

Craig Steven Schwartz

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Boulder, Colorado 80301

Curriculum Vitae
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EDUCATION

The University of Oklahoma, Norman, OK

- Master's of Science in Meteorology, May 2009
- Thesis: *An assessment of convection-allowing WRF-ARW configurations: Utility as next-day guidance and sensitivity to resolution and physical parameterizations*
- Thesis Adviser: John S. Kain
- GPA 4.00/4.00

The Pennsylvania State University, University Park, PA

- Bachelor of Science in Meteorology, May 2007
- Bachelor of Music, Composition Option, with Honors, May 2007
- Graduated with Highest Distinction, GPA 3.99/4.00
- The Schreyer Honors College

The Kentucky Institute for International Studies

- Studied in Salzburg, Austria for five weeks, May-June 2005

PROFESSIONAL EXPERIENCE

The National Center for Atmospheric Research (NCAR), Boulder, CO
Mesoscale and Microscale Meteorology (MMM) Laboratory

- Project Scientist II, 2017-present
- Project Scientist I, 2016-2017
- Associate Scientist III, 2011-2016
- Associate Scientist II, 2009-2011

The University of Oklahoma and National Severe Storms Laboratory, Norman, OK

- Graduate Research Assistant, 2007-2009

The National Weather Service, Juneau, AK

- Summer hire, May-July 2007
- Worked operational shifts

The Storm Prediction Center and National Severe Storms Laboratory, Norman, OK

- NOAA Ernest F. Hollings Scholarship Internship, Summer 2006

The Ocean Prediction Center, Camp Springs, MD

- Summer internship, 2002

TEACHING EXPERIENCE

Teaching Assistant, School of Meteorology, The University of Oklahoma, 2009

Teaching Assistant, Department of Meteorology, The Pennsylvania State University, 2006

HONORS AND AWARDS

American Meteorological Society (AMS)

- Editor's Award for *Weather and Forecasting*, 2015
- Graduate Fellowship, 2007-2008
- The District of Columbia Chapter of the AMS Scholarship Recipient, 2003

National Center for Atmospheric Research (NCAR)

- MMM Special Recognition Award, 2018
- MMM Special Recognition Award, 2014

National Oceanic and Atmospheric Administration (NOAA)

- Ernest F. Hollings Scholarship, 2005-2007
- Best Student Presentation, NOAA/EPP Forth Education and Science Forum, Tallahassee, FL, 2006

The University of Oklahoma

- Yoshi Sasaki Award for Best M.S. Student Publication, 2009

Astronaut Scholarship Foundation

- Scholarship recipient, 2008 — awarded nationally to ~25 students

The Pennsylvania State University

- Meteorological Honors and Awards:
 - John A. Dutton Award in Atmospheric Dynamics, 2007
 - Dr. Joel and Peggy Myers Scholarship in Meteorology, 2006-2007
 - Charles and Anna Hosler Scholarship in Meteorology, 2004-2006
 - John and Elizabeth Holmes Teas Scholarship in Earth and Mineral Sciences, 2004-2006
- University Honors and Awards:
 - John W. White Graduate Fellowship, 2007
 - Evan Pugh (Senior) Scholar Award for Academic Achievement, 2006-2007
 - Evan Pugh (Junior) Scholar Award for Academic Achievement, 2005-2006
 - President Sparks Award for Academic Excellence, 2004-2005

- President's Freshman Award for Academic Excellence, 2003-2004
- Schreyer Honors College Academic Excellence Scholarship, 2003-2007
- Music Honors and Awards:
 - College of Arts and Architecture Creative Achievement Award, 2007
 - College of Arts and Architecture Alumni Scholarship, 2006-2007
 - College of Arts and Architecture Reuben and Gladys Golumbic Scholarship for Humanistic Achievement in the Arts, 2005
 - Eleanor Beene Memorial Scholarship in Music, 2004-2005
 - School of Music Scholarship, 2003-2007

