

Blue Hill Observatory Climate and Weather Conference 2026

Saturday, October 24, 2026. MEDITECH, 7 Blue Hill River Road, Canton, MA 02021

Agenda

7:45 AM – 4:00 PM Registration open

8:30 – 10:45 AM	Morning Symposium		
8:30 – 8:40 AM	Welcome, introductions, and overview		
8:40 – 9:10 AM	Is it Weather or Climate? (Invited) Bob Chen, Professor and Director of Grand Scholarly Initiatives, University of Massachusetts Boston		
9:15 – 10:30 AM	Breakout sessions		
	Climate & Weather	AI & Technology and the Future	Weathering the Journey
	9:15 – 9:40 AM Atlantic Basin Seasonal Hurricane Prediction and a Pressure-Based Hurricane Categorization Scale Philip Klotzbach, Department of Atmospheric Science, Colorado State University	9:15 – 9:40 AM Connecting Forecast Verification to Real-World Decision Making Ashley Rodriguez, Tomorrow.io	9:15 – 9:40 AM A Conversation with Kristina Shalhoup Kristina Shalhoup, 7NEWS
	9:40 – 10:05 AM Disentangling the Coastal Sea Level Record and Its Implications for This Winter’s Flood Risk Christopher Little, JANUS Research Group / Atmospheric and Environmental Research	9:40 – 10:05 AM Exploring Possible Futures in the En-ROADS Climate Solutions Workshop Curt Newton, MIT OpenCourseWare; Climate Interactive En-ROADS Ambassador	9:40 – 10:05 AM A Conversation with Jason Brewer Jason Brewer, Chief Meteorologist, Marsh Agency
	10:05 – 10:30 AM The AGAGE Network: Monitoring 50 Greenhouse Gases for 50 Years Dr. Luke Western, Research Scientist, MIT Center for Sustainability Science and Strategy	10:05 – 10:30 AM AI for Weather and Climate Extremes: Advances, Challenges, and Opportunities Diyali Goswami and Shuochen Wang, Sustainability and Data Sciences Lab, Northeastern University	10:05 – 10:30 AM A Conversation with Dr. Tamara Shapiro Ledley Dr. Tamara Shapiro Ledley, Chair of Board of Trustees, Blue Hill Observatory & Science Center
10:30 – 10:45 AM	Break		
10:45 AM – 12:00 PM	Keynote Keynote Address Dr. J. Marshall Shepherd, University of Georgia		
12:00 – 2:00 PM	Conference Lunch — Hillside Pub Join fellow attendees at Hillside Pub – 2 Royall Avenue, Canton, MA 02021 ↗! Enjoy 10% off food purchases. Lunch is purchased individually and is not included in registration.		
2:00 – 7:00 PM	Afternoon & Evening Sessions		
2:00 – 2:30 PM	The Arctic Meltdown and Extreme Weather: How Are They Connected? Jennifer Francis, Woodwell Climate Research Center		
2:30 – 3:00 PM	Community Engagement and Extreme Weather: Lessons from Building Climate Resilience Hubs Rev. Vernon K. Walker		
3:05 – 3:30 PM	A Changing Climate in Massachusetts: Updates from the EEA Office of Climate Science Dr. Caitlin Spence, Assistant Climate Scientist, Massachusetts Executive Office of Energy and Environmental Affairs, Office of Climate Science		
3:30 – 4:00 PM	Winter Forecast 2026–27 Winter Forecast Blue Hill Observatory meteorologists		
4:00 – 4:15 PM	Main session closing		

4:45 – 7:00 PM

Evening

Poster Session and Reception

At Blue Hill Observatory, 1 Observatory Service Rd, Milton, MA 02186

Combining Long-Term Station Records with a Low-Cost, High-Density Sensor Network to Quantify Urban Heat Stress in Rhode Island

Emma Witanowski, Department of Earth, Environmental and Planetary Sciences, Brown University

Local to Regional Drivers of Salinity and Seawater Oxygen Isotope Variability in Narragansett Bay: A Community Science Approach

Sophia Gao, Institute at Brown for Environment and Society

Temperature, Salinity, and Oxygen Isotopes in Narragansett Bay Estuaries: Seasonal Variability and Hydrological Extremes

