

Fred Martin Ralph

- Personal Work Address: University of California at San Diego
Scripps Institution of Oceanography
Climate, Atmospheric Science and Physical Oceanography
8810 Shellback Way La Jolla, CA 92037
mralph@ucsd.edu
- Education Ph.D. in Atmospheric Sciences, December 1991
Dissertation title: Mesoscale studies using clear-air Doppler radar
University of California at Los Angeles, Department of Atmospheric Sciences
- M.S. in Atmospheric Sciences, June 1987
Major field: Atmospheric Dynamics (GPA: 3.82)
University of California at Los Angeles, Department of Atmospheric Sciences
- B.S. in Meteorology with Highest Distinction (GPA: 3.93), December 1984
Minor fields: Mathematics, Physics
University of Arizona, Department of Atmospheric Sciences
- Employment UCSD/SIO - Director (Founding), Center for Western Weather and Water
Extremes, University of California San Diego, Scripps Institution of
Oceanography, La Jolla, CA, since June 2013. (Academic Program Manager 2)
Researcher (Step 9), since 2016, UC San Diego/Scripps Inst. of Oceanography
- NOAA - Chief, Water Cycle Branch of the Earth System Research Laboratory
/Physical Sciences Division, Boulder, CO from 10/01/06 to 06/26/2013.
Chief, Regional Weather and Climate Applications Division, NOAA
Environmental Technology Lab., Boulder, CO. 07/01/01 – 09/30/06
Research meteorologist, NOAA/Environmental Technology Lab., Boulder, CO.
11/16/92 - 07/01/00. [Started 1992 as GS-12; by 2000 ZP-V (GS-15 equivalent)].
- National Research Council Research Associate, (NOAA/WPL) 1992
Teaching and Research Assistant, (UCLA, Dept. of Atmos. Sci.) 1985 to 1991
- CW3E Founded (2013) and Directs the Center for Western Weather and Water Extremes
at University of California San Diego/Scripps Institution of Oceanography
Funding raised: >\$200 million, >70 funded projects, \$25 million spent in FY 25
Programs started:
- Forecast-Informed Reservoir Operations (US Army Corps of Engineers)
- Atmospheric River Program (California Dept. of Water Resources)
- Atmospheric River Reconnaissance (NOAA, US Air Force and others)
People: >85 at CW3E as of Jan 2026, including staff, post docs and graduate
students, plus >15 experts and graduate students substantially funded at other
universities and businesses
Publications with CW3E authors: ~300

Honors (selected)

- 2025 Inducted as a “Fellow of the American Geophysical Union” “In recognition of eminence in Earth and Space Sciences”
- 2025 “Ambassador Award” from the American Geophysical Union “For leading, developing, and communicating groundbreaking regional to global research and socially beneficial applications of atmospheric river science.”
- 2024 “The Award for Outstanding Contribution to the Advance of Applied Meteorology, for contributions to understanding hydrometeorological extremes, employing new observing strategies, modeling, and the creation of innovative decision support tools, particularly as related to atmospheric rivers.” American Meteorological Soc.
- 2008 Fellow of the American Meteorological Society
- 1998 Dept. of Commerce Silver Medal (team) “For the extraordinary response to NOAA’s call to study and forecast the unusual weather associated with the El Nino of 1997/98”
- 2012 Dept. of Commerce Bronze Medal (team) “...for comprehensive flood mitigation efforts in response to a...weakened Howard Hansen Dam project with the potential of catastrophic flooding”
- 2006 Dept. of Commerce Bronze Medal to the Boulder Planning and Transition Team “...consolidation of six research organizations in Boulder, CO into the new NOAA Earth System Research Laboratory”
- 2003 Dept. of Commerce Bronze Medal to the PACJET Research and Development Team “For the development of a snow-level algorithm for boundary layer wind profilers which will improve national winter weather forecasts”
- 2024 Special Recognition Award for the groundbreaking scientific advances in our collective understanding of extreme precipitation in California and the western US. 2024 California Extreme Precipitation Symposium
- 2009 NOAA Administrator’s Award “for exemplary leadership of the NOAA Unmanned Aircraft Systems Program in its formative stage”
- 2007 NOAA Administrator’s Award (team) “For the successful planning, implementation and initial deployment...of the first NOAA/USGS Debris-Flow Warning System”
- 1998 NOAA/Oceanic and Atmospheric Research, Employee of the Year
- 2008 NOAA/OAR Outstanding Scientific Paper Award for “Meteorological characteristics and overland precipitation impacts of atmospheric rivers affecting the West Coast of North America based on eight years of SSM/I satellite observations.” J. Hydrometeorology, Vol. 9
- 2006 NOAA/OAR Outstanding Scientific Paper Award for “Flooding on California’s Russian River: Role of atmospheric rivers.” Geophysical Research Letters, Vol. 33
- 2004 NOAA/OAR Outstanding Scientific Paper Award for “The impact of a prominent rain shadow on flooding in California’s Santa Cruz mountains: A CALJET case study and sensitivity to the ENSO cycle.” J. Hydrometeor., Vol. 4
- 1990 Jacob A. Bjerknes Memorial Award for excellence in research, University of California at Los Angeles, Department of Atmospheric Sciences
- 1989 Morris Neiburger Memorial Award for excellence in teaching, University of California at Los Angeles, Department of Atmospheric Sciences
- 1985 Chancellor's Fellowship, University of California at Los Angeles
- 1984 B.S. With Highest Honors, University of Arizona, Tucson Arizona

Committees (selected)

Co-chair of NOAA Science Advisory Board, Environmental Information Services Working Group (EISWG) (member since 2020; co-chair since 2024)
Co-Chair WMO/WCRP/Global Precipitation Experiment (GPEX) Working Group on Global Field campaigns (since 2024)
External Advisory Group for UCAR Community Programs (since 2023)
NOAA Science Advisory Board "Priorities for Weather Research" co-lead for Observations and Data Assimilation recommendations (2021)
UCAR Member Representative, Scripps Institution of Oceanography (since 2014)
Univ. of Arizona Hydrology and Atmos. Science Advisory Board (2014-22)
Forecast-Informed Reservoir Operations Leadership Committee (since 2015)
Atmospheric River Colloquium (2019)
Forecast-Informed Reservoir Operations Colloquium (2021/22)
Atmospheric River Reconnaissance Modeling and Data Assimilation, co-chair (since 2018)
Forecast Informed Reservoir Operations (FIRO) Workshop, founded (since 2014)
Yampa Basin Rendezvous, founded (since 2018)
International Atmospheric River Conference, founded (since 2018)
FIRO Viability Assessments, co-chair of steering committees for Howard Hanson Dam (since 2021), Seven Oaks (since 2023), Russian River (since 2021), Yuba-Feather (since 2019), Prado Dam (since 2017), Lake Mendocino (2014-21)
Atmospheric River Tracking Method Intercomparison Project (2016-22)
GOES-R Science and Demonstration Executive Board (2012-2013)
Management Board, Developmental Testbed Center (2010-2013)
Chair, NOAA's USWRP Executive Committee (2004-2011)
NASA Global Precip. Mission, Ground Validation Advisory Panel (2006 -2010)
Symposium on Connections between Mesoscale processes and Climate Variability, (2006-07)
NOAA's Boulder Planning and Transition Team (2004-05)
Chair, NSF/NCAR Observing Facilities Advisory Panel (2003-04)
Chair, Amer. Meteorological Society Cmte. on Mesoscale Meteorology (2003-05)
U. S. Scientific Steering Committee, Mesoscale Alpine Project (1997-2001)
American Meteorological Society Committee on Radar Meteorology (1997-2000)
Co-Chair, 8th Conference on Mountain Meteorology (1996-1998)
Co-Chair, 4th International Symposium on Tropospheric Profiling (1996-1998)

Publications

Refereed: >250	Refereed (First authored): 38
Citations: >25700	H-Index: 83
Google Scholar profile: "F. Martin Ralph"	i10 Index: 229

Global rankings of most-cited authors on Google Scholar for specified subjects:
1st - Mountain Meteorology 1st - Mesoscale Meteorology
7th - Hydrometeorology 8th - Precipitation

Legislative

Numerous briefings of local, state and federal committees, committee staff,

Boards, and elected officials on science and solutions to address extremes in weather and water, including flood and drought. Advised on successful state and federal Bills.

Media Extensive experience communicating science to the public via television, radio, newspaper, magazine and online, e.g., in Jan 2023 over 600 news stories covered our work on atmospheric rivers; authored the Scientific American article “Forecasting Atmospheric Rivers” (2022)

Memberships American Meteorological Society
American Geophysical Union
American Association for the Advancement of Science

Staff/Budget Management Current/UCSD/SIO: Directs CW3E, with its 85 people, including three Deputies
NOAA position 2001-2013: Operated a Branch with 30-40 staff (combined federal, joint institute, contract). Provided strategic and tactical direction for the staff and facilities. Directly supervised 5-7 federal staff, who supervised 6-10 other federal staff, oversaw contract staff, and together advised 15-20 cooperative institute members and students. Responsible for the day-to-day operation of the branch, including management of personnel, budget, space, diversity, purchasing, travel approval, hiring, as well as performance evaluations and corrective actions. Responsible for strategic direction, fund raising, reporting and general execution of the mission. The overall budget was \$6-7 M/year; typically 15-20 projects.

Program Management - Program Manager, NOAA’s Science, Technology & Infusion Program (ST&I), 2004-10. ST&I was a \$75 M/year matrix program within NOAA’s formal Planning, Programming, Budgeting and Execution System (PPBES). It focused on research and its infusion into NOAA operational forecasting through test and evaluation. The Program Manager was responsible for Planning, Programming and Budgeting. ST&I included elements in NWS, OAR, and NESDIS, including NOAA’s Weather laboratories (ESRL/PSD, ESRL/GSD, AOML/HRD, NSSL), USWRP, THORPEX, as well as NEXRAD Product Improvement, Phased Array Radar, AWIPS evolution, etc. By FY2011, ST&I had played leading roles in generating over \$15 M/year of new base funding for innovation, including for hurricane research (\$2 M/yr), severe weather research (\$2.5 M/yr), testing of unmanned aircraft systems applications (\$3-6 M/yr), phased array radar (\$6 M/yr) and water resources research (\$2 M/yr).
- Director of NOAA/US Weather Research Program (2004-2011) - allocated \$4-5 M/year for research.
- Program Manager of NOAA/Unmanned Aircraft Systems Program (2006-2009): created new program, allocated \$3-6 M/year, handed off to a full-time manager.
- Led the development of NOAA’s Hydrometeorology Testbed (HMT).

Project Management “Forecast-Informed Reservoir Operations” – USACE project (2015-current)
“CalWater” - uncertainty in climate projections of precipitation (2009-2015)
NOAA’s Unmanned Aircraft Systems “Major Project” (2005-2008)

New England High Resolution Temperature Forecasting Pilot Study
California Land-falling Jets experiment (CALJET), and its follow-on (PACJET)
USWRP Quantitative precipitation forecasting research at NOAA/ETL

- Selected
Field Work Atmospheric River Airborne Reconnaissance, PI (2016 - current)
CalWater Co-lead (ground, air, ship campaigns from 2009-2015)
CALJET & PACJET experiments, Chief Scientist (1997-98, & 2001)
ONR Coastal Meteorology Accelerated Research Initiative (1994-95)
Mesoscale Alpine Project (Alps 1999), CaPE experiment (Florida, 1991)
- Research Atmospheric Rivers: dominant mechanism for horizontal water vapor transport
Hydrometeorological Processes: orographic precipitation
Mesoscale Processes: fronts, mountain waves, clear-air turbulence
Climate Processes: extreme precipitation, ENSO impacts on stream flow
Coastal Processes: coastally trapped disturbances, barrier jets
- Applications Reservoir operations: Forecast-informed reservoir operations
Testbeds: Hydrometeorological Testbed
Precipitation forecasting: extreme precipitation, snow information
Aviation weather: clear-air turbulence
Observing systems: AR Recon, mesoscale observing system design
Prototype performance measure development: ARs, extreme QPF, snow-level
- Teaching Contributions to education via teaching, advising graduate students/PostDocs, and creation of broader education opportunities, including a summer internship program at CW3E and two summer colloquia

Refereed Publications

- Crochet, M., F. Cuq, F.M. Ralph, and S.V. Venkateswaran, 1990: Clear-air radar observations of the great October storm of 1987. *Dynam. Atmos. Oceans.*, **14**, 443-461.
- Ralph, F.M., 1991: Mesoscale studies using clear-air Doppler radar. Ph.D. Dissertation, University of California at Los Angeles, 177 pp.
- Ralph, F.M., M. Crochet, and S.V. Venkateswaran, 1992: A study of mountain lee waves using clear-air Doppler radar. *Quart. J. Royal Meteorol. Soc.*, **118**, 597-627.
- Ralph, F.M., C. Mazaudier, M. Crochet, and S.V. Venkateswaran, 1993: Doppler sodar and radar wind profiler observations of gravity wave activity associated with a gravity current. *Mon. Wea. Rev.*, **121**, 444-463.
- Ralph, F.M., M. Crochet, and S.V. Venkateswaran, 1993: Observations of a mesoscale ducted gravity wave. *J. Atmos. Sci.*, **50**, 3277-3291.
- Wilczak, J.M., R.G. Strauch, F.M. Ralph, B.L. Weber, D.A. Merritt, J.R. Jordan, D.E. Wolfe, L.K. Lewis, D.B. Wuertz, J.E. Gaynor, S.A. McLaughlin, R.R. Rogers, A.C. Riddle, and T.S. Dye, 1995: Contamination of wind profiler data by migrating birds: Characteristics of corrupted data and potential solutions. *J. Atmos. Oceanic Technol.*, **12**, 449-467.
- Chalon, J.P., J.-L. Brenguier, J.-P. Cammas, S. Chauzy, M. Chong, M. Crochet, G. Donnadieu, V. Ducrocq, J.-F. Gayet, P. Gondot, H. Isaka, P. Laroche, Y. Lemaitre, F.M. Ralph, and S. Soula, 1995: LANDES-FRONTES 84: Bilan d'une expérience d'étude des systèmes frontaux convectifs. *La Meteorologie*, **8**, 10-28.
- Ralph, F.M., 1995: Using radar-measured radial vertical velocities to distinguish precipitation scattering from clear-air scattering. *J. Atmos. Oceanic Technol.*, **12**, 257-267.
- Ralph, F.M., P.J. Neiman, D.W. van de Kamp, and D. C. Law, 1995: Using spectral moment data from NOAA's 404-MHz radar wind profilers to observe precipitation. *Bull. Amer. Meteor. Soc.*, **76**, 1717-1739.
- Ralph, F.M., P.J. Neiman, and D. Ruffieux, 1996: Precipitation identification from radar wind profiler spectral moment data: Vertical velocity histograms, velocity variance and signal power-vertical velocity correlations. *J. Atmos. Oceanic Technol.*, **13**, 545-559.
- Ralph, F.M., 1996: Observations of 250-km-wavelength clear-air eddies and 750-km-wavelength mesocyclones associated with a synoptic-scale midlatitude cyclone. *Mon. Wea. Rev.*, **124**, 1199-1210.
- Jin, Y., S.E. Koch, Y.-L. Lin, F.M. Ralph, and C. Chen, 1996: Numerical simulations of an observed gravity current and gravity waves in an environment characterized by complex stratification and shear. *J. Atmos. Sci.*, **53**, 3570-3588.

- Marwitz, J.D., M.K. Politovich, B.C. Bernstein, F.M. Ralph, P.J. Neiman, R. Ashenden, and J.F. Bresch, 1997: Meteorological conditions associated with the ATR-72 aircraft accident near Roselawn, Indiana on 31 October 1994. *Bull. Amer. Meteor. Soc.*, **78**, 41-52.
- Ralph, F.M., P.J. Neiman, T.L. Keller, D. Levinson, and L. Fedor, 1997: Observations, simulations and analysis of nonstationary trapped lee waves. *J. Atmos. Sci.*, **54**, 1308-1333.
- Ralph, F.M., P.J. Neiman, and D. Levinson, 1997: Lidar observations of a breaking mountain wave associated with extreme turbulence. *Geophys. Res. Lett.*, **24**, 663-666.
- Smith, R., J. Paegle, T. Clark, W. Cotton, D. Durran, G. Forbes, J. Marwitz, C. Mass, J. McGinley, H.-L. Pan, and F.M. Ralph, 1997: Local and remote effects of mountains on weather: Research needs and opportunities. *Bull. Amer. Meteor. Soc.*, **78**, 877-892.
- Ralph, F.M., 1997: Comments on Use of ducting theory in an observed case of gravity waves. *J. Atmos. Sci.*, **54**, 2237-2239.
- Neiman, P.J., F.M. Ralph, M.A. Shapiro, B.F. Smull, and D. Johnson, 1998: An observational study of fronts and frontal mergers over the Continental United States. *Mon. Wea. Rev.*, **126**, 2521-2554.
- Ralph, F.M., L. Armi, J. Bane, C. Dorman, W.D. Neff, P. J. Neiman, W. Nuss, and P. O. G. Persson, 1998: Observations and analysis of the 10-11 June 1994 coastally trapped disturbance. *Mon. Wea. Rev.* **126**, 2435-2465.
- Ralph, F.M., P.J. Neiman, and T.L. Keller, 1999: Deep-tropospheric gravity waves created by lee-side cold fronts. *J. Atmos. Sci.*, **56**, 2986-3009.
- Ralph, F.M., 2000: Reply. *J. Atmos. Sci.*, **57**, 599-608.
- Clark, T.L., W.D. Hall, R.M. Kerr, D. Middleton, L. Radke, F.M. Ralph, P.J. Neiman, and D. Levinson, 2000: On the origins of aircraft-damaging clear-air turbulence during the 9 December 1992 Colorado downslope windstorm: Numerical simulations and comparison with observations. *J. Atmos. Sci.* **57**, 1105-1131.
- Nuss, W.A., J.M. Bane, W.T. Thompson, T. Holt, C.E. Dorman, F.M. Ralph, R. Rotunno, J.B. Klemp, W.C. Skamarock, R.M. Samelson, A.M. Rogerson, C. Reason, and P. Jackson, 2000: Coastally trapped wind reversals: Progress toward understanding. *Bull. Amer. Meteor. Soc.*, **81**, 719-744.
- Ralph, F.M., P.J. Neiman, P.O.G. Persson, J.M. Bane, M.L. Cancillo, J.M. Wilczak, and W. Nuss, 2000: Kelvin waves and internal bores on the marine boundary layer inversion and