COMMUNITY SERVICE

Journal Editorships and Peer review

- Associate Editor for *Weather and Forecasting*, Jan. 1, 2014-present
- Associate Editor for *Monthly Weather Review*, Jan. 1, 2016-present
- Reviewer for *Journal of Geophysical Research—Atmospheres*
- Reviewer for *Journal of Atmospheric Sciences*
- Reviewer for *Geoscientific Model Development*
- Reviewer for *Journal of Hydrometeorology*
- Reviewer for *Journal of Applied Meteorology and Climatology*
- Reviewer for *Quarterly Journal of the Royal Meteorological Society*
- Reviewer for *Theoretical and Applied Climatology*
- Reviewer for *Aerosol and Air Quality Research*
- Reviewer for *Atmospheric Research*
- Reviewer for the *Central European Journal of Geosciences*
- Reviewer for *Meteorology and Atmospheric Physics*
- Reviewer for *Advances in Atmospheric Sciences*
- Reviewer for *Remote Sensing*
- Reviewer for *Atmospheric Chemistry and Physics*
- Reviewer for *Journal of Meteorological Research*
- Reviewer for *International Journal of Remote Sensing*
- Reviewer for *Atmospheric Pollution Research*
- Reviewer for *Atmospheric Science Letters*
- Reviewer for *Journal of Environmental Management*
- Reviewer for *Atmospheric Environment*
- Reviewer for *Scientific Online Letters on the Atmosphere*
- Reviewer for *Meteorologische Zeitschrift*
- Reviewer for *Advances in Space Research*
- Reviewer for *Journal of Atmospheric and Solar-Terrestrial Physics*

Grant proposal review

- University of Wisconsin—Milwaukee
- Austrian Science Fund
- National Science Foundation

Conference Committees

- Science committee for the 6th International Symposium on Data Assimilation, 2018

Internal UCAR/NCAR Service

- MMM Diversity and Inclusion Committee, 2017-present
- UCAR Awards Jury, 2016, 2017
- MMM Paper of the Year Committee, 2012
- Various hiring committees

Field Projects and Experiments

- Front Range Air Pollution and Photochemistry Experiment (FRAPPE), Boulder, CO, 2014: Forecaster
- Mesoscale Prediction Experiment (MPEX), Boulder, CO, 2013: Lead forecaster
- Deep Convective Clouds and Chemistry (DC3), Salina, KS, 2012: Lead forecaster
- Vortex2, 2009: Participant (mobile mesonets)
- NOAA Hazardous Weather Testbed Spring Experiment, 2008, 2009, 2018, 2019: Participant

Educational Outreach

- K-12 science fair judge:
 - GLOBE International Virtual Science Symposium, March 2018, April 2019
 - New Vista High School, Boulder, CO, April 2015, 2019
 - Eisenhower Elementary School, Boulder, CO, February 2015
 - Peak to Peak High School, Lafayette, CO, January 2011, 2012
 - Boulder Valley School District, Boulder, CO, February 2010, 2011, 2012, 2013, 2015, 2016, 2018, 2019; March 2017
 - Oklahoma Mesonet Science Fair, Norman, OK, March 2008, February 2009
- UCAR and NCAR:
 - Instructor for GSI Tutorial for Thailand Weather Forecasters, June 2017
 - WRF Data Assimilation Tutorial instructor, July 2011, 2012, 2013, 2014, 2017, 2019; August 2015, 2016; October 2017
 - “Super Science Saturday” volunteer, October 2009, 2011; November 2015, 2017, 2018
 - Judge for summer internship program’s poster session, July 2014, 2015, 2016, 2017

- American Meteorological Society:
 - Student conference presenter: “Conversations with Professionals”, 92nd Annual Meeting, January 2012
 - Judge for student conference poster session, 92nd Annual Meeting, January 2012
- American Geophysical Union:
 - Judge for student posters, Annual Fall Meeting, December 2016, 2018
- University of Colorado:
 - Selection committee for Astronaut Scholarship Foundation nominees, February 2018, March 2019
- National Oceanic and Atmospheric Administration (NOAA):
 - Reviewer for Ernest F. Hollings Scholarship, February 2018

The Pennsylvania State University Campus Weather Service

- Penn State’s Campus Weather Service is the largest student-run forecasting organization in the United States of America
- President, 2006-2007
- Shift leader, 2004-2007
- Forecaster and radio broadcaster, 2003-2007

PROFESSIONAL MEMBERSHIPS

American Meteorological Society
 American Geophysical Union

RESEARCH GRANTS

6. Forecast System Development Activities Toward a Convective-scale HRRR Ensemble (Co-PI), National Oceanographic and Atmospheric Administration Award Number NA17OAR4590182, \$530,134, 2017–2019.
5. Use of NWP Models to Identify Convective Outflows for Fire Weather Forecasting (Co-PI), Joint Fire Science Program, \$344,397, 2017–2019.
4. Demonstration of a Rapid Update Convection-Permitting Ensemble Forecast System to Improve Flash Flood and Winter Weather Prediction (Co-PI), National Oceanographic and Atmospheric Administration Award Number NA17OAR4590122, \$293,080, 2017–2019.
3. Demonstration of a Rapid Update Convection-Permitting Ensemble Forecast System to Improve Hazardous Weather Prediction (Co-PI), National Oceanographic and Atmospheric Administration Award Number NA17OAR4590114, \$285,593, 2017–2019.

