



Our Vision

Resilient and sustainable Pacific communities using climate information to manage risks and support practical decision-making about climate variability and change.

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1. Introduction

Pacific RISA has completed its second successful year conducting interdisciplinary research and helping communities to understand, plan for, and respond to a changing climate. Activities during Year Two have pursued more in-depth collaborations and projects with stakeholder groups who were identified through previous research and outreach. The Pacific RISA Core Office and collaborators devoted a great deal of time to producing a report for the Pacific Islands Regional Climate Assessment (PIRCA), in support of the 2013 National Climate Assessment (NCA). The process cemented many relationships with regional decision-makers and collaborators and established new partnerships via travel and workshops. As PIRCA activities lessen, the Pacific RISA team is devoting more time to assessing the impact of future climate on water resource planning at an island scale.

2. Pacific Islands Regional Climate Assessment (PIRCA)

PIRCA is a Pacific region-wide collaboration of over 100 experts in Hawai'i and the US-Affiliated Pacific Islands formed to support the regional contribution to the 2013 National Climate Assessment. Scientists and other experts discussed the state of climate knowledge

relevant to three focus areas: (1) preserving fresh water resources and minimizing the impacts of drought; (2) fostering community resilience to the impacts of sea-level rise, coastal inundation, and extreme weather; and (3) sustaining aquatic and terrestrial ecosystems. PIRCA generated a regionally comprehensive report assessing climate impacts and adaptive capacity in the region.

By December 2012, the full report and executive summary will be available electronically and in hard copy. We are also generating subsidiary publications and products from the report, to be released throughout 2012 and 2013. Eight case studies developed for the assessment, exploring examples of both climate change impacts and adaptation in the Pacific, are currently available on the Pacific RISA website. (See <http://www.pacificrisa.org/education-outreach/case-studies-impacts/>).

An additional result of the PIRCA process was that Pacific RISA brought together researchers who agreed to integrate their individual data to make new images and products. One such image, highlighted in Chapter 3 of the PIRCA report, is a figure of past and future drought risk in Hawai'i. The combination of research from PIRCA contributors Dr. Pao-Shin Chu (historic drought trends) and Dr. Oliver Timm (future drought risk) creates a powerful image (Figure 1) that demonstrates the evolution of increased drought risk in areas previously identified as vulnerable.

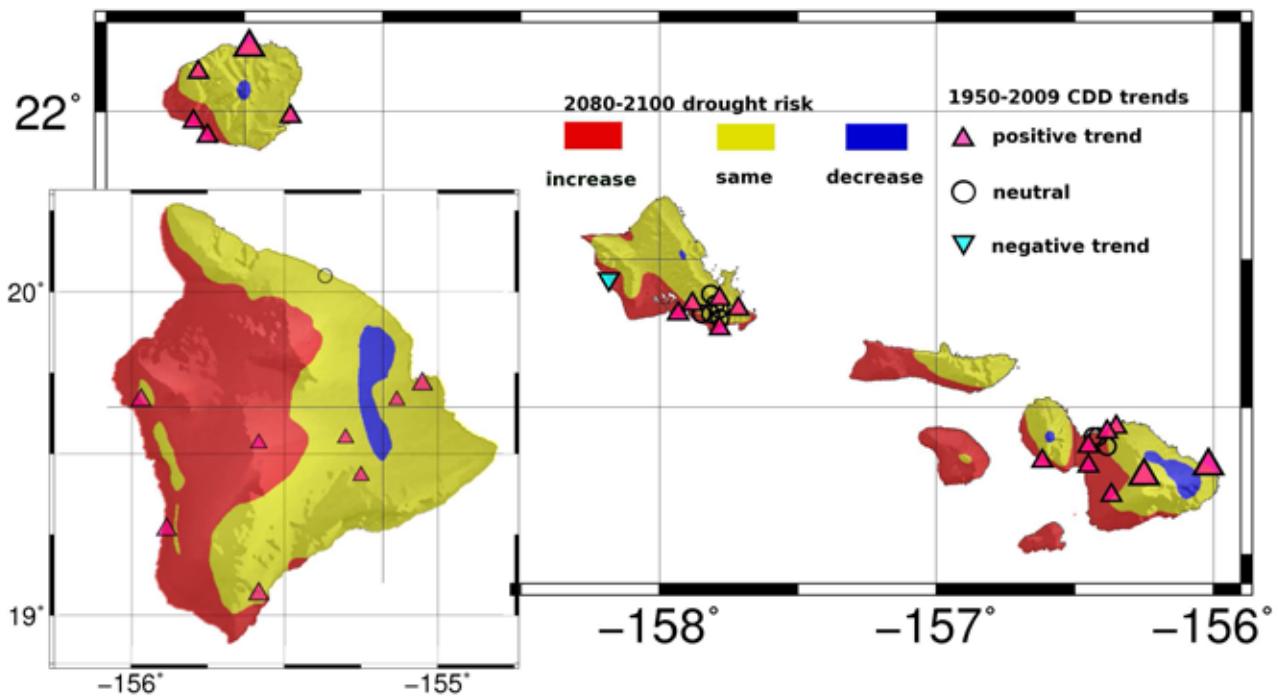


Figure 1. The four major Hawaiian Islands (O’ahu, Kaua’i, Maui, and Hawai’i Island) have experienced increasing winter drought since the 1950s, defined by a longer annual maximum number of consecutive dry days. Upward triangles denote increasing drought trends, while downward triangles denote decreasing drought trends. Larger triangles indicate where trends are significant with 90% confidence (data from P.S. Chu et al., 2010). Background colors highlight changes in the number of low precipitation months during the wet season (Nov-Apr) based on statistically downscaled climate change scenarios from six models of the IPCC AR4 report for the years 2080-2100 (Takahashi et al., 2011).

Other original figures and tables were created to better communicate specific aspects of climate knowledge in the Pacific Islands to varied decision-makers. An original PIRCA product, the “Indicators of Climate Change in the Pacific Islands” graphic (Figure 2) serves to make a global issue regionally specific, using facts discussed in the PIRCA report and images immediately recognizable by island resource managers. We have received positive feedback on the graphic thus far, and plan to highlight it through our outreach programs.