- their relationship to coastally trapped wind reversals. *Mon. Wea. Rev.*, **128**, 283-300.
- White, A. B., J. R. Jordan, B. E. Martner, F. M. Ralph, and B. W. Bartram, 2000: Extending the dynamic range of an S-band radar for cloud and precipitation studies. *J. Atmos. Oceanic Technol.*, **17**, 1226-1234.
- Lehmiller, G.S., H.B. Bluestein, P.J. Neiman, F.M. Ralph, and W.F. Feltz, 2001: Wind structure in a supercell thunderstorm as measured by a UHF wind profiler. *Mon. Wea. Rev.*, **129**, 1968-1986.
- Neiman, P.J., F.M. Ralph, R.L. Weber, T. Uttal, L.B. Nance, D.H. Levinson, 2001: Observations of nonclassical frontal propagation and frontally forced gravity waves adjacent to steep topography. *Mon. Wea. Rev.*, **129**, 2633-2659.
- Neiman, P.J., F.M. Ralph, A.B. White, D.A. Kingsmill, and P.O.G. Persson, 2002: The statistical relationship between upslope flow and rainfall in California's coastal mountains: Observations during CALJET. *Mon. Wea. Rev.*, **130**, 1468-1492.
- White, A. B., D.J. Gattas, E.T. Strem, F.M. Ralph, P.J. Neiman, 2002: An automated brightband height detection algorithm for use with Doppler radar spectral moments. *J. Atmos. Oceanic Technol.*, **19**, 687-697.
- White, A.B., P.J. Neiman, F.M. Ralph, D.E. Kingsmill, and P.O.G. Persson, 2003: Coastal orographic rainfall processes observed by radar during the California Land-Falling Jets experiment. *J. Hydrometeor.*, **4**, pp. 264-282.
- Ralph, F.M., P.J. Neiman, D.E. Kingsmill, P.O.G. Persson, A.B. White, E.T. Strem, E.D. Andrews, and R.C. Antweiler, 2003: The impact of a prominent rain shadow on flooding in California's Santa Cruz mountains: A CALJET case study and sensitivity to the ENSO cycle. *J. Hydrometeor.*, **4**, 1243-1264.
- Neiman, P.J., P.O.G. Persson, F.M. Ralph, D.P. Jorgensen, A.B. White, and D.A. Kingsmill, 2004: Modification of Fronts and Precipitation by Coastal Blocking during an Intense Landfalling Winter Storm in Southern California: Observations during CALJET. *Mon. Wea. Rev.*, **132**, 2422-2473.
- Andrews, E.D., R.C. Antweiler, P.J. Neiman, and F.M. Ralph, 2004: Influence of ENSO on flood frequency along the California coast. *J. Climate*, **17**, 337-348.
- Ralph, F.M., P.J. Neiman, and G.A. Wick, 2004: Satellite and CALJET aircraft observations of atmospheric rivers over the eastern North-Pacific Ocean during the El Niño winter of 1997/98. *Mon. Wea. Rev.*, **132**, 1721-1745.
- Ralph, F.M., P.J., Neiman and R. Rotunno, 2005: Dropsonde observations in low-level jets over

- the Northeastern Pacific Ocean from CALJET-1998 and PACJET-2001: Mean vertical-profile and atmospheric-river characteristics. *Mon. Wea. Rev.*, **133**, 889-910.
- Neiman, P.J., B.E. Martner, A.B. White, G.A. Wick, F.M. Ralph, D.E. Kingsmill, 2005: Wintertime nonbrightband rain in California and Oregon during CALJET and PACJET: Geographic, interannual, and synoptic variability. *Mon. Wea. Rev.*, **133**, 1199-1223.
- Persson, P.O.G., P.J. Neiman, B. Walter, J.-W. Bao and F.M. Ralph, 2005: Contributions from California coastal-zone surface fluxes to heavy coastal precipitation: A CALJET case study During the Strong El Niño of 1998. *Mon. Wea. Rev.*, **133**, 1175-1198.
- Dabberdt, W.F., T.W Schlatter, F.H. Carr, E.W.J. Friday, D. Jorgensen, S. Koch, M. Pirone, F.M. Ralph, J. Sun, P. Welsh, J.W. Wilson, and X. Zou, 2005: Multifunctional Mesoscale Observing Networks. *Bull. Amer. Meteor. Soc.*, **86**, 961-982.
- Matrosov, S.Y., D.E. Kingsmill, B.E. Martner, and F.M. Ralph, 2005: The utility of X-band polarimetric radar for quantitative estimates of rainfall parameters. *J. Hydrometeor.*, **6**, 248-262.
- Ralph, F.M., R.M. Rauber, B.F. Jewett, D.E. Kingsmill, P. Pisano, P. Pugnier, R.M. Rasmussen, D.W. Reynolds, T.W. Schlatter, R.E. Stewart and J.S. Waldstreicher, 2005: Improving short-term (0-48 hour) Cool-season quantitative precipitation forecasting: Recommendations from a USWRP Workshop. *Bull. Amer. Meteor. Soc.*, **86**, 1619-1632.
- Bao, J.-W., S.A. Michelson, P.J. Neiman, F.M. Ralph and J.M. Wilczak, 2006: Interpretation of enhanced integrated water vapor bands associated with extratropical cyclones: Their formation and connection to tropical moisture. *Mon. Wea. Rev.*, **134**, 1063-1080.
- Stensrud, D.J., N. Yossouf, M.E. Baldwin, J.T. McQueen, J. Du, B. Zhou, B. Ferrier, G. Manikin, F.M. Ralph, J.M. Wilczak, A.B. White, I. Djalalova, J.-W. Bao, R.J. Zamora, S.G. Benjamin, P.A. Miller, T.L. Smith, T. Smirnova, and M.F. Barth, 2006: The New England High-Resolution Temperature Program (NEHRTP). *Bull. Amer. Meteor. Soc.*, **87**, 491-498.
- Neiman, P.J., F.M. Ralph, A.B. White, D.D. Parrish, J.S. Holloway, and D.L. Bartels, 2006: A multiwinter analysis of channeled flow through a prominent gap along the Northern California coast during CALJET and PACJET. *Mon. Wea. Rev.*, **134**, 1815-1841.
- Kingsmill, D.E., P.J. Neiman, F.M. Ralph, and A.B. White, 2006: Synoptic and topographic variability of Northern California precipitation characteristics in landfalling winter storms observed during CALJET. *Mon. Wea. Rev.*, **134**, 2072-2094.
- Ralph, F.M., P.J. Neiman, G.A. Wick, S.I. Gutman, M.D. Dettinger, D.R. Cayan, and A.B. White, 2006: Flooding on California's Russian River: Role of atmospheric rivers.

Geophys. Res. Lett., **33**, L13801, doi:10.1029/2006GL026689.

- Williams, C.R., A.B. White, K.S. Gage, and F.M. Ralph, 2007: Vertical structure of precipitation and related microphysics observed by NOAA profilers and TRMM during NAME 2004. *J. Climate*, **20**, 1693-1712.
- Morss, R.E., and F.M. Ralph, 2007: Use of information by National Weather Service Forecasters and emergency managers during the CALJET and PACJET-2001. *Wea. Forecast.*, **22**, 539-555.
- Neiman, P.J., F.M. Ralph, G.A. Wick, J.D. Lundquist and M.D. Dettinger, 2008: Meteorological characteristics and overland precipitation impacts of atmospheric rivers affecting the West Coast of North America based on eight years of SSM/I satellite observations. *J. Hydrometeor.*, **9**, 22-47.
- Lundquist, J.D., P.J. Neiman, B. Martner, A.B. White, D.J. Gattas, and F.M. Ralph, 2008: Rain versus snow in the Sierra Nevada, California: Comparing radar and surface observations of melting level. *J. Hydrometeor.*, **9**, 194-211.
- Martner, B.E., S.E. Yuter, A.B. White, S.Y. Matrosov, D.E. Kingsmill, and F.M. Ralph, 2008: Raindrop size distributions and rain characteristics in California coastal rainfall for periods with and without a radar bright band. *J. Hydrometeor.*, **9**, 408-425.
- Wick, G.A., Y. Kuo, F.M. Ralph, T. Wee, and P.J. Neiman, 2008: Intercomparison of integrated water vapor retrievals from SSM/I and COSMIC, *Geophys. Res. Lett.*, **35**, L21805, doi:10.1029/2008GL035126.
- Neiman, P.J., F.M. Ralph, G.A. Wick, Y.-H. Kuo, T.-K. Wee, Z. Ma, G.H. Taylor, and M.D. Dettinger, 2008: Diagnosis of an intense atmospheric river impacting the Pacific Northwest: Storm summary and offshore vertical structure observed with COSMIC satellite retrievals. *Mon. Wea. Rev.*, **136**, 4398-4420.
- Coplen, T.B., P.J. Neiman, A.B. White, J.M. Landwehr, F.M. Ralph, and M.D. Dettinger, 2008: Extreme changes in stable hydrogen isotopes and precipitation characteristics in a landfalling Pacific storm, *Geophys. Res. Lett.*, **35**, L21808, doi:10.1029/2008GL035481.
- Neiman, P.J., A.B. White, F.M. Ralph, D.J. Gattas, and S.I. Gutman, 2009: A Water Vapor Flux Tool for Precipitation Forecasting. U.K. */Journal of Water Management/*, **162**, 83-94.
- Neiman, P.J., E.M. Sukovich, F.M. Ralph, and M. Hughes, 2010: A seven-year wind profiler-based climatology of the windward barrier jet along California's Sierra Nevada. *Mon. Wea. Rev.* **138**, 1206-1233.
- White, A.B., D.J. Gattas, A.F. Henkel, P.J. Neiman, F.M. Ralph, S.I. Gutman, 2010: Developing

- a performance measure for snow-level forecasts. *J. Hydrometeor* **11**, 739-753.
- Ralph, F.M., E. Sukovich, D. Reynolds, M. Dettinger, S. Weagle, W. Clark, P.J. Neiman, 2010: Assessment of extreme quantitative precipitation forecasts and development of regional extreme event thresholds using data from HMT-2006 and COOP observers. *J. Hydrometeor.*, **11**, 1288-1306.
- Ralph, F.M., P.J. Neiman, G.N. Kiladis, K. Weickman, and D.W. Reynolds, 2011: A multi-scale observational case study of a Pacific atmospheric river exhibiting tropical-extratropical connections and a mesoscale frontal wave. *Mon. Wea. Rev.*, **139**, pp. 1169-1189, doi: 10.1175/2010MWR3596.1.
- Ma, Z., Y.-H. Kuo, F.M. Ralph, P.J. Neiman, G.A. Wick, E. Sukovich, and B. Wang, 2011: Assimilation of GPS radio occultation data for an intense atmospheric river with the NCEP Regional GSI system. *Mon. Wea. Rev.*, **139**, 2170 – 2183.
- Dettinger, M.D., F.M. Ralph, T. Das, P.J. Neiman, and D. Cayan, 2011: Atmospheric rivers, floods, and the water resources of California. *Water*, **3** (Special Issue on Managing Water Resources and Development in a Changing Climate), 455-478.
- Ralph, F.M., and M.D. Dettinger, 2011: Storms, Floods and the Science of Atmospheric Rivers. *EOS, Transactions, Amer. Geophys. Union.*, **92**, 265-266.
- Ault, A., C. Williams, A. White, P. Neiman, J. Creamean, C. Gaston, F.M. Ralph, and K. Prather, 2011: Detection of Asian Dust in California Orographic Precipitation. *J. Geophys. Res. – Atmospheres*, **116**, D16205, doi:10.1029/2010JD015351.
- Zamora, R.J., F.M. Ralph, E. Clark and T.S. Schneider, 2011: The NOAA Hydrometeorology Testbed soil moisture observing networks: Design, instrumentation and preliminary results. *J. Atmos. Oceanic Technol.*, **28**, 1129-1140, doi: 10.1175/2010JTECHA1465.1.
- Neiman, P.J., L.J. Schick, F.M. Ralph, M. Hughes, G.A. Wick, 2011: Flooding in Western Washington: The Connection to Atmospheric Rivers. *J. Hydrometeor.*, **12**, 1337-1358, doi: 10.1175/2011JHM1358.1
- Dettinger, M.D., F.M. Ralph, M. Hughes, T. Das, P.J. Neiman, D. Cox, G. Estes, D. Reynolds, R. Hartman, D. Cayan, and L. Jones, 2012: Design and quantification of an extreme winter storm scenario for emergency preparedness and planning exercises in California, *Nat. Hazards*, **60**, 1085-1111.
- White, A.B., B. Colman, G.M. Carter, F.M. Ralph, R.S. Webb, D.G. Brandon, C.W. King, P.J. Neiman, D.J. Gottas, I. Jankov, K.F. Brill, Y. Zhu, K. Cook, H.E. Buehner, H. Opitz, D.W. Reynolds, L.J. Schick, 2012: NOAA's Rapid Response to the Howard A. Hanson Dam Flood Risk Management Crisis. *Bull. Amer. Meteorol. Soc.*, **93**, 189-207, doi: 10.1175/BAMS-D-11-00103.1

- Moore, B.J., P.J. Neiman, F.M. Ralph, F. Barthold, 2012: Physical processes associated with heavy flooding rainfall in Nashville, Tennessee and vicinity during 1-2 May 2010: The role of an atmospheric river and mesoscale convective systems. *Mon. Wea. Rev.*, **140**, 358-378, doi.org/10.1175/MWR-D-11-00126.1
- Ralph, F.M., and M.D. Dettinger, 2012: Historical and national perspectives on extreme West Coast precipitation associated with atmospheric rivers during December 2010. *Bull. Amer. Meteor. Soc.*, **93**, 783-790, doi:10.1175/BAMS-D-11-00188.1
- Newman, M., G.N. Kiladis, K.M. Weickman, F.M. Ralph and P.D. Sardeshmukh, 2012: Relative contributions of synoptic and low-frequency eddies to time-mean atmospheric moisture transport, including the role of atmospheric rivers. *J. Climate*, **25**, 7341-7361, doi:10.1175/JCLI-D-11-00665.1
- Hughes, M., P.J. Neiman, E. Sukovich and F.M. Ralph, 2012: Representation of the Sierra Barrier Jet in 11 years of a high-resolution dynamical reanalysis downscaling compared with long-term wind profiler observations. *J. Geophys. Res. – Atmos.*, **117**, D18116, doi:10.1029/2012JD017869
- Wick, G.A., P.J. Neiman, and F.M. Ralph, 2013: Description and validation of an automated objective technique for identification and characterization of the integrated water vapor signature of atmospheric rivers. *IEEE Trans. Geosci. Remote Sensing*, **51**, 2166-2176, doi:10.1109/TGRS.2012.2211024
- Ralph, F.M., J. Intrieri, D. Andra Jr., S. Boukabara, D. Bright, P. Davidson, B. Entwistle, J. Gaynor, S. Goodman, J. Gwo-Jiing, A. Harless, J. Huang, G. Jedlovec, J. Kain, S. Koch, B. Kuo, J. Levit, S.T. Murillo, L.P. Riishojgaard, T. Schneider, R. Schneider, T. Smith, and S. Weiss, 2013: The emergence of weather-focused testbeds linking research and forecasting operations. *Bull. Amer. Meteor. Soc.*, **94**, 1187-1210, doi:10.1175/BAMS-D-12-00080.1
- Creamean, J.M., K.J. Suski, D. Rosenfeld, A. Cazorla, P.J. DeMott, R.C. Sullivan, A.B. White, F.M. Ralph, P. Minnis, J.M. Comstock, J.M. Tomlinson, K.A. Prather, 2013: Dust and Biological Aerosols from the Sahara and Asia Influence Precipitation in the Western U.S. *Science*, **339**, 1572-1578 (2013). doi: 10.1126/science.1227279
- Ralph, F.M., T. Coleman, P.J. Neiman, R. Zamora, and M.D. Dettinger, 2013: Observed impacts of duration and seasonality of atmospheric-river landfalls on soil moisture and runoff in coastal northern California. *J. Hydrometeorol.*, **14**, 443-459, doi:10.1175/JHM-D-12-076.1, doi.org/10.1175/JHM-D-12-076.1
- Neiman, P.J., F.M., Ralph, B.J. Moore, M. Hughes, K.M. Mahoney, J.M. Cordeira and M.D. Dettinger, 2013: The landfall and inland penetration of a flood-producing atmospheric

- river in Arizona. Part 1: Observed synoptic-scale, orographic and hydrometeorological characteristics. *J. Hydrometeorol.*, **14**, 460-484, doi.org/10.1175/JHM-D-12-0101.1
- Kingsmill, D.K., P.J. Neiman, B.J. Moore, M. Hughes, S.E. Yuter and F.M. Ralph, 2013: Kinematic and thermodynamic structures of Sierra barrier jets and overrunning atmospheric rivers during a land-falling winter storm in Northern California. *Mon. Wea. Rev.*, **141**, 2015-2036, doi:10.1175/MWR-D12-00277.1
- White, A.B., M.L. Anderson, M.D. Dettinger, F.M. Ralph, A. Hinojosa, D.R. Cayan, R.K. Hartman, D.W. Reynolds, L.E. Johnson, T.L. Schneider, R. Cifelli, Z. Toth, S.I. Gutman, C.W. King, F. Gehrke, P.E. Johnston, C. Walls, D. Mann, D.J. Gottas and T. Coleman, 2013: A 21st century California observing network for monitoring extreme weather events. *J. Atmos. Ocean. Technol.*, **30**, 1585-1603. doi.org/10.1175/JTECH-D-12-00217.1
- Cordeira J.M., F.M. Ralph and B.J. Moore, 2013: The development and evolution of two atmospheric rivers in proximity to Western North Pacific tropical cyclones in October 2010. *Mon. Wea. Rev.*, **141**, 4234–4255, doi:10.1175/MWR-D-13-00019.1
- Wick, G.A., P.J. Neiman, F.M. Ralph, and T.M. Hamill, 2013: Evaluation of forecasts of the water vapor signature of atmospheric rivers in operational numerical weather prediction models. *Wea. Forecasting*, **28**, 1337-1352, doi:10.1175/WAF-D-13-00025.1
- Neiman, P.J., M. Hughes, B.J. Moore, F.M. Ralph and E.M. Sukovich, 2013: Sierra barrier jets, atmospheric rivers and precipitation characteristics in Northern California: A composite perspective based on a network of wind profilers. *Mon. Wea. Rev.*, **141**, 4211-4233, doi:10.1175/MWR-D-13-00112.1
- Rutz, J.J., W.J. Steenburgh, and F.M. Ralph, 2014: Climatological characteristics of atmospheric rivers and their inland penetration over the western United States. *Mon. Wea. Rev.*, **142**, 905-921, doi.org/10.1175/MWR-D-13-00168.1
- Matrosov, S.Y., F.M. Ralph, P.J. Neiman and A.B. White, 2014: Quantitative assessment of operational weather radar rainfall estimates over California's Northern Sonoma County using HMT-West data. *Journal of Hydrometeorology*, **15**, 393-410, doi:10.1175/JHM-D-13-045.1
- Ralph, F.M., M.D. Dettinger, A. White, D. Reynolds, D. Cayan, T. Schneider, R. Cifelli, K. Redmond, M. Anderson, F. Gherke, J. Jones, K. Mahoney, L. Johnson, S. Gutman, V. Chandrasekar, J. Lundquist, N.P. Molotch, L. Brekke, R. Pulwarty, J. Horel, L. Schick, A. Edman, P. Mote, J. Abatzoglou, R. Pierce and G. Wick, 2014: A vision for future observations for Western U.S. extreme precipitation and flooding– Special Issue of *J. Contemporary Water Resources Research and Education*, Universities Council for Water Resources, Issue **153**, pp. 16-32, doi:10.1111/j.1936-704X.2014.03176.x