2. Resolution Dependence of Simulated Convective Storms in the Southeast United States (Co-PI), National Oceanographic and Atmospheric Administration Award Number NA15OAR4590238, \$206,685, 2015–2017.
1. Convection-Permitting Ensemble Forecast System for Prediction of Extreme Weather (Co-PI), National Oceanographic and Atmospheric Administration Award Number NA15OAR4590191, \$247,208, 2015–2017.

PEER-REVIEWED PUBLICATIONS

40. **Schwartz, C. S.**, and R. A. Sobash, 2019: Revisiting sensitivity to horizontal grid spacing in convection-allowing models over the central–eastern United States. *Mon. Wea. Rev.*, In press, doi:10.1175/MWR-D-19-0115.1.
39. Yang, J., M. Astitha, and **C. S. Schwartz**, 2019: Assessment of storm wind speed prediction using gridded Bayesian regression applied to historical events with NCAR’s real-time ensemble forecast system. *J. Geophys. Res. Atmos.*, **124**, 9241–9261, doi:10.1029/2018JD029590.
38. Sobash, R. A., **C. S. Schwartz**, G. S. Romine, and M. L. Weisman, 2019: Next-day prediction of tornadoes using convection-allowing models with 1-km horizontal grid spacing. *Wea. Forecasting*, **34**, 1117–1135, doi:10.1175/WAF-D-19-0044.1.
37. **Schwartz, C. S.**, 2019: Medium-range convection-allowing ensemble forecasts with a variable-resolution global model. *Mon. Wea. Rev.*, **147**, 2997–3023, doi:10.1175/MWR-D-18-0452.1.
36. **Schwartz, C. S.**, G. S. Romine, R. A. Sobash, K. R. Fossell, and M. L. Weisman, 2019: NCAR’s real-time convection-allowing ensemble project. *Bull. Amer. Meteor. Soc.*, **100**, 321–343, doi:10.1175/BAMS-D-17-0297.1.
35. Gowan, T. M., W. J. Steenburgh, and **C. S. Schwartz**, 2018: Validation of mountain precipitation forecasts from the convection-permitting NCAR Ensemble and operational forecast systems over the Western United States. *Wea. Forecasting*, **33**, 739–765, doi:10.1175/WAF-D-17-0144.1.
34. Zhang, X., E. N. Anagnostou, and **C. S. Schwartz**, 2018: NWP-based adjustment of IMERG precipitation for flood-inducing complex terrain storms: Evaluation over CONUS. *Remote Sensing*, **10**, 642, doi:10.3390/rs10040642.
33. **Schwartz, C. S.**, and R. A. Sobash, 2017: Generating probabilistic forecasts from convection-allowing ensembles using neighborhood approaches: A review and recommendations. *Mon. Wea. Rev.*, **145**, 3397–3418, doi:10.1175/MWR-D-16-0400.1.
32. **Schwartz, C. S.**, G. S. Romine, K. R. Fossell, R. A. Sobash, and M. L. Weisman, 2017: Toward 1-km ensemble forecasts over large domains. *Mon. Wea. Rev.*, **145**, 2943–2969, doi:10.1175/MWR-D-16-0410.1.