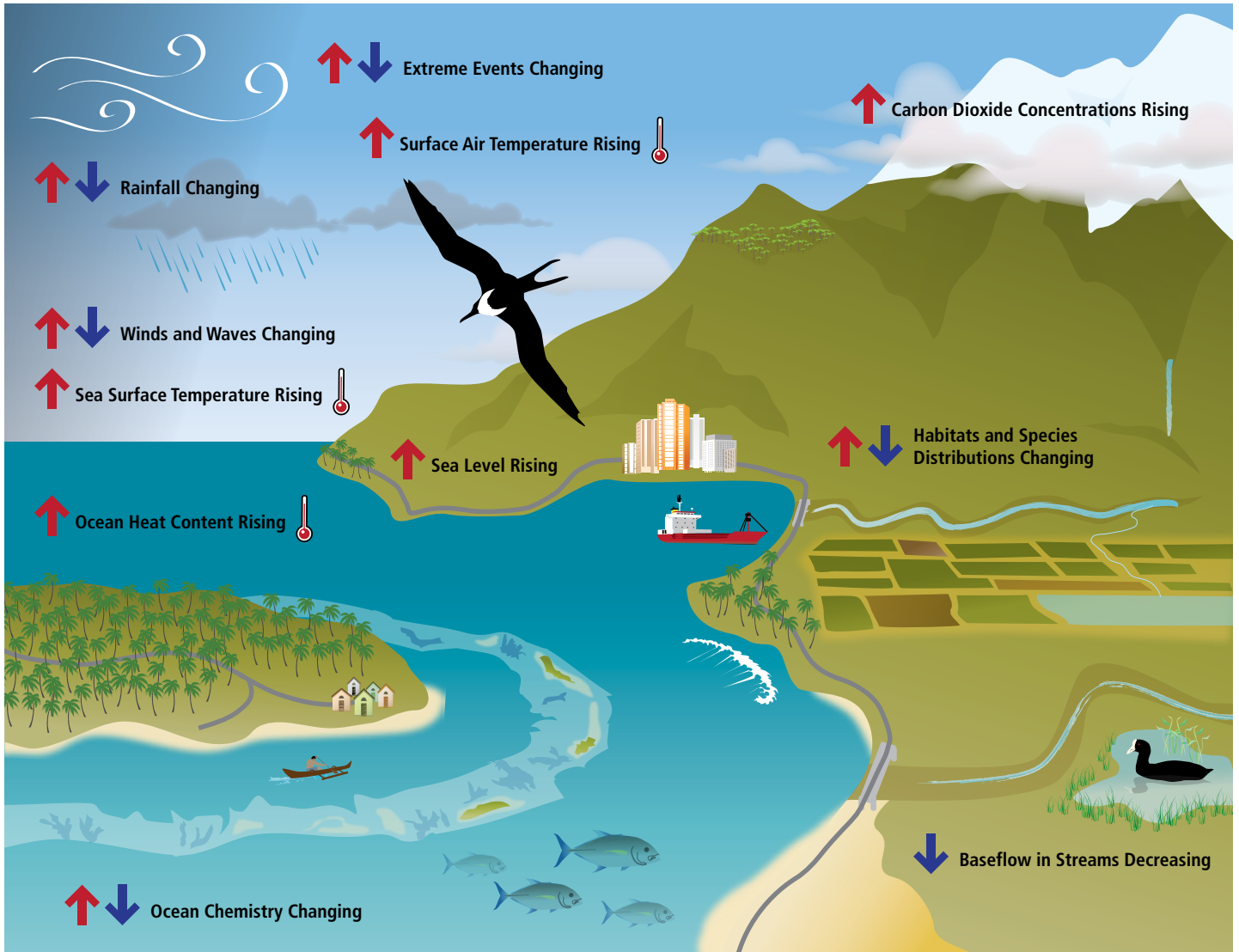


Figure 2. Indicators of Climate Change in the Pacific Islands. (Adapted from “Ten Indicators of a Warming World” by NOAA NCDC, 2009 State of the Climate Report.)

3. Research Updates

Climate Modeling Research

Activities. The climate modeling team at the University of Hawai'i International Pacific Research Center (IPRC) took a multipronged approach to advancing climate modeling in the Pacific this past year. Dr. Kevin Hamilton and research associates (1) performed and evaluated extensive high resolution regional climate model simulations for Hawai'i; (2) conducted simulations appropriate for expected late 21st century conditions; and, (3) studied cloud properties during trade wind conditions for the Hawaiian Islands region, taking advantage of recent developments in satellite remote sensing techniques.

Findings. The Hawai'i Regional Climate Model (HRCM) simulations show that the model can obtain a reasonably good representation of average rainfall at a relatively small scale (3 km grid box) in Hawai'i. To some extent, the observed large-scale variations in the island-averaged rainfall for a particular timeframe can also be captured with significant skill in the model simulation. The HRCM results also show that a more realistic representation of the small-scale structure of land surface properties leads to an overall improvement in high resolution simulations for the islands (notably for the surface temperatures and surface winds).

Pacific RISAs Researchers Awarded Funding for Social Network Analysis of Climate Information



*Dr. Victoria Keener,
Fellow, East-West Center*



*Dr. Kati Corlew, Post-Doctoral
Fellow, East-West Center*

Grants from NOAA and the DOI Pacific Islands Climate Science Center will support research into communication patterns and how climate information spreads across different sectors and countries in the Pacific Islands region. Using the upcoming release of the PIRCA report as a springboard, **Dr. Victoria Keener** and recently-hired Post-Doctoral Fellow **Dr. Kati Corlew** will collect data to analyze the professional and scientific networks of climate stakeholders in Hawai'i and the US-Affiliated Pacific Islands.

By tracking information flows, key hubs, and isolated groups using network analysis and statistical methods, the researchers plan to map out strengths and gaps in the communication and flow of climate information, allowing Pacific RISA and other groups to focus research and resources on areas that may have been previously ignored.

“There are no existing formal analyses that track the flow, sources, and quality of this information across the Pacific Islands region, so this project will help address the blind spot researchers and agencies currently have as to which communities and stakeholders may be not be getting access to key knowledge,” said the East-West Center’s Dr. Keener, the project’s Principal Investigator.

Additionally, comparisons of various techniques to estimate cloud top heights and trade wind inversion height show generally good agreement around Hawai'i. Figure 3 (below) shows that simulated cloud data using the HRCM are closely matched to satellite imaging data. The estimated cloud thicknesses were found to be significantly correlated with rainfall rates, with thick clouds corresponding to higher rainfall rates on average. In subsequent high-resolution simulations of island-scale climate, the accurate representation of clouds will be essential for producing realistic maps of historic and future precipitation under different global warming scenarios. To integrate with other Pacific RISA research objectives, IPRC researchers are currently using the validated HRCM to produce high resolution simulations of current and future climate on Maui.

