Dr. Amy Hawes Butler

325 Broadway, Boulder, Colorado 80305
Phone: 303-817-9621 / E-mail: amy.butler@noaa.gov / Twitter: @DrAHButler

Career Summary

I am an expert in large-scale climate variability, teleconnections, atmospheric dynamics, stratospheric processes, and sub-seasonal to seasonal prediction. One of my noteworthy research findings is demonstrating the opposing responses of the storm tracks to Arctic amplification and tropical upper tropospheric warming. I have also provided evidence for the role of the stratosphere in sub-seasonal to seasonal prediction, and the importance of the stratospheric pathway of the El Nino-Southern Oscillation (ENSO) teleconnection. Finally, I have developed a new database of sudden stratospheric warmings and led international efforts to clarify their definition. My key achievements outside of my research are my leadership roles as chair of the AMS Middle Atmosphere Committee and co-chair of a WCRP/SPARC initiative, my clear communication of science, and developing international collaborative research projects.

Education

2009 **Ph.D. Atmospheric Science**, Colorado State University, Fort Collins, Colorado.
Dissertation: "The Atmospheric Circulation Response to Climate Change-Like Thermal Forcings in a Simple General Circulation Model". Advisor: David W. J. Thompson

2006 **M.S. Atmospheric Science**, Colorado State University, Fort Collins, Colorado.

2003 **B.A. Physics** (*magna cum laude*) and **Astrophysics**, University of Colorado-Boulder, Boulder, Colorado. Minor: Atmospheric Science.

Professional Employment

2020- **Research Physicist ZP-3**. NOAA Chemical Sciences Laboratory, Boulder, Colorado.

2019-2020 **Research Scientist III**. Cooperative Institute for Research in Environmental Sciences (CIRES)/University of Colorado, NOAA/ESRL/Chemical Sciences Division, Boulder, Colorado
2013-2019 **Research Scientist II**.

- *Notable Results*: New database of sudden stratospheric warming events developed (https://www.esrl.noaa.gov/csd/groups/csd8/sswcompendium/); designed and performed global model simulations using NCAR CESM to evaluate changes in ozone and transport in future climate scenarios; led international collaborations on the role of the stratosphere in sub-seasonal to seasonal forecasts; trained to be

a flight meteorologist for measurement missions; advised students.

2009-2013 **Research Meteorologist GS-11** (Step 4). Climate Prediction Center, NOAA/National Weather Service, College Park, Maryland

- *Notable Results:* Described the stratospheric teleconnection of El Niño-Southern Oscillation and its importance for seasonal forecasting; evaluated operational forecast models such as CFSv2; analyzed relationship of Eurasian snow cover to stratospheric variability; provided input for improvements to NOAA forecast models; developed stratospheric forecasting products.

2003-2009 **Graduate research assistant**, Colorado State University

2000-2003 **Undergraduate research assistant**, NOAA Aeronomy Lab. Advisor: Susan Solomon

Awards and Fellowships

2019 NASA Group Achievement Award, Atmospheric Tomography Mission
2018 CIRES award for outstanding service as flight meteorologist for NASA ATom
2018 Visiting Scientist, NCEP Climate Prediction Center, UCAR CPAESS Short-term Research Collaboration Opportunity.
2014 Editor's Citation for Excellence in Refereeing, Geophysical Research Letters
2009 EPA Science to Achieve Results (STAR) Graduate Fellowship
2007 Herbert Riehl Memorial Award for Graduate Students, Colorado State University
2004 American Meteorological Society Graduate Fellowship

Service and Professional Activities

Teaching and Advising

2019- **Advisor**, Melissa Breeden, NOAA Climate and Global Change Post-doctoral Fellow

2018-2019 **Advisor**, Reese Kelly, Monarch High School Senior Seminar Student
- *Reese correlated time series of stratospheric ozone in the tropics, extratropics, and polar regions with the Quasi-biennial Oscillation time series, in both model runs and observations. He presented his work at a regional science fair and won a special award for Excellence in Atmospheric Science from the American Meteorological Society.*

2018 **Advisor**, Jordan Benjamin, NOAA Hollings Scholar undergraduate summer student
- *Jordan evaluated stratospheric ozone intrusions in pre-industrial and future climate simulations to see how and where they will change in the future, and how they relate to the Northern Annular Mode. He presented*

his results at AGU 2018 and AMS 2019.