31. Powers, J. G., J. B. Klemp, W. C. Skamarock, C. A. Davis, J. Dudhia, D. O. Gill, J. L. Coen, D. J. Gochis, R. Ahmadov, S. E. Peckham, G. A. Grell, J. Michalakes, S. Trahan, S. G. Benjamin, C. R. Alexander, G. J. DiMego, W. Wang, **C. S. Schwartz**, G. S. Romine, Z. Liu, C. Snyder, F. Chen, M. J. Barlage, W. Yu, and M. G. Duda, 2017: The Weather Research and Forecasting (WRF) Model: Overview, system efforts, and future directions. *Bull. Amer. Meteor. Soc.*, **98**, 1717–1737, doi:10.1175/BAMS-D-15-00308.1.
30. **Schwartz, C. S.**, 2017: A comparison of methods used to populate neighborhood-based contingency tables for high-resolution forecast verification. *Wea. Forecasting*, **32**, 733–741, doi:10.1175/WAF-D-16-0187.1.
29. Sobash, R. A., G. S. Romine, **C. S. Schwartz**, D. J. Gagne, and M. L. Weisman, 2016: Explicit forecasts of low-level rotation from convection-allowing models for next-day tornado prediction. *Wea. Forecasting*, **31**, 1591–1614, doi:10.1175/WAF-D-16-0073.1.
28. Romine, G. S., **C. S. Schwartz**, R. D. Torn, and M. L. Weisman, 2016: Impact of assimilating dropsonde observations from MPEX on ensemble forecasts of severe weather events. *Mon. Wea. Rev.*, **144**, 3799–3823, doi:10.1175/MWR-D-15-0407.1.
27. **Schwartz, C. S.**, 2016: Improving large-domain convection-allowing forecasts with high-resolution analyses and ensemble data assimilation. *Mon. Wea. Rev.*, **144**, 1777–1803, doi:10.1175/MWR-D-15-0286.1.
26. Sobash, R. A., **C. S. Schwartz**, G. S. Romine, K. R. Fossell, and M. L. Weisman, 2016: Severe weather prediction using storm surrogates from an ensemble forecasting system. *Wea. Forecasting*, **31**, 255–271, doi:10.1175/WAF-D-15-0138.1.
25. **Schwartz, C. S.**, G. S. Romine, R. A. Sobash, K. R. Fossell, and M. L. Weisman, 2015: NCAR’s experimental real-time convection-allowing ensemble prediction system. *Wea. Forecasting*, **30**, 1645–1654, doi:10.1175/WAF-D-15-0103.1.
24. **Schwartz, C. S.**, G. S. Romine, M. L. Weisman, R. A. Sobash, K. R. Fossell, K. W. Manning, and S. B. Trier, 2015: A real-time convection-allowing ensemble prediction system initialized by mesoscale ensemble Kalman filter analyses. *Wea. Forecasting*, **30**, 1158–1181, doi:10.1175/WAF-D-15-0013.1.
23. **Schwartz, C. S.**, Z. Liu, and X.-Y. Huang, 2015: Sensitivity of limited-area hybrid variational-ensemble analyses and forecasts to ensemble perturbation resolution. *Mon. Wea. Rev.*, **143**, 3454–3477, doi:10.1175/MWR-D-14-00259.1.
22. Newman, K. M., **C. S. Schwartz**, Z. Liu, H. Shao, and X.-Y. Huang, 2015: Evaluating forecast impact of assimilating Microwave Humidity Sensor (MHS) radiances with a regional ensemble Kalman filter data assimilation system. *Wea. Forecasting*, **30**, 964–983, doi:10.1175/WAF-D-14-00091.1.
21. Weisman, M. L., R. J. Trapp, G. S. Romine, C. Davis, R. Torn, M. Baldwin, L. Bosart, J. Brown, M. Coniglio, D. Dowell, A. C. Evans, T. J. Galarneau Jr., J. Haggerty, T. Hock,