Molly Coughlin, Barrington High School, Barrington, RI

Quantifying Atmospheric Drivers of Extreme Precipitation Associated with ITCZ Migration

You Zhang, Climate Dynamics Lab, Department of Marine and Environmental Sciences, Northeastern University

Understanding Rhode Island Hydrological Variability Through Water Isotopes: A Community Science Project

Sarah Knox, Brown University

Talks, abstracts, and speakers

8:40 – 9:10 AM

Is it Weather or Climate? (Invited)

Bob Chen, Professor and Director of Grand Scholarly Initiatives, University of Massachusetts Boston

ABSTRACT

Extreme weather events are becoming more common, and people often ask is this due to climate change or just wacky New England weather? The answer is yes. Weather events sitting on a decades long shifting baseline are difficult to predict, difficult to attribute, and difficult to prepare for. We will briefly explore how to understand and communicate these phenomena.

ABOUT THE SPEAKER

Bob Chen received his AB from Harvard University in Chemistry and Physics and his PhD in Oceanography from Scripps Institution of Oceanography. He lives in Milton and has remained at UMass Boston since 1992. His research interests include carbon biogeochemistry in coastal systems, sensor networks for estuarine health, and nature-based approaches for coastal resilience. He received the Margalef Prize for Excellence in Education from the Association of the Sciences for Limnology and Oceanography (ASLO) and currently serves as the President-Elect of ASLO. He also works with communities to tell stories of coastal adaptation, STEM diversity, and environmental justice.

9:15 – 9:40 AM, Climate & Weather

Atlantic Basin Seasonal Hurricane Prediction and a Pressure-Based Hurricane Categorization Scale

Philip Klotzbach, Department of Atmospheric Science, Colorado State University

ABSTRACT

This presentation will discuss the methodology behind Colorado State University's seasonal hurricane predictions, including an in-depth discussion of the outlook for the ongoing 2026 Atlantic hurricane season and a preliminary verification of the season given typically the season winds down by late October. We will discuss the modeling techniques that Colorado State University uses to issue its forecasts, including new artificial intelligence-based approaches. In addition, we will consider the implications of the current strong El Niño for the 2027 Atlantic hurricane season.

Hurricanes are currently categorized using the Saffir-Simpson Hurricane Wind Scale. While maximum sustained winds are a useful metric, we find that minimum sea level pressure is a more effective metric for conveying the potential threat that a hurricane causes. Minimum sea level pressure convolves both size and intensity into a single, easily-measured point-based metric. Minimum sea level pressure correlates better than maximum sustained wind with peak observed storm surge, hurricane-caused damage and hurricane-caused direct fatalities, with the biggest improvement occurring for storms making landfall from Georgia to Maine.

ABOUT THE SPEAKER

Phil Klotzbach is a Research Scientist in the Department of Atmospheric Science at Colorado State University where he received his Ph.D. in 2007. Klotzbach has worked in the Department of Atmospheric Science since 2000 and was co-author on the Atlantic basin hurricane forecasts with Dr. William Gray through 2005, becoming first author in 2006. He has authored over 100 articles in peer-reviewed meteorological and climate journals. Klotzbach has thru-hiked the Appalachian Trail from Georgia to Maine (2100+ miles) and has also climbed all 54 14,000 foot peaks in Colorado.

9:40 – 10:05 AM, Climate & Weather

Disentangling the Coastal Sea Level Record and Its Implications for This Winter’s Flood Risk

Christopher Little, JANUS Research Group / Atmospheric and Environmental Research

ABSTRACT

Coastal sea level variations are driven by a diverse set of physical processes, including the annual cycle, persistent seasonal-to-interannual climate modes (e.g., El Niño), and long-term contributions from glaciers and ice sheets. These processes do not affect every coastline in the same way, and they are superimposed on weather- and storm-driven water level variations. Understanding historical variations in sea level, and predicting their impact on coastal flood risk, thus requires disentangling the regional role of many different processes.