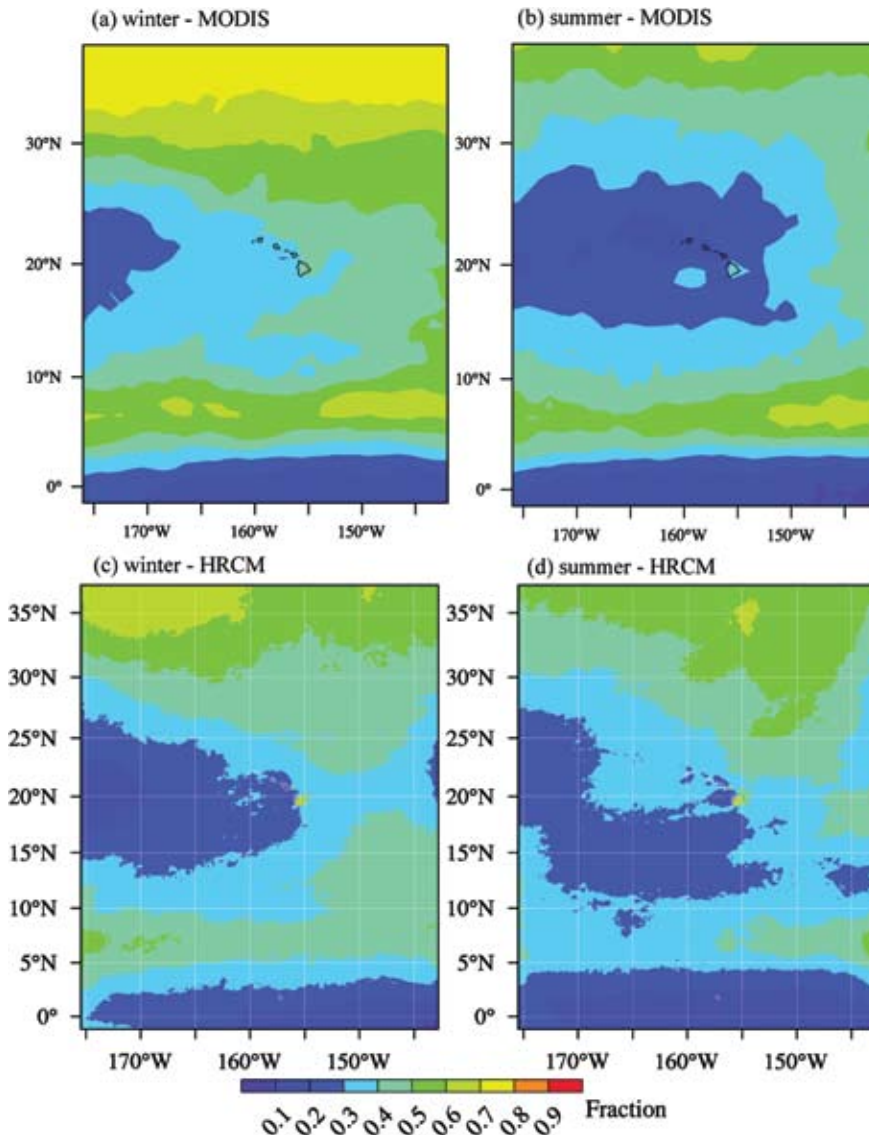


Figure 3. Data from MODIS satellite imaging (top) and model simulated total cloud fraction over Hawai'i for winter (a, c) and summer (b, d). (From Zhang et al., 2012)

Hydrological Research

Activities. This year, hydrological research at the University of Hawai'i Water Resources Research Center (WRRRC) focused on developing a method for converting preliminary 1 km and 3 km climate simulation data into formats that can be used to input into the water budget model for the Maui study area. Together, WRRRC and IPRC researchers determined which hydrological data would be predicted by the IPRC for Maui. In addition to this preparation for hydrologic modeling for Maui, WRRRC researched hydrologic models and analytical tools currently used for the Pearl Harbor Aquifer region on O'ahu and assessed their transferability to other parts of the Pacific Region.

In a separate study, Pacific RISA hydrologist, Dr. Victoria Keener, has been collaborating with Dr. Delwyn Oki and Dr. Lisa Miller at the USGS Pacific Islands Water Science Center (PI-WSC) to look more generally at the effects of seasonal climate variability on historic streamflow and precipitation at sites throughout Hawai'i, American Sāmoa, and Guam. Streamflow represents combined precipitation over a large spatial area and multi-day timeframe, and thus is a good indicator variable to observe short-term climatic fluctuations that impact the Pacific Islands region, such as the El Niño-Southern Oscillation (ENSO). Researchers are also studying how ENSO has historically affected trends in streamflow across the Pacific Islands, and how those effects may be shifting with climate change and the potential advent of new ENSO regimes.

Findings. Previous work by the USGS found significant annual decreases in baseflow (the groundwater component of streamflow) over the last century across the Hawaiian Islands, and this new research finds that the majority of decreasing streamflow trends occur in the dry-season summer months (May to August). Figure 4 (below) shows the trends in steamflow for Hawai'i, Guam, and American Sāmoa over the last three decades.