- K. Manning, P. Roebber, P. Romashkin, R. Schumacher, **C. S. Schwartz**, R. Sobash, D. Stensrud, and S. Trier, 2015: The Mesoscale Predictability Experiment (MPEX). *Bull. Amer. Meteor. Soc.*, **96**, 2127–2149, doi:10.1175/BAMS-D-13-00281.1.
20. Romine, G. S., **C. S. Schwartz**, J. Berner, K. R. Fossell, C. S. Snyder, J. L. Anderson, and M. L. Weisman, 2014: Representing forecast error in a convection-permitting ensemble system. *Mon. Wea. Rev.*, **142**, 4519–4541, doi:10.1175/MWR-D-14-00100.1.
19. **Schwartz, C. S.**, G. S. Romine, K. R. Smith, and M. L. Weisman, 2014: Characterizing and optimizing precipitation forecasts from a convection-permitting ensemble initialized by a mesoscale ensemble Kalman filter. *Wea. Forecasting*, **29**, 1295–1318, doi:10.1175/WAF-D-13-00145.1.
18. Chen, D., Z. Liu, **C. S. Schwartz**, H.-C. Lin, J. D. Cetola, Y. Gu, and L. Xue, 2014: The impact of aerosol optical depth assimilation on aerosol forecasts and radiative effects during a wild fire event over the United States. *Geosci. Model Dev.*, **7**, 2709–2715, doi:10.5194/gmd-7-2709-2014.
17. Pagowski, M., Z. Liu, G. A. Grell, M. Hu, H.-C. Lin, and **C. S. Schwartz**, 2014: Implementation of aerosol assimilation in Gridpoint Statistical Interpolation (v. 3.2) and WRF-Chem (v. 3.4.1). *Geosci. Model Dev.*, **7**, 1621–1627, doi:10.5194/gmd-7-1621-2014.
16. **Schwartz, C. S.**, Z. Liu, H.-C. Lin, and J. D. Cetola, 2014: Assimilating aerosol observations with a “hybrid” variational-ensemble data assimilation system. *J. Geophys. Res. Atmos.*, **119**, doi:10.1002/2013JD020937.
15. **Schwartz, C. S.**, 2014: Reproducing the September 2013 record-breaking rainfall over the Colorado Front Range with high-resolution WRF model forecasts. *Wea. Forecasting*, **29**, 393–402, doi:10.1175/WAF-D-13-00136.1.
14. **Schwartz, C. S.**, and Z. Liu, 2014: Convection-permitting forecasts initialized with continuously-cycling limited-area 3DVAR, ensemble Kalman filter, and “hybrid” variational-ensemble data assimilation systems. *Mon. Wea. Rev.*, **142**, 716–738, doi:10.1175/MWR-D-13-00100.1.
13. Saide, P. E., G. R. Carmichael, Z. Liu, **C. S. Schwartz**, H.-C. Lin, A. M. da Silva, and E. Hyer, 2013: Aerosol optical depth assimilation for a size-resolved sectional model: impacts of observationally constrained, multi-wavelength and fine mode retrievals on regional scale analyses and forecasts. *Atmos. Chem. Phys.*, **13**, 10425–10444, doi:10.5194/acp-13-10425-2013.
12. **Schwartz, C. S.**, Z. Liu, X.-Y. Huang, Y.-H. Kuo, and C.-T. Fong, 2013: Comparing limited-area 3DVAR and hybrid variational-ensemble data assimilation methods for typhoon track forecasts: Sensitivity to outer loops and vortex relocation. *Mon. Wea. Rev.*, **141**, 4350–4372, doi:10.1175/MWR-D-13-00028.1.

11. Jiang, Z., Z. Liu, T. Wang, **C. S. Schwartz**, H.-C. Lin, and F. Jiang, 2013: Probing into the impact of 3DVAR assimilation of surface PM₁₀ observations over China using process analysis. *J. Geophys. Res.*, **118**, 6738–6749, doi:10.1002/jgrd.50495.
10. Romine, G. S., **C. S. Schwartz**, C. Snyder, J. L. Anderson, and M. L. Weisman, 2013: Model bias in a continuously cycled assimilation system and its influence on convection-permitting forecasts. *Mon. Wea. Rev.*, **141**, 1263–1284, doi:10.1175/MWR-D-12-00112.1.
9. **Schwartz, C. S.**, Z. Liu, H.-C. Lin, and S. A. McKeen, 2012: Simultaneous three-dimensional variational assimilation of surface fine particulate matter and MODIS aerosol optical depth. *J. Geophys. Res.*, **117**, D13202, doi:10.1029/2011JD017383.
8. Liu, Z., **C. S. Schwartz**, C. Snyder, and S.-Y. Ha, 2012: Impact of assimilating AMSU-A radiances on forecasts of 2008 Atlantic tropical cyclones initialized with a limited-area ensemble Kalman filter. *Mon. Wea. Rev.*, **140**, 4017–4034, doi:10.1175/MWR-D-12-00083.1.
7. **Schwartz, C. S.**, Z. Liu, Y. Chen, and X.-Y. Huang, 2012: Impact of assimilating microwave radiances with a limited-area ensemble data assimilation system on forecasts of typhoon Morakot. *Wea. Forecasting*, **27**, 424–437, doi:10.1175/WAF-D-11-00033.1.
6. Liu, Z., Q. Liu, H.-C. Lin, **C. S. Schwartz**, Y.-H. Lee, and T. Wang, 2011: Three-dimensional variational assimilation of MODIS aerosol optical depth: Implementation and application to a dust storm over East Asia. *J. Geophys. Res.*, **116**, D23206, doi:10.1029/2011JD016159.
5. Brooks, H. E., P. T. Marsh, A. M. Kowaleski, P. Groenemeijer, T. E. Thompson, **C. S. Schwartz**, C. M. Shafer, A. Kolodziej, N. Dahl, and D. Buckley, 2011: Evaluation of European Storm Forecast Experiment (ESTOFEX) forecasts. *Atmos. Res.*, **100**, 538–546, doi:10.1016/j.atmosres.2010.09.004.
4. Kain, J. S., M. Xue, M. C. Coniglio, S. J. Weiss, F. Kong, T. L. Jensen, B. G. Brown, J. Gao, K. Brewster, K. W. Thomas, Y. Wang, **C. S. Schwartz**, and J. J. Levit, 2010: Assessing advances in the assimilation of radar data and other mesoscale observations within a collaborative forecasting–research environment. *Wea. Forecasting*, **25**, 1510–1521, doi:10.1175/2010WAF2222405.1.
3. **Schwartz, C. S.**, J. S. Kain, S. J. Weiss, M. Xue, D. R. Bright, F. Kong, K. W. Thomas, J. J. Levit, M. C. Coniglio, and M. S. Wandishin, 2010: Toward improved convection-allowing ensembles: Model physics sensitivities and optimizing probabilistic guidance with small ensemble membership. *Wea. Forecasting*, **25**, 263–280, doi:10.1175/2009WAF2222267.1.
2. **Schwartz, C. S.**, J. S. Kain, S. J. Weiss, M. Xue, D. R. Bright, F. Kong, K. W. Thomas, J. J. Levit, and M. C. Coniglio, 2009: Next-day convection-allowing WRF model guidance: A second look at 2 vs. 4 km grid spacing. *Mon. Wea. Rev.*, **137**, 3351–3372, doi:10.1175/2009MWR2924.1.