- Neff, W., G.P. Compo, F.M. Ralph and M.D. Shupe, 2014: Continental heat anomalies and the extreme melting of the Greenland ice surface in 2012 and 1889. *J. Geophys. Res.*, **119**, doi:10.1002/2014JD021470
- Sukovich, E.M., F.M. Ralph, F.E. Barthold, D.W. Reynolds and D.R. Novak, 2014: Extreme quantitative precipitation forecast performance at the Weather Prediction Center from 2001 to 2011. *Wea. Forecast.*, **29**, 894-911, doi:10.1175/WAF-D-13-00061.1
- Neiman, P.J., F.M. Ralph, B.J. Moore and R. J. Zamora, 2014: The regional influence of an intense Sierra Barrier Jet and landfalling atmospheric river on orographic precipitation in northern California: A case study. *J. Hydrometeor.*, **15**, 1419-1439, doi:10.1175/JHM-D-13-0183.1
- Neiman, P.J., G.A. Wick, B.J. Moore, F.M. Ralph, J.R. Spackman and B. Ward, 2014: An Airborne Study of an Atmospheric River over the Subtropical Pacific during WISPAR: Dropsonde Budget-box Diagnostics, and Precipitation Impacts in Hawaii. *Mon. Wea. Rev.*, **142**, 3199-3223, doi:10.1175/MWR-D-00383.1
- Hughes, M., K.M. Mahoney, P.J. Neiman, B.J. Moore, M. Alexander and F.M. Ralph, 2014: The landfall and inland penetration of a flood-producing atmospheric river in Arizona. Part II: Sensitivity of modeled precipitation to terrain height and atmospheric river orientation. *J. Hydrometeor.*, **15**, 1954-1974, doi:10.1175/JHM-D-13-0176.1
- Creamean, J.M., C. Lee, T.C. Hill, A.P. Ault, P.J. DeMott, A.B. White, F.M. Ralph, and K.A. Prather, 2014: Chemical properties of insoluble precipitation residue particles. *J. Aerosol Sci.*, **76**, 13-27, doi:10.1016/j.jaerosol.2014.05.005
- Gorodetskaya, I.V., M. Tsukernik, K. Claes, F.M. Ralph, W.D. Neff, and N.P.M. Van Lipzig, 2014: The role of atmospheric rivers in anomalous snow accumulation in East Antarctica. *Geophys. Res. Lett.*, **41**, 6199-6206, doi.org/10.1002/2014GL060881
- Neiman, P.J., D.J. Gattas, A.B. White, L.J. Schick and F.M. Ralph, 2014: The use of snow-level observations derived from vertically profiling radars to assess hydrometeorological characteristics and forecasts over Washington's Green River basin. *J. Hydrometeor.*, **15**, 2522-2541, doi:10.1175/JHM-D-14-0019.1
- Mahoney, K., F.M. Ralph, K. Wolter, N. Doesken, M.D. Dettinger, D. Gattas, T. Coleman, and A. White, 2015: Climatology of extreme daily precipitation in Colorado and its diverse spatial and seasonal variability. *J. Hydrometeor.* **16**, 781-792, doi:10.1175/JHM-D-14-0112.1
- Creamean, J.M., A.P. Ault, A.B. White, P.J. Neiman, F.M. Ralph, P. Minnis and K.A. Prather, 2015: Impact of interannual variations in sources of insoluble aerosol species on orographic precipitation over California's central Sierra Nevada. *Atmos. Chem. Phys.*, **15**, 6535-6548.

- Lavers, D.A., F.M. Ralph, D.E. Waliser, A. Gershunov and M.D. Dettinger, 2015: Climate change intensification of horizontal water vapor transport in CMIP5. *Geophys. Res. Lett.*, **42**, doi:10.1002/2015GL064672
- Rutz, J.J., J.W. Steenburgh and F.M. Ralph, 2015: The Inland Penetration of Atmospheric Rivers over Western North America: A Lagrangian Analysis. *Mon. Wea. Rev.*, **143**, 1924-1944.
- Coplen, T.B., P.J. Neiman, A.B. White and F.M. Ralph, 2015: Categorisation of Northern California rainfall for periods with and without a radar bright band using stable isotopes and a novel automated precipitation collector. *Tellus B*, **67**, 28574, doi:10.3402/tellusb.v67.28574
- White, A.B., P.J. Neiman, J.M. Creamean, T. Coleman, F.M. Ralph and K.A. Prather, 2015: The Impacts of California's San Francisco Bay Area Gap on Precipitation Observed in the Sierra Nevada during HMT and CalWater. *J. Hydrometeorol.*, **16**, 1048–1069, doi: 10.1175/JHM-D-14-0160.1
- Dettinger, M.D., F.M. Ralph, and D.A. Lavers, 2015: Setting the stage for a global science of atmospheric rivers, *EOS*, **96**, doi:10.1029/2015EO038675
- Ralph, F.M., K.A. Prather, D. Cayan, J.R. Spackman, P. DeMott, M. Dettinger, C. Fairall, R. Leung, D. Rosenfeld, S. Rutledge, D.E. Waliser, A.B. White, J.M. Cordeira, A. Martin, J. Helly, and J. Intrieri, 2016: CalWater Field Studies Designed to Quantify the Roles of Atmospheric Rivers and Aerosols in Modulating U.S. West Coast Precipitation in a Changing Climate. *Bull. Amer. Meteorol. Soc.*, **97**, 1209-1228.
- Neiman, P.J., B.J. Moore, A.B. White, G.A. Wick, J. Aikins, D.L. Jackson, J.R. Spackman, and F.M. Ralph, 2016: An airborne and ground-based study of a long-lived and intense atmospheric river impacting California during the CalWater-2014 Early-Start field campaign. *Mon. Wea. Rev.*, **144**, 1115-1144.
- Guan, B., D.E. Waliser, F.M. Ralph, E.J. Fetzer, and P.J. Neiman, 2016: Hydrometeorological characteristics of rain-on-snow events associated with atmospheric rivers. *Geophys. Res. Lett.*, **43**, 2964–2973, doi:10.1002/2016GL067978
- Ralph, F.M., J.M. Cordeira, P.J. Neiman and M. Hughes, 2016: Landfalling atmospheric rivers, the Sierra barrier jet and extreme daily precipitation in northern California's upper Sacramento River watershed. *J. Hydrometeorol.*, **17**, 1905-1914.
- Lavers, D.A., D.E. Waliser, F.M. Ralph, and M.D. Dettinger, 2016: Predictability of horizontal water vapor transport relative to precipitation: Enhancing situational awareness for forecasting western U.S. extreme precipitation and flooding, *Geophys. Res. Lett.*, **43**, 2275–2282, doi:10.1002/2016GL067765

- Cordeira, J.M., F.M. Ralph, A. Martin, N. Gaggini, J.R. Spackman, P.J. Neiman, J.J. Rutz and R. Pierce, 2017: Forecasting atmospheric rivers during CalWater 2015. *Bull. Amer. Meteor. Soc.*, **98**, 449-459.
- Oakley, N.S., J.T. Lancaster, M.L. Kaplan, and F.M. Ralph, 2017: Synoptic conditions associated with cool season post-fire debris flows in the Transverse Ranges of southern California. *Natural Hazards*, 1-28. **88**: 327-354, doi:10.1007/s11069-017-2867-6
- Hu, H., F. Dominguez, Z. Wang, D.A. Lavers, G. Zhang and F.M. Ralph, 2017: Linking Atmospheric River Hydrological Impacts on the U.S. West Coast to Rossby Wave Breaking. *J. Clim.*, **30**, 3381-3399.
- Ralph, F.M., M.D. Dettinger, D.A. Lavers, I.V. Gorodetskaya, A. Martin, M. Viale, A.B. White, N.S. Oakley, J.J. Rutz, J.R. Spackman, H. Wernli and J.M. Cordeira, 2017: Atmospheric Rivers Emerge as a Global Science and Applications Focus. *Bull. Amer. Meteorol. Soc.*, **98**, 1969-1973. doi:10.1175/BAMS-D-16-0262.1
- Gershunov A., T.M. Shulgina, F.M. Ralph, D.A. Lavers and J.J. Rutz, 2017: Assessing climate-scale behavior of Atmospheric Rivers affecting western North America. *Geophysical Research Letters*, **44**, 7900-7908. doi:10.1002/2017GL074175
- Lamjiri, M.A., M.D. Dettinger, F.M. Ralph and B. Guan, 2017: Hourly storm characteristics along the U.S. West Coast: Role of atmospheric rivers in extreme precipitation. *Geophys. Res. Lett.*, doi:10.1002/2017GL074193
- Ralph, F.M., S.F. Iacobellis, P.J. Neiman, J.M. Cordeira, J.R. Spackman, D.E. Waliser, G.A. Wick, A.B. White, and C. Fairall, 2017: Dropsonde observations of total water vapor transport within North Pacific atmospheric rivers. *J. Hydrometeor.* **18**, 2577-2596.
- Ralph, F.M., and T.J. Galarneau Jr., 2017: The Chiricahua Gap and the role of easterly water vapor transport in southeastern Arizona monsoon precipitation. *J. Hydrometeor.*, **18**, 2511-2520.
- Sellars, S.L., B. Kawzenuk, P. Nguyen, F.M. Ralph, and S. Sorooshian, 2017: Genesis, pathways, and terminations of intense global water vapor transport in association with large-scale climate patterns. *Geophys. Res. Lett.*, **44**, 12,465–12,475. doi: 10.1002/2017GL075495
- Guan, B., D.E. Waliser, and F.M. Ralph, 2018: An Inter-comparison between reanalysis and dropsonde observations of the total water vapor transport in individual atmospheric rivers. *J. Hydrometeor.*, **19**, 321-337.
- Ralph, F.M., M.D. Dettinger, M.M. Cairns, T.J. Galarneau, and J. Eylander, 2018: Defining

- “atmospheric river” How the *Glossary of Meteorology* helped resolve a debate. *Bull. Amer. Meteor. Soc.*, **99**, 837-839.
- DeFlorio, M.J., D.E. Waliser, B. Guan, D.A. Lavers, F.M. Ralph and F. Vitart, 2018: Global assessment of atmospheric river prediction skill. *J. Hydrometeorol.*, **19**, 409-426.
- Flint, L.E., A.L. Flint, J. Mendoza, J. Kalansky, F.M. Ralph, 2018: Characterizing drought in California: New drought indices and scenario-testing in support of resource management. *Ecological Processes*, **7**, doi: 10.1186/s13717-017-0112-6.
- Nash, D., D. Waliser, B. Guan, H. Ye and F.M. Ralph, 2018: The Role of Atmospheric Rivers in Extratropical and Polar Hydroclimate. *J. Geophys. Res. – Atmos.*, **123**, 6804–6821. doi: 10.1029/2017JD028130.
- Shields, C.A., J.J. Rutz, L.-Y. Leung, F.M. Ralph, M. Wehner, et al. 2018: Atmospheric River Tracking Method Intercomparison Project (ARTMIP): project goals and experimental design, *Geosci. Model Dev.*, **11**, 2455-2474, doi: 10.5194/gmd-11-2455-2018
- Lavers, D.A., M.J. Rodwell, D.S. Richardson, F.M. Ralph, J.D. Doyle, C.A. Reynolds, V. Tallapragada, and F. Pappenberger, 2018: The gauging and modeling of rivers in the sky. *Geophys. Res. Lett.*, **45**, doi:10.1029/2018GL079019.
- Martin, A., F.M. Ralph, R. Demirdjian, L. DeHaan, R. Weihs, J. Helly, D. Reynolds and S.F. Iacobellis, 2018: Evaluation of Atmospheric River Predictions by the WRF Model Using Aircraft and Regional Mesonet Observations of Orographic Precipitation and Its Forcing. *J. Hydrometeorol.*, **19**, 1097-1113.
- Dettinger, M.D., F.M. Ralph, and J.J. Rutz, 2018: Empirical Return Periods of the Most Intense Vapor Transports during Historical Atmospheric River Landfalls on the U.S. West Coast. *J. Hydrometeorol.*, **19**, 1363-1377, doi:10.1175/JHM-D-17-0247.1
- Oakley, N.S., J.T. Lancaster, B.J. Hatchett, J. Stock, F.M. Ralph, S. Roj, and S. Lukashov, 2018: A 22-Year Climatology of Cool Season Hourly Precipitation Thresholds Conducive to Shallow Landslides in California. *Earth Interact.*, **22**, 1–35, doi: 10.1175/EI-D-17-0029.1
- Nardi, K.M., E.A. Barnes, and F.M. Ralph, 2018: Assessment of Numerical Weather Prediction Model Reforecasts of the Occurrence, Intensity, and Location of Atmospheric Rivers along the West Coast of North America. *Mon. Wea. Rev.*, **146**, 3343–3362, doi: 10.1175/MWR-D-18-0060.1
- Oakley, N.S., F. Cannon, E. Boldt, J. Dumas and F.M. Ralph, 2018: Origins and Variability of Extreme Precipitation in the Santa Ynez River Basin of Southern California. *J. Hydro.: Regional Studies*, **19**, 164-176, doi: 10.1016/j.ejrh.2018.09.001.
- Espinoza, V., D.E. Waliser, B. Guan, D.A. Lavers, and F.M. Ralph, 2018: Global analysis of

- climate change projection effects on atmospheric rivers. *Geophys. Res. Lett.*, **45**, doi: 10.1029/2017GL076968.
- Viale, M., R. Valenzuela, R.D. Garreaud, and F.M. Ralph, 2018: Impacts of Atmospheric Rivers on Precipitation in Southern South America. *J. Hydrometeor.*, **19**, 1671–1687, doi: 10.1175/JHM-D-18-0006.1
- Guirguis, K., A. Gershunov, R.E.S. Clemesha, T. Shulgina, A.C. Subramanian and F.M. Ralph, 2018: Circulation Drivers of Atmospheric Rivers at the North American West Coast. *Geophys. Res. Lett.*, **45**, doi: 10.1029/2018GL079249.
- Oakley, N.S., F. Cannon, R. Munroe, J.T. Lancaster, D. Gomberg and F.M. Ralph, 2018: Brief Communication: Meteorological and climatological conditions associated with the 9 January 2018 post-fire debris flows in Montecito and Carpinteria California, USA. *Nat. Hazards Earth Syst. Sci.*, **18**, 3037-3043, doi: 10.5194/nhess-18-3037-2018
- Ralph, F.M., J.J. Rutz, J.M. Cordeira, M. Dettinger, M.L. Anderson, D. Reynolds, L.J. Schick and C. Smallcomb, 2019: A Scale to Characterize the Strength and Impacts of Atmospheric Rivers. *Bull. Amer. Meteor. Soc.*, **100**, 269-289, doi: 10.1175/BAMS-D-18-0023.1
- Ramos, A.M., A.M. Wilson, M.J. DeFlorio, M.D. Warner, E. Barnes, R. Garreaud, I.V. Gorodetskaya, D.A. Lavers, B. Moore, A. Payne, C. Smallcomb, H. Sodemann, M. Wehner, and F.M. Ralph, 2018: International Atmospheric Rivers Conference: Multi disciplinary studies and high impact applications of atmospheric rivers. *Atmos Sci Lett.*, **20**, e935, doi: 10.1002/asl.935
- Chapman, W.E., A.C. Subramanian, L. Delle Monache, S.P. Xie, & F.M. Ralph, 2019: Improving atmospheric river forecasts with machine learning. *Geophysical Research Letters*, **46**, 10627– 10635, doi: 10.1029/2019GL083662
- Cao, Q., A. Mehran, F.M. Ralph, and D.P. Lettenmaier, 2019: The role of hydrological initial conditions on Atmospheric River floods in the Russian River basin, *J. Hydrometeor.* **20**, 1667-1686, doi: 10.1175/JHM-D-19-0030.1
- Corringham, T.W., F.M. Ralph, A. Gershunov, D.R. Cayan and C.A. Talbot, 2019: Atmospheric rivers drive flood damages in the western United States. *Science Advances*, **5**, eaax4631 doi: 10.1126/sciadv.aax4631
- Guirguis, K., A. Gershunov, T. Shulgina, R. Clemesha, F.M. Ralph, 2018: Atmospheric rivers impacting Northern California and their modulation by a variable climate. *Clim Dyn* **52**, 6569–6583, doi: 10.1007/s00382-018-4532-5
- Fish, M.A., A.M. Wilson, and F.M. Ralph, 2019: Atmospheric River Families: Definition and Associated Synoptic Conditions. *J. Hydrometeor.*, **20**, 2091–2108, doi: 10.1175/JHM-D-

18-0217.1

- DeFlorio, M.J., D.E. Waliser, B. Guan, F.M. Ralph, F. Vitart, 2019: Global evaluation of atmospheric river subseasonal prediction skill. *Clim. Dyn.* **52**, 3039–3060, doi: 10.1007/s00382-018-4309-x
- DeFlorio, M. J., D.E. Waliser, F.M. Ralph, B. Guan, A. Goodman, P.B. Gibson, S. Asharaf, L. Delle Monache, Z. Zhang, A.C. Subramanian, F. Vitart, H. Lin, and A. Kumar, 2019: Experimental Subseasonal to Seasonal (S2S) Forecasting of Atmospheric Rivers Over the Western United States. *Journal of Geophysical Research: Atmospheres*, **124**, 11,242–11,265, doi: 10.1029/2019JD031200
- Ralph, F.M., A.M. Wilson, T. Shulgina, B. Kawzenuk, S. Sellars, J.J. Rutz, M.A. Lamjiri, E.A. Barnes., A. Gershunov, B. Guan, K. M. Nardi, T. Osborne and G.A. Wick, 2019: ARTMIP-early start comparison of atmospheric river detection tools: how many atmospheric rivers hit northern California’s Russian River watershed?. *Clim. Dyn.*, **52**, 4973–4994, doi: 10.1007/s00382-018-4427-5
- Rutz, J. J., C.A. Shields, J.M. Lora,...Ralph, F.M. ,...and M. Viale, 2019: The atmospheric river tracking method intercomparison project (ARTMIP): quantifying uncertainties in atmospheric river climatology. *Journal of Geophysical Research: Atmospheres*, 2019; **124**: 13777– 13802, doi: 10.1029/2019JD030936
- Wilson, A.M., W. Chapman, A. Payne, A.M. Ramos, C. Boehm, D. Campos, J. Cordeira, R. Garreaud, I.V. Gorodetskaya, J.J. Rutz, C. Viceto, and F.M. Ralph, 2020: Training the Next Generation of Researchers in the Science and Application of Atmospheric Rivers. *Bull. Amer. Meteor. Soc.*, **101**, doi: 10.1175/BAMS-D-19-0311.1
- Cordeira, J.M., J. Stock, M.D. Dettinger, A.M. Young, J.F. Kalansky, and F.M. Ralph, 2019: A 142-Year Climatology of Northern California Landslides and Atmospheric Rivers. *Bull. Amer. Meteor. Soc.*, **100**, 1499–1509, doi: 10.1175/BAMS-D-18-0158.1
- Martin, A.C., F.M. Ralph, A.M. Wilson, L. DeHaan and B. Kawzenuk, 2019: Rapid Cyclogenesis from a Mesoscale Frontal Wave on an Atmospheric River: Impacts on Forecast Skill and Predictability during Atmospheric River Landfall. *J. Hydro*, **20**, 1779–1794.
- Zhang, Z., F.M. Ralph and M. Zheng, 2019: The Relationship between Extratropical Cyclone Strength and Atmospheric River Intensity and Position. *Geophys. Res. Lett.*, **46**, 164–176, doi: 10.1029/2018GL07907.
- Shields, C.A., J.J. Rutz, L.R. Leung, F.M. Ralph, M. Wehner, T. O’Brien, and R. Pierce, 2019: Defining uncertainties through comparison of atmospheric river tracking methods. *Bull. Amer. Meteor. Soc.*, **100**, ES93-ES96, doi: 10.1175/BAMS-D-18-0200.1.