2016 **Advisor**, NOAA high school summer student (Rohini Dasan).
- *Rohini looked at the relationship between El Nino-Southern Oscillation and stratospheric final warmings.*

2015-16 **Advisor**, post-doctoral researcher (Dr. Jeremiah Sjoberg)
- *Jeremiah helped develop the Sudden Stratospheric Warming Compendium (SSWC) using five different reanalysis products. He co-authored a paper on the database.*

2007 **Teaching Assistant**, Objective Analysis in the Atmospheric Sciences. Colorado State University, Dept of Atmospheric Science

2005 **Teaching Assistant**, Objective Analysis in the Atmospheric Sciences. Colorado State University, Dept of Atmospheric Science

Committees

2020- **Member** of the Regional Focal Point for the WCRP consultation of the North and Central America and the Caribbean region (SPARC representative)

2020- **Liaison**, between the U.S. Weather Research Science Working Group (WRSWG)-S2S and the international S2S Prediction Project

2019-2027 **Member**, International Commission of the Middle Atmosphere (ICMA), International Association of Meteorology and Atmospheric Science (IAMAS)

2018-2023 **Co-chair**, S2S sub-project on the Stratosphere (joint with SNAP)

2018-2021 **Member**, US CLIVAR Process Studies and Model Improvement (PSMI) panel

2018-2021 **Chair**, AMS Middle Atmosphere Committee

2017- **Co-chair**, WCRP/SPARC project Stratospheric Network for the Assessment of Predictability (SNAP)

2016-2017 **Member**, AMS Middle Atmosphere Committee

2010- **Member**, SPARC DynVar Committee

Reviewing and Editing

2020 **Proposer**, AGU Special Collection "*The Exceptional Arctic Stratospheric Polar Vortex in 2019/2020: Causes and Consequences*", JGR-Atmospheres and GRL.

2019 **Guest Editor**, US CLIVAR "Variations", Vol. 17(1), *The role of stratospheric teleconnections on climate variability and predictability across timescales,* https://indd.adobe.com/view/b0e5a374-5321-4058-a31d-4b2130ac765e. Associated webinar: https://www.youtube.com/watch?v=gm1Pi3sXPQM

2017 **Reviewer**, WMO/UNEP Ozone Assessment Report Chapter

2017 **Panel reviewer**, NOAA Climate Program Office

2013 **Reviewer**, WMO/UNEP Ozone Assessment Report Chapter

2009- **Manuscript Reviewer**, *Geophysical Research Letters, Journal of Climate, Journal of Geophysical Research- Atmospheres, Environmental*

Research Letters, Climate Dynamics, Journal of the Meteorological Society of Japan, Atmospheric Chemistry and Physics, Proceedings of the National Academy of Sciences, Quarterly Journal of the Royal Meteorological Society, Nature Climate Change, Science Advances

2009- **Proposal Reviewer**, National Science Foundation, NASA Postdoctoral Program

Organizing Conferences

2019 **Convener**, Advances and Challenges for Subseasonal to Seasonal Prediction, AGU fall meeting session

2019 **Planning Committee**, SPARC DynVarMIP-SNAP workshop, Madrid, Spain

2019 **Program chair**, AMS 20th Middle Atmosphere Conference, Phoenix, Arizona

2015 **Planning Committee**, SPARC regional workshop in Boulder, Colorado

2012 **Co-organizer**, NOAA's 37th Climate Diagnostics and Prediction Workshop

Professional Societies

2003- **Member**, American Meteorological Society

2003- **Member**, American Geophysical Union

Outreach

2018 NOAA Summer Intern Speed Mentoring

2018 Smoky Hill High School World Awareness Day, "Lessons from the Antarctic Ozone Hole", Parker, Colorado

2016- Professional twitter account, @DrAHButler, with 2290 followers- 2000 tweets about stratospheric polar vortex events and large-scale circulation

2016 Denver Public Schools 8th Grade Career Fair

2015 Judge, Corden Pharma Colorado Regional Science Fair, University of Colorado-Boulder

2008 Smoky Hill High School, "Carbon Dioxide: Where it comes from, where it goes, and what we can do about it", Parker, Colorado

Media

Twitter, @DrAHButler, 4500+ followers

2020 *"Signs point to a strong polar vortex to start winter. Here's what that may mean",* https://www.washingtonpost.com/weather/2020/11/19/polar-vortex-start-winter/

"How largest Ozone 'hole' ever over the north pole is tied to Polar Vortex that hit parts of US", https://www.9news.com/video/weather/weather-colorado/how-largest-ozone-hole-ever-over-the-north-pole-is-tied-to-polar-vortex-that-hit-parts-of-us/73-1af55e83-279d-42d7-8b07-ba5e48b26754

"Spring 2020 brings rare ozone 'hole' to the Arctic",
https://climate.gov/news-features/event-tracker/spring-2020-brings-rare-ozone-%E2%80%9Chole%E2%80%9D-arctic

"The demise of the polar vortex could spell weather surprises this spring",
https://www.washingtonpost.com/weather/2020/03/14/polar-vortex-spring-weather/

2019 "*Scientists review impact of the stratosphere on weather*",
https://www.ecmwf.int/en/about/media-centre/news/2019/scientists-review-impact-stratosphere-weather

"Strong winds leave Arctic regions on thin ice",
https://eos.org/articles/strong-winds-leave-arctic-regions-on-thin-ice

"The polar vortex is running wild—and it may not be because of climate change", https://www.popsci.com/climate-change-polar-vortex

Live interview with NPR's On Point on the polar vortex, January 30, 2019,
https://www.wbur.org/onpoint/2019/01/30/withstanding-this-weeks-polar-vortex-the-coldest-temperatures-in-at-least-20-years

"Record cold temperatures don't mean the planet isn't warming",
https://www.popsci.com/cold-weather-climate-change