This talk will present several United States-focused case studies showing how tide gauges and high-resolution climate and ocean model simulations can be used together to interpret regional coastal sea level variability. This brief survey will also provide a basis for discussing the implications of the current strong El Niño on winter-season flooding risk in different parts of the country.

ABOUT THE SPEAKER

Dr. Christopher Little is a physical oceanographer and Principal Scientist at JANUS Research Group/Atmospheric and Environmental Research. His research seeks to improve understanding of physical controls on the rate of sea level change, focusing on: 1) coupled ocean-ice sheet interactions; and 2) the relationship between basin-scale sea level changes and those occurring at coastlines. He is the currently the lead principal investigator of the 5-year IGROWL project, focusing on the drivers of coastal flooding along the United States Gulf coast. Chris received his Ph.D. in Geosciences from Princeton University, and a B.A. in Chemistry from Williams College. Despite being a modeler by training, he is lucky enough to have set foot on both Greenland and Antarctica.

10:05 – 10:30 AM, Climate & Weather

The AGAGE Network: Monitoring 50 Greenhouse Gases for 50 Years

Dr. Luke Western, Research Scientist, MIT Center for Sustainability Science and Strategy

ABSTRACT

The AGAGE network has continuously monitored atmospheric composition for almost 50 years, providing critical data to assess their chemical and radiative effects. Now measuring over 50 compounds throughout the world, this talk will highlight some recent scientific achievements of the AGAGE network, show how these measurements directly support international treaties and assessments, and highlight the challenges in monitoring the most potent super polluting compounds.

ABOUT THE SPEAKER

Luke Western is a Research Scientist at MIT's Center for Sustainability Science and Strategy. He earned his PhD from the University of Bristol in the UK studying remote sensing of volcanic ash, then transitioned to atmospheric trace gas research at the University of Bristol and NOAA's Global Monitoring Laboratory. Luke leads the theory and modelling research efforts of the AGAGE monitoring network at MIT to quantify global emissions of ozone-depleting and climate-forcing gases using atmospheric observations and inverse modelling. He is a lead author of the United Nations’ 2026 Scientific Assessment of Ozone Depletion and was awarded the 2024 Dobson Award from the International Ozone Commission for his contribution to the field.

9:15 – 9:40 AM, AI & Technology and the Future

Connecting Forecast Verification to Real-World Decision Making

Ashley Rodriguez, Tomorrow.io

ABSTRACT

What makes a weather forecast useful? Traditional verification measures such as bias, root mean square error, and skill scores provide essential information about forecast performance. However, these measures alone do not fully describe how well a forecast supports the people making weather-sensitive decisions. A forecast may perform well on average while missing a brief period of strong winds, low visibility, or freezing temperatures that matters most to a particular user.

This presentation explores an approach to forecast evaluation that begins with the decisions that forecasts are intended to support. By combining statistical verification with meaningful weather thresholds and targeted examination of individual events, we can better understand when forecasts provide useful guidance and where important limitations remain. Examples drawn from aviation, commercial businesses, and insurance companies illustrate how the timing, location, and severity of weather conditions shape the relevance of specific forecast information.

The discussion also considers the role of observations in evaluating forecasts, including the challenges of assessing localized conditions where observing networks provide limited coverage. Matching forecasts and observations at appropriate spatial and temporal scales is essential to interpreting results and communicating uncertainty.

Connecting forecast performance to real-world customer needs provides a more meaningful basis for building trust in weather information. The goal is to help users understand what a forecast can reliably tell them, when greater caution is warranted, and how that information can support better-informed decisions.

9:40 – 10:05 AM, AI & Technology and the Future

Exploring Possible Futures in the En-ROADS Climate Solutions Workshop

Curt Newton, MIT OpenCourseWare; Climate Interactive En-ROADS Ambassador

ABSTRACT

In this interactive experience, participants test climate strategies and assess impacts in real-time using the free online En-ROADS Climate Solutions Simulator. This workshop enables you to test your intuitions and explore the implications of various global climate actions in a data-driven, collaborative setting.

ABOUT THE SPEAKER

Curt Newton is an experienced En-ROADS Climate Ambassador, facilitating activities with the free En-ROADS simulator in educational and civic settings. Professionally, he is Director of MIT OpenCourseWare, which shares free online learning materials from thousands of MIT courses and is used every year by millions of learners and educators around the world.

