi, 10.1088/1748-9326/11/4/044013.

Year 2015

Cao, L.*, G. Bala, M. Zheng, and K. Caldeira (2015), Fast and slow climate responses to CO₂ and solar forcing: A linear multivariate regression model characterizing transient climate change, *Journal of Geophysical Research: Atmospheres*, 120, doi:10.1002/2015JD023901.

Wolff, N. H., Donner, S. D., **L. Cao**, Iglesias-Prieto, R., Sale, P. F. and Mumby, P. J. (2015), Global inequities between polluters and the polluted: climate change impacts on coral reefs. *Global Change Biology*, 21: 3982–3994. doi:10.1111/gcb.13015

Cao. L.*, Chao-Chao Gao, Li-Yun Zhao (2015), Geoengineering: Basic science and ongoing research efforts in China, *Advances in Climate Change Research*, ISSN 1674-9278, <http://dx.doi.org/10.1016/j.accre.2015.11.002>.

Y. Tian, Y. P. Xu, M. J. Booij, **L. Cao**, (2015), Impact assessment of multiple uncertainty sources on high flows under climate change. *Hydrology Research*. doi:10.2166/nh.2015.008.

Year 2014

Cao L.*, W. Shuangjing, Z. Meidi, Z. Han (2014), Sensitivity of ocean acidification and oxygen to the uncertainty in climate change *Environmental Research Letters*, 9(2014) 9 064005 doi:10.1088/1748-9326/9/6/064005

Cao L.*, Z. Han, Z. Meidi, W. Shuangjing, (2014), Response of ocean acidification to a gradual increase and decrease of atmospheric CO₂, *Environmental Research Letters*, 9(2014) 024012 doi:10.1088/1748-9326/9/2/024012

Year 2013

Davis, S., **L. Cao**, K. Caldeira, and M Hoffert (2013), Rethinking Wedges, *Environmental Research Letters*, 8(2013) 01 1001 doi: 10.1088/1748-9326/8/1/01 1001

Caldeira, K., G. Bala, and **L. Cao** (2013), The Science of Geoengineering, *Annual Review of Earth and Planetary Sciences*, Vol. 41:231-256 (Volume publication date May 2013) doi: 10.1146/annurev-earth-042711-105548

Bala G., S. Krishna, D. Narayanappa, **L. Cao**, K. Caldeira and R. Nemani (2013) An estimate of equilibrium sensitivity of global terrestrial carbon cycle using NCAR CCSM4, *Climate Dynamics*, 40, Issue 7-8, 1671-1686, doi 10.1007/s00382-012-1495-9

Wendy B. Foden, Stuart H. M. Butchart, Simon N. Stuart, Jean-Christophe Vie, H. Resit Akcakaya, Ariadne Angulo, Lyndon M. DeVantier, Alexander Gutsche, Emre Turak, **L. Cao**, Simon D. Donner, Vineet Katariya, Rodolphe Bernard, Robert A. Holland, Adrian F. Hughes, Susannah E. O’Hanlon, Stephen T. Garnett, Cagan H. S ,ekercioglu, Georgina M. Mace (2013) Identifying the World's Most Climate Change Vulnerable Species: A Systematic Trait-Based Assessment of all Birds, Amphibians and Corals. *PLoS ONE* 8(6): e65427. doi:10.1371/journal.pone.0065427

W.-C. Hsieh, W. D. Collins, Y. Liu, J. C. H. Chiang, C.-L. Shie, K. Caldeira, and **L. Cao** (2013) Climate response due to carbonaceous aerosols and aerosol-induced SST effects in NCAR community atmospheric model CAM3.5 *Atmospheric Chemistry and Physics*, 13, 7489-7510.

Year 2012

Cao, L.*, G. Bala, and K. Caldeira (2012), Climate response to changes in atmospheric carbon dioxide and solar irradiance on the time scale of days to weeks, *Environmental Research Letters*, 7 034015 doi:10.1088/1748-9326/7/3/034015

Pongratz, J., D. B. Lobell, **L. Cao** and K. Caldeira (2012), Crop yields in a geoengineered climate, *Nature Climatic Change*, doi: 10.1038/NCLIMATE1373

Year 2011

Devaraju, N., **L. Cao**, , G. Bala, K. Caldeira, and R. Nemani (2011), A model investigation of vegetation-atmosphere interactions on a millennial timescale, *Biogeosciences* ,doi:10.5194/bg-8-3677-2011

Gopalakrishnan R., G. Bala, M. Jayaraman, **L. Cao**, R. Nemani and N.H. Ravindranath (2011), Sensitivity of terrestrial water and energy budgets to CO₂-physiological forcing: an investigation using an offline land model, *Environmental Research Letters* doi: 10.1088/1748-9326/6/4/044013

George A Ban-Weiss, Govindasamy Bala, **L. Cao**, J. Pongratz and K. Caldeira (2011) Climate forcing and response to idealized changes in surface latent and sensible heat, *Environmental Research Letters*, 6 034032 doi:10.1088/1748-9326/6/3/034032

Ban-Weiss, George A., **L. Cao**, G. Bala, K. Caldeira (2011), Dependence of climate forcing and response on the altitude of black carbon aerosols, *Climate Dynamics*, doi: 10.1007/s00382-011-1052-y

Cao, L.*, G. Bala, and K. Caldeira (2011), Why is there a short-term increase in global precipitation in response to diminished CO₂ forcing?, *Geophysical Research Letters* doi:10.1029/2011GL046713