- Martin, A.C., G. Cornwell, C.M. Beall, F. Cannon, S. Reilly, B. Schaap, D. Lucero, J. Creamean, F.M. Ralph, H.T. Mix, and K. Prather, 2019: Contrasting local and long-range-transported warm ice-nucleating particles during an atmospheric river in coastal California, USA, *Atmos. Chem. Phys.*, **19**, 4193-4210, doi: 10.5194/acp-19-4193-2019.
- Gershunov, A., T.M. Shulgina, R.E.S. Clemesha, K. Guirguis, D.W. Pierce, M.D. Dettinger, D.A. Lavers, D.R. Cayan, S.D. Polade, J. Kalansky and F.M. Ralph, 2019: Precipitation regime change in Western North America: The role of Atmospheric Rivers. *Nature Scientific Reports*, **9**:9944, doi:10.1038/s41598-019-46169-w. <https://rdcu.be/bJPK0>
- Reynolds, C. A., J.D. Doyle, F.M. Ralph and R. Demirdjian, 2019: Adjoint sensitivity of North Pacific atmospheric river forecasts. *Mon. Wea. Rev.*, **147**:1871-1897. doi:10.1175/MWR-D-18-0347.1
- Stone, R.E., C.A. Reynolds, J.D. Doyle, R. Langland, N. Baker, D.A. Lavers, and F.M. Ralph, 2020: Atmospheric River Reconnaissance Observation Impact in the Navy Global Forecast System. *Mon. Wea. Rev.*, **148**, 763-782, doi: 10.1175/MWR-D-19-0101.1
- Ryoo J., S. Chiao, R.J. Spackman, L.T. Iraci, F.M. Ralph, A. Martin, R.M. Dole, J.E. Marrero, E.L. Yates, T.P. Bui, J.M. Dean-Day, C.S. Chang, 2020: Terrain Trapped Airflows and Precipitation Variability during an Atmospheric River Event. *J. Hydrometeor.*, **21**, 355-375, doi: 10.1175/JHM-D-19-0040.1
- Nguyen, P., E.J. Shearer, M. Ombadi, V.A. Goroooh, K. Hsu, S. Sorooshian, W.S. Logan, and F.M. Ralph, 2020: PERSIANN Dynamic Infrared–Rain Rate Model (PDIR) for High-Resolution, Real-Time Satellite Precipitation Estimation. *Bull. Amer. Meteor. Soc.*, **101**, E286–E302, doi: 10.1175/BAMS-D-19-0118.1
- Gibson, P.B., D.E. Waliser, B. Guan, M.J. DeFlorio, F.M. Ralph, and D.L. Swain, 2020: Ridging associated with drought across the Western and Southwestern United States: characteristics, trends and predictability sources *J. Climate*, **33**, 2485-2508, doi: 10.1175/JCLI-D-19-0439.1
- Sierks, M.D., J. Kalansky, F. Cannon, and F.M. Ralph, 2020: Characteristics, Origins, and Impacts of Summertime Extreme Precipitation in the Lake Mead Watershed. *J. Climate*, **33**, 2663-2680, doi: 10.1175/JCLI-D-19-0387.1
- Demirdjian, R., J.D. Doyle, C.A. Reynolds, J.R. Norris, A.C. Michaelis, F.M. Ralph, 2020: A Case Study of the Physical Processes Associated with the Atmospheric River Initial Condition Sensitivity from an Adjoint Model. *J. Atmos. Sci.*, **77**, 691-709. doi: 10.1175/JAS-D-19-0155.1
- Demirdjian, R., J.R. Norris, A. Martin, and F.M. Ralph, 2020: Dropsonde Observations of the Ageostrophy within the Pre-Cold-Frontal Low-Level Jet Associated with Atmospheric

- Rivers. *Mon. Wea. Rev.*, **148**, 1389-1406, doi: 10.1175/MWR-D-19-0248.1
- Henn, B., R. Weihs, A.C. Martin, F.M. Ralph, and T. Osborne, 2020: Skill of Rain–Snow Level Forecasts for Landfalling Atmospheric Rivers: A Multimodel Assessment Using California’s Network of Vertically Profiling Radars. *J. Hydrometeor.*, **21**, 751–771, doi: 10.1175/JHM-D-18-0212.1
- Ralph, F. M., F. Cannon, V. Tallapragada, C.A. Davis, J.D. Doyle, F. Pappenberger, A. Subramanian, A.M. Wilson, D.A. Lavers, C.A. Reynolds, J. Haase, J.J. Rutz, J.M. Cordeira, M. Zheng, C.W. Hecht, B. Kawzenuk, L. Delle Monache, 2020: West Coast Forecast Challenges and Development of Atmospheric River Reconnaissance. *Bull. Amer. Meteor. Soc.*, **101**, E1357–E1377, doi: 10.1175/BAMS-D-19-0183.1
- Cao, Q., A. Gershunov, T. Shulgina, F.M. Ralph, N. Sun, and D.P. Lettenmaier, 2020: Floods due to Atmospheric Rivers along the U.S. West Coast: The Role of Antecedent Soil Moisture in a Warming Climate. *J. Hydrometeor.*, **21**, 1827–1845, doi: 10.1175/JHM-D-19-0242.1
- Cannon, F., J.M. Cordeira, C.W. Hecht, J.R. Norris, A.C. Michaelis, R. Demirdjian, and F.M. Ralph, 2020: GPM Satellite Radar Observations of Precipitation Mechanisms in Atmospheric Rivers. *Mon. Wea. Rev.*, **148**, 1449–1463, doi: 10.1175/MWR-D-19-0278.1
- Voss, K.K., A.T. Evan, K.A. Prather, and F.M. Ralph, 2020: Dusty Atmospheric Rivers: Characteristics and Origins. *J. Climate*, **33**, 9749–9762, doi: 10.1175/BAMS-D-19-0183.1 10.1175/JCLI-D-20-0059.1
- Lamjiri, M.A., F.M. Ralph, and M.D. Dettinger, 2020: Recent Changes in United States Extreme 3-Day Precipitation Using the R-CAT Scale. *J. Hydrometeor.*, **21**, 1207–1221, doi: 10.1175/JHM-D-19-0171.1.
- Guirguis, K., A. Gershunov, M.J. DeFlorio, ...and F.M. Ralph, 2020: Four atmospheric circulation regimes over the North Pacific and their relationship to California precipitation on daily to seasonal timescales. *Geophys. Res. Lett.*, **47**, e2020GL087609, doi: 10.1029/2020GL087609
- Sumargo, E., F. Cannon, F.M. Ralph, and B. Henn, 2020: Freezing level forecast error can consume reservoir flood control storage: Potentials for Lake Oroville and New Bullards Bar reservoirs in California. *Water Resources Res.*, **56**, e2020WR027072, doi: 10.1029/2020WR027072
- Cannon, F., N.S. Oakley, C.W. Hecht, ..., and F.M. Ralph, 2020: Observations and Predictability of a High-Impact Narrow Cold-Frontal Rainband over Southern California on 2 February 2019. *Wea. Forecast.*, **35**, 2083–2097, doi: 10.1175/WAF-D-20-0012.1
- Lavers, D.A., N.B. Ingleby, A.C. Subramanian, D.S. Richardson, F.M. Ralph, J.D. Doyle, C.A.

- Reynolds, R.D. Torn, M.J. Rodwell, V. Tallapragada and F. Pappenberger, 2020: Forecast Errors and Uncertainties in Atmospheric Rivers. *Wea. Forecast.*, **35**, 1447–1458, doi: 10.1175/WAF-D-20-0049.1
- Sumargo, E., A.M. Wilson, F.M. Ralph, R. Weihs, A. White, J. Jasperse, M. Asgari-Lamjiri, S. Turnbull, C. Downer, and L. Delle Monache, 2020: The Hydrometeorological Observation Network in California’s Russian River Watershed: Development, Characteristics, and Key Findings from 1997 to 2019. *Bull. Amer. Meteor. Soc.*, **101**, E1781–E1800, doi: 10.1175/BAMS-D-19-0253.1
- Lavers, D.A., F.M. Ralph, D.S. Richardson, and F. Pappenberger, 2020: Improved forecasts of atmospheric rivers through systematic reconnaissance, better modelling, and insights on conversion of rain to flooding. *Commun. Earth Environ.*, **1**, doi: 10.1038/s43247-020-00042-1
- Delaney, C. J., R.K. Hartman, J. Mendoza, M. Dettinger, L. Delle Monache, J. Jasperse, F.M. Ralph, et al., 2020: Forecast informed reservoir operations using ensemble streamflow predictions for a multipurpose reservoir in Northern California. *Water Resources Research*, **56**, e2019WR026604, doi: 10.1029/2019WR026604
- Hatchett, B. J., Q. Cao, P.B. Dawson, C.J. Ellis, C.W. Hecht, B. Kawzenuk, J.T. Lancaster, T.C. Osborne, A. M. Wilson, M.L. Anderson, M.D. Dettinger, J.F. Kalansky, M.L. Kaplan, D.P. Lettenmaier, N.S. Oakley, F.M. Ralph, D.W. Reynolds, A.B. White, M. Sierks and E. Sumargo, 2020: Observations of an extreme atmospheric river storm with a diverse sensor network. *Earth and Space Science*, **6**, e2020EA001129, doi: 10.1029/2020EA001129
- Nguyen, P., M. Ombadi, V. Afzali Gorooh, E.J. Shearer, M. Sadeghi, S. Sorooshian, K. Hsu, D. Bolvin, F.M. Ralph, 2020: PERSIANN Dynamic Infrared-Rain Rate (PDIR-Now): A Near-real time, Quasi-Global Satellite Precipitation Dataset. *J. Hydrometeor.*, **21**, 2893-2906. doi: 10.1175/JHM-D-20-0177.1
- Henn, B., K.N. Musselman, L. Lestak, F.M. Ralph and N.P. Molotch, 2020: Extreme runoff generation from atmospheric river driven snowmelt during the 2017 Oroville Dam spillways incident. *Geophys. Res. Lett.*, **47**, e2020GL088189, doi: 10.1029/2020GL088189
- Cao, Q., A. Gershunov, T. Shulgina, F.M. Ralph, N. Sun, D.P. Lettenmaier, 2020: Floods due to atmospheric rivers along the U.S. West Coast: The role of antecedent soil moisture in a warming climate. *J. Hydrometeor.*, **21**, 1827-1845, doi: 10.1175/JHM-D-19-0242.1
- Norris, J.R., F.M. Ralph, R. Demirdjian, F. Cannon, B. Blomquist, C.W. Fairall, J.R. Spackman, S. Tanelli, D.E. Waliser, 2020: The Observed Water Vapor Budget in an Atmospheric River over the Northeast Pacific. *J. Hydrometeor.*, **12**, 2655-2673, doi: 10.1175/JHM-D-

- Payne, A.E., M. Demory, L.R. Leung, A.M. Ramos, C.A. Shields, J.J. Rutz., N. Siler, G. Villarini, A. Hall, F.M. Ralph, 2020: Responses and impacts of atmospheric rivers to climate change. *Nat Rev Earth Environ* **1**, 143–157, doi: 10.1038/s43017-020-0030-5
- Cobb, A., A.C. Michaelis, S. Iacobellis, F.M. Ralph, L. Delle Monache, 2021: Atmospheric River Sectors: Definition and Characteristics Observed Using Dropsondes from 2014–20 CalWater and AR Recon. *Monthly Weather Review*, **149** (3),623-644, doi: 10.1175/MWR-D-20-0177.1
- Cordeira, J.M. and F.M. Ralph, 2021: A Summary of GFS Ensemble Integrated Water Vapor Transport Forecasts and Skill along the U.S. West Coast during Water Years 2017–20. *Wea. Forecast.*, **36**, 361-377.
- Cao, Q., S. Shukla, M.J. DeFlorio, F.M. Ralph, & D.P. Lettenmaier, 2021: Evaluation of the subseasonal forecast skill of floods associated with atmospheric rivers in coastal Western U.S. watersheds. *J. Hydromet.*, **22**, 1535-1552.
- Chapman, W.E., A.C. Subramanian, S.P. Xie, M.D. Sierks, F.M. Ralph, and Y. Kamae, 2021: Monthly modulations of ENSO teleconnections: Implications for potential predictability in North America. *J. Clim.*, **34**, 5899-5921.
- Cobb, A., L. Delle Monache, F. Cannon, and F.M. Ralph, 2021: Representation of Dropsonde-Observed Atmospheric River Conditions in Reanalyses. *Geophys. Res. Lett.*, **48**, p.e2021GL093357.
- DeHaan, L.L., A.C. Martin, R.R. Weihs, L. Delle Monache, & F.M. Ralph, 2021: of atmospheric river predictions in the northeast Pacific. *Weather and Forecasting*, **36** (4), 1575-1587.
- Eiras-Barca, J., A.M. Ramos, I. Algarra, M. Vázquez, F. Dominguez, G. Miguez-Macho, R. Nieto, L. Gimeno, J. Taboada, and F. M. Ralph, 2021: European West Coast atmospheric rivers: A scale to characterize strength and impacts. *Weather and Climate Extremes*, **31**, p.100305.
- Mascioli, Nora R., A. Evan, and F.M. Ralph, 2021: Influence of dust on precipitation during landfalling atmospheric rivers in an idealized framework. *Journal of Geophysical Research: Atmospheres*, **126**, no. 22: e2021JD034813.
- Michaelis, A., A.C. Martin, M.A. Fish, C.W. Hecht, and F.M. Ralph, 2021: Modulation of atmospheric rivers by mesoscale frontal waves and latent heating: Comparison of two US West Coast events. *Mon. Wea. Rev.*, **149**, 2755-2776.
- Pagano, T.J., D.E. Waliser, B. Guan, H. Ye, F.M. Ralph, and J. Kim, 2021: Extreme Surface Winds during Landfalling Atmospheric Rivers: The Modulating Role of Near-Surface

- Stability. *Journal of Hydrometeorology*, **22**, no. 6, 1681-1693, doi: 10.1175/JHM-D-20-0165.1
- Prince, H.D., P.B. Gibson, M.J. DeFlorio, T.W. Corringham, A. Cobb, B. Guan, F.M. Ralph, and D.E. Waliser, 2021: Genesis locations of the costliest atmospheric rivers impacting the western United States. *Geophys. Res. Lett.*, **48**, e2021GL093947.
- Ramos, A. M., R. Roca, P.M.M. Soares, A.M. Wilson, R.M. Trigo, and F.M. Ralph, 2021: Uncertainty in different precipitation products in the case of two atmospheric river events. *Environmental Res. Lett.*, **16**, no. 4: 045012.
- Sumargo, E., H. McMillan, R. Weihs, C.J. Ellis, A.M. Wilson, and F.M. Ralph, 2021: A soil moisture monitoring network to assess controls on runoff generation during atmospheric river events. *Hydrological Processes*, **35**, p.e13998.
- Sun, R., A.C. Subramanian, B.D. Cornuelle, M.R. Mazloff, A.J. Miller, F.M. Ralph, H. Seo, and I. Hoteit, 2021: The Role of Air–Sea Interactions in Atmospheric Rivers: Case Studies Using the SKRIPS Regional Coupled Model. *Journal of Geophysical Research: Atmospheres*, **126**, e2020JD032885
- Voss, K.K., A.T. Evan, and F.M. Ralph, 2021: Evaluating the meteorological conditions associated with dusty atmospheric rivers. *Journal of Geophysical Research: Atmospheres*, **126**, e2021JD035403.
- Zhang, Z., and F.M. Ralph, 2021: The influence of antecedent atmospheric river conditions on extratropical cyclogenesis. *Mon. Wea. Rev.*, **149**, 1337-1357.
- Zheng, M., L. Delle Monache, X. Wu, F.M. Ralph, B. Cornuelle, V. Tallapragada, J.S. Haase, A.M. Wilson, M. Mazloff, A. Subramanian, and F. Cannon, 2021: Data gaps within atmospheric rivers over the northeastern Pacific. *Bull. Amer. Meteorol. Soc.*, **102**, E492-E524.
- Zheng, M., L. Delle Monache, B.D. Cornuelle, F.M. Ralph, V.S. Tallapragada, A. Subramanian, J.S. Haase, Z. Zhang, X. Wu, M.J. Murphy, T.B. Higgins, L. DeHaan, 2021: Improved forecast skill through the assimilation of dropsonde observations from the Atmospheric River Reconnaissance program. *Journal of Geophysical Research: Atmospheres*, **126**, e2021JD034967
- Fish, M.A., J.M. Done, D.L. Swain, A.M. Wilson, A.C. Michaelis, P.B. Gibson, and F.M. Ralph, 2022: Large-scale environments of successive atmospheric river events leading to compound precipitation extremes in California. *J. Climate*, **35**, 1515-1536, doi: 10.1175/JCLI-D-21-0168.1s
- Sun, Wei, Z. Liu, C.A. Davis, F.M. Ralph, L. Delle Monache, and M. Zheng, 2022: Impacts of

