

CURRICULUM VITAE, APRIL 2023

## MICHAEL J. MUELLER

michael.mueller@noaa.gov  
3450 Mitchell Ln  
Boulder, CO, 80301

### EDUCATION

Ph. D.	Meteorology, Saint Louis University	May 2013
M.S.	Meteorology, Saint Louis University	Jan 2010
B.S.	Meteorology, Saint Louis University	May 2007

### PROFESSIONAL EXPERIENCE

**April 2020 – Current**

**University Corporation for Atmospheric Research, Boulder, CO  
Project Scientist (NOAA/AOML)**

#### Lead data impact experiments in support of NOAA's QOSAP

- Conducted observing system experiments (OSEs) and Observing System Simulation Experiments (OSSEs) to test impact of real and proposed observing systems on global and tropical cyclone forecasts in NOAA's GDAS/GFS system.
- Assimilated CYGNSS v2.1 scatterometer winds using GDAS system after modifying GSI code to accept data and print diagnostics. Led research to quantify impact of CYGNSS on tropical cyclone forecasts in global and regional models.
- Conducting global weather forecasts with different simulated satellite architectures to help determine the global observing system of the future.
- Conducted OSEs to evaluate with influence of WindBorne Systems long-range balloon observations in the GDAS/GFS system.

#### Support development of new OSSE system for NOAA's QOSAP

- Validated simulated microwave and infrared radiances (clear-sky and all-sky) for new OSSE system based on ECO1280 nature run.
- Simulated and validated radio occultation (RO) bending angles for new OSSE system using simulator based on GSI RO forward operator.
- Leading effort to simulate space-based Doppler Wind Lidar observations in collaboration with scientists at University of Wisconsin and the Royal Netherlands Meteorological Institute (KNMI)

Accomplishments: *One peer-reviewed publication, 5 conference presentations, and 2 invited seminars.*

**Feb 2017 – March 2020**

**CIRES, University of Colorado, Boulder, CO**

**Research Scientist (NOAA/ESRL/Global Systems Division)**

*Conduct data impact experiments in support of NOAA's QOSAP*

- Led production of GFS forecasts quantifying impact of future RO constellation, fulfilling work mandated by the Weather Research and Forecasting Act of 2017 (H.R. 353).
- Led impact studies of COSMIC-2 RO refractivity and CYGNSS scatterometer winds.
- Tested impact of targeted dropsonde and tail Doppler radar from G-Class recon aircraft, fulfilling a request by NOAA's OMAO

*Accomplishments: 3 peer-reviewed publications and 5 conference presentations.*

**Dec 2014 – Jan 2017**

**CIRES, University of Colorado, Boulder, CO**

**Postdoctoral Research Associate (NOAA/ESRL/Physical Sciences Division)**

*Support U.S. Bureau of Reclamation dam safety risk assessments*

- Designed WRF ensemble to produce physically-consistent extreme precipitation scenarios for Colorado's Taylor Park Dam
- WRF ensemble composed of different microphysics parameterizations, lateral boundary conditions, perturbations using Stochastic Kinetic Energy Backscatter (SKEB) scheme.
- WRF precipitation and uncertainty used in hydrologic models such as WRF-Hydro.

*Led research into inland penetrating atmospheric rivers*

- Set up and ran 4-km WRF model to study moisture corridors through the Pacific Northwest United States, focusing on an extreme case in 2006.
- Applied climate change temperature and humidity deltas from CESM ensemble to WRF initial and boundary conditions to study an extreme atmospheric river flooding event under plausible future climate scenarios.
- Served as weather forecast decision support and mission scientist aboard NOAA G-IV and P-3 aircraft during CalWater2015, Sensing Hazards with Operational Unmanned Technology, and El Nino Rapid Response field campaigns.

*Accomplishments: 3 peer-reviewed publications, 2 technical reports to stakeholders, and 8 conference presentations.*

**June 2013 – Nov 2014**

**Midwest Meteorology, LLC, St. Louis, MO**

**President and Founder**

*Operational forecaster specializing in industry-specific needs*

- Founded weather research and forecasting company to service the needs of weather-prone businesses in Missouri and Illinois.
- Core client-base was snow and ice removal companies in need of customized forecasts for worksites.
- Used weather observations to produce event reports to support my clients' billing procedure.
- Business operations required frequent consultations with clients and adapting my product to changing needs.