Kenneth R. N. Anthony, J. Maynard, G. Diaz-Pulido, P.J. Mumby, P.A. Marshall, **L. Cao**, and O. Hoegh-Guldberg (2011), Ocean acidification and warming will lower coral reef resilience, *Global Change Biology*, DOI: 10.1111/j.1365-2486.2010.02364.x

Year 2010

Cao, L.*, G. Bala, K. Caldeira, R. Nemani, and G. Ban-Weiss (2010), Importance of carbon dioxide physiological forcing to future climate change, *Proceedings of the National Academy of Sciences*, doi 10.1073/pnas.0913000107

Cao, L.*, and K. Caldeira (2010), Can ocean iron fertilization mitigate ocean acidification? *Climatic Change* doi: 10.1007/s10584-010-9799-4

Cao, L.*, and K. Caldeira (2010), Atmospheric carbon dioxide removal: long-term consequences and commitment, *Environmental Research Letters*, 5, doi:10.1088/1748-9326/5/2/024011.

Ray G. Anderson, Josep G. Canadell, James T. Randerson, Robert B. Jackson, Bruce A. Hungate, Dennis D. Baldocchi, George Ban-Weiss, **L. Cao**, Noah S. Diffenbaugh, Kevin R. Gurney, Beverly E. Law, Sebastiaan Luyssaert (2010), Biophysical considerations in forestry for climate protection, *Frontiers in Ecology and the Environment*, doi:10.1890/090179.

Bala, G., K. Caldeira, R. Nemani, **L. Cao**, G. Ban-Weiss, and S. Ho-Jeong (2010), Albedo enhancement of marine clouds to counteract global warming: impacts on the hydrological cycle, *Climate Dynamics*, doi: 10.1007/s00382-010-0868-1

Year 2009

Cao, L.*, G. Bala, R. Nemani, K. Caldeira and G. Ban-Weiss (2009), Climate response to physiological forcing of carbon dioxide simulated by the coupled Community Atmosphere Model (CAM3.1) and Community Land Model (CLM3.0), *Geophysical Research Letters*, 36, L10402, doi:10.1029/2009GL037724.

Cao, L.*, M. Eby, A. Ridgwell, K. Caldeira, D. Archer, A. Ishida, F. Joos, K. Matsumoto, U. Mikolajewicz, A. Mouchet, J. C. Orr, G.-K. Plattner, R. Schlitzer, K. Tokos, I. Totterdell, T. Tschumi, Y. Yamanaka, and A. Yool (2009), The role of ocean transport in the uptake of anthropogenic CO₂, *Biogeosciences*, 6, 375-390.

Silverman, J., B. Lazar, **L. Cao**, K. Caldeira, and J. Erez (2009), Coral reefs may start dissolving when atmospheric CO₂ doubles, *Geophysical Research Letters*, 36, L05606, doi:10.1029/2008GL036282.

Matthews, D., **L. Cao** and K. Caldeira (2009), Sensitivity of ocean acidification to geoengineered climate stabilization, *Geophysical Research Letters*, L10706, doi:10.1029/2009GL037488.

Archer D., M. Eby, V. Brovkin, A. Ridgwell, **L. Cao**, U Mikolajewicz, K. Caldeira, K. Matsumoto, G. Munhoven, A. Montenegro, and K. Tokos (2009), Atmospheric lifetime of fossil-fuel carbon dioxide, *Annual review of Earth and Planetary Sciences*, 37, 117-34.

Year 2008

Cao L.*, and K. Caldeira, Atmospheric CO₂ stabilization and ocean acidification, (2008), *Geophysical. Research Letters*, doi:10.1029/2008GL035072

Cao L.* and A. K. Jain, Learning about the ocean carbon cycle from observational constraints and model simulations of multiple tracers (2008), *Climatic change*, doi 10.1007/s10584-008-9421-1

Year 2007

Caldeira K, D. Archer, J.P. Barry, R.G.J. Bellerby, P.G. Brewer, **L. Cao** , A.G. Dickson, S.C. Doney, H. Elderfield, V.J. Fabry, R.A. Feely, J-P Gattuso, P.M. Haugan, O. Hoegh-Guldberg, A.K. Jain, J.A. Kleypas, C. Langdon, J.C. Orr, A. Ridgwell, C.L. Sabine, B.A. Seibel, Y. Shirayama, C. Turley, A. J. Watson, R.E. Zeebe (2007), Comment on “Modern-age buildup of CO₂ and its effects on seawater acidity and salinity”, *Geophysical. Research. Letters*, 34, L18608, doi:10.1029/2006GL027288.

Cao L., K. Caldeira K., and A.K. Jain (2007), Effects of carbon dioxide and climate change on ocean acidification and carbonate mineral saturation, *Geophysical Research Letters*, 34, L05607, doi:10.1029/2006GL028605.

Year 2005

Cao, L.* and A. K. Jain (2005), An earth system model of intermediate complexity: simulation of the role of ocean mixing parameterizations and climate change in estimated uptake for natural and bomb radiocarbon and anthropogenic CO₂, *Journal of Geophysical Research: Oceans*, 110, C09002, doi:10.1029/2005JC002919.

Jain, A. K., and **L. Cao** (2005), Assessing the effectiveness of direct injection for ocean carbon sequestration under the influence of climate change, *Geophysical Research Letters*, 32, L09609, doi:10.1029/2005GL022818.

Year 2004

Mueller K. **L. Cao**, K Caldeira, and A. K. Jain (2004), Differing methods of accounting ocean carbon sequestration efficiency, *Journal of Geophysical Research: Oceans*, 109, C12018, doi: 10.1029/2003JC002252.