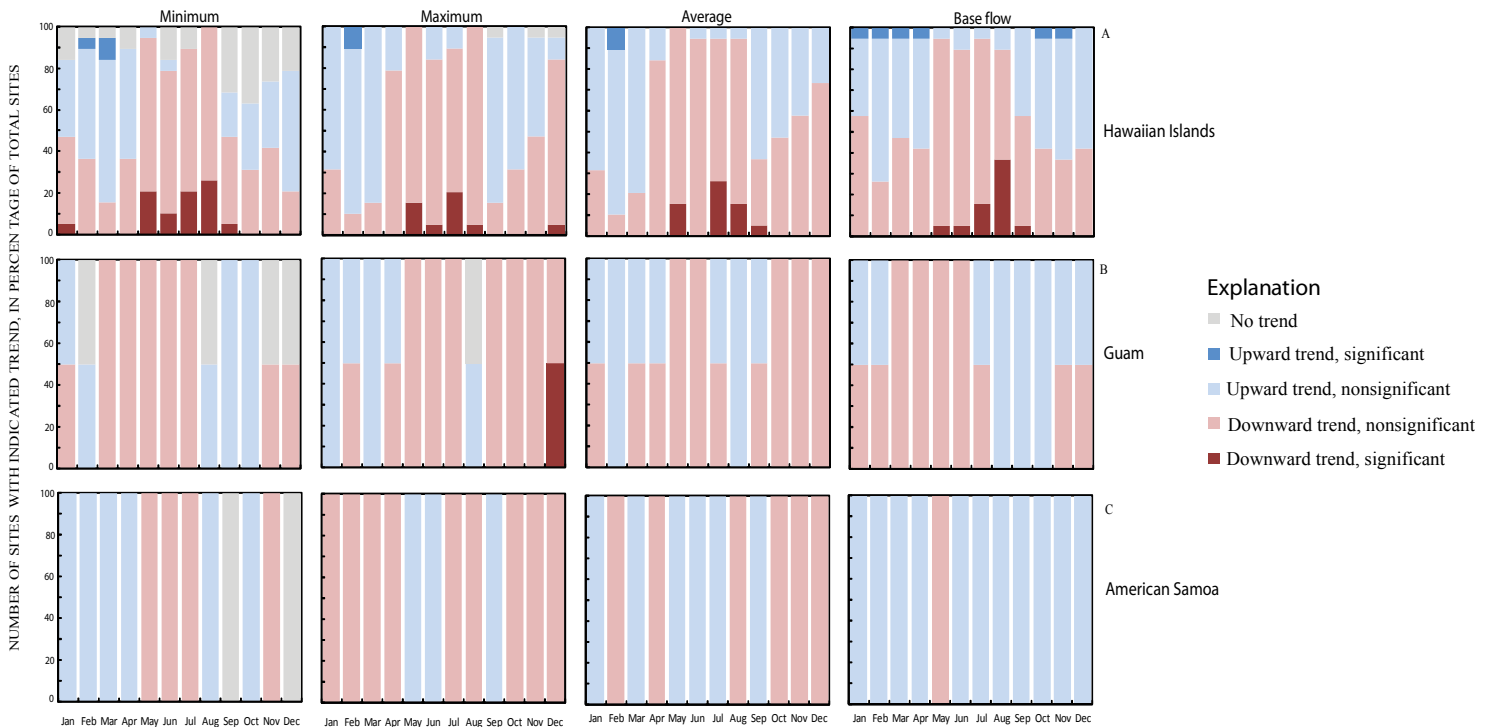


Figure 4. Trends in minimum, maximum, average, and base streamflow values for the Hawaiian Islands, Guam, and American Sāmoa, 1978–2008. (Miller and Keener, forthcoming)

Policy-Related Research

Decision Assessment

Activities. Dr. Melissa Finucane led a team of researchers at the East-West Center and UH Center for Island Climate Adaptation and Policy to finalize data collection and analyses of in-depth interviews with stakeholders, workshops, and an online survey for the Central O'ahu Watershed Assessment. The assessment was aimed at determining stakeholders' climate sensitive decisions, their capacity to use climate information, and their decision-support needs.

Findings. The interviews, workshops, and survey results revealed that people managing water resources (mostly male, highly educated, and from diverse professional and ethnic backgrounds) make a wide range of decisions. Their climate-sensitive decisions focus largely on: what fresh water will be available in the long-term (amount, when, for how long, where)? The climate information found to be most relevant for decision-makers includes vulnerability assessments incorporating long-term projections for temperature, rainfall distribution, storms, sea-level rise, and stream flow changes. Table 1 shows results from a survey question asking resource managers to indicate how useful various types of information would be to their decision-making. Participants also highlighted the need to disentangle natural variability from long-term climate change. They were interested in receiving information about the *most probable* and *worst-case* scenarios and their implications for issues such as runoff, pollutant loads, salinity, and water supply. Barriers to the wider use of climate information that were identified through this study include the lack of a clear legal mandate and insufficient staff time to locate climate information.

Respondents' climate literacy was high, as would be expected since they were mostly highly educated and experienced in the field of environmental management. Nonetheless, a substantial proportion of the respondents incorrectly believed that (1) there is a lot of disagreement among climate scientists about whether or not climate change is happening and (2) aerosol spray cans are a major cause of climate change. Those with higher climate literacy seemed more comfortable using uncertain information, and those with lower climate literacy were more likely to trust information from familiar or personal sources such as extension agents and television weather reporters.

A research paper reporting the results of this assessment is under review at the journal *Weather, Climate & Society*.

Table 1. What type of information would be useful in supporting the decisions you or your agency/organization makes?

	Not at all useful (%)	A little useful (%)	Moderately useful (%)	Very useful (%)	Don't know (%)
Location-specific vulnerability assessment (i.e., assessing the water resource's and water users' exposure, sensitivity, and capacity to adapt to climate change)	0.0	0.0	11.6	81.4	0.0
Implications of climate change for runoff, pollutant loads, salinity, and water supply	2.3	2.3	16.3	74.4	0.0
Location-specific climate change predictions (temperature, precipitation, etc.) for the medium or long term (more than 10 years in the future)	0.0	2.4	29.3	65.9	2.4
Location-specific climate change projections (temperature, precipitation, etc) for the short term (from now to 10 years in the future)	0.0	0.0	30.2	62.8	2.3
Seasonal forecasts	0.0	11.6	23.3	60.5	0.0
More reliable forecasting of El Nino events and any changes in the frequency or severity of such events under climate change	0.0	4.7	32.6	58.1	0.0
Cost projections of water rates in various climate scenarios	2.3	18.6	20.9	51.2	2.3

Note: Missing data means that percentages will add to less than 100.

Adapted from: Finucane, M. L., Miller, R., Corlew, L. K., Keener, V. W., Burkett, M., Grecni, Z. 2012. Understanding the climate-sensitive decisions and information needs of fresh water resource managers in Hawai'i. Under review at *Weather, Climate & Society*.

Hazards and Adaptive Capacity Assessment

Activities. Dr. Cheryl Anderson conducted an inventory and assessment of hazard mitigation plans throughout the US-Affiliated Pacific Islands. These states and territories are required by the US Federal Emergency Management Agency (FEMA) to develop hazard mitigation plans in order to receive funds for post-disaster recovery. Although FEMA does not explicitly list climate change as a hazard that should be considered in the plans, proposed mitigation actions are often the same for climate adaptation and climate-related hazards. Therefore, considerable opportunities exist to leverage resources by engaging in joint planning activities for hazard mitigation and climate adaptation.