He works to spark and strengthen lifelong climate literacy and engagement through open knowledge programs and practices at MIT and beyond. His personal climate activism includes helping launch the Boston Green New Deal Coalition in 2022, living in a net-zero energy retrofit home, and performing improvised solo drumset concerts dedicated to climate action.

10:05 – 10:30 AM, AI & Technology and the Future

AI for Weather and Climate Extremes: Advances, Challenges, and Opportunities

Diyali Goswami and Shuochen Wang, Sustainability and Data Sciences Lab, Northeastern University

ABOUT THE SPEAKER

Shuochen Wang is a fourth-year PhD candidate in the Sustainability and Data Sciences Lab at Northeastern University, under the supervision of Prof. Auroop R. Ganguly. He holds a bachelor’s degree in Atmospheric Science and a master’s degree in Environmental Science at Carnegie Mellon University. His research focuses on applying machine learning to weather and climate modeling, with an emphasis on climate model parameterization, downscaling, and tropical cyclone track forecasting.

Diyali Goswami is a third-year PhD candidate in the Sustainability and Data Sciences Lab at Northeastern University. She holds a bachelor’s degree in Electronics and Computer Engineering and a master’s degree in Electrical and Computer Engineering from Northeastern University. Her research lies at the intersection of artificial intelligence and spatiotemporal systems, with a focus on nonlinear dynamical systems and AI-driven approaches to precipitation nowcasting. She has completed two Applied Scientist internships with Amazon Science, working on geospatial machine learning, and is a recipient of the Google TPU Research Cloud Award.

9:15 – 9:40 AM, Weathering the Journey

A Conversation with Kristina Shalhoup

Kristina Shalhoup, 7NEWS

ABOUT THE SPEAKER

Kristina Shalhoup is a certified meteorologist and a 7NEWS meteorologist. A New York University graduate, she began her career at the Golf Channel before moving into broadcast meteorology in 2016. Over eight years on air, she has covered severe storms, tornadoes, Nor’easters, hurricanes, and more. A lifelong competitive golfer, she was a four-year starter and three-year captain of NYU's golf team.

9:40 – 10:05 AM, Weathering the Journey

A Conversation with Jason Brewer

Jason Brewer, Chief Meteorologist, Marsh Agency

ABOUT THE SPEAKER

In my 26 years as a meteorologist, it’s been rewarding to communicate weather data in an understandable way that helps us protect from destructive weather and plan for future impacts. At Marsh Agency, I have the resources to help businesses and families manage the risks they face. Natural hazards and catastrophe risk to real estate, construction, & supply chains are a growing concern. Let's understand, mitigate, and adapt to these risks to build a resilient future.

10:05 – 10:30 AM, Weathering the Journey

A Conversation with Dr. Tamara Shapiro Ledley

Dr. Tamara Shapiro Ledley, Chair of Board of Trustees, Blue Hill Observatory & Science Center

ABOUT THE SPEAKER

Dr. Tamara Shapiro Ledley is a climate scientist and STEM education leader with a career spanning research, teaching, and science communication. She currently serves as chair of the Board of Trustees of the Blue Hill Observatory and Science Center; an Adjunct Professor at Bentley University, where she teaches Global Climate Change to undergraduate business students; and as a consultant through Sustaining Science Consulting. She was elected a 2026 Fellow of the American Geophysical Union "for fundamental research to enable impactful use of Earth system science data and information in education, business, and public decision-making." She previously served for 20 years as a senior scientist and chair of the Center for STEM Teaching and Learning at TERC. Dr. Ledley is a 2017 Harvard Advanced Leadership Initiative Fellow, an En-ROADS Climate Ambassador, and Secretary of the Education Section of the American Association for the Advancement of Science. She has served on the Blue Hill Observatory & Science Center Board since 2018. She holds a Ph.D. in Meteorology and Physical Oceanography from MIT and a B.S. in Astronomy from the University of Maryland.