1. Kain, J. S., S. J. Weiss, D. R. Bright, M. E. Baldwin, J. J. Levit, G. W. Carbin, **C. S. Schwartz**, M. L. Weisman, K. K. Droegemeier, D. B. Weber, and K. W. Thomas, 2008: Some practical considerations regarding horizontal resolution in the first generation of operational convection-allowing NWP. *Wea. Forecasting*, **23**, 931–952, doi:10.1175/WAF2007106.1.

NON-REFEREED PUBLICATIONS (IF FIRST AUTHOR, ALSO ORAL PRESENTATION)

12. Bresch, J. F., J. G. Powers, **C. S. Schwartz**, and J. L. Coen, 2019: Supporting fire weather forecasting through a tool to identify convective outflows in numerical weather prediction models. Proceedings, *6th Intl Fire Behavior and Fuels Conference*, Albuquerque, NM, The International Association of Wildland Fire, May 2019.
11. Descombes, G., T. D. Auligne, H.-C. Lin, D. Xu, **C. S. Schwartz**, and F. Vandenberghe, 2014: Multi-sensor Advection Diffusion nowCast (MADCast) for cloud analysis and short-term prediction. NCAR Technical Note NCAR/TN-509+STR, 21 pp, doi: 10.5065/D62V2D37.
10. **Schwartz, C. S.**, Z. Liu, X.-Y. Huang, and Y.-H. Kuo, 2014: A limited-area dual-resolution hybrid-variational ensemble data assimilation system for the WRF model. Preprints, *15th WRF Users' Workshop*, Boulder, CO, National Center for Atmospheric Research, 6A.3.
9. **Schwartz, C. S.**, and Z. Liu, 2012: Bias correction and assimilation of microwave radiance measurements over the Antarctic. Preprints, *16th Symposium on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans and Land Surface*, New Orleans, LA, Amer. Meteor. Soc., 10.1.
8. **Schwartz, C. S.**, and Z. Liu, 2011: Assimilating satellite microwave radiance measurements over the Antarctic. Preprints, *12th WRF Users' Workshop*, Boulder, CO, National Center for Atmospheric Research, 7B.1.
7. Liu, Z., Q. Liu, H.-C. Lin, **C. S. Schwartz**, and Y.-H. Lee, 2011: Assimilating MODIS aerosol optical depth using WRF/Chem and GSI: Application to a Chinese dust storm. Preprints, *12th WRF Users' Workshop*, Boulder, CO, National Center for Atmospheric Research, 8A.4.
6. **Schwartz, C. S.**, Z. Liu, Y. Chen, and X.-Y. Huang, 2011: Satellite radiance data assimilation with a limited-area ensemble Kalman filter and 3D-Var analysis system. Preprints, *15th Symposium on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans and Land Surface*, Seattle, WA, Amer. Meteor. Soc., 5.5.
5. **Schwartz, C. S.**, Z. Liu, Y. Chen, and X.-Y. Huang, 2010: Studying typhoon Morakot with a coupled WRFDA-DART system. Preprints, *11th WRF Users' Workshop*, Boulder, CO, National Center for Atmospheric Research, 3A.11.