Findings. US-Affiliated Pacific Island jurisdictions with current mitigation plans are shown in Table 2. Both Hawai‘i and American Sāmoa specifically consider climate variability and change in their plans, and the Commonwealth of the Northern Mariana Islands lists climate variability as a possible hazard related to extreme climate events (Anderson, 2012a). Further, there is an opportunity to integrate national action plans for disaster risk reduction and climate change adaption through the initiation of the Joint National Action Plans for Disaster Risk Management. The Republic of the Marshall Islands, Federated States of Micronesia, and the Republic of Palau each have developed a report on integrating climate-related information in disaster risk reduction planning and have created plans for adaptation to climate-related disaster risks (Anderson, 2012b).

One major gap in existing hazard mitigation plans is the inclusion of climate change impacts in modeling hazard risk and vulnerability. Models and assessment tools provide some information about impacts resulting from natural hazards, but many data sets are too short-term to understand climate change trends (Anderson, 2012a). Impacts from severe weather coupled with climate change impacts, such as sea-level rise and coastal inundation, are likely to exacerbate the effects of natural hazards. Another gap relates to estimating economic losses from climate-related hazards. Since projected losses primarily rely on historical records, projections for climate change damages need to be improved (Anderson, 2012c).

Table 2: Existing hazard mitigation plans in Hawai‘i and the US-Affiliated Pacific Islands

<i>Location</i>	<i>Plan Type</i>	<i>Year Created/ Updated</i>
American Sāmoa	American Sāmoa Revision and Update of the Territory Hazard Mitigation Plan	2008
Commonwealth of the Northern Mariana Islands	Commonwealth of the Northern Mariana Islands Standard State Mitigation Plan	2010
Guam	2008 Guam Hazard Mitigation Plan	2008
State of Hawai‘i	State of Hawai‘i Multi-Hazard Mitigation Plan, 2010 Update	2010 (Update)
County of Hawai‘i	County of Hawai‘i Multi-Hazard Mitigation Plan	2010
County of Kaua‘i	Kaua‘i County Multi-Hazard Mitigation Plan, 2009 Update	2009
County of Maui	Maui County Multi-Hazard Mitigation Plan, 2010, Volumes I and II	2010
County of Honolulu	Multi-Hazard Pre-Disaster Mitigation Plan for the City and County of Honolulu, Volumes I and II	2010

Adapted from: Anderson, C. L. 2012b. Overview of climate risk reduction in the US Pacific Islands hazard mitigation planning efforts. Honolulu, HI: Hazards, Climate & Environment Program, University of Hawai‘i Social Science Research Institute, Technical Report No. 201103A.

Law and Policy Analysis

Activities. Mr. Richard Wallsgrove and other legal scholars at the UH Center for Island Climate Adaptation and Policy (ICAP) have analyzed Hawai'i's law and policy framework to identify ways of enhancing climate adaptation for Hawai'i's water resources. As of March 2012, ICAP's analysis is available in two forms: a full-length white paper and a condensed summary. Using those documents as a launching point, researchers are proceeding with the next phase of the project, which is to further engage water resource decision-makers, stakeholders, and legislators throughout the Hawaiian Islands. The goal of that outreach is three-fold: (1) to identify priorities and barriers for implementing the recommended adaptive tools, in specific regard to each island setting; (2) to identify the most efficient and advantageous support that Pacific RISA can lend to the next steps of implementation; and (3) to educate regarding ICAP's existing findings and recommendations. ICAP held outreach workshops on the island of O'ahu in April and May 2012. After acquiring feedback from those events, ICAP held a subsequent workshop on Maui in July 2012. In total, the workshops convened 35 water resource decision-makers from: state, county, and federal agencies; private businesses; non-profit organizations; the state legislature; and public boards and councils. Each workshop opened with a presentation of the legal analysis and findings, and an overview of the twelve adaptive tools. Where possible, ICAP presented models that have been tested in Hawai'i or the continental US or elsewhere to illustrate the various planning, regulatory, and market-based strategies. Discussion followed each presentation and detailed notes captured participants' comments. A report summarizing decision-maker perspectives and identifying priorities for research and support was completed in August 2012.

Findings. After reviewing recent case studies and peer-reviewed literature on adaptive governance, ICAP found that four characteristics define the "adaptive capacity" of laws and policies:

- i. **Forward-looking**—focused on crisis avoidance over crisis mitigation;
- ii. **Flexible**—able to adjust to changing needs and conditions;
- iii. **Integrated**—able to address climate-related impacts that cut across political and geographical boundaries; and
- iv. **Iterative**—utilizing a continuous loop of monitoring, feedback, and reevaluation.

ICAP's recent white paper identifies those four characteristics embedded within Hawai'i's existing water law and policy regime. ICAP's analysis revealed that Hawai'i's legal framework for managing water resources displays those adaptive characteristics at every level, from top-tier constitutional provisions that require the protection and conservation of water and the state's public trust over all water resources, to a single integrated Hawai'i Water Plan through which all water management should be coordinated. Additionally, ICAP has proposed twelve tools to improve climate adaptation for the benefit of Hawai'i's water resources. The findings and adaptive tools are explained in the white paper, *Water Resources and Climate Change Adaptation in Hawai'i : Adaptive Tools in the Current Law and Policy Framework* (<http://icap.seagrantsoest.hawaii.edu/icap-publications>).

During workshops and presentations, participants demonstrated a high level of interest in ICAP's research and recommendations. The Deputy Director of the Hawai'i Commission on Water Resource Management (CWRM), William Tam, was an active participant in the two O'ahu workshops, and provided introductory remarks at the second. The Water Commission later extended a special invitation for ICAP Senior Attorney Richard Wallsgrove to brief the Commission at their August 2012 meeting. A video of this presentation is available at http://hawaii.gov/dlnr/cwrw/info_climate.htm.



Senior Attorney Richard Wallsgrove briefs the Commission on Water Resource Management at their August 2012 meeting (top) and presents at the July 2012 ICAP workshop on Maui (below).



4. Outreach

Essential to our work, outreach activities help to build and sustain community partnerships while providing timely, relevant information to decision-makers and the public. Beyond the outreach mentioned above in relation to specific research projects, Pacific RISA has undertaken the following projects and activities to promote a two-way dialogue with island communities.