10:45 AM – 12:00 PM, Keynote

Keynote Address

Dr. J. Marshall Shepherd, University of Georgia

ABOUT THE SPEAKER

Dr. J. Marshall Shepherd is the Georgia Athletic Association Distinguished Professor of Atmospheric Sciences at the University of Georgia and Director of its Atmospheric Sciences Program. He is a past President of the American Meteorological Society, hosts The Weather Channel's Weather Geeks, and is a widely followed voice on weather, climate, and their impact on society, contributing regularly to outlets including Forbes and CNN.

2:00 – 2:30 PM

The Arctic Meltdown and Extreme Weather: How Are They Connected?

Jennifer Francis, Woodwell Climate Research Center

ABSTRACT

Does it seem as though the weather gods have gone crazy lately? It is not your imagination. Is it related to climate change? I will discuss recent studies linking the rapidly warming and melting Arctic to increasing extreme weather events.

ABOUT THE SPEAKER

Jennifer Francis is a Senior Scientist at the Woodwell Climate Research Center in Falmouth, Massachusetts. Previously she spent 24 years as a Research Professor in the Department of Marine and Coastal Sciences at Rutgers University, where she studied the Arctic climate system and how rapid Arctic change is affecting areas beyond the Arctic, particularly extreme weather in the Northern Hemisphere. Jennifer earned a B.S. in Meteorology from San Jose State University in 1988 and a PhD in Atmospheric Sciences from the University of Washington in 1994. She and her husband circumnavigated the globe by sail during the early 1980s, including the Arctic, which is where her interest in the region began.

2:30 – 3:00 PM

Community Engagement and Extreme Weather: Lessons from Building Climate Resilience Hubs

Rev. Vernon K. Walker

ABOUT THE SPEAKER

Rev. Vernon K. Walker is a climate justice leader and minister who has spent his career building climate resilience in the communities most exposed to extreme weather. As the inaugural Program Manager and later Program Director of Communities Responding to Extreme Weather (CREW), he grew a national network of Climate Resilience Hubs from zero to more than 150 partner sites. He later served as Climate Justice Program Director at Clean Water Action and co-chaired the Climate Justice Work Group of Massachusetts's Global Warming Solutions Act Implementation Advisory Committee. Most recently, he served as On-Site Director of Brown University's Environmental Leadership Lab (BELL), which includes a summer residential program for high school students.

His climate justice work has been featured in the Boston Globe, WBUR, The Guardian, and on CBS Boston and NBC 10 Boston. He has lectured on climate justice and extreme weather at universities across the country, including Columbia University, Harvard University, Georgetown University, Rice University, Tufts University, Boston College, Northeastern University, Brandeis University, and Wellesley College, and he has been an annual invited speaker at Columbia's Climate Change and Health Boot Camp since 2023. He holds a Master of Public Policy from Tufts University and a Master of Theological Studies from Boston University, and he is currently enrolled in the Master of Organizational Leadership program at Brown University, which he expects to complete in May 2027. He is a native of Philadelphia.

3:05 – 3:30 PM

A Changing Climate in Massachusetts: Updates from the EEA Office of Climate Science

Dr. Caitlin Spence, Assistant Climate Scientist, Massachusetts Executive Office of Energy and Environmental Affairs, Office of Climate Science

ABSTRACT

Massachusetts Executive Office of Energy and Environmental Affairs’ (EOEEA’s) Office of Climate Science will provide an overview of several ongoing weather and climate initiatives, including a preview of the first Massachusetts Climate Science Report (CSR), which will be finalized and released by the end of 2026. The report summarizes the state of the science on climate change and related hazards in Massachusetts, including the key drivers of flooding. The CSR will include a storylines chapter synthesizing possible climate futures for Massachusetts; hazard chapters with comprehensive evaluations of the state of the climate science for Massachusetts, including extreme precipitation and flood hazards; and a data chapter with the latest climate data resources available for Massachusetts and data user guidance.