- dropsonde and satellite observations on the forecasts of two atmospheric river- related heavy rainfall events. *Atmospheric Research*, **278**: 106327, 38 pp,
- Brandt, W.T., F. Cannon, A. Cooper, L. Delle Monache, K. Haleakala, B.J. Hatchett, ... & F. M. Ralph, 2022: Complementary observations aid identification of the mountain rain-snow transition elevation. *Authorea Preprints*, doi: 10.1002/essoar.10510466.
- Chapman, W.E., L. Delle Monache, S. Alessandrini, A. C. Subramanian, F. M. Ralph, S.-P. Xie, S. Lerch, and N. Hayatbini, 2022: Probabilistic Predictions from Deterministic Atmospheric River Forecasts with Deep Learning. *Mon. Wea. Rev.*, **150**, 215-234.
- de Orla-Barile, M., F. Cannon, N.S. Oakley, and F. M. Ralph, 2022: A Climatology of Narrow Cold-Frontal Rainbands in Southern California. *Geophys. Res. Lett.*, **49**, e2021GL095362.
- Corringham, T.W., J. McCarthy, T. Shulgina, A. Gershunov, D.R. Cayan, F.M. Ralph, 2022: Climate change contributions to future atmospheric river flood damages in the western United States. *Scientific Reports*, **12**, 13747.
- Michaelis, A. C., A. Gershunov, A. Weyant, M.A. Fish, T. Shulgina, and F.M. Ralph, 2022: Atmospheric River Precipitation Enhanced by Climate Change: A Case Study of the Storm That Contributed to California's Oroville Dam Crisis. *Earth's Future*, **10**, e2021EF002537.
- O'Brien, T.A., M.F. Wehner, A.E. Payne, C.A. Shields, J.J. Rutz, L.-R. Leung , F.M. Ralph , A. Collow, I. Gorodetskaya, B. Guan , J.M. Lora , E. McClenny , K.M. Nardi, A.M. Ramos , R. Tomé , C. Sarangi, E.J. Shearer , P.A. Ullrich, C. Zarzycki , B. Loring , H. Huang , H.A. Inda-Díaz, A.M. Rhoades , and Y. Zhou, 2022: Increases in future AR count and size: Overview of the ARTMIP Tier 2 CMIP5/6 Experiment. *Journal of Geophysical Research: Atmospheres*, **127**, e2021JD036013, doi: 10.1029/2021JD036013
- White, C. J., D.I.V. Domeisen, N. Acharya, ...F.M. Ralph,...and R.G. Wilson, 2022: Advances in the application and utility of subseasonal-to-seasonal predictions. *Bulletin of the American Meteorological Society* **103**, no. 6 (2022): E1448-E1472, doi: 10.1175/BAMS-D-20-0224.1
- Wilson, A.M., A. Cobb, F.M. Ralph, V. Tallapragada, C. Davis, J. Doyle, L. Delle Monache, F. Pappenberger, C. Reynolds, A. Subramanian, F. Cannon, J.M. Cordeira, J. Haase, C. Hecht, D.A. Lavers, J.J. Rutz, and M. Zheng, 2022: Atmospheric River Reconnaissance Workshop Promotes Research and Operations Partnership. *Bulletin of the American Meteorological Society*, **103**, no. 3: E810-E816.
- Stewart, B. E., J.M. Cordeira, and F.M. Ralph, 2022: Evaluating GFS and ECMWF Ensemble Forecasts of Integrated Water Vapor Transport Along the U.S. West Coast. *Weather and*

Forecasting, 50 pp., doi: 10.1175/WAF-D-21-0114.1

- Hecht, C.W., A.C. Michaelis, A.C. Martin, J.M. Cordeira, F. Cannon, F.M. Ralph, 2022: Illustrating ensemble predictability across scales associated with the 13-15 February 2019 atmospheric river event: *Bulletin, American Meteorological Society*, **103**, E911-E922, doi: 10.1175/BAMS-D-20-0292.1.
- Garreaud, R., F.M. Ralph, A.M. Wilson, A.M. Ramos, J. Eiras-Barca, H.C. Steen-Larsen, J.J. Rutz, C. Albano, N. Tilinina, M. Warner, and M. Viale, 2022: Running a scientific conference during pandemic times: *Bulletin, American Meteorological Society*, **103**, E1650-E1657, doi: 10.1175/BAMS-D-22-0023.1
- Gorooh, V.A., E.J. Shearer, P. Ngyugen, K. Hsu, S. Sorooshian, F. Cannon, and F.M. Ralph, 2022: Performance of new near-real-time PERSIANN product (PDIR-Now) for atmospheric river events over the Russian River basin, California: *Journal of Hydrometeorology*, **23**, 1899-1911, doi: 10.1175/JHM-D-22-0066.1.
- Woodside, G.D., A.S. Hutchinson, F.M. Ralph, C. Talbot, R.K. Hartman, and C. Delaney, 2022: Increasing stormwater capture and recharge using forecast informed reservoir operations, Prado Dam: *Groundwater*, **60**, 636-640, doi: 10.1111/gwat.13162.
- Stewart, B. E., J. M. Cordeira, and F.M. Ralph, 2022: Evaluating GFS and ECMWF ensemble forecasts of integrated water vapor transport along the US West Coast. *Weather and Forecasting* 37.11 (2022): 1985-2004, doi: 10.1175/WAF-D-21-0114.1
- Wilson, A. M., A. Cobb, F. M. Ralph, V. Tallapragada, C. Davis, J. Doyle, L. Delle Monache et al, 2022: Atmospheric River Reconnaissance Workshop Promotes Research and Operations Partnership. *Bulletin of the American Meteorological Society* **103**, no. 3 (2022): E810-E816, doi: 10.1175/BAMS-D-21-0259.1
- Guirguis, K., A. Gershunov, B. Hatchett, T. Shulgina, M.J. DeFlorio, A.C. Subramanian, J. Guzman-Morales, R. Aguilera, R. Clemesha, T.W. Corringham, and L. Delle Monache, 2022: Historical Catalog of Winter Weather Regimes Impacting California, 1949-2017, doi: 10.6075/J089161B
- Cobb, A., J.M. Cordeira, M.D. Dettinger, C. Aikens, C. Delaney, J. Forbis, J. Jasperse, R.K. Hartman, F.M. Ralph, E. Sumargo, C. Talbot, A.M. Wilson, and E. Yeates, 2023: A multidisciplinary training opportunity for the next generation of Forecast-Informed Reservoir Operations (FIRO) collaborators: *Bull., Amer. Meteorol. Soc.*, **104**, pp. E1372-E138, doi: 10.1175/BAMS-D-23-0004.1
- Howard, I., D. Stahle, M.D. Dettinger, C. Poulsen, F.M. Ralph, F.M., M.C.A. Torbenson, and A. Gershunov, 2023: A 440-yr reconstruction of heavy precipitation in California from blue-oak tree rings: *J. Hydromet.*, **24**, 463-477, doi: 10.1175/JHM-D-22-0062.1

- Lord, S.J., X. Wu, V. Tallapragada, and F.M. Ralph, 2023: The impact of dropsonde data on the performance of the NCEP Global Forecast System during the 2020 Atmospheric Rivers Observing Campaign—Part I, Precipitation: *Wea. Forecast.*, **38**, 17-45, doi: 10.1175/WAFD-22-0036.1.
- Reynolds, C.A., R.E. Stone, J.D. Doyle, N.L. Baker, A.M. Wilson, F.M. Ralph, D.A. Lavers, A.C. Subramanian, and L. Centurioni, 2023: Impacts of Northeastern Pacific Buoy Surface Pressure Observations: *Mon. Wea. Rev.*, **151**, 211-226, doi: 10.1175/MWR-D-22-0124.1.
- Guirguis, K., A. Gershunov, B. Hatchett, T. Shulgina, M.J. DeFlorio, A.C. Subramanian... & F.M. Ralph, 2023: Winter wet–dry weather patterns driving atmospheric rivers and Santa Ana winds provide evidence for increasing wildfire hazard in California. *Clim. Dynam.*, **60**, 1729-1749, doi: 10.1007/s00382-022-06361-7
- Shields, C.A., A.E. Payne, E.J. Shearer, M.F. Wehner, T.A. O’Brien, J.J. Rutz, L.R. Leung, F.M. Ralph, et al., 2023: Future atmospheric rivers and impacts on precipitation: Overview of the ARTMIP Tier 2 high-resolution global warming experiment. *Geophysical Research Letters*, **50**(6), p.e2022GL102091, doi: 10.1029/2022GL102091
- Gorodetskaya, I.V., C. Durán-Alarcón, S. González-Herrero...F.M. Ralph,... et al., 2023: Record-high Antarctic Peninsula temperatures and surface melt in February 2022: a compound event with an intense atmospheric river. *npj climate and atmospheric science*, **6**(1), p.202, doi: 10.1038/s41612-023-00529-6
- DeHaan, L.L., A.M. Wilson, B. Kawzenuk...and F.M. Ralph, 2023: Impacts of Dropsonde Observations on Forecasts of Atmospheric Rivers and Associated Precipitation in the NCEP GFS and ECMWF IFS Models. *Weather and Forecasting*, **38**(12),2397-2413, doi: 10.1175/WAF-D-23-0025.1
- Badrinath, A., L. Delle Monache, N. Hayatbini, W. Chapman, F. Cannon, and F.M. Ralph, 2023: Improving precipitation forecasts with convolutional neural networks. *Weather and Forecasting*, **38**(2), pp.291-306, doi: 10.1175/WAF-D-22-0002.1
- Shulgina, T., A. Gershunov, B.J. Hatchett, K. Guirguis, A.C. Subramanian, S.A. Margulis... & F.M. Ralph, 2023: Observed and projected changes in snow accumulation and snowline in California’s snowy mountains. *Climate Dynamics*, **61**(9), 4809-4824, doi: 10.1007/s00382-023-06776-w
- Guirguis, K., A. Gershunov, B.J. Hatchett, M.J. DeFlorio, A.C. Subramanian, R. Clemesha, L. Delle Monache, and F.M. Ralph, 2023: Subseasonal prediction of impactful California winter weather in a hybrid dynamical–statistical framework. *Geophysical Research Letters*, **50**(23), p.e2023GL105360, doi: 10.1029/2023GL105360

- Zhang, Z., M.J. DeFlorio, L. Delle Monache, A.C. Subramanian, F.M. Ralph, D.E. Waliser, M. Zheng, B. Guan, A. Goodman, A.M. Molod, and F. Vitart, 2023: Multi-Model Subseasonal Prediction Skill Assessment of Water Vapor Transport Associated With Atmospheric Rivers Over the Western US. *Journal of Geophysical Research: Atmospheres*, **128**(7), p.e2022JD037608, doi: 10.1029/2022JD037608
- Zou, X., P.M. Rowe, I.V. Gorodetskaya, D.H. Bromwich, M.A. Lazzara, R.R. Cordero, Z. Zhang, B. Kawzenuk, J.M. Cordeira, J.D. Wille, and F.M. Ralph, 2023: Strong warming over the Antarctic Peninsula during combined atmospheric river and foehn events: contribution of shortwave radiation and turbulence. *Journal of Geophysical Research: Atmospheres*, **128**(16), p.e2022JD038138, doi: 10.1029/2022JD038138
- Castellano, C.M., M.J. DeFlorio, P.B. Gibson, L. Delle Monache, J.F. Kalansky, J. Wang, K. Guirguis, A. Gershunov, F.M. Ralph, A.C. Subramanian, and M.L. Anderson, 2023: Development of a statistical subseasonal forecast tool to predict California atmospheric rivers and precipitation based on MJO and QBO activity. *JGR Atmospheres*, **128**, p.e2022JD037360, doi: 10.1029/2022JD037360
- Lavers, D.A., R.D. Torn, C. Davis, D.S. Richardson, F.M. Ralph, and F. Pappenberger, 2023: Forecast evaluation of the North Pacific jet stream using AR Recon dropwindsondes. *Quart. J. Roy. Meteorol. Soc.*, **149**, pp.3044-3063, doi: 10.1002/qj.4545
- Gorodetskaya, I., Durán-Alarcón, C., Gonzalez-Herrero... F. M. Ralph... & B. Pohl, 2023: Compound drivers behind new record high temperatures and surface melt at the Antarctic Peninsula in February 2022, doi: 10.1038/s41612-023-00529-6
- Zou, X., J.M. Cordeira, S.M. Bartlett, B. Kawzenuk, S. Roj, C. Castellano, C. Hecht, and F.M. Ralph, 2023: Mesoscale and synoptic scale analysis of narrow cold frontal rainband during a landfalling atmospheric river in California during January 2021. *JGR Atmospheres*, **128**, p.e 2023JD039426, doi: 10.1029/2023JD039426
- Guan, B., D.E. Waliser and F.M. Ralph, 2023: Global application of the atmospheric river scale. *Journal of Geophysical Research: Atmospheres*, **128**, p.e 2022JD037180, doi: 10.1029/2022JD037180
- Hu, W., M. Ghazvinian, W.E. Chapman, A. Sengupta, F.M. Ralph, and L. Delle Monache, 2023: Deep learning forecast uncertainty for precipitation over the Western United States. *Monthly Weather Review*, **151**(6), pp.1367-1385, doi: 10.1175/MWR-D-22-0268.1
- Lavers, D.A., A.M. Wilson, F.M. Ralph, V. Tallapragada, F. Pappenberger, C. Reynolds, J.D. Doyle, L. Delle Monache, C. Davis, A. Subramanian, and R.D. Torn, 2024: Advancing atmospheric river science and inspiring future development of the Atmospheric River Reconnaissance Program. *Bul. Amer. Meteorol. Soc.*, **105**, pp.E75-E83, doi: 10.1175/BAMS-D-23-0278.1

- DeFlorio, M.J., A. Sengupta, C.M. Castellano... F.M. Ralph,... and M.L. Anderson, 2024: From California's extreme drought to major flooding: Evaluating and synthesizing experimental seasonal and subseasonal forecasts of landfalling atmospheric rivers and extreme precipitation during winter 2022/23. *Bull. Amer. Meteorol. Soc.*, **105**, E84-E104, doi: 10.1175/BAMS-D-22-0208.1
- Li, L., F. Cannon, M.R. Mazloff, A.C. Subramanian, A.M. Wilson, and F.M. Ralph, 2024: Impact of atmospheric rivers on Arctic Sea ice variations. *The Cryosphere*, **18**(1), pp.121-137, doi: 10.5194/tc-18-121-2024
- Lin, W.S., J.R. Norris, M.J. DeFlorio, and F.M. Ralph, 2024: Local and Object-based Perspectives on Atmospheric Rivers Making Landfall on the Western North American Coastline. *Journal of Hydrometeorology*, **25**, (5) pp.673-688, doi: 10.1175/JHM-D-22-0155.1
- Zhang, Z., F.M. Ralph, X. Zou, B. Kawzenuk, M. Zheng, I.V. Gorodetskaya, P.M. Rowe, and D.H. Bromwich, 2024: Extending the CW3E Atmospheric River Scale to the Polar Regions. *EGUsphere*, 2024, pp.1-36, doi: 10.5194/egusphere-2024-254
- Zheng, M., R. Torn, L. Delle Monache, J. Doyle, F.M. Ralph, V. Tallapragada, C. Davis, D. Steinhoff, X. Wu, A.M. Wilson, and C. Papadopoulos, 2024: An Assessment of Dropsonde Sampling Strategies for Atmospheric River Reconnaissance. *Monthly Weather Review*, **152**(3), pp.811-835, doi: 10.1175/MWR-D-23-0111.1
- Zheng, M., L. Delle Monache, X. Wu, B. Kawzenuk, F.M. Ralph, Y. Zhu, R. Torn, V.S Tallapragada, Z. Zhang, K. Wu, and J. Wang, 2024: Impact of Atmospheric River Reconnaissance Dropsonde Data on the Assimilation of Satellite Radiance Data in GFS. *J. Atmospheric and Oceanic Technol.*, **41**, 819-832.
- Wille, J.D., S.P. Alexander, C. Amory,...F.M. Ralph...et al., 2024: The extraordinary March 2022 East Antarctica "heat" wave. Part I: observations and meteorological drivers. *Journal of Climate*, **37**(3), pp.757-778, doi: 10.1175/JCLI-D-23-0175.1
- Wille, J.D., S.P. Alexander, C. Amory,... F.M. Ralph,...et al., 2024: The extraordinary March 2022 East Antarctica "heat" wave. Part II: impacts on the Antarctic ice sheet. *Journal of Climate*, **37**(3), pp.779-799, doi:10.1175/JCLI-D-23-0176.1
- Martens, H.R., N. Lau, M.J. Swarr, D.F. Argus, Q. Cao, Z.M. Young, A. Borsa, M. Pan, A.M. Wilson, E. Knappe, F.M. Ralph and W.P. Gardner, 2024: GNSS geodesy quantifies water storage gains and drought improvements in California spurred by atmospheric rivers. *Geophys. Res. Lett.*, **51**, e2023GL107721, doi: 10.1029/2023GL107721
- Bromwich, D. H., I.V. Gorodetskaya, S. Carpentier... F.M. Ralph...and X. Zou, 2024: Winter