"How the shutdown reordered American Life",
https://www.nytimes.com/2019/01/26/us/government-shutdown-over.html

"The polar vortex has split, sending frigid air howling into the U.S., Europe",
https://www.axios.com/polar-vortex-means-winter-is-coming-to-east-coast-and-europe-5fb653fd-1664-41aa-9a99-549e2541d89a.html

"The polar vortex could bring record cold to this weekend's Chiefs-Patriots Championship game", Earther, https://earther.gizmodo.com/the-polar-vortex-could-bring-record-cold-to-this-weeken-1831771032

"The polar vortex split apart. Here's what to expect", Popular Science,
https://www.popsci.com/polar-vortex-fractured

"The polar vortex is about to split into 3 pieces: Here's what it means",
Axios, https://www.axios.com/polar-vortex-is-about-to-split-up-5c2e7460-67fb-49da-b73a-079ffbe205b9.html

2018 *"The polar vortex might weaken soon, and that could unleash a much colder January"*, The Weather Channel,
https://weather.com/forecast/national/news/2018-12-18-polar-vortex-weakening-colder-jan-2019

2016 *"There is a searing scientific debate about missing Arctic ice"*, BuzzFeed, https://www.buzzfeednews.com/article/dinograndoni/sea-ice-winter-weather#.iejEGgjB2

Field Experience

2018 Flight Meteorologist for NASA Atmospheric Tomography Mission 4
2017 Flight Meteorologist for NASA Atmospheric Tomography Mission 3

Climate Analysis, Modeling, and Computational Experience

Programming in IDL, Matlab, Fortran, Unix, GrAds, introductory Python, NCL, CDO
Experience running NCAR's Whole Atmosphere Community Climate Model (WACCM/CESM) on NOAA supercomputers Zeus/Theia
Experience running a dry idealized general circulation model at Colorado State University
Experience in analysis of large datasets using statistical/predictive tools: regression, correlation, empirical orthogonal functions, spectral analysis

Funded Grants

***Note, an asterisk indicates a proposal for which I was required to have a federal PI but for all intents and purposes served as the lead investigator.**

A diagnostic toolbox for the verification and validation of subseasonal stratosphere-troposphere coupling processes in NOAA's Unified Forecast System. NWS Office of Science and Technology Integration: Unified Forecast System, Weeks 3-4 Competition. Lead PI: **Amy H. Butler**. Co-I: Judith Perlwitz and Craig Long. Budget: $288,584. 2020-2022. Time commitment for A.H. Butler: 4 months/yr.

The influence of climate variability and change on stratospheric intrusions of ozone over North America. National Science Foundation. **Lead PIs**: John R. Albers, **Amy H. Butler**. Budget: $312,334. Dec 2018-Dec 2021. Time commitment for A.H. Butler: 4 months/year.

Climate Forecast System Reanalysis model-level products for reanalysis validation and intercomparison. NOAA HPCC Information Technology Incubator Proposal. Lead PI: Karen Rosenlof. **Co-I: Amy H. Butler**, Sean Davis, Craig Long. Budget: $109,000. 2016-2017.

A comprehensive atlas of mid-winter sudden stratospheric warmings and associated surface climate extremes. NOAA/Climate Program Office/COM. Lead PI: Dian Seidel. **Co-PI: Amy H. Butler***. Total Budget: $338,903. 2013-2016.

Analysis of IPCC-AR5 and CFS model simulated stratosphere-troposphere coupling and its links to Eurasian snow cover variability. NOAA/Climate Program Office/CPPA. Grant#:NA10OAR4310163, Lead PI: Judah Cohen, Arun Kumar. **Co-I**: **Amy H. Butler**, J. Furtado, E. Riddle. Total Budget: $421,604. 2010-2013.

Pending Grants

Process-oriented diagnostics of dynamical coupling between the troposphere and stratosphere in Earth System Models. Lead PI: **Amy H. Butler** (NOAA CSL). Co-PI: Zachary D. Lawrence (CIRES). Co-Is: Judith Perlwitz (NOAA PSL). NOAA Climate Program Office MAPP. Budget: $517,700. FY2022-2025. Time commitments: A. H. Butler (3 months/year).

Publications

Refereed Journal Articles (number = 49, h-index = 21)

49. Domeisen, D.I.V. and **A.H. Butler**, Stratospheric drivers of extreme events at the Earth's surface, accepted to Nature Communications Earth & Environment, 2020.

48. Baldwin, M.P., B. Ayarzaguena, T. Birner, N. Butchart, **A.H. Butler**, A.J. Charlton-Perez, D.I.V. Domeisen, C.I. Garfinkel, H. Garny, E.P. Gerber, M.I. Hegglin, U. Langematz, and N.M. Pedatella, Sudden stratospheric warmings, accepted to Reviews of Geophysics, 2020.

47. Martin, Z., A. Sobel, **A.H. Butler**, S. Wang, Variability in QBO temperature anomalies on annual and decadal timescales, accepted to Journal of Climate, **2020**.