- **Climate Matters** is an outreach video project featuring real-world stories of climate impacts on Pacific Islands. Produced by Dr. Melissa Finucane with assistance from Dr. Victoria Keener, four short videos, or “Documoments,” portray personal narratives about why climate and climate information is important for various sectors in Hawai‘i. Each video features an interview with an individual in an important sector: a representative from the hotel and tourism industry in Waikiki; an independent rancher in the Ka‘u district of Hawai‘i Island; the administrator of a construction landfill in Waianae, O‘ahu; and the Meteorologist-In-Charge of the National Weather Service in Honolulu. Funding for video production and editing was provided by East-West Center seed funds (Dr. Finucane), while RISA funding supported the researchers’ time and travel. The videos are freely available for viewing on Vimeo (<https://vimeo.com/pacificrisa>), and on the Pacific RISA website (<http://www.pacificrisa.org/education-outreach/documoments/>). As of October 2012, the Documoments have been played over 430 times in 23 different countries. The still images on the opposite page are the opening scenes from the videos, featuring a quote by each individual interviewed about why climate matters to them personally or professionally.
- Additionally, Dr. Wendy-Lin Bartels from the Southeast Climate Consortium RISA visited Pacific RISA last year, and transmitted the idea of Climate Documoments to the southeast. In partnership with the NOAA Climate Program Office and Climate Watch, she assisted with the creation of two videos focusing on climate impacts in her RISA’s region.



Dr. Melissa Finucane on set for production of
“Climate Matters for Waikiki Beach”

Climate Matters Documentments

Available at: <http://www.pacificrisa.org/education-outreach/documoments/>



"Climate Matters for Island Environments"



"Climate Matters for Waikiki Beach"



"Climate Matters for Ranchers in Hawai'i"



"Climate Matters for Pacific Island Decision Makers"

- Pacific RISA launched a **new website** in September 2012 at www.PacificRISA.org. The user-friendly site features interactive media and a wealth of information on current Pacific RISA research projects, and the places in the Pacific RISA region. We extend our thanks to Rachel Miller for creating content and managing the transition to the new site.
- The ICAP Director, Maxine Burkett, and Regional Climate Services Director, John Marra, briefed members of the Hawai'i State Legislature's House Committee on Energy and Environmental Protection and the Senate Committee on Energy and Environment in a special **legislative hearing on climate change** at the opening of the 2012 Hawai'i legislative session. In addition to presenting a summary of climate change law and policy in Hawai'i, Ms. Burkett outlined Pacific RISA's legal analysis and model

tools for adaptive water resource management. Dr. Marra summarized federal programs addressing climate change and presented the timeline for the Pacific Islands' contribution to the National Climate Assessment. The briefing was held at the State Capitol on January 17, 2012. Over 75 members of the public were in attendance, and the briefing was filmed and aired live on local television stations.

- Based on legislators' interest and follow-up questions at the January 2012 briefing, ICAP recognized a need to prepare a briefing sheet expanding on this presentation to provide complete, accurate, updated, and accessible information to decision-makers, interest groups, and the general public. The ***Climate Change Law and Policy in Hawai'i, Briefing Sheet, 2012*** (August 2012) examines mitigation measures, adaptation measures, and concludes with a timeline summarizing the discussion. For each law and policy, the briefing sheet provides background information, an overview, key elements, and recent updates. Research for the briefing sheet involved reviewing and analyzing climate-related acts and measures from the past six years including, for example, Hawai'i's climate change law (Act 234, 2007) and the Hawai'i Clean Energy Initiative (HCEI); tracking proposed legislation; reading relevant law journal articles and other secondary sources; and consulting with private, public, and non-profit professionals. The document is publicly available for free online, electronically, and in print. See <http://www.pacificrisa.org/projects/water/policy-governance/> to download a PDF copy.

Hawai'i Climate Change Adaptation Priority Guidelines (Act 286, 2012): Planning for Climate Change

Background and Overview. During the 2012 legislative session, the Hawai'i Legislature passed Act 286, which adds climate change adaptation priority guidelines to the Hawai'i State Planning Act, Hawaii Revised Statutes Chapter 226 ("Chapter 226"). The stated purpose of the climate change adaptation priority guidelines is "to encourage collaboration and cooperation among county, state, and federal agencies, policy makers, businesses, and other community partners to plan for the impacts of climate change and avoid, minimize, or mitigate loss of life, land, and property of future generations."

Key Elements. The climate change adaptation priority guidelines are intended to prepare the state for climate change impacts on agriculture, conservation lands, coastal and nearshore marine areas, natural and cultural resources, energy, higher education, health, historic preservation, water resources, the built environment (e.g., housing, recreation, and transportation), and the economy.

Update. Priority guidelines are part of the statewide planning system, which coordinates and guides all major state and county activities and implements Chapter 226. As a priority guideline, climate change adaptation must now be considered in state and county budgetary, land use, and other decision-making processes. In particular, the state Land Use Commission and Board of Land and Natural Resources must consider whether land use entitlements are consistent with the priority guidelines. In addition, land use planning, coastal permitting, and zoning at the county level must be consistent with county general plans, which must be consistent with Chapter 226. Note, however, that state and county actions may, under some circumstances, deviate from priority guidelines "without penalty or sanction."

*Excerpted from Wager, K. 2012. **Climate Change Law and Policy in Hawai'i, Briefing Sheet, 2012.** Center for Island Climate Adaptation and Policy, Honolulu, HI.*

5. New Collaborations and Initiatives Launched in Year 2

Pacific Islands Climate Science Center (PI-CSC). In October 2011, the US Department of Interior (DOI) announced the establishment of a regional Climate Science Center in Honolulu, led by Dr. Kevin Hamilton and researchers at the University of Hawai'i. Through the East-West Center, Pacific RISA has been involved in setting research priorities for the new center and creating clear lines of communication between PI-CSC administration and other regional climate research groups. The PI-CSC will be a strong collaborator in the coming years, as their focus on specific areas of climate science will allow Pacific RISA to pursue more in-depth research in stakeholder-driven high priority sectors.