**Aug 2007 – May 2013 Saint Louis University, St. Louis, MO**

**Graduate Research Assistant**

*Research focused on improving forecasts for weather-prone organizations*

- Led observing system experiment testing a surface mesonet and targeted radiosonde data funded by regional electric company AmerenMissouri to improve severe weather forecasts.
- Used WRF to generate forecasts both with and without radiosondes and mesonet.
- Helped select sensor sites and gathered metadata on each sensor.
- Provided real-time forecasts for AmerenMissouri, Major League Baseball, and the St. Louis Cardinals Baseball Club through the same effort.

**PEER-REVIEWED PUBLICATIONS**

**Mueller, M.J.**, S.M. Leidner, B. Annane, and L. Cucurull, 2021: Impact of CYGNSS-derived winds on tropical cyclone forecasts in a global and regional model **49**, 3433-3447, <https://doi.org/10.1175/MWR-D-21-0094.1>.

**Mueller, M.J.**, A. C. Kren, L. Cucurull, R. Atlas, R. Hoffman, G. Ge, and T. Peevey, 2020: Impact of refractivity profiles from a proposed GNSS-RO constellation on tropical cyclone forecasts in a global modeling system. *Mon. Wea. Rev.*, **148**, 3037-3057, <https://doi.org/10.1175/MWR-D-19-0360.1>.

Cucurull, L. and **M.J. Mueller**, 2020: An analysis of alternatives for the COSMIC-2

constellation in the context of global observing system simulation experiments. *Wea. Forecasting*, **35**, 51–66, <https://doi.org/10.1175/WAF-D-19-0185.1>.

Cucurull, L., **M.J. Mueller**, R. Atlas, R. Hoffman, and A.C. Kren, 2018: An observing system simulation experiment with a constellation of radio occultation satellites. *Mon. Wea. Rev.*, **146**, 4247–4259, <https://doi.org/10.1175/MWR-D-18-0089.1>.

Mahoney, K.M., D. Swales, **M.J. Mueller**, M. Alexander, M. Hughes, and K. Malloy, 2018: An examination of an inland-penetrating atmospheric river flood event under potential future thermodynamic conditions. *J. Climate*, **31**, 6281–6297, <https://doi.org/10.1175/JCLI-D-18-0118.1>.

Dole, R. M., and **coauthors**, 2018: Advancing Science and Services during the 2015-16 El Nino: The NOAA El Nino Rapid Response Field Campaign. *Bull. Amer. Meteor. Soc.*, **99**, 975–1001, <https://doi.org/10.1175/BAMS-D-16-0219.1>.

**Mueller, M.J.**, K.M. Mahoney, and M. Hughes, 2017: High-resolution model-based investigation of moisture transport into the Pacific Northwest during a strong atmospheric river event. *Mon. Wea. Rev.*, **145**, 3861–3879, <https://doi.org/10.1175/MWR-D-16-0466.1>

## **OTHER PUBLICATIONS**

Mahoney, K.M., J. J. Lucas, and **M.J. Mueller**: *Colorado – New Mexico Regional Extreme Precipitation Study Summary Report, Volume VI: Considering Climate Change in the Estimation of Extreme Precipitation for Dam Safety*. Monograph – Technical Report. CO Division of Water Resources and NM Office of the State Engineer. November 2018.

**Mueller M.J.** and K.M. Mahoney. *Improving extreme precipitation estimation using regional, high-resolution model-based methods: Final summary for performance period February 2014 - 2016*, U.S. Bureau of Reclamation, 2016.

**Mueller M.J.** *Nonlinear Model Sensitivity to Quantum Weather Observations*. Dissertation, Saint Louis University. Ann Arbor: ProQuest/UMI, 2013. (Publication No. AAT 3587363).

**Mueller M.J.** *Data Impact Study Using Ameren-UE Quantum Weather Mesonet Stations*. M.S. Thesis, Saint Louis University, 2010.

## **CONFERENCE PRESENTATIONS AND SEMINARS**

*Mueller MJ*: An Introduction to NOAA’s Quantitative Observing System Assessment Program (QOSAP), CPAESS Discovery Seminar, Jan. 25, 2023.

*Mueller MJ, T Hutchinson, J. Creus-Costa, L. Cucurull, VS Tallapragada: Assimilation of WindBorne Systems Long-Duration Smart Weather Balloon Observations in NCEP's Global Data Assimilation System. 103<sup>rd</sup> AMS Annual Meeting, Denver, CO, Jan. 2023.*

*Mueller MJ, G-J Marseille, L Cucurull, Ad Stoffelen, A Vidal, A Lim, SPF Casey: A Doppler wind lidar simulator for observing system simulation experiments. 102<sup>nd</sup> AMS Annual Meeting, Virtual, Jan. 2022.*

*Mueller MJ and B Annane: Impact of CYGNSS-derived winds on tropical cyclone forecasts in a global and regional model. CYGNSS Hurricane and Data Assimilation Working Group, 10 November 2021, Invited.*