46. Lawrence, Z.D., J. Perlwitz, **A.H. Butler,** G.L. Manney, P.A. Newman, S.H. Lee, and E.R. Nash, The remarkably strong Arctic stratospheric polar vortex of winter 2020: Links to record-breaking Arctic Oscillation and ozone loss, *Jour. Geophys. Res.*, 125, e2020JD033271, **2020**. Related AGU EOS summary: https://eos.org/research-spotlights/an-extraordinary-winter-in-the-polar-north

45. Lee, S.H., Z.D. Lawrence, **A.H. Butler,** and A. Karpechko, Seasonal forecasts of the exceptional Northern Hemisphere winter of 2020, *Geophys. Res. Lett.*, 47, e2020GL090328, **2020**.

44. Butler, A.H., Z.D. Lawrence, S.H. Lee, S.P. Lillo, and C.S. Long, Differences between the 2018 and 2019 stratospheric polar vortex split events, *Quar. Jour. Roy. Met. Soc.*, 1-19, **2020**.

43. Sprintall, J., V.J. Coles, K.A. Reed, **A.H. Butler**, G.R. Foltz, S.G. Penny, and H. Seo, Best practice strategies for process studies designed to improve climate modeling, *BAMS*, 101, E1842–E1850, **2020**.

42. Ayarzagüena, B., A. J. Charlton-Perez, **A. H. Butler**, P. Hitchcock, I. R. Simpson, L. M. Polvani, N. Butchart, E. P. Gerber, L. Gray, B. Hassler, P. Lin, F. Lott, E. Manzini, R. Mizuta, C. Orbe, S. Osprey, D. Saint-Martin, M. Sigmond, M. Taguchi, E. M. Volodin, S. Watanabe, Uncertainty in the response of sudden stratospheric warmings and stratosphere-troposphere coupling to quadrupled CO2 concentrations in CMIP6 models, *J. Geophys. Res.*, 125, e2019JD032345, **2020**.

41. Mariotti, A., C. Baggett, E. A. Barnes, E. Becker, **A.H. Butler**, D.C. Collins, P.A. Dirmeyer, L. Ferranti, N.C. Johnson, J. Jones, B. P. Kirtman, A.L. Lang, A. Molod, M. Newman, A.W. Robertson, S. Schubert, D.E. Waliser, and J. Albers, Windows of opportunity for skillful forecasts subseasonal to seasonal and beyond, *BAMS*, 101, E608-E625, **2020**.

40. Merryfield, W.J., J. Baehr, L. Batte, E.J. Becker, **A.H. Butler**, et al., Current and emerging developments in subseasonal to decadal prediction, *BAMS*, 101, E869–E896, **2020**.

39. King, A. D., **A.H. Butler**, M. Jucker, N.O. Earl, and I. Rudeva, Observed relationships between sudden stratospheric warmings and European climate extremes, *J. Geophys. Res*., 124, 13943-13961, **2019**.

38. Domeisen, D.I.V., **A.H. Butler,** A.J. Charlton-Perez, B. Ayarzaguena, M.P. Baldwin, E. Dunn-Sigouin, J.C. Furtado, C.I. Garfinkel, P. Hitchcock, A. Yu. Karpechko, H. Kim, J. Knight, A.L. Lang, E.-P. Lim, A. Marshall, G. Roff, C. Schwartz, I.R. Simpson, S.-W. Son, M. Taguchi, The role of stratosphere-troposphere coupling in sub-seasonal to seasonal prediction. Part I: Predictability in the Stratosphere, *J. Geophys. Res.*, 125, e2019JD030920, **2019**.

37. Domeisen, D.I.V., **A.H. Butler,** A.J. Charlton-Perez, B. Ayarzaguena, M.P. Baldwin, E. Dunn-Sigouin, J.C. Furtado, C.I. Garfinkel, P. Hitchcock, A. Yu. Karpechko, H. Kim, J. Knight, A.L. Lang, E.-P. Lim, A. Marshall, G. Roff, C. Schwartz, I.R. Simpson, S.-W. Son, M. Taguchi, The role of stratosphere-troposphere coupling in sub-seasonal to seasonal prediction. Part II: Predictability arising from stratosphere-troposphere coupling, *J. Geophys. Res.*, 125, e2019JD030923, **2019**.

36. Lee, S.H. and **A.H. Butler**, The 2018-19 Arctic stratospheric polar vortex, *Weather*, doi:10.1002/wea.3643, **2019**.

35. Butler, A.H., A. Charlton-Perez, D.I.V. Domeisen, I.R. Simpson, and J. Sjoberg, The predictability of Northern Hemisphere final stratospheric warmings and their surface impacts, *Geophys. Res. Lett.*, 46, 10578-10588, **2019**.

34. Garfinkel, C.I., C. Schwartz, D.I.V. Domeisen, **A.H. Butler**, S.-W. Son, and I.P. White, Weakening of the teleconnection of El Niño-Southern Oscillation to the Arctic stratosphere over the past few decades: What can be learned from subseasonal forecast models?, *J. Geophys. Res*., 124, https://doi.org/10.1029/2018JD029961, **2019**.