The CSR will be accompanied by an update to the ResilientMass Temperature and Precipitation Projections, which supported the 2022 Massachusetts Climate Change Assessment. The update will incorporate improved downscaled projections from the latest-available generation of global climate modelling experiments (CMIP6), with localization methods tailored to Massachusetts, and additional change statistics to better address heat-related stakeholder needs. Projected streamflow statistics, including flood discharge return periods, will be released by June 2027 following the temperature and precipitation statistics. The CSR and updated ResilientMass projections will support the upcoming 5-year updates to the Massachusetts Climate Change Assessment (2027) and ResilientMass Plan (2028). These cyclical updates will provide the latest summary of potential climate change impacts on Massachusetts, including those from flooding, and an update to the state agency action strategy to address these impacts over the next five years.

ABOUT THE SPEAKER

Caitlin Spence is the Assistant Climate Scientist focusing on Hydroclimatology within EOEEA’s Office of Climate Science. She provides technical assistance, project coordination, and data service strategy related to the Commonwealth’s climate change projections. Before joining EEA, Caitlin worked in climate-informed stormwater modelling in engineering consulting, analytics and data service provision at MAPC, and as a climate risk management researcher at Penn State University. Caitlin is an author on several peer-reviewed publications on flood risk management under uncertain future climate and of several research and data release reports on climate vulnerability, extreme heat, flooding, water resources, clean energy siting, and housing production in Massachusetts and the Greater Boston area. She obtained her Ph.D. in water resources engineering from the University of Massachusetts Amherst.

4:45 – 7:00 PM, Poster session

Combining Long-Term Station Records with a Low-Cost, High-Density Sensor Network to Quantify Urban Heat Stress in Rhode Island

Emma Witanowski, Department of Earth, Environmental and Planetary Sciences, Brown University

AUTHORS

Emma A. Witanowski, Kim M. Cobb, Emanuele Di Lorenzo, Seda Salap-Ayca, Sol Cooperdock, Allan Just (Brown University DEEPS; Institute at Brown for Environment and Society; Brown School of Public Health)

ABSTRACT

Extreme heat is the leading cause of weather-related mortality in the U.S., contributing to over 69,000 deaths between 1999 and 2024. Impacts are amplified in urban environments, where the urban heat island (UHI) effect can raise temperatures by ~4°C above rural surroundings. Rising nighttime minimum temperatures and humidity compound heat stress, which disproportionately affects marginalized and vulnerable communities, including low-income residents and communities of color. The Northeast has warmed faster than the global average, with New England annual temperatures rising 1.5°C compared to 1.2°C globally since 1900. Rhode Island (RI) has experienced similar warming trends over the same period, with annual temperatures rising by 2.4°C. The densely populated state includes dense urban areas, agricultural lands, forests, and a long, intricate coastline, resulting in a complex patchwork of microclimates. Epidemiological studies demonstrate that a 5.6°C increase in maximum daily temperature was associated with a 24% increase in heat-related ED visit and 4% increase in all cause mortality in Providence, RI. However, the state’s long-term NOAA stations are located at rural airports, leaving urban centers, where most residents live, unmonitored. In this study, we use an integrated approach combining spatiotemporal analysis, statistical reconstruction and a stakeholder-designed sensor network to quantify neighborhood-level extreme heat risk. Daily and hourly temperature (T) and humidity (H) across five long-term stations are used to quantify trends in seasonal means, heatwave frequency, duration and intensity. We then evaluate whether patterns arising from a national machine-learning temperature and humidity product (XIS) can extend sparse station-based observations to unmonitored locations. Time series of modeled daily anomalies (2005-2023) agree with station records (r = 0.84-0.95 for T; r = 0.94-0.98 for H), and EOF analysis shows that a single leading mode explains 99% and 84%, respectively, of modeled and observed T variance, with reduced variation along the coast. Projecting station anomalies onto this mode reconstructs daily conditions at an unmonitored downtown Providence site with high skill (r = 0.95, RMSE = 1.21°C for T; r = 0.98, RMSE = 1.19°C for H). This methodology demonstrates that a sparse station network, combined with model-derived spatial modes, can recover daily T variability.

A high-resolution T and H monitoring network spanning Providence will further provide direct, real-time observations needed to characterize exposure at the neighborhood-level, complementing long-term station data. Reconstruction uncertainty, existing infrastructure and resident input from a workshop co-led with a local community-based organization jointly inform siting of a new heat sensor network across Providence, developed in collaboration with PEMA and RIPTA. Integrated with long-term spatiotemporal trend analysis and stakeholder-guided deployment, this approach provides a transferable framework for resolving neighborhood-scale exposure to bolster heat resilience planning at local and state levels.