Hawai'i Commission on Water Resource Management (CWRM). Pacific RISA launched a knowledge exchange with members of the CWRM, and Department of Land and Natural Resources staff for CWRM, regarding climate change adaptation in Hawai'i's water resource sector. Following ICAP's spring/summer 2012 workshops, at which several members of the Commission participated, ICAP Senior Attorney Richard Wallsgrave presented findings at CWRM's August 2012 meeting. Shortly after, Water Commissioner **Jonathan Starr** attended Pacific RISA's September 2012 team meeting and gave a presentation titled, "Changing Waters of Maui: An Ongoing Science Experiment," about Maui's water history and current water challenges. In Year Three, Pacific RISA will continue outreach to the Water Commission and support their adaptation-related efforts.

USDA Forest Service Pacific Southwest Research Station, Institute of Pacific Islands Forestry. Through the PIRCA process, Dr. Victoria Keener established a collaboration with the Forest Service in Hilo, Hawai'i Island. Forest Service researchers are looking at potential scenarios of future precipitation amounts on modeled distributions of invasive flora and stream flows through a previously parameterized DHSVM model. Pacific RISA is leveraging researcher time and expertise (Dr. Keener) to assist with time-series and statistical analyses. Through this collaboration, we hope to expand our networks on Hawai'i Island and create opportunities for future Pacific RISA research into ecosystem function under climate change projections.

Ocean Resources Management Plan (ORMP) Working Group and Hawai'i State Office of Planning. The Hawai'i Office of Planning has stepped forward as a state governmental leader in the integration of climate knowledge and adaptation plans into statewide policy. In January 2012, the governor, with support from the ORMP Working Group and the State Office of Planning, introduced a successful bill to the legislature to insert climate change adaptation priority guidelines into the Hawai'i State Planning Act. Pacific RISA was a participant, consultant, and reviewer to the bill, now signed into law as Act 286. As a follow-up, Drs. Finucane and Keener serve on the ORMP Integrated Planning and Education and Outreach working groups.

Maui County Department of Water Supply. In accordance with our Year Two focus on a place-based water resource issue, we are focusing heavily on the island of Maui in Hawai'i, specifically the 'Āo -Waihe'e watershed in central and west Maui. In this context, in addition to working with a wide variety of stakeholders, we are specifically supporting planners at the Maui Department of Water Supply to apply future downscaled climate projections to their current planning scenarios.

6. Key Presentations and Meetings Attended

“Climate Risks in the Pacific Islands Region,” National Defense University, College of International Security Affairs, Washington, DC. Dr. Melissa Finucane presented a talk for the Combating Terrorism Fellowship Program. October 24, 2012.

“Responding to Risk in a Global Context,” East-West Center, Honolulu, Hawai‘i. Dr. Melissa Finucane presented a lecture for the Asia-Pacific Leadership Program. September 18, 2012.

“Forum: Pacific Islands Regional Climate Assessment,” The 20th Hawai‘i Conservation Conference, Honolulu, Hawai‘i. Pacific Islands Regional Climate Assessment (PIRCA) lead editors Dr. Victoria Keener and Dr. Melissa Finucane (Pacific RISA), Ms. Deanna Spooner (PICCC), and Dr. John Marra (NOAA), convened a panel discussion on the PIRCA findings at this year’s Hawai‘i Conservation Conference. The well-attended session started with a presentation of the technical findings of the report and a summary of the assessment process, followed by a question and answer session with the audience. August 2, 2012.

Dialogue on Communicating Climate Projections within a Natural Resources Management Context, Honolulu, Hawai‘i. Pacific RISA, PICCC, and other collaborators co-hosted a meeting for a small group of climate scientists and resource managers that focused on how best to present climate projections and other technical information to natural resource decision-makers. Dr. Melissa Finucane gave a presentation titled, “Climate-Sensitive Decisions: When Is Climate Science Useful?” June 26, 2012.

“Regional Climate Change for Hawaii: Some Preliminary Results,” Seminar at the National Center for Atmospheric Research, Boulder, Colorado. Dr. Kevin Hamilton gave a presentation of results from IPRC’s regional computer models simulating present day and projected future climate in Hawai‘i. June 25, 2012.

Hawai‘i Drought Impact Reporter Workshop. The Hawai‘i Commission on Water Resource Management and the National Drought Mitigation Center presented a workshop to train participants on contributing to the process of observing, reporting and summarizing the effects of drought in Hawai‘i, through the Drought Impact Reporter web-based tool. Drs. Victoria Keener and Melissa Finucane attended the training session at CWRM’s invitation. June 20, 2012.

Australian Department of Foreign Affairs and Trade and the Australian Consul General, Honolulu, Hawai‘i. Dr. Melissa Finucane participated in a discussion with Australian officials about regional climate risks. June 7, 2012.

“Climate Change Here and Now: Impacts on Pacific Islands, Coastlines, and Ocean,” Climate Change Teacher Professional Development Day, Waikiki Aquarium, Honolulu, HI. Dr. Victoria Keener presented a talk, “Pacific RISA: Integrating Social & Physical Climate Sciences,” about climate science in the Pacific Islands and Pacific RISA’s research. Dr. John Marra spoke about the state of climate knowledge in the Pacific and the PIRCA process. April 28, 2012.

PACIFIC UNITY Subject Matter Expert Exchange, Honolulu, HI. Dr. Victoria Keener gave a presentation and led a discussion on the 2012 PIRCA with visitors from the Royal Malaysian Air Force and the US Air Force. April 16, 2012.

Pacific RISA in the Media



“Can you weather a white paper on climate change?” *The Conversation on Hawai‘i Public Radio* interviewed ICAP Senior Attorney, **Richard Wallsgrove**, regarding climate-adaptive tools for water resource management presented in the 2012 ICAP white paper, and regarding upcoming workshops to discuss the findings with decision-makers. April 25, 2012.

“New Science, New Risks” Conference, University of Pittsburgh, Pennsylvania. Dr. Melissa Finucane presented an invited paper on “Changing Risk Paradigms” at the conference. March 30-31, 2012.

Hawai‘i Water Law Conference, Honolulu, Hawai‘i. This presentation, delivered by ICAP Senior Attorney Richard Wallsgrove, focused on the implications of ICAP’s recommended twelve tools, for two distinct groups in attendance: (1) attorneys in private practice, whose clients are likely to be affected by climate impacts and by adaptive responses; and (2) government attorneys and water managers, whose role will be to ensure that management strategies appropriately protect Hawai‘i’s water resources from climate impacts, as mandated by the Hawai‘i constitution and other laws. January 11, 2012.