33. Domeisen, D.I.V., C.I. Garfinkel, and **A.H. Butler**, The teleconnection of El Niño-Southern Oscillation to the Stratosphere, *Reviews of Geophysics*, 57, https://doi.org/10.1029/2018RG000596, **2019**. Related AGU EOS summary: https://eos.org/editors-vox/global-impacts-of-ensos-reach-into-the-stratosphere

32. Garfinkel, C.I., C. Schwartz, D.I.V. Domeisen, S.-W. Son, **A.H. Butler**, and I.P. White, Extratropical atmospheric predictability from the Quasi-Biennial Oscillation in subseasonal forecast models, *Jour. Geophys. Res.*, 123 (15), 7855-7866, **2018**.

31. Martineau, P., S.-W. Son, M. Taguchi, and **A.H. Butler**, A comparison of the momentum budget in reanalysis datasets during sudden stratospheric warming events, *Atmos. Chem. Phys. Discuss.*, https://doi.org/10.5194/acp-2017-837, **2018**.

30. Butler, A.H., and E.P. Gerber, Optimizing the definition of a sudden stratospheric warming, *J. Climate*, 31, 2337-2334, **2018**.

29. Albers, J.R., J. Perlwitz, G.N. Kiladis, Z. Lawrence, **A.H. Butler**, T. Birner, G.L. Manney, A.O. Langford, and J. Dias, Mechanisms governing interannual stratosphere to troposphere ozone transport, *Jour. Geophys. Res.: Atmospheres*, 123, 234-260, **2018**.

28. L'Heureux, M., M. Tippett, A. Kumar, **A.H. Butler**, L. Ciasto, Q. Ding, K. Harnos, and N. Johnson, Strong relations between ENSO and the Arctic Oscillation in the North American Multi-model Ensemble, *Geophys. Res. Lett.,* 44, 11654-11662, https://doi.org/10.1002/2017GL074854, **2017**.

27. Williams, P.D., M.J. Alexander, E.A. Barnes, **A.H. Butler**, H.C. Davies, C.I. Garfinkel, Y. Kushnir, T.P. Lane, J.K. Lundquist, R.N. Maue, W.R. Peltier, O. Romppainen-Martius, K. Sato, A.A. Scaife, C. Zhang, A census of atmospheric variability from seconds to decades, *Geophys. Res. Lett.*, 44, 11201-11211, https://doi.org/10.1002, **2017**.

26. Tompkins, A., M. Inez Ortis de Zarate, R.I. Sarraul, C. Vera, C. Saulo, W. J. Merryfield, M. Sigmond, W.-S. Lee, O. Alves, F. Tseitkin, J. Baehr, A. Braun, M. Deque, **A.H. Butler**, F. J. Doblas-Reyes, M. Gordon, A. Scaife, Y. Imada, M. Ishii, T. Ose, R. Koster, B. Kirtman, A. Kumar, W. A. Muller, A. Pirani, T. Stockdale, M. Rixen, and T. Yasuda, The Climate-system Historical Forecast Project: providing open access to seasonal forecast ensembles from centers around the globe, *Bull. Amer. Meteor. Soc.,* 98, 2293–2301, https://doi.org/10.1175/BAMS-D-16-0209.1, **2017**.

25. Calvo, N., M. Iza, M.M. Hurwitz, E. Manzini, C. Pena-Ortiz, **A.H. Butler**, C. Cagnazzo, S. Ineson, and C. Garfinkel, Northern Hemisphere stratospheric pathway of different El Nino flavors in CMIP5 models, *J. Climate,* **30**, 4351–4371, https://doi.org/10.1175/JCLI-D-16-0132.1, **2017**.

24. Butler, A.H., J. Sjoberg, D. Seidel., and K.H. Rosenlof, A sudden stratospheric warming compendium, Earth Syst. Sci. Data, 9, 63-76, **2017**.

23. Polvani, L.M., Sun, L., **A.H. Butler**, J.H. Richter, and C. Deser, Distinguishing stratospheric sudden warmings from ENSO as key drivers of wintertime climate variability over the North Atlantic and Eurasia, *J. Climate*, 30, 1959-1969, doi:10.1175/JCLI-D-16-0277.1, **2017**.

22. Butler, A.H., J.S. Daniel, R.W. Portmann, A.R. Ravishankara, P.J. Young, D. Fahey, K. Rosenlof, Diverse policy implications for future ozone and surface UV in a changing climate, *Environ. Res. Lett.*, 11 (6), 064017, **2016**.

21. Dessler, A.E., H. Ye, T. Wang, M.R. Schoeberl, L.D. Oman, A.R. Douglass, **A.H Butler**, K.H Rosenlof, S.M. Davis, and R.W. Portmann, Transport of ice into the stratosphere and the humidification of the stratosphere over the 21st century, *Geophys. Res. Lett.,* 42, doi: 10.1002/2016GL067991, **2016**.