- Targeted Observing Periods during the Year of Polar Prediction in the Southern Hemisphere (YOPP-SH). *Bull. Amer. Meteorol. Soc.*, 105, E1662-E1684.
- Frank, L.R., V.L. Galinsky, Z. Zhang, and F.M. Ralph, 2024: Characterizing the Dynamics of Multi-Scale Global High Impact Weather Events. *Scientific Reports*, doi: 10.21203/rs.3.rs-4193430/v1
- Ghazvinian, M., L. Delle Monache, V.A. Gorooh... and F.M. Ralph, 2024: Deep Learning of a 200-member Ensemble with a Limited Historical Training to improve the prediction of Extreme Precipitation Events. *Monthly Weather Review*, 152, 1587-1605, doi: 10.1175/MWR-D-23-0277.1
- Wang, J., M.J. DeFlorio, A. Gershunov, K. Guirguis, L. Delle Monache, F.M. Ralph, 2024: Association of western US compound hydrometeorological extremes with Madden-Julian oscillation and ENSO interaction. *Commun Earth Environ* 5, 314. <https://doi.org/10.1038/s43247-024-01449-w>
- Guirguis, K., B. Hatchett, A. Gershunov, M. DeFlorio, R. Clemesha, W.T. Brandt, K. Haleakala, C. Castellano, R. Luna Niño, A. Tardy, M. Anderson and F. M. Ralph, 2024: Reinterpreting ENSO's role in modulating impactful precipitation events in California, *Geophys. Res. Lett.*, 51, e2024GL110326
- Yang Z, MJ DeFlorio, A Sengupta, J Wang, CM Castellano, A Gershunov, K Guirguis, E Slinsky, B Guan, L Delle Monache, and FM Ralph, 2024: Seasonality and climate modes influence the temporal clustering of unique atmospheric rivers in the Western U.S. *Commun Earth Environ*, 5, 734. doi: 10.1038/s43247-024-01890-x. Epub 2024 Nov 23. PMID: 39583331; PMCID: PMC11584389.
- Ralph, F.M., M. Simpson, S.F. Iacobellis, J.M. Cordeira, F. Cannon, A. Cobb, A.C. Michaelis, and L. Delle Monache, 2024: Dropsonde Observations of the Stable Marine Boundary Layer Beneath Atmospheric Rivers. *Mon. Wea. Rev.* 152, 2735-2751.
- Cordeira, J.M., Ralph, F.M., Talbot, C., Forbis, J., Novak, D.R., Nelson, J.A., Mahoney, K., Weihs, R., Slinsky, E. and Delle Monache, L., 2025. A Summary of US Watershed Precipitation Forecast Skill and the National Forecast Informed Reservoir Operations Expansion Pathfinder Effort. *Wea. Forecast.* 40, 1529–1542. <https://doi.org/10.1175/WAF-D-24-0188.1>
- Sengupta, A., Waliser, D.E., DeFlorio, M.J., Guan, B., Delle Monache, L. and Ralph, F.M., 2025. Role of evolving sea surface temperature modes of variability in improving seasonal precipitation forecasts. *Commun Earth Environ* 6, 256 (2025). <https://doi.org/10.1038/s43247-025-02235-y>.
- Poulsen, C.D., Clemesha, R.E., Howard, I.M., Gershunov, A., Dettinger, M.D., Zhang, Z.,

- Luna-Niño, R., Stahle, D.W. and Ralph, F.M., 2025. The 1991 California ‘Miracle March’: precipitation myth or miracle?. *Environ. Res. Commun.*, 7(5), p.051004. 10.1088/2515-7620/add3cc.
- Rowe, P.M., Zou, X., Gorodetskaya, I., Stillwell, R.A., Cordero, R.R., Bromwich, D., Zhang, Z., Ralph, F.M. and Neshyba, S., 2025. Comparison of cloud and radiation measurements to models over the Southern Ocean at Escudero Station, Island. *J. Geophys. Res – Atmos.*, 130(16), p.e2025JD043563.
- Rowe, P.M., Zou, X., Gorodetskaya, I., Stillwell, R.A., Cordero, R.R., Sepulveda, E., Bromwich, D.H., Zhang, Z., Ralph, F.M. and Neshyba, S., 2025. Observations of clouds and radiation over King George Island and implications for the Southern Ocean and Antarctica. *J. Geophys. Res – Atmos.*, 130(18), p.e2024JD042787.
- Guan, B., Waliser, D.E., Ralph, F.M. and Zheng, M., 2025. Lightning characteristics of atmospheric rivers over the Americas observed by GOES-16. *Geophys. Res. Lett.*, 52(22), p.e2025GL118477.
- Wang, J., Lavers, D.A., Delle Monache, L., Ingleby, B., Zheng, M., Wu, X., Ralph, F.M. and Pappenberger, F., 2025. Impacts of atmospheric river reconnaissance dropsondes on ECMWF Integrated Forecasting System precipitation forecasts. *Quart. J. Roy. Meteorol. Soc.*, p.e70019.
- Luna-Niño, R., Gershunov, A., Ralph, F.M., Weyant, A., Guirguis, K., DeFlorio, M.J., Cayan, D.R. and Williams, A.P., 2025. Heresy in ENSO teleconnections: atmospheric rivers as disruptors of canonical seasonal precipitation anomalies in the Southwestern US. *Clim. Dyn.*, 63(2), p.115.
- Zheng, M., Ralph, F.M., Wu, X., Guan, B., Waliser, D., Genkova, I., Delle Monache, L., Tallapragada, V., Zhang, Z., Santek, D. and Li, Z., 2025. Comparison of GOES-17 atmospheric motion vectors with AR Recon dropsonde data and assessment of wind fields in the Global Forecast System during Atmospheric River Events. *J. Geophys. Res. – Atmos.*, 130(18), p.e2024JD043267.
- Lavers, D.A., Centurioni, L., Wilson, A.M., Ingleby, B. and Ralph, F.M., 2025. An overview of drifting-buoy deployments in atmospheric river reconnaissance from 2019 to 2024. *Quart. J. Roy. Meteorol. Soc.*, p.e5049.
- Battula, S.B., Cordeira, J.M. and Ralph, F.M., 2025. Characteristics and predictability of extreme precipitation related to atmospheric rivers, mesoscale convective systems, and tropical cyclones in the US Southeast. *J. Geophys. Res. – Atmos.*, 130(15), p.e2024JD042471.
- Nash, D., Rutz, J.J., Cordeira, J., Zhang, Z., Ralph, F.M., Sanders, K. and Walter, E., 2025. A Trajectory-based method for estimating the contribution of landfalling atmospheric rivers

- to top-decile precipitation across Colorado. *J. Geophys. Res. – Atmos*, 130(17), p.e2025JD043580.
- Rush, W.D., Lora, J.M., Skinner, C.B., Menemenlis, S.A., Shields, C.A., Ullrich, P., O'Brien, T.A., Brands, S., Guan, B., Mattingly, K.S., McClenny, E., and F.M. Ralph, 2025. Atmospheric river detection under changing seasonality and mean-state climate: ARTMIP tier 2 paleoclimate experiments. *J. Geophys. Res. – Atmos*, 130(1), p.e2024JD042222.
- Cordeira, J.M., Kawzenuk, B.K., Bartlett, S.M., Hecht, C., Castellano, C., Roj, S. and Ralph, F.M., 2025. A Case Study of Forecast Uncertainty Prior to a High-Impact Landfalling Atmospheric River in California in January 2021. *Wea. Forecast.* **40**, 1543–1561. <https://doi.org/10.1175/WAF-D-24-0088.1>
- Delle Monache, L., Steinhoff, D.F., Weihs, R., Simpson, M., Ghazvinian, M., Afzali Goroooh, V., Lupo, K.M., Mulrooney, P., Papadopoulos, C. and Ralph, F.M., 2025. CW3E's West-WRF 200-member Ensemble. *Mon. Wea. Rev.*, p. 1401-1429, <https://doi.org/10.1175/MWR-D-24-0136.1>.
- Ogle, S.E., McGurk, G., Jensen, A., Ralph, F.M. and Levy, M.C., 2025. Imagery classification of stream stage to support ephemeral stream monitoring. *EGUsphere*, 2025, pp.1-54.
- Goroooh, V.A., Sengupta, A., Roj, S., Weihs, R., Kawzenuk, B., Monache, L.D., and Ralph, F.M., 2025. Enhancing Deterministic Freezing Level Predictions in the Northern Sierra Nevada Through Deep Neural Networks. *arXiv preprint arXiv:2504.11560*.
- Zou, X., Cordeira, J.M., Bartlett, S.M. and Ralph, F.M., 2025. A case study of an exceptional atmospheric river and explosively deepening cyclone over the US central plains in March 2019. *J. Geophys. Res. – Atmos*, 130(1), p.e2024JD042309.
- Gershunov, A., Hatchett, B., Weyant, A., Dettinger, M., Su, L., Rhoades, A., Williams, P., Anderson, M., Rittelmeyer, P., Lettenmayer, D., Cayan, D. and Ralph, F.M., 2025. Atmospheric Rivers and Floods in California's Changing Hydroclimate. *San Francisco Estuary and Watershed Science*, 23(3).
- Lin, W.S., Norris, J.R., DeFlorio, M.J., Rutz, J.J., Cordeira, J.M. and Ralph, F.M., 2025. Characteristics of precipitation patterns in moisture-dominated versus wind-dominated atmospheric rivers over Western North America. *J. Geophys. Res. – Atmos*, 130(9), p.e2024JD041966.
- Viale, M., Garreaud, R., and Ralph, F.M., 2025. Atmospheric Rivers in Southern South America. *Oxford Research Encyclopedia of Climate Science*. Retrieved 7 Jan. 2026, from <https://oxfordre.com/climatescience/view/10.1093/acrefore/9780190228620.001.0001/acrefore-9780190228620-e-987>.

- Yang, Y., Pan, M., Feng, D., Xiao, M., Dixon, T., Hartman, R., Shen, C., Song, Y., Sengupta, A., Monache, L.D. and Ralph, F.M., 2025. Improving Streamflow Simulation through Machine Learning-Powered Data Integration and Its Implications for Forecasting in the Western US. *EGUsphere*, 2025, pp.1-29.
- Zheng, M., Ralph, F.M., Wu, X., Guan, B., Waliser, D.E., Genkova, I., Delle Monache, L., Tallapragada, V., Zhang, Z., Santek, D. and Li, Z., 2025. Validation of GOES-16/17 Atmospheric Motion Vectors Using AR Recon Dropsonde Data and Assessment of Wind Fields in the Global Forecast System at NCEP. *Authorea Preprints*.
- Xiao, M., Pan, M., Yang, Y., Cao, Q., Dixon, T., Lewis, G., Su, L., Hartman, R., DeFlorio, M.J., Kalansky, J.F., Delle Monache, L. and Ralph, F.M., 2025. LSTM-based Post-Processing Improves Streamflow Prediction in the Sierra Nevada. *Authorea Preprints*.
- Slinsky, E.A., Rutz, J.J., Guan, B. and Ralph, F.M., 2025. The NCEI Historical Data Record for Atmospheric Rivers: Visualization over the Western United States. *Bull. Amer. Meteorol. Soc.*, 106(12), pp.E2598-E2605.

Books or Book Chapters

- Ralph, F.M. (Chief Editor), M.D. Dettinger, D. Waliser, J.J. Rutz (Co-Editors), 2020: Atmospheric Rivers. Springer, 286 pp.
- Ralph, F.M., M. Dettinger, L. Schick and M. Anderson, 2020: Introduction to Atmospheric Rivers. In Atmospheric Rivers. F.M. Ralph, M. D. Dettinger, J. J. Rutz, D. E. Waliser. Eds. Springer, 286 pp.
- Ralph, F.M., A. White, G. Wick, M. L. Anderson and J. J. Rutz, 2020: Observing and Detecting Atmospheric Rivers. In Atmospheric Rivers. F.M. Ralph, M. D. Dettinger, J. J. Rutz, D. E. Waliser. Eds. Springer, 286 pp.
- Ralph, F.M., D. Waliser, M.D. Dettinger, J.J. Rutz, M.L. Anderson, I. Gorodetskaya, B. Guan and W. Neff, 2020: The Future of Atmospheric River Research and Applications. In Atmospheric Rivers. F.M. Ralph, M. D. Dettinger, J. J. Rutz, D. E. Waliser. Eds. Springer, 286 pp.
- Rutz, J.J., B. Guan, D. Bozkurt, I. Gorodetskaya, A. Gershunov, D.A. Lavers, K.M. Mahoney, B.J. Moore, W. Neff, P.J. Neiman, F.M. Ralph, A.M. Ramos, H.C. Steen-Larsen, M. Tsukernik, R. Valenzuela, and M. Viale, 2020: Global and Regional Perspectives on Atmospheric Rivers. In Atmospheric Rivers. F.M. Ralph, M. D. Dettinger, J. J. Rutz, D. E. Waliser. Eds. Springer, 286 pp.
- Sodemann, H., H. Wernli, P. Knippertz, J.M. Cordeira, F. Dominguez, B. Guan, H. Hu, F.M.

Ralph and A. Stohl, 2020: Structure, Process and Mechanism of Atmospheric Rivers. In Atmospheric Rivers. F.M. Ralph, M. D. Dettinger, J. J. Rutz, D. E. Waliser. Eds. Springer, 286 pp.

Schick, L.J., M.L. Anderson, F.M. Ralph, M.D. Dettinger, D.A. Lavers, F. Pappenberger, D.S. Richardson and E. Zsoter, 2020: Applications of Knowledge and Predictions of Atmospheric Rivers. In Atmospheric Rivers. F.M. Ralph, M. D. Dettinger, J. J. Rutz, D. E. Waliser. Eds. Springer, 286 pp.

Cayan, D.R., Dettinger, M.D., Pierce, D., Das, T., Knowles, N., Ralph, F.M., and E. Sumargo, 2016: Natural Variability, Anthropogenic Climate Change, and Impacts on Water Availability and Flood Extremes in the Western United States, pp 17-44. In *Water Policy and Planning in a Variable and Changing Climate*. K.A. Miller, A.F. Hamlet, D.S. Kenney and K.T. Redmond. eds. CRC Press, 434 pp, ISBN 9781482227970.

Other reports:

NOAA, 2012: Understanding the Water Cycle: Findings from NOAA's Water Cycle Science Challenge Workshop, 60 pp, F. M. Ralph and R. Davis Co-Chairs, <http://www.esrl.noaa.gov/psd/events/2011/pdf/waterCycle-report-reformat.final.pdf>.

Porter, Keith, Wein, Anne, Alpers, Charles, Baez, Allan, Barnard, Patrick, Carter, James, Corsi, Alessandra, Costner, James, Cox, Dale, Das, Tapash, Dettinger, Michael, Done, James, Eadie, Charles, Eymann, Marcia, Ferris, Justin, Gunturi, Prasad, Hughes, Mimi, Jarrett, Robert, Johnson, Laurie, Dam Le-Griffin, Hanh, Mitchell, David, Morman, Suzette, Neiman, Paul, Olsen, Anna, Perry, Suzanne, Plumlee, Geoffrey, Ralph, Martin, Reynolds, David, Rose, Adam, Schaefer, Kathleen, Serakos, Julie, Siembieda, William, Stock, Jonathon, Strong, David, Sue Wing, Ian, Tang, Alex, Thomas, Pete, Topping, Ken, and Wills, Chris; Jones, Lucile, Chief Scientist, Cox, Dale, Project Manager, 2011: Overview of the ARkStorm scenario: U.S. Geological Survey Open-File Report 2010-1312, 183 p. and appendixes.

CalWater Science White Paper, 2012: Precipitation, aerosols and Pacific atmospheric rivers experiment. <http://www.esrl.noaa.gov/psd/calwater/pdf/CalWater2-08July14.pdf>, 29 pp, F.M. Ralph, K. Prather, D. Cayan (co-leads), R. Spackman, M. Dettinger, C. Fairall, R. Leung, D. Rosenfeld, S. Rutledge, D. Waliser.

FIRO Steering Committee Workplan, 2015: Lake Mendocino Forecast-Informed Reservoir Operations Viability Assessment Workplan, 329 pp, F. M. Ralph and J. Jasperse (co-chairs), M. Anderson, L. Brekke, M. Dillabough, R. Hartman, C. Jones, M. Dettinger, P. Rutten, C. Talbot, R. Webb.

Lake Mendocino Forecast Informed Reservoir Operations Preliminary Viability Assessment, 2017: 72 pp, F.M. Ralph and J. Jasperse (co-chairs), M. Anderson, L. Brekke, M.

Dillabough, R. Hartman, C. Jones, M. Dettinger, P. Rutten, C. Talbot, R. Webb.

Lake Mendocino Forecast Informed Reservoir Operations Final Assessment, 2020: 141pp, Jasperse, J., Ralph, F. M., Anderson, M., Brekke, L., Malasavage, N., Dettinger, M. D., Forbis, J., Fuller, J., Talbot, C., Webb, R., & Haynes, A. (2020). Lake Mendocino Forecast Informed Reservoir Operations Final Viability Assessment. UC San Diego. <https://escholarship.org/uc/item/3b63q04n>.

Prado Dam Forecast Informed Reservoir Operations Preliminary Viability Assessment, 2021: 122 pp, Ralph, F. M., Woodside, G., Anderson, M., Cleary-Rose, K., Haynes, A., Jasperse, J., Sweeten, J., Talbot, C., Tyler, J., Vermeeren, R. (2021). Prado Dam Forecast Informed Reservoir Operations Preliminary Viability Assessment. UC San Diego. Retrieved from <https://escholarship.org/uc/item/13091539>

Yuba Feather Forecast Informed Reservoir Operations Preliminary Viability Assessment, 2022: Ralph, F.M., James, J., Leahigh, J., Anderson, M., Forbis, J., Haynes, A., Jasperse, J., Lindley, S., Talbot, C., White, M. (2022). Yuba-Feather Forecast Informed Reservoir Operations: Draft Preliminary Viability Assessment. UC San Diego. Retrieved from <https://escholarship.org/uc/item/8x57n58b>

Panels, Invited Presentations, Academic Seminars and selected other Presentations

- 2025, Presenter, “Putting the “F” in FIRO: The Challenges and Opportunities of Better Predicting Extreme Precipitation and Stream Flow and the Storms That Produce Them,” 2025 AGU Conference, New Orleans, Dec.
- 2025, Presenter, “Atmospheric Rivers: From Science to Solutions,” 2025 AGU Conference, New Orleans, Dec.
- 2025, Invited, “Initial Condition Errors and Diabatic Heating Location Implications for AR Forecast Errors,” SA3NDBAR Workshop, Office of Naval Research (ONR), Monterey, CA, Dec.
- 2025, Panelist, “California Foundation on the Environment and the Economy,” California Foundation on the Environment and the Economy (CFEE), Nov
- 2025, Invited, "Atmospheric Rivers and FIRO," Cakebread Cellars, Napa, CA, Nov
- 2025, Panelist, “FIRO Documentation,” 12th Annual Forecast Informed Reservoir Operations Training & Workshop, SIO, La Jolla, CA, August
- 2025, Panelist, “Updates from FIRO Relevant Federal Agencies and Implications for FIRO,” 12th Annual Forecast Informed Reservoir Operations Training & Workshop, SIO, La Jolla, CA, August
- 2025, Invited, “The Global Precipitation Experiment,” AR Recon Workshop, La Jolla, CA, Oct.
- 2025, Keynote, “Center for Western Weather and Water Extremes (CW3E): From Science to Solutions,” Urban Resilience Conference, UC San Diego, Institute of the Americas, Oct.
- 2025, Invited, “CW3E & Navy Research Partnerships,” Rear Adm Jarrett, SIO visit, Sept.
- 2025, Invited, “Advancing the Forecast Skill of Extreme Rainfall Events and the Modeling of Hydrologic Response,” CIROH Annual Meeting, Tuscaloosa, AL, Sept.