*Mueller MJ, B Annane, M Leidner, and L Cucurull: Impact of CYGNSS-derived near-surface winds on tropical cyclone forecasts in a global model. 101<sup>st</sup> AMS Annual Meeting, Virtual, Jan. 2021.*

*Mueller MJ, A Vidal, SPF Casey, L Cucurull, and B Johnson: Validation of simulated radiance observations from the ECO1280 nature run. 101<sup>st</sup> AMS Annual Meeting, Virtual, Jan. 2021.*

*Mueller MJ, B Annane, M Leidner, and L Cucurull: Impact of CYGNSS data assimilation on FV3-GFS tropical cyclone forecasts in October 2018. 100<sup>th</sup> AMS Annual Meeting, Boston, MA, Jan. 2020.*

*Cucurull L and MJ Mueller: An analysis of alternatives for the COSMIC-2 constellation in the context of global observing system simulation experiments. 99<sup>th</sup> AMS Annual Meeting, Phoenix, AZ, Jan. 2019.*

*Mueller MJ, B Annane, AC Kren, and L Cucurull: Impact of CYGNSS data assimilation on tropical cyclone forecasts in August 2017. 99<sup>th</sup> AMS Annual Meeting, Phoenix, AZ, Jan. 2019.*

*Mueller MJ, AC Kren, L Cucurull, RN Hoffman, R Atlas, and TR Peevey: Impact of refractivity profiles from a proposed GNSS-RO constellation on tropical cyclone forecasts in a global modeling system. 99<sup>th</sup> AMS Annual Meeting, Phoenix, AZ, Jan. 2019.*

*Mueller MJ, A Kren, L Cucurull, R Atlas, R Hoffman, and T Peevey: Impact of a proposed constellation of radio occultation data on tropical cyclone forecasts. 98<sup>th</sup> AMS Annual Meeting, Austin, TX, Jan. 2018.*

*Mueller MJ, K Mahoney, and M Hughes: High-resolution model-based investigation of moisture transport into the Pacific Northwest during a strong atmospheric river event. 98<sup>th</sup> AMS Annual Meeting, Austin, TX, Jan. 2018.*

*Mueller MJ, K Mahoney, and M Hughes: High-resolution model-based investigation of moisture transport into the Pacific Northwest during a strong atmospheric river event, CIRES*

*Rendezvous*, University of Colorado-Boulder, Boulder, CO, May 2017.

Mueller MJ and K Mahoney: Moisture transport during the inland penetrating atmospheric river of early November 2006 in the Pacific Northwest: A high-resolution model-based study, *International Atmospheric Rivers Conference*, La Jolla, CA, Aug. 2016.

Mueller MJ and K Mahoney: Investigation of an inland penetrating atmospheric river over the Pacific Northwest using a high resolution modeling method, *CIRES Rendezvous*, University of Colorado-Boulder, Boulder, CO, May 2016.

Mueller MJ, Mahoney K, Holman K, and D Gochis: Using a high-resolution ensemble modeling method to inform risk-based decision-making at Taylor Park Dam, Colorado, *American Geophysical Union Fall Meeting 2015*, San Francisco, CA, Dec. 2015.

Mueller MJ and K Mahoney, 2015: Evaluating a WRF ensemble suite for two precipitation events of the Taylor Park watershed, *ATOC 9<sup>th</sup> Annual Earth System and Space Science Poster Conference*, Boulder, CO, Nov. 2015.

Mueller MJ, 2015: WRF background and ensemble modeling initial results, *U.S. Bureau of Reclamation/CIRES/NOAA/NCAR meeting seminar*, Lakewood, CO, Sept. 2015.

Mueller MJ, Mahoney K, and M Hughes: Investigating a precipitation event over the Taylor Park watershed using a multiphysics and stochastic ensemble, *16<sup>th</sup> WRF Users' Workshop*, Boulder, CO, June 2015.

Mueller MJ, Mahoney K, and J Scott: The impact of extreme precipitation on reservoir inflow at Taylor Park Dam, *CIRES Rendezvous*, University of Colorado – Boulder, Boulder, CO, May 2015.

Mueller MJ: Nonlinear Model Sensitivity to QuantumWeather Observations. Ph.D. Defense. Saint Louis University, St. Louis, MO, May 2013.

Mueller MJ, Pasken RW, and W Dannevik: Performance of QuantumWeather data assimilation system using surface mesonet and radiosonde data. *The 18<sup>th</sup> Annual Graduate Research Symposium*, Saint Louis University, St. Louis, MO, April 2012.