20. Butler, A.H., A. Arribas, M. Athanassiadou, J. Baehr, N. Calvo, A. Charlton-Perez, M. Deque, D.I.V. Domeisen, K. Froehlich, H. Hendon, Y. Imada, M. Ishii, M. Iza, A. Karpechko, A. Kumar, C. MacLachlan, W.J. Merryfield, W.A. Mueller, A. O'Neill, A.A. Scaife, J. Scinocca, M. Sigmond, T.N. Stockdale, and T. Yasuda, The Climate-system Historical Forecasting Project: Do stratosphere-resolving models make better seasonal climate predictions in boreal winter?, *Q. J. Roy. Meteor. Soc*., 142, 1413-1427, doi:10.1002/qj.2743, **2016**.

19. Scaife, A.A., A.-Yu. Karpechko, M.P. Baldwin, A. Brookshaw, **A.H. Butler**, R. Eade, M. Gordon, C. MachLachlan, N. Martin, N. Dunstone, and D. Smith, Seasonal winter forecasts and the stratosphere, *Atmospheric Science Letters*, 17: 51–56, doi: 10.1002/asl.5982015, **2016**.

18. Butler, A.H., D.J. Seidel, S. Hardiman, N. Butchart, T. Birner, and A. Match, Defining sudden stratospheric warmings, *Bull. Amer. Met. Soc.*, doi: http://dx.doi.org/10.1175/BAMS-D-13-00173.1, **2015**.

17. Furtado, J.C., J.L. Cohen, **A.H. Butler**, E.E. Riddle, and A. Kumar, Eurasian snow cover variability and links to winter climate in the CMIP5 models, *Climate Dynamics*, doi:10.1007/s00382-015-2494-4, **2015**.

16. Domeisen, D.I.V., **A.H. Butler**, K. Frohlich, M. Bittner, W.A. Muller, and J. Baehr, Seasonal predictability over Europe arising from El Niño and stratospheric variability in the MPI-ESM seasonal prediction system, *J. Climate*, doi:10.1175/JCLI-D-14-00207.1, **2015**.

15. Hurwitz, M.M, N. Calvo, C.I. Garfinkel, **A.H. Butler**, S. Ineson, C. Cagnazzo, E. Manzini, and C. Pena-Ortiz, Extratropical atmospheric response to ENSO in CMIP5 models, *Climate Dynamics*, doi:10.1007/s00382-014-2110-z, **2014**.

14. Butler, A.H., L.M. Polvani, and C. Deser, Separating the stratospheric and tropospheric pathways of El Niño-Southern Oscillation teleconnections, *Environ. Res. Lett*., 9, doi:10.1088/1748-9326/9/2/024014, **2014**.

13. Riddle, E.E., **A.H. Butler**, J.C. Furtado, J.L. Cohen, and A. Kumar, CFSv2 ensemble prediction of the wintertime Arctic Oscillation, *Climate Dynamics,* 41, 1099-1116, **2013**.

12. Young, P.J., **A. H. Butler**, N. Calvo, L. Haimberger, P.J. Kushner, D.R. Marsh, W.J. Randel, and K.H. Rosenlof, Agreement in late twentieth century Southern Hemisphere stratospheric temperature trends in observations and CCMVal-2, CMIP3 and CMIP5 models, *J. Geophys. Res.*, doi: 10.1002/jgrd.50126, **2013**.

11. Charlton-Perez, A., M.P. Baldwin, T. Birner, R.X. Black, **A.H. Butler**, et al., On the lack of stratospheric dynamical variability in low-top versions of the CMIP5 models, *J. Geophys. Res.,* doi:10.1002/jgrd.50125, **2013**.

10. Garfinkel, C.I., M. Hurwitz, D.W. Waugh, and **A.H. Butler**, Are the teleconnections of Central Pacific and Eastern Pacific El Niño distinct in boreal wintertime?, *Climate Dynamics*, doi: 10.1007/s00382-012-1570-2, **2012**.

9. Thompson, D.W.J., D.J. Seidel, W.J. Randel, C. Sou, **A.H. Butler**, R. Lin, C. Long, C. Mears, and A. Osso, The mystery of recent stratospheric temperature trends, *Nature*, doi:10.1038/nature11579, **2012**.

8. Garfinkel, C.I., **A.H. Butler**, D.W. Waugh, M.M. Hurwitz, and L.M. Polvani, Why might stratospheric sudden warmings occur with similar frequency in El Niño and La Niña winters? *J. Geophys. Res*., 117, D19106, doi:10.1029/2012JD017777, **2012**.

7. Gerber, E. P., **A. Butler**, N. Calvo, A. Charlton-Perez, M. Giorgetta, E. Manzini, J. Perlwitz, L. M. Polvani, F. Sassi, A. A. Scaife, T. A. Shaw, S.-W. Son and S. Watanabe, Assessing and Understanding the Impact of Stratospheric Dynamics and Variability on the Earth System, *Bull. Amer. Meteor. Soc*., 93, 845-859, **2012**.

6. Butler, A.H., D.W.J. Thompson, and T. Birner, Isentropic slopes, downgradient eddy fluxes, and the extratropical atmospheric circulation response to tropical tropospheric heating. *J. Atmos. Sci*, 68, 2292-2305, **2011**.

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4. L'Heureux, M., **A.H. Butler**, B. Jha, A. Kumar, and W. Wang, Unusual Extremes in the Negative Phase of the Arctic Oscillation during 2009. *Geophys. Res. Lett*., 37, L10704, doi:10.1029/2010GL043338, **2010**.