- 2025, Invited, “Forecast-Informed Reservoir Operations (FIRO) at Howard Hanson Dam,” Tacoma Public Utilities, PUB, Board meeting, Sept.
- 2025, Invited, “Atmospheric River Reconnaissance, Filling Gaps in Pacific Weather Observations,” NASA Nurture Science meeting, Virtual, Sept.
- 2025, Keynote, “Emerging Approaches to Forecasting Extreme Precipitation in the Western US,” NHWC Conference, Tucson, AZ, June
- 2025, Invited, “Yuba-Feather Forecast-Informed Reservoir Operations (FIRO) Final Viability Assessment,” Oroville Citizen Advisory Commission (OCAC), June
- 2025, Invited, “Yampa Basin Rendezvous Atmospheric River (AR) impacts in the Yampa Basin,” YBR 8, Steamboat Springs, CO, May
- 2025, Invited, “Atmospheric River Research and AQPI”, San Mateo County Emergency Management, San Mateo, CA, May
- 2025, Panel, “Forecast Informed Reservoir Operations (FIRO),” ASCE Infrastructure Conference, Long Beach Convention Center, April
- 2025, Invited, “Forecast Informed Reservoir Operations (FIRO),” DWR California Water Commission, April
- 2025, Invited, “Increasing Water Management Flexibility Through Atmospheric River Science & Forecasting,” Water Education Foundation (WEF), Water Works 101, McGregor School of Law, Davis, CA, April
- 2025, Invited, Informational briefing on FIRO and Atmospheric Rivers, House Republican Caucus of California, US Capitol Building, Washington, DC, March 25, 2025
- 2025, Invited, “Atmospheric Rivers and the Global Atmospheric River Reconnaissance Program (GARRP),” TCORF/IHC, Winter Season Working Group, Florida, March.
- 2025, Invited, “Yuba-Feather FIRO and New Bullards Bar Water Control Manual Update,” Yuba County Board Presentation, Feb.
- 2025, Panelist, NOAA Research: Societal Challenges panel, Interagency Coordination within the Federal Weather Enterprise, “Managing Too Much and Too Little Water,” AMS 2025, New Orleans, Jan.
- 2025, Keynote, “Atmospheric Rivers and AR Recon,” Vaisala Event, AMS 2025, New Orleans, Jan.
- 2025, Invited, “Chasing Atmospheric Rivers,” AMS ICAMS session, AMS 2025, New Orleans, Jan.
- 2024, Invited, “Putting the “F” in FIRO: The Challenges and Opportunities of Better Predicting Extreme Precipitation and Stream Flow and the Storms That Produce Them,” Water and Society - FIRO, Dec, AGU 2024, Washington, DC
- 2024, Invited, “Atmospheric Rivers: From Science to Solutions,” Decision-Relevant Understanding of Weather and Climate Extremes and Their Impacts, Dec at AGU, Washington, DC
- 2024, Invited, “Forecast Informed Reservoir Operations (FIRO): Overview, Atmospheric Rivers and National Expansion,” National Association of County Officials, Dec at Sonoma, CA
- 2024, Panelist, “Forecast Informed Reservoir Operations (FIRO): Overview, Atmospheric Rivers and National Expansion,” Association of California Water Agencies, Indian Wells, CA, Dec.
- 2024, Invited, “AR Research, Observations and Prediction,” NOAA/Precipitation Prediction

- Grand Challenge Workshop, NOAA/NWS/NCEP, College Park, MD, Nov.
- 2024, Invited, “Atmospheric Rivers, Mesoscale Frontal Waves and Extreme Precipitation,” Precipitation Extremes from Atmospheric Rivers (PEAR) experiment, NOAA/NCEP/WPC, College Station, MD, Nov.
- 2024, Invited, “Yuba Feather FIRO and New Bullards Bar Water Control Manual Update,” Marysville, CA, Nov.
- 2024, Invited, “Advancing the Forecast Skill of Extreme Rainfall Events and the Modeling of Hydrologic Response,” CIROH Science Meeting, Tuscaloosa, AL, Oct.
- 2024, Invited, “Atmospheric River Reconnaissance: A Research And Operations Partnership (RAOP),” AR Recon Workshop, NCEP, College Park, MD, Oct.
- 2024, Invited, “Atmospheric Rivers: Driver of Compound Hydrologic Extreme Events from Drought to Flood,” Hagler Symposium, Hydro-climatological extremes and advances in the theory of compound Hazards, Texas A&M, College Station, TX, Oct.
- 2024, Keynote, “From Science to Solutions: The Arc of Atmospheric Rivers from Research to Practical Utility and Future Directions,” California Extreme Precipitation Symposium, UC Davis, July
- 2024, Panelist, “Global Precipitation Experiment (GPEX)” of WCRP, at the International Atmospheric River Conference, UC San Diego/Scripps Oceanography, June
- 2024, Invited, “Atmospheric Rivers: Overview and Situational Awareness Communication Using the AR Scale,” June, Broadcast Meteorology Conf., Myrtle Beach, South Carolina
- 2024, Seminar, San Diego OSHER group, UC San Diego, June
- 2024, Invited presentation, USAF, NOAA, NSWOP, Winter Season Reconnaissance Working Group, “AR Recon Overview”, Lakeland, FL., Mar.
- 2024, Invited, Society of American Military Engineers, “Atmospheric Rivers and Forecast-Informed Reservoir Operations: Addressing Climate Change,” Climate Change Webinar, Mar.
- 2024, Invited, “From Drought to Flood: Summary and Impacts of Atmospheric Rivers” California Caucus of US House of Representatives, Feb.
- 2024, Invited presentation, Hydro Outlook, San Joaquin Valley Water Managers meeting presentation to Rep. Jim Costa. Fresno, CA., Jan.
- 2024, Keynote and Panelist, “Interagency Coordination within the Federal Weather Enterprise” “Atmospheric River Reconnaissance: A Research And Operations Partnership” AMS, Baltimore, MD. Jan.
- 2023, Informational briefing at a Bipartisan, Bicameral meeting in the US Capital Building on the Atmospheric Rivers Reconnaissance, Operations and Warning Act under consideration in the US Senate and House, Nov, Washington, DC
- 2023, Lunch and Learn speaker, Pacific Northwest National Laboratory (PNNL) FIRO National Expansion Pathfinder: Science Background and Next Steps,” Virtual, Oct.
- 2023, Invited, CoCoRaHS Webinar, “Atmospheric Rivers,” Oct, Albany, NY.
- 2023, Seminar, SUNY Albany, NY., “Atmospheric Rivers and Forecast-Informed Reservoir Operations – FIRO,” Oct.
- 2023, Invited presentation, Assemblymember Chris Ward, San Diego, CA., Oct.
- 2023, Panelist, “FIRO National Expansion Pathfinder: Science Background and Next Steps” “Forecast Informed Reservoir Operations: Coming to a Community near you,” National

- Waterways Conference, Sacramento, CA., Oct.
- 2023, Panelist, Texas FIRO Workshop, “FIRO National Expansion Pathfinder: Science Background and Next Steps,” Univ. of Texas Arlington, TX, Sep.
- 2023, Luncheon speaker, Arizona Hydrological Society 2023 Annual Symposium, “Arizona Extreme Precipitation and Streamflow: Atmospheric Rivers and Summer Monsoon,” Flagstaff, AZ., Sep.
- 2023, Keynote, California Stormwater Quality Association (CASQA) Annual Conference, “Atmospheric Rivers and Extreme Precipitation,” San Diego, CA. Sep.
- 2023, Invited presentation, “Atmospheric Rivers and Forecast-Informed Reservoir Operations (FIRO),” National Water Supply Alliance Annual Meeting, Denver, CO., Sep.
- 2023, Keynote, Urban Water Institute, “Atmospheric Rivers and Forecast-Informed Reservoir Operations – FIRO,” San Diego, CA., Aug.
- 2023, Invited presentation, USACE Mekong - Mississippi Sister River Planning Meeting, “Atmospheric Rivers: Science to Solutions,” La Jolla, CA., Aug.
- 2023, Keynote, San Bernardino County Water Conference, “Atmospheric Rivers and Forecast-Informed Reservoir Operations - FIRO,” Ontario, CA., Aug.
- 2023, Invited opening presentation, “Atmospheric River Reconnaissance,” ECMWF, Reading, UK., Jun.
- 2023, Panelist, “Atmospheric Rivers”, National Association of Counties, Weathering Weather Whiplash: Ensuring Sustainable Water Supplies in the Face Record Drought and Flooding, St. George, UT, May
- 2023, Northwest Weather Workshop, “Atmospheric Rivers of early 2023” Seattle, WA., May
- 2023, Invited presentation, “From Drought to Flood and Science to Solutions” California Municipal Utilities Association, San Diego, CA., Apr.
- 2023, Panelist, Panel on “Future California Vision,” “From Drought to Flood and Science to Solutions,” 2023 ASCE Region 9 California Annual Infrastructure Symposium CAIS, San Diego, CA., Apr.
- 2023, Association of Women in Water, Energy & Environment (AWEEE), Panelist, “Preparing and Managing California Water from Dry to Drench”. Virtual, Mar.
- 2023, Invited presentation, “Atmospheric Rivers and Hydrometeorology”, San Diego Water Board, Mar.
- 2023, Invited presentation, “Forecast Informed Reservoir Operations FIRO “, San Diego County Water Authority Presentation.
- 2023, Invited presentation, “Improving forecasts of damaging storms”, California Joint Legislative Hearing, Feb.
- 2023, Invited presentation, “California has been broadsided repeatedly by what meteorologists call “atmospheric rivers” or a “Pineapple Express”. So-Cal Water Dialogue, Jan.
- 2023, NOAA Partner Webinar, “More Pacific Storm Atmospheric River with Heavy Precipitation and Wind”, Jan.
- 2023, NOAA Partner Webinar, Jan.
- 2022, Atmospheric rivers and forecast-informed reservoir operations (FIRO) CFEE Water Conference, Coronado, CA, Dec.
- 2022, Panelist, “Atmospheric Rivers: Connecting Oceans to Water Supply and Flood” United Nations/COP27, Ocean Pavilion, Sharm El Sheikh, Egypt, Nov.

2022, Panelist, American Water Resources Association, “Putting the “F” in FIRO (Forecasting),” Seattle, WA., Nov.

2022, Keynote, AR Recon Workshop, Oct.

2022, Keynote, Drought to Flood Symposium, California Dept of Water Resources, Dacramento, CA, Oct.

2022, Panelist, Salt River Project, Southwest Water Resiliency Conference, Natural Variability vs. Climate Change (Projections) and a Sustainable Water Supply, Oct.

2022, Invited presentation, IARC, Universidad de Los Lagos, Santiago, Chile, Oct.

2022, Panelist, Soil Moisture, Yampa Basin Rendezvous, Sept.

2022, Seminar, “Scripps Institution of Oceanography, Atmospheric rivers and Forecast-informed reservoir operations”, Southern Cross University, New South Wales, Australia, Aug.

2022, Panelist, Environmental Design, Flood & Drought Panel, ASCE Region 9 Annual California Infrastructure Symposium, April.

2022, Seminar, UCLA, "Careers in Earth System, Environment and Space Sciences", Feb.

2022, Keynote, West Cost Storms and 21st Century Innovations Supporting Water Decisions, NorCal PUG, Feb.

2022, Panelist, AMS 2023 Conference, virtual, Jan.

2022, FIRO Webinar series, #4, Jan. 2022.

2021, FIRO Webinar series, #3, Dec. 2021.

2021, FIRO Webinar series, #2, Nov. 2021.

2021, Invited presentation, Salt River Project Conference, Phoenix, AZ., Oct. 2021.

2021, Panelist, Orange County Water Summit, Water Prediction, Oct. 2021

2021, Invited presentation, FIRO Webinar series, #1, Oct. 2021.

2021, Invited presentation, Valley Water, “Atm. River Research” Vince Gin, June 2021.

2021, Invited presentation, Climate Information for Adaptation, “Atmospheric rivers and the development of situational awareness tools to support decision making related to weather and water extremes.” virtual, May 2021.

2021, Invited presentation, SDCWA Citizens Water Academy, “Climate Change and regional water supply” April 2021.

2021, Invited presentation, USAF, NOAA, CARCAH, SDM, EMC, NCEP, “Winter Season Reconnaissance Working Group, Overview AR Recon, virtual, April 2021

2021, “Climate and Weather Hazards Briefing, SANDAG, Scripps Oceanography, April 2021

2021, Invited presentation, ARTMIP: T2 Telecon: Reanalysis, Updates and Future Directions, Mar. 2021.

2021, Invited presentation, Texas Water Agencies, and affiliates, “FIRO” Webinar, Mar. 2021.

2021, Invited presentation, Brigadier General Owen, FIRO Introduction, Mar. 2021.

2021, Panelist, NWA Hydrocamp, “You Can’t Do It Alone- Multi-Agency Coordination of Reservoir” virtual, Feb. 2021.

2021, Panelist, AIH/AWRA “FIRO Introduction”, virtual, Jan. 2021.

2020, Panelist, Yuba Feather Workshop, FIRO 2.0, Jan. 2021.

2020, Invited presentation, AGU Dec. 2020.

2020, Invited presentation, NHA Hydropower Conference (NHA) 2020, California Regional Virtual Meeting, “Innovation Focus: Using Storm Forecasting to Operate Reservoirs Smarter and Safer”, Dec. 2020.

2020, Panelist, NOAA-DOE Precipitation Processes and Predictability Workshop, “Atmospheric Rivers and Their Impact on Precipitation Forecasts in the West Coast, Virtual, Dec. 2020.

2020, Panelist, CalEPA/OEHHA Indicators of Climate Change in California workshop: Exploring California Climate Change Connections, “California’s Changing Climate” Virtual, Dec. 2020.

2020, Seminar, AOS UCLA, "Atmospheric Rivers: Recent developments in science, impacts and policies" Virtual, Oct. 2020

2020, Invited presentation, IARC, Universidad del Los Lagos, Oct. 2020.

2020, Keynote presentation, BSMAR/SWEPSYM, "Bridging the Gap between Atmospheric Science and MAR!" Virtual, Oct. 2020.

2020, Seminar, Stonybrook University, NY, Virtual, Oct. 2020.

2020, Invited presentation, Yampa Basin Rendezvous 4-part Webinar series, A Dialogue on Measuring and Managing Seasonal Variability, Virtual, June 2020.

2020, Keynote, Northern California PUG, West Coast Storms and 21st Century Innovations Supporting Water Decisions, Feb. 2020.

2020, Invited presentation, AMS Boston, MA., Jan. 2020.

2020, FIRO Townhall, AMS Boston, “Forecast-Informed Reservoir Operations -- A Discussion of the Definition Under Development for the Glossary of Meteorology”, MA., Jan. 2020.

2019, Invited presentation, AGU, San Francisco, CA., Dec. 2019.

2019, Invited presentation, IARC, Universidad de Los Lagos, virtual Nov. 2019

2019, Invited presentation, Climate Change Vulnerability Assessment and Adaptation Workshop, Sacramento, CA., Sept. 2019.

2019, Keynote presentation, Floodplain Management Conference, San Diego, CA., Sept. 2019.

2019, Keynote presentation, San Bernardino County Water Conference, Ontario, CA., Aug. 2019.

2019, Invited presentation, California Foundation on the Environment Sink or Swim: Rising to the Resiliency Challenge, California’s Climate Outlook, Carlsbad, CA., Nov. 2019.

2019, Keynote presentation, 13th Annual SBC Water Conference, Urban Water Institute, San Diego, CA Aug. 2019.

2019, Invited presentation, Federal Interagency Sedimentation and Hydrologic Modeling Conference (SEDHYD), “Forecast-Informed Reservoir Operations: Lessons Learned From A Multi- Agency Joint Research and Operations Effort”, Reno, NV., June 2019

2019, Invited presentation, Yampa Basin Rendezvous, Steamboat Springs, CO., June 2019.

2019, Invited speaker, Association of California Water Agencies (ACWA) “Climate Change Resiliency: Capturing the Full Benefits of Atmospheric Rivers” Monterey, CA, May 2019.

2019, Seminar, University of Arizona, 2019

2019, Invited presentation, California Chamber of Commerce Water Policy Committee, Santa Monica, CA. Mar. 2019.

2019, Invited presentation, Southwest Extreme Precipitation Symposium (SWEPSYM) 2019, “CW3E Research and Applications Development on Southwest U.S. Extreme Precipitation” Mar. 2019.

2019, Invited presentation, AMS Sustainable Cities Network of Arizona, Jan 2019

2018, Panelist, AWRA Reservoir Operations Webinar, Oct. 2018.