Keener, V., Staal, L., & Finucane, M.L. ***Two Sides of the Same Coin: Communicating Climate Change Science to Stakeholders in Florida and Hawai‘i.*** Poster presented at the Annual Meeting of the American Geophysical Union, “Scientist Participation in Science Communication” Session, San Francisco, CA. December 5-9, 2011.

Water Resource Sustainability Issues on Tropical Islands Conference, Honolulu, HI. ICAP Senior Attorney, Richard Wallsgrove, gave a presentation that focused on strategies for using Hawai‘i’s law and policy framework to address climate-related findings such as those presented by scientists at the conference. November 14, 2011.

Finucane, M.L., Miller, R., Corlew, K., Keener, V., Burkett, M., & Grecni, Z. ***Climate Adaptation Decisions: Who, How, and Why?*** Poster presented at the Annual Meeting of the Society for Judgment and Decision Making, Seattle, WA. November 4-7, 2011.

“Translating Research into Better Decisions about Risk,” Geography Department, University of Hawai‘i, Honolulu, Hawai‘i. Presented by Dr. Melissa Finucane. October 27, 2011.

“Natural Resource Challenges Related to Climate Risks in the Pacific Islands Region,” **Australian-American Leadership Dialog, Subject Matter Expert Exchange**, Honolulu, Hawai‘i. Dr. Melissa Finucane attended and gave this presentation for participants of the exchange. October 2-6, 2011.

ORMP Joint Planning Meeting: Visioning Hawaii’s Adaptation to Climate Change, Waikiki, Honolulu, HI. Pacific RISA investigators and collaborators attended a meeting hosted by the Hawai’i Office of Planning and Ocean Resources Management Plan Working Group to develop a framework for a state climate change adaptation policy, introduced during the 2012 legislative session. August 22-23, 2011.

Pacific RISA in the Media

- **“Rising to the Occasion: Reporting Changes in Sea level Law,”** on *The Conversation* on Hawai’i Public Radio. ICAP’s Director, **Maxine Burkett**, was interviewed on a weekday morning radio show on Hawai’i Public Radio. January 23, 2012.



- **“Insights – Climate Change”** on *Insights* on PBS Hawai’i. A weekly television program featured Pacific RISA investigators and collaborators ICAP Director, **Maxine Burkett**; PICCC Director, **Deanna Spooner**; and NOAA Regional Climate Services Director, **John Marra**; along with Office of Planning Director, **Jesse Souki**, on a panel of experts to discuss climate change and the impacts on Hawai’i and Pacific Island communities. December 15, 2011.

7. Year Two Publications

Anderson, C. L. 2012a. **Overview of climate risk reduction in the US Pacific Islands Freely Associated States.** Honolulu, HI: Hazards, Climate & Environment Program, University of Hawai’i Social Science Research Institute, Technical Report No. 201103B.

Anderson, C. L. 2012b. **Overview of climate risk reduction in the US Pacific Islands hazard mitigation planning efforts.** Honolulu, HI: Hazards, Climate & Environment Program, University of Hawai’i Social Science Research Institute, Technical Report No. 201103A.

Anderson, C.L. 2012c. **Analysis of integrating disaster risk reduction and climate change adaptation in the US Pacific Islands and Freely Associated States.** Honolulu, HI: Hazards, Climate & Environment Program, University of Hawai'i, Social Science Research Institute, Technical Report No. 201105.

Hagedorn, K.B., Mair, A. and El-Kadi, A.I. 2011. **Inventory of research, tools, and information to support decision making about the Pearl Harbor Aquifer under a changing climate.** Honolulu, HI: University of Hawai'i, Water Resources Research Center.

Finucane, M.L., Marra, J.J., Keener, V.W., Smith, M.H. **Pacific Islands Region Overview.** In: Keener, V. W., Marra, J. J., Finucane, M. L., Spooner, D., Smith, M. H., editors. *Climate Change and Pacific Islands: Indicators and Impacts.* Report for the 2012 Pacific Islands Regional Climate Assessment (PIRCA). Washington, DC: Island Press; 2012.

Finucane, M. L., Miller, R., Corlew, L. K., Keener, V. W., Burkett, M., Grecni, Z. 2012. **Understanding the climate-sensitive decisions and information needs of fresh water resource managers in Hawai'i.** Under review at *Weather, Climate & Society*.

Keener, V.W., and Izuka, S.K. **Fresh water and drought on Pacific islands.** In: Keener, V. W., Marra, J. J., Finucane, M. L., Spooner, D., Smith, M. H., editors. *Climate Change and Pacific Islands: Indicators and Impacts.* Report for the 2012 Pacific Islands Regional Climate Assessment (PIRCA). Washington, DC: Island Press; 2012.

Keener, V. W., Marra, J. J., Finucane, M. L., Spooner, D., Smith, M. H., editors. **Climate Change and Pacific Islands: Indicators and Impacts.** Report for the 2012 Pacific Islands Regional Climate Assessment (PIRCA). Washington, DC: Island Press; 2012.

Wallsgrove, R. and Penn, D. 2012. **Water Resources and Climate Change Adaptation in Hawai'i: Adaptive Tools in the Current Law and Policy Framework.** Honolulu, HI: Center for Island Climate Adaptation and Policy. Available at <http://icap.seagrant.soest.hawaii.edu/icap-publications> and www.islandclimate.org.

Wallsgrove, R. and Penn, D. 2012. **Executive Summary of Adaptive Tools From Water Resources and Climate Change Adaptation in Hawai'i: Adaptive Tools in the Current Law and Policy Framework.** Honolulu, HI: Center for Island Climate Adaptation and Policy. Available at <http://icap.seagrant.soest.hawaii.edu/icap-publications> and www.islandclimate.org.

Zhang, C., Wang, Y., Lauer, A., Hamilton, K. 2012. **Configuration and evaluation of the WRF model for the study of Hawaiian regional climate.** *Monthly Weather Review* 140 (10): 3259–3277. doi: <http://dx.doi.org/10.1175/MWR-D-11-00260.1>.

Zhang, C., Wang, Y., Hamilton, K. 2011. **Improved representation of boundary layer clouds over the Southeast Pacific in WRF-ARW using a modified Tiedtke cumulus parameterization scheme.** *Monthly Weather Review* 139 (11): 3489-3513. doi: <http://dx.doi.org/10.1175/MWR-D-10-05091.1>



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