4:45 – 7:00 PM, Poster session

Quantifying Atmospheric Drivers of Extreme Precipitation Associated with ITCZ Migration

You Zhang, Climate Dynamics Lab, Department of Marine and Environmental Sciences, Northeastern University

ABSTRACT

The Intertropical Convergence Zone (ITCZ) is characterized by persistent tropical precipitation, while variations in extreme precipitation reflect changes in both atmospheric moisture and large-scale vertical circulation. Distinguishing these thermodynamic and dynamical influences provides a framework for examining how ITCZ migration relates to precipitation extremes and how these relationships differ geographically.

This study develops a quantitative framework using more than four decades of NASA MERRA-2 reanalysis data from 1983–2025. Daily precipitation is computed and compiled to characterize the distribution of precipitation extremes across the tropics, with the 80th, 90th, 95th, and 99th percentiles used to identify progressively more extreme precipitation. These distributions are examined alongside changes in ITCZ position and migration across distinct tropical regions, enabling comparison of precipitation extremes and their atmospheric environments between regions.

To investigate the mechanisms underlying regional differences, the analysis incorporates specific humidity (QV) and pressure-level vertical velocity (OMEGA). Changes in precipitation are decomposed into dynamical, thermodynamic, and nonlinear components using an omega–specific-humidity decomposition, separating the effects of changes in vertical motion, atmospheric moisture, and their interaction.

The resulting framework is designed to quantify how the atmospheric environment changes as the ITCZ shifts and to compare the relative contributions of thermodynamic and dynamical processes across precipitation extremes and geographic regions. Applying this methodology consistently across more than 40 years of global reanalysis data provides a systematic approach for investigating why extreme precipitation associated with tropical circulation varies between regions and how large-scale atmospheric dynamics and moisture jointly shape these differences.

4:45 – 7:00 PM, Poster session

Local to Regional Drivers of Salinity and Seawater Oxygen Isotope Variability in Narragansett Bay: A Community Science Approach

Sophia Gao, Institute at Brown for Environment and Society

AUTHORS

Sophia Gao, Claire Collins, Molly Coughlin, Dylan Peixoto, Elska Alario, Zanylah Alston, Iris Yang, Claudia Leonard, Lia Urefña, Alexa Pereira, Sarah Knox, Kim M. Cobb, Samantha Levin (Institute at Brown for Environment and Society; Barrington High School; East Providence High School)

ABSTRACT

Anthropogenic climate change has a profound effect on hydrological extremes, including droughts, flooding, and extreme rainfall. These events exact a large toll on coastal communities’ public health and economies. The generation of local adaptation plans informed by local geography and governing hydrological dynamics is necessary. In this study, high school interns generated weekly hydrological time series from a range of Rhode Island sites, including Narragansett Bay, surrounding estuaries, and surface-water sites. The timeseries consists of roughly biweekly salinity and oxygen isotope (δ18O) measurements of seawater and daily rainwater δ18O spanning 2023–2026. These records are compared with daily rainfall and temperature data to examine how seasonal and extreme hydrological conditions influence coastal waters.

Our analyses document a strong positive relationship between salinity and seawater δ18O across sites. Site-specific regressions produced slopes of 0.15 ± 0.01 per mil per psu at Barrington Beach, 0.20 ± 0.01 per mil per psu at Mussabuck Beach, and 0.16 ± 0.01 per mil per psu at Walker Farm. Across the full dataset, the regression slope was 0.16 ± 0.008 per mil per psu, with a y-intercept of -6.21 ± 0.19 per mil. Using this y-intercept to quantify the freshwater endmember of the estuarine and bay systems, it compares favorably with the observed average rainwater δ18O of -6.71 ± 4.60 per mil (N = 123; December 28, 2023 to March 10, 2026). This finding suggests that precipitation input is the dominant control on the observed salinity-isotope relationship.