4. Kain, J. S., S. J. Weiss, M. C. Coniglio, M. Xue, F. Kong, M. L. Weisman, M. Pyle, R. A. Sobash, **C. S. Schwartz**, D. R. Bright, J. J. Levit, and G. W. Carbin, 2009: New developments in applied research for severe weather convection forecasting in the Hazardous Weather Testbed, Norman, OK, U.S.A. Preprints, *5th European Conference on Severe Storms*, Landshut, Germany, O05-20.
3. **Schwartz, C. S.**, J. S. Kain, S. J. Weiss, M. Xue, D. R. Bright, F. Kong, K. W. Thomas, J. J. Levit, M. C. Coniglio, and M. S. Wandishin, 2009: Optimizing probabilistic high resolution ensemble guidance for hydrologic prediction. Preprints, *23rd Conference on Hydrology*, Phoenix, AZ, Amer. Meteor. Soc., 9.4.
2. Kain, J. S., S. J. Weiss, S. R. Dembek, J. J. Levit, D. R. Bright, J. L. Case, M. C. Coniglio, A. R. Dean, R. A. Sobash, and **C. S. Schwartz**, 2008: Severe-weather forecast guidance from the first generation of large domain convection-allowing models: Challenges and opportunities. Preprints, *24th Conference on Severe Local Storms*, Savannah, GA, Amer. Meteor. Soc., 12.1.
1. **Schwartz, C. S.**, J. S. Kain, S. J. Weiss, M. Xue, D. R. Bright, F. Kong, K. W. Thomas, J. J. Levit, M. C. Coniglio, and M. S. Wandishin, 2008: Toward improved convection-allowing ensembles: Model physics sensitivities and optimizing probabilistic guidance with small ensemble membership. Preprints, *24th Conference on Severe Local Storms*, Savannah, GA, Amer. Meteor. Soc., 11A.5.

SELECTED FIRST-AUTHORED PRESENTATIONS

35. **Schwartz, C. S.**, 2019: Medium-range convection-allowing ensemble forecasts with a variable-resolution global model. *18th Conference on Mesoscale Processes*, Savannah, GA, American Meteorological Society, 4.5.
34. **Schwartz, C. S.**, and R. A. Sobash, 2019: Revisiting sensitivity to horizontal grid spacing in convection-allowing models over the central–eastern United States using a large dataset. *Joint WRF/MPAS Users’ Workshop*, Boulder, CO, National Center for Atmospheric Research, 6.5.
33. **Schwartz, C. S.**, and R. A. Sobash, 2018: Global convection-allowing ensemble forecasts with MPAS. *Joint WRF/MPAS Users’ Workshop*, Boulder, CO, National Center for Atmospheric Research, 10.5.
32. **Schwartz, C. S.**, G. S. Romine, R. A. Sobash, K. R. Fossell, and M. Wong, 2018: Evaluating the NCAR Ensemble’s initialization approach. *29th Conference on Weather Analysis and Forecasting/25th Conference on Numerical Weather Prediction*, Denver, CO, American Meteorological Society, 15B.1.
31. **Schwartz, C. S.**, G. S. Romine, K. R. Fossell, R. A. Sobash, and M. L. Weisman, 2018: Recent progress in high-resolution ensemble development over the United States. *WRF-GRAPES workshop*. Boulder, CO, National Center for Atmospheric Research. (invited)