3. Butler, A.H., D.W.J. Thompson, and R. Heikes, The steady state atmospheric circulation response to climate change-like thermal forcings in a simple general circulation model. *J. Climate*, 23 (13), 3474-3496, **2010**.

2. Butler, A.H., D.W.J. Thompson, and K. Gurney, Observed relationships between the Southern Annular Mode and atmospheric carbon dioxide. *Global Biogeochemical Cycles*, **21**, GB4014, doi:10.1029/2006GB002796, **2007**.

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Book and Report Chapters

Gerber, E. P., P. Martineau, B. Ayarzaguena, D. Barriopedro, T. J. Bracegirdle, **A. H. Butler**, N. Calvo, S. C. Hardiman, P. Hitchcock, M. Iza, U. Langematz, H. Lua, G. Marshall, A. Orr, F. M. Palmeiro, S.-W. Son, and M. Taguchi: Extratropical Stratosphere–troposphere Coupling, Stratosphere-troposphere Processes and their Role in Climate (SPARC) Reanalysis Intercomparison Project (S-RIP) Chapter 6, M. Fujiwara, G. L. Manney, L. Gray, and J. S. Wright, Eds., in press, **2020**.

Butler, A.H., A. Charlton-Perez, D.I.V. Domeisen, C. Garfinkel, E.P. Gerber, P. Hitchcock, A.-Yu Karpechko, A.C. Maycock, M. Sigmond, I. Simpson, S.-W. Son, Sub-seasonal Predictability and the Stratosphere- Chapter 11, The Gap Between Weather and Climate Forecasting, p. 223-241, Elsevier, https://doi.org/10.1016/B978-0-12-811714-9.00011-5, **2019**.

Manuscripts under Review

Breeden, M., **A.H. Butler**, J.R. Albers, M. Sprenger, and A.O. Langford, The spring transition of the North Pacific jet and its relation to deep stratosphere-to-troposphere mass transport over western North America, submitted to ACP, 2020.

Lim, E.-P., H. H. Hendon, **A.H. Butler**, D.W.J. Thompson, Z. Lawrence, A.A. Scaife, T.G. Shepherd, I. Polichtchouk, H. Nakamura, C. Kobayashi, R. Comer, L. Coy, A. Dowdy, R.D. Garreaud, P.A. Newman, and G. Wang, The 2019 Southern Hemisphere polar stratospheric warming and its impacts, submitted to BAMS, 2020.

Banerjee, A., **A.H. Butler**, L.M. Polvani, A. Robock, I.R. Simpson, L. Sun, Robust winter warming over Eurasia under stratospheric sulfate geoengineering- the role of stratospheric dynamics, submitted to ACP, 2020.

Martin, Z., S.-W. Son, **A.H. Butler**, H. Hendon, H. Kim, A. Sobel, S. Yoden, and C. Zhang, The influence of the quasi-biennial oscillation on the Madden-Julian Oscillation, in prep for Nature Review Earth and Environment, 2020.

Manuscripts in Preparation

Albers, J.R., **A.H. Butler**, M. Breeden, A.O. Langford, and G.N. Kiladis, Subseasonal prediction of springtime Pacific-North American transport using upper-level wind forecasts, in prep, 2020.

A.H. Butler and D.I.V. Domeisen, The wave geometry of final stratospheric warming events, in prep, 2020.

Other Publications (not peer-reviewed)

Newman, P., E.R. Nash, N. Kramarova, **A.H. Butler,** 2020: The 2019 southern stratospheric warming [in “State of the Climate in 2019"]. Bull. Amer. Meteor. Soc., **101** (8), S297–S298, https://doi.org/10.1175/BAMS-D-20-0090.1.

Karpechko, A., **A.H. Butler**, N. Calvo, A. Charlton-Perez, D. Domeisen, E. Gerber, E. Manzini, and A. Ming, Joint DynVarMIP/CMIP6 and SPARC DynVar & SNAP Workshop: Atmospheric circulation in a changing climate, SPARC newsletter, 54, p. 33-39, February 2020.

Domeisen, D.I.V., **A.H. Butler**, A.J. Charlton-Perez, The role of the stratosphere in sub-seasonal to seasonal prediction, SPARC newsletter, 54, p. 14-18, February 2020.

Lim, E.-P., H.H. Hendon, **A.H. Butler**, R. Garreaud, I. Polichtchouk, T.G. Shepherd, A. Scaife, R. Comer, L. Coy, P.A. Newman, D.W.J. Thompson, and H. Nakamura, The 2019 Antarctic sudden stratospheric warming, SPARC newsletter, 54, p. 10-13, February 2020.

Hendon, H.H., D.W.J. Thompson, E.-P. Lim, **A.H. Butler**, P.A. Newman, L. Coy, A. Scaife, I. Polichtchouk, R. Garreaud, T.G. Shepherd, and H. Nakamura, Rare forecasted climate event under way in the Southern Hemisphere, *Nature Correspondence*, 573, p. 495, 2019.