Seasonal comparisons further illustrate differences in the variability of coastal-water conditions. During winter 2023–2024, average salinity was 24.08 ± 1.26 psu (n = 5) and average seawater δ18O was -2.70 ± 0.18 per mil (n = 5). No winter samples were available for 2024–2025. During winter 2025–2026, average salinity was 26.72 ± 3.52 psu (n = 9) and average seawater δ18O was -2.20 ± 0.93 per mil (n = 9). Rather than indicating a significant difference in average conditions between the two sampled winters, the more notable result is the substantially greater variability during winter 2025–2026. The standard deviation of salinity increased from 1.26 to 3.52 psu, while the standard deviation of seawater δ18O increased from 0.18 to 0.93 per mil. Rainwater δ18O showed a similar increase in variability: winter 2023–2024 had an average rainwater δ18O of -7.63 ± 2.63 per mil (n = 5), whereas winter 2025–2026 had an average of -14.38 ± 6.71 per mil (n = 13), more than twice the variability. This increased variability in precipitation isotopic composition may help explain some of the greater variability observed in coastal-water δ18O during the recent winter, consistent with variable freshwater inputs influencing coastal-water isotopic composition.

Together, these results demonstrate how salinity, precipitation, seasonal conditions, and stable oxygen isotopes can be used to characterize freshwater-seawater mixing and hydrological variability in Rhode Island coastal environments. Future work will include a community outreach survey that will collect information about flood awareness, preparedness, and perceptions among Rhode Island residents. Ultimately, we seek to characterize and address the effects of anthropogenic climate change in our community by building a better understanding of the dynamics of hydrological extremes in Rhode Island.

4:45 – 7:00 PM, Poster session

Understanding Rhode Island Hydrological Variability Through Water Isotopes: A Community Science Project

Sarah Knox, Brown University

AUTHORS

Sarah Knox (Brown University), Kim M. Cobb (Brown University), Samantha Levin (Brown University), Sophia Gao (Barrington High School), Molly Coughlin (Barrington High School), Claire Collins (Barrington High School), Zanylah Alston (Barrington High School), Elska Alario (East Providence High School), Dylan Peixoto (East Providence High School), Paul Hall (Brown University), Samantha Stevenson (University of California, Santa Barbara)

ABSTRACT

Rhode Island, like many states across the northeast, is feeling the effects of anthropogenic climate change through increasingly common extreme rainfall events as well as extreme drought events. Precipitation extremes leave low lying coastal communities at risk for major flooding events, while extreme droughts can lead to wildfires, such as in 2022, when the state experienced over 80 wildfires due to the dry conditions (RIDEM). Our current understanding of the processes that govern the local watershed dynamics in RI is limited, which limits the accuracy of local hydrological models used for flood and drought projections. Water isotopes [oxygen (18O/16O) and hydrogen (D/H) isotopes] act as physical tracers of water in the atmosphere, land surface, and ocean, with changes that reflect the balance of precipitation, evaporation, physical mixing, and more. The goal of this research is to construct a long-term time series of water isotope observations from surface waters around RI for comparison to local meteorological data from TF Green Airport.

From October 2023 to the present, several cohorts of local high school interns have participated in water sample collection in and around the greater Providence area and Narragansett Bay. Working in a laboratory at Brown, they generated biweekly time series of seawater δ18O and salinity, and daily rainwater δ18O. Through this analysis, we document a strong correlation between rainwater δ18O and the daily mean temperature. In rainwater, colder temperatures are associated with more negative δ18O values, owing to the effects of Rayleigh distillation, whereby colder temperatures drive a successive depletion in rainwater δ18O values. We also see that over recent decades, increased local precipitation is associated with decreased salinity in the bay. This may indicate that as precipitation and drought patterns fluctuate due to anthropogenic climate change, the salinity of the bay will also continue to change. By comparing the new water isotope time series to output from an isotope-enabled version of the Regional Ocean Modeling System (ROMS, Stevenson et al., 2016), we will gain further insights into the local to regional hydroclimate dynamics in RI.

4:45 – 7:00 PM, Poster session

Temperature, Salinity, and Oxygen Isotopes in Narragansett Bay Estuaries: Seasonal Variability and Hydrological Extremes

Molly Coughlin, Barrington High School, Barrington, RI