30. **Schwartz, C. S.**, G. S. Romine, and K. R. Fossell, 2018: How does covariance inflation impact EnKF-initialized convection-allowing ensemble forecasts? *6th International Symposium on Data Assimilation*, Munich, Germany, Ludwig-Maximilians University, 7.1.
29. **Schwartz, C. S.**, G. S. Romine, K. R. Fossell, R. A. Sobash, and M. L. Weisman, 2017: Comparing 3- and 1-km probabilistic forecasts from WRF model ensembles over the United States. *NCAS/NCAR WRF Tutorials and Workshop*, Durham, England.
28. **Schwartz, C. S.**, 2017: Ensemble forecast verification. *18th WRF Users' Workshop*, Boulder, CO, National Center for Atmospheric Research. (invited)
27. **Schwartz, C. S.**, G. S. Romine, K. R. Fossell, R. A. Sobash, and M. L. Weisman, 2017: Toward 1-km ensemble forecasts over large domains. *18th WRF Users' Workshop*, Boulder, CO, National Center for Atmospheric Research, 3.1.
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24. **Schwartz, C. S.**, G. S. Romine, R. A. Sobash, and K. R. Fossell, 2016: Toward operational convection-allowing ensembles over the United States. *Northeast Regional Operational Workshop XVII*, Albany, NY, National Weather Service and University at Albany, Session F.
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22. **Schwartz, C. S.**, 2016: Ensemble forecast verification. "Ensemble prediction with the WRF model" mini-tutorial, Boulder, CO, National Center for Atmospheric Research. (invited)
21. **Schwartz, C. S.**, G. S. Romine, R. A. Sobash, and K. R. Fossell, 2016: An update on NCAR's experimental real-time convection-allowing ensemble prediction system. *17th WRF Users' Workshop*, Boulder, CO, National Center for Atmospheric Research, 9.4.
20. **Schwartz, C. S.**, G. S. Romine, R. A. Sobash, and K. R. Fossell, 2016: NCAR's experimental real-time convection-allowing ensemble prediction system. *Second annual NCAR Day of Networking and Discovery*, Boulder, CO.
19. **Schwartz, C. S.**, 2016: Toward unified convection-allowing analysis and forecast systems over large domains. *NCAR/MMM Seminar Series*, Boulder, CO. (invited)

18. **Schwartz, C. S.**, 2015: The future of weather forecasting: high-resolution ensembles. University of Connecticut, Department of Civil & Environmental Engineering, Storrs, CT. (invited)
17. **Schwartz, C. S.**, 2015: Practical applications of hybrid variational-ensemble data assimilation approaches. *IMAGe Theme of the Year—Frontiers in Ensemble Data Assimilation for Geoscience Applications*, Boulder, CO, National Center for Atmospheric Research. (invited)
16. **Schwartz, C. S.**, 2015: Toward large-domain high-resolution continuously cycling data assimilation systems. *16th WRF Users' Workshop*, Boulder, CO, National Center for Atmospheric Research, 4A.2.
15. **Schwartz, C. S.**, and Z. Liu, 2014: Convection-permitting forecasts initialized with continuously cycling limited-area 3DVAR, ensemble Kalman filter, and “hybrid” variational-ensemble data assimilation systems. *1st World Weather Open Science Conference*, Montreal, Quebec, World Meteorological Organization, SCI-PS103.02.
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12. **Schwartz, C. S.**, Z. Liu, X.-Y. Huang, Y.-H. Kuo, and C.-T. Fong, 2013: Comparing limited-area 3DVAR and hybrid variational-ensemble data assimilation methods for typhoon track forecasts: Sensitivity to outer loops and vortex relocation. *14th WRF Users' Workshop*, Boulder, CO, National Center for Atmospheric Research, 5A.1.
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8. **Schwartz, C. S.**, Z. Liu, C. Snyder, and S.-Y. Ha, 2012: Sensitivity of tropical cyclone forecasts to microwave radiance data assimilation with a limited-area ensemble Kalman filter. *16th Symposium on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans and Land Surface*, New Orleans, LA, Amer. Meteor. Soc., 12.4.
7. **Schwartz, C. S.**, and Z. Liu, 2011: Assimilating satellite microwave radiance measurements over the Antarctic. *Workshop on Polar Simulations with the WRF Model*, Columbus, OH.
6. **Schwartz, C. S.**, M. L. Weisman, and W. Wang, 2011: When can high-resolution NWP model forecasts be trusted? Using error characteristics of the initial conditions to evaluate the likelihood of accurate forecasts. *24th Conference on Weather and Forecasting/20th Conference on Numerical Weather Prediction*, Seattle, WA, Amer. Meteor. Soc., 11B.1.
5. **Schwartz, C. S.**, 2010: Using error characteristics of the initial conditions to evaluate the likelihood of accurate forecasts. *Developmental Testbed Center Verification Workshop*, Boulder, CO. (invited)
4. **Schwartz, C. S.**, M. L. Weisman, and W. Wang, 2010: When can high-resolution NWP model forecasts be trusted? Using error characteristics of the initial conditions to evaluate the likelihood of accurate forecasts. *25th Conference on Severe Local Storms*, Denver, CO, Amer. Meteor. Soc., 13B.4.
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