2018, Keynote presentation, International Atmospheric Rivers Conference (IARC) 2018

- 2018, Panelist, AMS Washington Policy Forum, Washington, DC, April 2018.
- 2018, Invited presentation, Southwestern Extreme Precipitation Symp., La Jolla, CA, Mar.
- 2018, Seminar, Water Resources Research Center, Tucson, AZ, Feb. 2018.
- 2018, Panelist, California Irrigation Institute, Sacramento, CA, Jan. 2018.
- 2017, Invited presentation, New Zealand Annual Weather Conference, “Recent developments in atmospheric river science, prediction and applications,” Dunedin, New Zealand, Nov. 2017.
- 2017, Seminar, European Centre for Medium-Range Weather Forecasting (ECMWF), “Recent developments in atmospheric river science, prediction and applications,” in concert with the ECMWF Atmospheric River Meeting, Reading, U.K., 7 Sept. 2017.
- 2017, Invited presentation, Mesoscale Meteorology Conference, “Emergence of the Concept of Atmospheric Rivers,” San Diego, CA 25 July 2017.
- 2017, Keynote presentation, World Environmental and Water Resources Congress (EWRI-ASCE), “Atmospheric Rivers: Recent Developments in Science and Applications,” Sacramento, CA, 22 May 2017.
- 2017, Seminar, Universidad de Chile, “Atmospheric Rivers: Recent developments in science and applications,” Santiago Chile, 25 April 2017.
- 2017, Invited presentation, American Society of Civil Engineers California Annual Infrastructure Conference, “Unlocking the Science of Atmospheric rivers,” Los Angeles, CA, 31 March 2017
- 2017, Seminar, University of Arizona, Hydrology and Atmospheric Sciences Dept., “The Chiricahua Gap: A key to the wettest monsoon days in southeastern Arizona,” Tucson, AZ, 3 Feb 2017
- 2017, Seminar, Seattle Public Utilities Climate Science Seminar Series, “Unlocking the Science of Atmospheric rivers,” Seattle, WA, 23 Jan 2017
- 2016, Invited presentation, AGU, “Emergence of applications of the atmospheric river concept,” San Francisco, CA, 15 Dec 2016
- 2016, Keynote presentation, Association of California Water Agencies (ACWA), “Unlocking the Science of Atmospheric rivers,” Anaheim, CA, 30 Nov 2016
- 2016, National Water Resources Association (NWRA), Advanced weather forecasting and water supply panel, “Atmospheric rivers,” San Diego, CA 14 Nov 2016
- 2016, American Water Works Association/California-Nevada Section, Invited Banquet Speaker, “Atmospheric rivers,” San Diego, CA 25 Oct 2016
- 2016, California Extreme Precipitation Symposium, “Forecast-Informed Reservoir Operations on Lake Mendocino,” Sacramento, CA 6 Sep 2016
- 2016, Keynote presentation, “Evolution of the Concept of Atmospheric Rivers,” International Atmospheric Rivers Conference, La Jolla, CA, 8 Aug 2016
- 2016, Congressional Briefing on Frontiers in Western Water Operations, U.S. House of Representatives, Washington DC, 13 Jul 2016
- 2016, San Diego Regional Chamber of Commerce, San Diego, CA, 7 July 2016
- 2016, Atmospheric Rivers, Water Management Workshop, Sacramento, CA 30 June 2016
- 2016, Progress on FIRO at Scripps, FIRO Workshop, La Jolla, CA, 27 June 2016
- 2016, Congressional Briefing on Basic Geoscience Support of American Security, Sponsored by AGU, U.S. House of Representatives, Washington, DC, 12 May 2016

- 2016, Western U.S. Observational Needs Supporting Water Management, NOAA-Western States Water Council Workshop on Western Water Information Needs, NCEP, College Park MD, 29 April 2016
- 2016, Seminar, UC Irvine, “Atmospheric Rivers – Progress in Understanding and Applications,” Irvine, CA, April 2016
- 2016, California Environmental Dialogue, “Atmospheric Rivers,” Universal City, CA, March 2016
- 2016, Scripps Institution of Oceanography, CASPO Science Seminar, “Horizontal Water Vapor Transport: The role of atmospheric rivers and impacts on precipitation,” La Jolla, CA 5 Jan 2016
- 2015, AGU, Invited presentation, “Atmospheric river forecasting: Current capabilities, gaps and emerging directions,” San Francisco, CA 17 Dec 2015.
- 2015, Western States Water Council strategy meeting with Lower Colorado River water managers for subseasonal to seasonal precipitation forecasting for the western U.S., “The role of extreme events in seasonal precipitation,” Las Vegas, NV, 15 Dec 2015
- 2015, USGS Innovation Summit, invited presentation, “Pacific storms of the future,” Menlo Park, CA 11 Dec 2015.
- 2015, Association of California Water Agencies annual winter meeting, Panel discussion on atmospheric rivers with water managers, Indian Wells, CA 3 Dec 2015
- 2015, Winter Outlook Workshop, “The role of coastal SST anomalies during a strong El Nino in amplifying landfalling atmospheric river intensity,” Scripps Inst. Of Oceanography, La Jolla, CA 19 Nov 2015.
- 2015, Western States Water Council strategy meeting with Upper Colorado River Basin water managers for subseasonal to seasonal precipitation forecasting for the western U.S., “The roles of summer monsoon and winter atmospheric rivers in western U.S. extreme precipitation,” Salt Lake City UT, 19 Oct 2015.
- 2015, Western States Water Council, Water Resources Committee, “Westwide Weather and Water Monitoring System Needs and Summary of a Concept for Forecast-Informed Reservoir Operations (FIRO),” Manhattan KS, 8 Oct 2015.
- 2015, Atmospheric River Workshop, “A brief history of atmospheric rivers as a US West Coast focus,” Scripps Inst. of Oceanography, La Jolla, CA 15 June 2015.
- 2015, UCAR Weather Day on the Hill, Seasonal Prediction Panel, Wash. DC 14 May 2015.
- 2015, AMS Washington Policy Forum, Water Resources Panel, Wash. DC, 21-23 April 2015.
- 2015, “Atmospheric Rivers: California’s Rainmakers,” Perspectives on Ocean Science Public Lecture Series at Birch Aquarium, La Jolla, CA 13 April 2015.
- 2015, Sonoma County Climate Adaptation Forum, Panel on “Extreme Weather Science –Drought & Deluge in Sonoma County,” Sonoma St. Univ., Rohnert Park, CA 8 Apr 2015.
- 2015, California Water Policy Conference, Panel on “Atmospheric Rivers and Reservoirs: The Solution to California’s Drought?” Claremont, CA, 19 March 2015.
- 2015, “Anticipating extreme precipitation events,” Panel on “Climate Change: The New Normal, Bay Area Flood Protection Agencies Association (BAFPAA), Oakland, CA, 19 Feb 2015.
- 2015, Kickoff presentation at the Media Day for “CalWater-2015” field experiment, Sacramento,

- CA 3 Feb 2015.
- 2015, “CalWater 2015 field experiment,” AMS Annual Meeting, Phoenix, AZ, 7 Jan 2015.
- 2014, “Forecast-informed reservoir operations: A concept supporting water supply and flood control.” Presented at a Congressional Hill briefing on Univ. of California Water Research, House Rayburn Building, Wash. DC, 6 May 2014.
- 2013, “Atmospheric rivers: A brief review and emerging directions.” Seminar at Univ. of Notre Dame’s “*Environmental Fluid Dynamics & Environmental Change Initiative*” seminar series within the *Dept. of Civil and Environmental Engineering & Earth Sciences*,” South Bend, Indiana, September 2013.
- 2013, “Current and emerging directions in atmospheric river research and applications.” Keynote presentation at Univ. of Arizona’s *Atmospheric and Interdisciplinary Research Symposium*,” Tucson, s, April 2013.
- 2013, “Storms, floods and atmospheric rivers—Putting the extreme into West Coast extremes” An invited public lecture, Victoria, Canada, March 2013.
- 2013, “Atmospheric rivers Research and Applications” OAR seminar, Silver Spring, MD, Feb 2013.
- 2013, “A whirl-wind testbed tour: First stop, HMT.” Special symposium on advancing weather and climate forecasts: Innovative techniques and applications, Austin, Texas, Jan 2013.
- 2012, “Observed impacts of duration and seasonality of atmospheric-river landfalls on soil moisture and runoff in coastal northern California and the role of long-duration atmospheric rivers in creating extreme hydrometeorological events,” Invited presentation at Fall AGU session on “Hotspots on a Changing Planet: Identifying Water-Energy-Food Security Challenges Under a Changing Climate,” San Francisco, CA, Dec 2012.
- 2012, “Recent and emerging science and applications relating to precipitation and atmospheric rivers in the Western U.S.,” Seminar at University of California at Irvine, Oct 2012.
- 2012, Panel on “Perspectives on Emerging Mountain-Climate Institutions,” Mountain Climate Research Conference - 2012, Estes Park, Colorado, Oct 2012.
- 2012, “The emerging science of flooding in the Russian River watershed.” Seminar at Sonoma State Univ., Santa Rosa, California, Sept 2012.
- 2012, “21st Century Western Observing System for Extreme Precipitation: Research Developments and Implementation Alternatives.” Workshop on Extreme Weather Events: Science, Planning and Preparedness Sponsored by the Western States Water Council, San Diego, California, July 2012.
- 2012, “NOAA’s Hydrometeorology Testbed - HMT.” NOAA Testbed Workshop, Boulder, Colorado, May 2012.
- 2012, “Atmospheric rivers and observing networks.” Pacific Northwest Weather and Climate Outlook Forum: Dealing with Extreme Events – The Pacific Northwest. Sponsored by NOAA and Western Governors Association, Seattle, Washington, Apr 2012.
- 2012, “Physical understanding and forecasting of extreme west coast precipitation.” Presented to National Academy of Sciences/Boards of Atmospheric Sciences and Climate, La Jolla, California, Apr 2012.
- 2012, “Recent and emerging science and applications relating to precipitation and atmospheric rivers in the Western U.S.,” Seminar at University of Colorado Hydrology Research Series (invited), Boulder, Colorado, Mar 2012.

- 2012, "Recent and emerging science and applications relating to precipitation and atmospheric rivers in the Western U.S.," Seminar at University of Utah (invited), Salt Lake City, Utah, Mar 2012.
- 2012, "Recent and emerging science and applications relating to precipitation and atmospheric rivers in the Western U.S.," Seminar at NASA Jet Propulsion Laboratory, part of Colloquium Series on Water Resources (invited), Pasadena, California, Feb 2012.
- 2011, "Extreme events: Water hazards, and water supply," Symposium on Vulnerability and adaptation to extreme events in California in the context of a changing climate: New scientific findings, Scripps Institution of Ocean. (invited) La Jolla, CA, Dec 2011
- 2011, "Physical understanding and forecasting of extreme precipitation events and flooding: Atmospheric Rivers," AGU Fall Meeting, Hydroclimate Extremes: Monitoring, Diagnosis and Prediction (invited), San Francisco, Dec. 2011.
- 2011, "An Observing Network Design for Extreme Precipitation, Flooding and Climate," Workshop on Extreme Weather and Water Conditions in the Western U.S. – Linkages Between Data Collection Needs and Extreme Event Monitoring, Forecasting, Science and Hydroclimate Trend Detection (invited), Western States Water Council meeting, Idaho Falls, ID, Oct 2011.
- 2011, "Atmospheric Rivers," Univ. of Arizona (invited), Tucson, Arizona, Sep 2011
- 2011, "Observing System Needs – Hydrometeorology Testbed," AMS Summer Community Meeting, Boulder, CO, Aug. 2011
- 2011, "A Vision of Observations for Extreme Precipitation and Flooding in the Western U.S.," Western States Water Council, Bend, OR, Jul 2011.
- 2011, "ARkStorm: An Emergency Preparedness Scenario," Luncheon presentation at the National Hydrologic Warning Council conference, San Diego, CA, May 2011.
- 2011, "Atmospheric Rivers," Western States Water Council, San Diego, CA, Mar 2011
- 2010, "The role of atmospheric rivers in generating precipitation via orographic processes," COMET Forecaster Training Course on Intense QPF, Boulder, CO, Nov. 2010.
- 2010, "CalWater – Monitoring aerosols and atmospheric rivers," Invited presentation at the 2010 Water and Climate Change Adaptation Symposium," Long Beach, CA 19 October.
- 2010, "A multi-scale observational case study of a Pacific atmospheric river exhibiting tropical-extratropical connections and a mesoscale frontal wave," CMMAP (Center for Multi-scale Modeling of Atmospheric Processes) team meeting, 3 August 2010, Fort Collins, CO.
- 2010, "Weather, Water, and Climate Service Needs and Science Priorities," panelist at "NOAA SES Summit," 3 June 2010, Lansdowne, VA.
- 2010, "Grand Challenges in NOAA Water and Weather Science," Invited presentation at the "Workshop on Strengthening NOAA Science," 20 April 2010, Washington, DC.
- 2010, "Atmospheric Rivers," seminar at INSTAAR, 19 April 2010, Boulder, CO.
- 2010, "Climate systems observations and analysis: Summary and way forward," Presentation at ESRL Physical Sciences Lab Review, 11 March 2010, Boulder, CO.
- 2010, "Research to improve climate, weather and water services," Presentation at ESRL Physical Sciences Lab Review, 10 March 2010, Boulder, CO.
- 2009, "A Climatic look forward - Precipitation," invited presentation, South Platte Forum, Longmont, Colorado, 21 October 2009.

- 2009, "Water resources management and hydrology," Joint Executive Meeting of NOAA and the Indian Ministry of Earth Sciences (MoES), Delhi, India, 6 October 2009.
- 2009, "A Winter storm scenario for the USGS Multihazards demonstration project." Extreme Precipitation Symposium, Davis, CA, 24 June 2009.
- 2009, NCAR Advanced Study Program Seminar Series, "Atmospheric Rivers," 19 May 2009, Boulder, CO.
- 2009, AMS Annual Meeting, Opening presentation at the 13th Conference on Integrated Observing and Data Assimilation Systems; "Exploring the Potential of Unmanned Aircraft Systems (UAS) to Meet NOAA Mission Requirements Involving Weather, Water, Climate and Marine Ecosystems", 12 January 2009, Phoenix, AZ.
- 2008, Kickoff meeting of the USGS-led Multi-Hazards Project Winter Storm Scenario Planning, "California's Super Storm: Plausible Hydrometeorological Characteristics of a 'Worst- Case' Winter Storm in California," 29 October 2008, CalTech University, Pasadena, CA.
- 2008, NOAA Science Advisory Board; Overview of NOAA's UAS Project, 17 July 2008, Sandusky, OH
- 2008, NOAA Research Council; status report on the NOAA Unmanned Aircraft Systems Project – from Planning to execution, 5 May 2008, Silver Spring, MD.
- 2008, NOAA/OAR Senior Research Council; presentation of "Flooding on California's Russian River: Role of atmospheric rivers," which had been selected as an "OAR Outstanding Paper," 10 March 2008, Washington, DC
- 2007, Panel on "Industry, FAA and Agency Vision for Unmanned Aircraft Systems" at the Symposium on "Civilian Applications of Unmanned Aircraft Systems," 2 October 2007, Boulder, Colorado
- 2007: "A 21st Century Observing System for California Weather and Climate: Current Plans and Future Possibilities," California Climate Change Conference, 11 September 2007, Sacramento, California
- 2007: "Town Hall Meeting on Use of Unmanned Aircraft Systems in NOAA," at Association for Unmanned Vehicle Systems International (AUVSI) Conference, 8 August 2007, Washington, DC
- 2007: "Atmospheric Rivers: Connecting weather and climate in the water cycle," Seminar, Stanford University, 7 May 2007, Palo Alto, California.
- 2007: "Atmospheric Rivers: Connecting weather and climate in the water cycle," Presidential Forum at the 2007 AMS Annual meeting, 15 January 2007, San Antonio, Texas.
- 2006: "Testbeds: Bridging the Gap Between Observing Systems and Predictions," (Dedication of the Earth Systems Research Laboratory - ESRL, Boulder, CO, 24 Aug)
- 2006: Panelist on "Feasibility of Multi-Partner, Multifunctional Mesoscale Observing Networks," 2nd Annual Summer Community Meeting of the AMS Commission on the Weather, Climate Enterprise, 26-29 June 2006, Boulder, CO.
- 2006: "Atmospheric Rivers and Hydrometeorological Testbed" Panelist for H2Open Forum at American Water Works Association Annual Meeting, San Antonio, TX, 14 June
- 2006: "Profiling Needs for Boundary Layer Mesoscale Research and Operations," Keynote address at 7th International Symposium on Tropospheric Profiling: Needs and Technologies. Boulder, CO, 12 June.

- 2005: "NOAA Research Perspective on: Hydrometeorological Testbed." Presentation to the National Academy of Sciences', Committee on "The future of Rainfall Measuring Satellite Missions. Washington, DC 18 October.
- 2004: "Southern California Hydrometeorology and Flash Flood Forecasting." Presentation to The National Academies= ACommittee to Assess NEXRAD Flash Flood Forecasting Capabilities at Sulphur Mountain, California. Ventura, CA.
- 2004: "Atmospheric Rivers: Connecting weather and climate in the water cycle." 21st Annual Pacific Climate (PACLIM) Workshop, Monterey, CA.
- 2004: "Atmospheric Rivers: Connecting weather and climate in the water cycle." SCRIPPS Climate Seminar, La Jolla, CA.
- 2003: "Radar applications to winter-season West Coast research and forecasting in the CALJET and PACJET experiments" Amer. Meteor. Soc. Conference on Radar Meteorology, Seattle, WA.
- 2001: "Structure and Origins of Coastally Trapped Winds in Land-Falling Pacific Winter Storms in California" Gordon Research Conference on Coastal Ocean Circulation, New London, NH.
- 2001: "West Coast Precipitation." Lecture at COMET Hydrometeorological training Course for river forecasters, 30 November 2001.
- 2000: Pacific Coast Winter Storms: Societal Impacts, The Forecast Problem, and Exploring Solutions. Operation Sierra Storm, 19 January, 2000, South Lake Tahoe, NV. Symposium, 27-29 March, Boulder, CO.
- 1999: Mountain Wave Behavior and Forecasting. Lecture at COMET Mesoscale Analysis and Prediction Course, 23 August, Boulder, CO.
- 1999: The California Landfalling Jets Experiment (CALJET): Motivation, strategy, and description of a flooding event. Seminar at the California Weather Symposium, Sacramento, CA.
- 1999: A summary of CALJET observing systems for improved winter coastal storm prediction. National Weather Service Western Region Marine Forecaster Training Course, 25-28 May, Monterey, CA.
- 1998: Wind profiler applications and lee-side cold fronts. Winter Weather Workshop at the Denver office of the National Weather Service, Denver, CO.
- 1998: Observations of the marine environment: Profilers and other vertical structure along the coast. National Weather Service Western Region Marine Forecaster Training Course, 23-26 June, Monterey, CA.
- 1997: An overview of recent applications of wind profiler and RASS measurements in mesoscale meteorological studies and forecasting in the western United States. COST-76 Profiler Workshop, Engelberg, Switzerland.
- 1997: Appropriate roles of surface-based and in-situ observations. U. S. Weather Research Program, Data Assimilation Workshop, 8-10 December, Monterey, CA.