Mueller MJ, Dannevik W, and RW Pasken: The QuantumWeather Mesonet: A University-Industry Partnership. *92<sup>nd</sup> AMS annual meeting*, New Orleans, LA, Jan. 2012.

Mueller MJ: Nonlinear Model Sensitivity to QuantumWeather Observations. Ph.D.

prospectus defense. Saint Louis University, St. Louis, MO, Aug. 2011.

*Mueller MJ, Pasken RW, and W Dannevik: Implementation of radiosondes within the QuantumWeather data assimilation system. The 17<sup>th</sup> Annual Graduate Research Symposium, Saint Louis University, St. Louis, MO, April 2011.*

*Mueller MJ, Pasken RW, Dannevik W, and CA Graves: WRF-ARW sensitivity testing using QuantumWeather project mesonet data. The 46<sup>th</sup> Annual Meeting of the Missouri Academy of Science, Maryville, MO, April 2010.*

*Mueller MJ: Data Impact Study Using Ameren-UE Quantum Weather Mesonet Stations. M.S. defense. Saint Louis University, St. Louis, MO, Dec. 2009.*

*Mueller MJ, Pasken RW, Dannevik W, and TP Eichler: Impact of Saint Louis University-AmerenUE QuantumWeather project mesonet data on WRF-ARW forecasts. The 10<sup>th</sup> WRF Users' Workshop, Boulder, CO, June 2009.*

*Mueller MJ, Pasken RW, Dannevik W, and TP Eichler: Impact of Saint Louis University-AmerenUE QuantumWeather Project Mesonet Data on Numerical Weather Prediction Model Forecasts. The 15<sup>th</sup> Annual Graduate Research Symposium, Saint Louis University, St. Louis, MO, April 2009.*

*Mueller MJ, Pasken RW, Dannevik W, and CA Graves: Impact of Saint Louis University-AmerenUE QuantumWeather Project Mesonet Data on Numerical Weather Prediction Model Forecasts. The 44<sup>th</sup> Annual Meeting of the Missouri Academy of Science, Springfield, MO, April 2008.*

## **ATMOSPHERIC MODELING**

- GDAS/FV3-GFS with 4DEnVar GSI (2019 – present)
- GDAS/GSM-GFS with 3DEnVar and 4DEnVar GSI (2017 – 2020)
- WRF-ARW (2009 – 2017)
- MM5 (2007 – 2008)

## **PROGRAMMING AND COMPUTING**

- Shell scripting (csh and bash)
- NCAR Command Language (NCL)
- Python (Numpy, Matplotlib)
- FORTRAN
- High performance computing: University of Colorado's *Janus/Summit*
- High performance computing: NOAA's *Theia* and *Hera*

## **FIELD RESEARCH**

- **El Nino Rapid Response**, Honolulu, HI (March 2016): *Mission scientist aboard G-IV aircraft; weather forecast decision support.*
- **Sensing Hazards with Operational Unmanned Technology**, Edwards AFB (February 2016): *Weather forecast decision support; real-time dropsonde data quality assurance and dissemination.*
- **CalWater2015**, Sacramento, CA (January-February 2015): *Weather forecast decision support; observer aboard mission flight (P-3 aircraft)*
- **Hazardous Weather Testbed**, Norman, OK (May 2012): *Launch radiosondes from remote locations and compare brands (e.g. Vaisala vs InterMet)*
- **Radiosonde launches** (Ph.D. data collection) (2010-2012)
- **Mesonet site surveys & metadata collection** (2008-2010): *QuantumWeather*

## **PROFESSIONAL ASSOCIATIONS**

- Member of American Meteorological Society since 2005
- Member of American Geophysical Union since 2014

## **PROFESSIONAL SERVICE AND OUTREACH**

- Conference Session Chair: AMS Annual Meeting (2021, 2022)
- Peer Reviewer: *Pure and Applied Geophysics, JGR Atmospheres, Natural Hazards, Atmospheric Research, Remote Sensing, Journal of Applied Meteorology and Climatology*
- Mentored: Kelsey Malloy (Hollings Scholar), Luca Collins (Research Experience for Community College Students), Steve Olsen (Saint Louis University)
- David Skaggs Research Center tour guide, 2015-2019
- Vice President, AMS-Greater St. Louis Chapter, 2011-2013
- Radiosonde (iMet-3050) launch instructor, 2012

## **AWARDS**

- Gold Star Award, Visits and Employee Engagement, David Skaggs Research Center, Dec. 2016
- Ross Heinrich Award for Outstanding Senior, Department of Earth and Atmospheric Sciences, Saint Louis University, May 2007