Butler, A.H., How winds miles above the Arctic may have brought wintry weather to mid-latitudes, https://www.climate.gov/news-features/blogs/enso/february-and-march-madness-how-winds-miles-above-arctic-may-have-brought, NOAA ENSO blog, April 27, 2018.

Butler, A.H., El Niño and the stratospheric polar vortex, NOAA ENSO blog, https://www.climate.gov/news-features/blogs/enso/el-nino-and-stratospheric-polar-vortex, April 28, 2016.

Butler, A.H., E.P. Gerber, D. Mitchell, and W. Seviour, New efforts in developing a standard definition for sudden stratospheric warmings, SPARC Newsletter, 43, p. 23-24, July 2014.

Seminars and Conference Proceedings

Invited Talks

2020 "Stratospheric polar vortex extremes, their impacts, and implications for future climate change", Institute for Atmospheric and Climate Science, ETH-Zurich webinar

2020 "Exceptional atmospheric dynamics in boreal winter-spring 2020", Interagency Arctic Research Policy Committee Atmosphere Collaboration Team webinar

2020 "The Stratosphere: how winds miles above us can be used to predict the weather weeks in advance", CIRES Education and Outreach webinar, https://cires.colorado.edu/outreach/scienceathome/butler

2020 "Stratospheric polar vortex influence on sub-seasonal predictive skill of surface temperature", NOAA Geophysical Fluid Dynamics Laboratory seminar, Princeton, New Jersey.

2019 "The representation of stratosphere-troposphere coupling in S2S models", ECMWF Workshop on Stratospheric predictability and impact on the troposphere, Reading, UK.

2018 "Stratosphere-troposphere coupling processes on S2S and longer timescales", SPARC General Assembly, Kyoto, Japan.

2018 "The role of the stratosphere in sub-seasonal to seasonal predictability", Second International Conference on Subseasonal to Seasonal Prediction, Boulder, CO

2018 "Sub-seasonal to seasonal predictability and the stratospheric polar vortex", NOAA Climate Prediction Center working group meeting telecon

2018 "How important is the stratospheric pathway of ENSO for Northern Hemisphere wintertime climate variability?", AMS Annual Meeting, Austin, TX

2017 "Uncertainties in future stratospheric ozone and surface UV," Climate Engineering Conference, Berlin, Germany.

2016 "El Niño and the stratospheric polar vortex: improving seasonal prediction of mid-latitude winter climate," NOAA Chemical Sciences Division, Boulder, CO

2014 "Separating the stratospheric and tropospheric pathways of ENSO teleconnections", NCAR Climate Variability and Change Working Group meeting.

2014 "Do stratosphere-resolving models make improved seasonal climate predictions?", NCAR Atmospheric Modeling and Predictability seminar.

2013 "Toward a consistent definition for sudden stratospheric warmings", Colorado State University, Atmospheric Dynamics group seminar.

2013 "The Stratosphere-resolving Historical Forecast Project", SPARC DynVar Workshop, Reading, UK.

2011 "The atmospheric circulation response to climate change-like thermal forcings in an idealized GCM", Johns Hopkins University, Center for Applied and Environmental Fluid Mechanics (CEAFM), and Center for Ocean Land Atmosphere (COLA).

2010 "The atmospheric circulation response to climate change-like thermal forcings in an idealized GCM", Columbia University, SEAS colloquium.

Contributed Talks

2019 "Predictability of Northern Hemisphere final stratospheric warmings and their surface impacts", SPARC DynVar/SNAP workshop, Madrid, Spain.

2019 "NOAA Chemical Sciences Division: Contributions to S2S efforts", NOAA OAR S2S Collaboration Workshop, Princeton, New Jersey (remote presentation)

2019 "The predictability of Northern Hemisphere stratospheric final warmings and their surface impacts", AMS Annual Meeting, Phoenix, Arizona.

2017 "Optimizing the definition for sudden stratospheric warmings", AMS Middle Atmosphere Meeting, Portland, OR.

2016 "Can the compact O_3-N_2O relationship be used to detect ozone recovery?", AGU Fall Meeting, San Francisco, CA.

2016 "Do stratosphere-resolving models make better seasonal climate predictions in boreal winter?", SPARC DynVar meeting, Helsinki, Finland.

2016 "The future stratospheric ozone layer conundrum", American Meteorological Society (AMS) Annual Meeting, New Orleans, LA

2015 "Do stratosphere-resolving models make better seasonal climate predictions in boreal winter?", Climate Diagnostics and Prediction Workshop, Denver, CO

2015 "Defining sudden stratospheric warmings", EGU General Assembly, Vienna, Austria. Led townhall discussion.

2015 "Defining sudden stratospheric warmings", AMS Annual Meeting, Phoenix, AZ. Led townhall discussion.

2014 "Reconsidering the standard definition for sudden stratospheric warmings", SPARC General Assembly, Queenstown, New Zealand.

2012 "Stratosphere-troposphere coupling in response to an idealized polar cooling", AGU Fall Meeting, San Francisco, CA

2012 "Equal Frequency of stratospheric sudden warmings in El Niño and La Niña", Climate Diagnostics and Prediction Workshop, Fort Collins, CO