Workshop Summary Report

Regional Climate Change and Environmental Response in Hawai‘i

Asia Room - Imin International Conference Center
University of Hawai‘i at Mānoa Campus, Honolulu, Hawai‘i, USA

July 22-23, 2014

Workshop Organizers: Oliver Elison Timm & Tamara Wong

Hosting Institution: International Pacific Research Center

The primary goals of this meeting were to: (1) improve the mutual understanding of the scientific research methods in the physical climate research and the environmental impact studies with emphasis on Hawai‘i’s unique ecosystems environment, and (2) strengthen the exchange of transdisciplinary information.

Report of activities and main conclusions from day 1

We initially invited 42 researchers from departments at the University of Hawai‘i and other national universities, and professionals from various USGS regional agencies. On the first day, the attendance list registered 48 participants (Appendix 2). A number of walk-in students as encouraged by their local academic advisors, participated in the discussion sessions.

On the first day of the workshop, a series of short presentations were held for the participants. The talks were grouped into two sessions. The first session included speakers with experience in global and regional climate research, and early-career researchers such as graduate and PhD students with special interest in various aspects of local climate variability and climate change in Hawai‘i.
In the second session, experts from various biological disciplines (including terrestrial and marine ecology, biodiversity conservation, wildlife and avian ecology) presented climate-change impact studies. The sessions included several current research activities sponsored by the Pacific Islands Climate Science Center (PICSC) and Pacific Islands Climate Change Cooperative (PICCC), all which aim for an improved knowledge-basis that can be incorporated into resource management and decision making processes.

Session 1: Climate Change in Hawai'i

The first session "*Climate Change in Hawai'i*" included presentations on regional downscaling methods for observed and projected changes in rainfall, sources of uncertainty, and quantification of confidence intervals. Talks proceeded with an overview on changes in solar radiation and temperature with elevation, and parts of the terrestrial hydrological system, in particular specific characteristic of stream flows in ungauged rivers. One of the most critical outcomes from this session underlined the urgent need to resolve current discrepancies between the future rainfall change projections. Dynamical and statistical downscaling methods show some general agreement in the winter season rainfall projections, but do not agree in the dry summer season scenarios. For example, the Big Island shows a windward-leeward dipole structure in the expected rainfall anomalies during the wet season, but the exact form and amplitude must be considered uncertain (Appendix 1)

Session 2: Environmental & Ecosystem Response to Climate Change

In the second session "*Environmental & Ecosystem Response to Climate Change*", an overview talk about the current vegetation mapping technologies, remote sensing methods, and available data products was presented. The subsequent speakers detailed the steps needed to estimate environmental changes with the available downscaled climate information. The presentations showed examples of scientific research methods linking climatic factors with plant species-specific abundance and provide quantitative projections of their future habitats and abundance. Other speakers highlighted the importance of an integrated resource management system to cope with climate change, with examples of how modern research methods could benefit from adopting the '*ridge-to-reef*' concept in environmental impact studies. A series of talks addressed research on the impacts of climate change on vector-borne diseases and native bird populations. In one case a dynamical malaria-bird population model was used under different transient climate change scenarios. This specific example demonstrated not only the need to reduce uncertainty among the different climate change scenarios, but also the importance of increasing our understanding of ecosystem response timing and rates of change that could occur in the next decades (Appendix 1).

Questionnaire and evaluation summary

Participants were asked to fill out a short questionnaire, which helped the organizers to integrate the participants' feedback into the structure of breakout group activities on day 2 of the workshop (Appendix 3). For example, participants were asked to identify 'high-priority research questions' and make recommendations for future research activities. Further, participants were asked to rank their own level of confidence, and participants rated the accessibility of climate change or ecological change information.

The most striking outcome was that there is still a need for improved climate-data transfer from climate research groups to the users in the ecological disciplines. Second, the experts indicated that the current understanding for estimating confidence or

uncertainty levels along all analytical process steps (from the climate change input stage down to the local impacts on the ecosystem) are still a weak component in the integrated system analysis process. All participants indicated that they give high priority towards an immediate resolution of the apparent discrepancies between the future projected rainfall change maps developed by the dynamical and statistical downscaling research teams. It was also emphasized that natural modes of climate variability must be taken into account in the projection of scenarios to better understand the full envelope of physically possible climate trajectories.

Participants indicated that meetings scheduled on an annual basis similar in size and mix of expertise would improve the overall lines of information exchange and establish a deeper understanding for the various scientific methods, the jargon, and the basic approaches to research problems. The meetings should include representatives from groups and institutions whose primary objective is to integrate climate-change information into the decision making process (e.g. land managers).

Report of activities and main conclusions from day 2

Day 2 activities were divided into two parts: (1) break-out group discussion, and (2) summary reports. The organizers reviewed and integrated feedback from the questionnaire and protocols from the sessions and discussions of day 1. Based on this information, a set of key questions was developed for the breakout groups, in order to guide and direct the discussions. The organizers formed three break-out groups to facilitate the discussion of specific questions among a smaller group. Each of the groups was chaired by two participants. The breakout group leaders were encouraged to moderate the discussions and steer the communication towards the main goals of the workshop taking into account the day 1 feedback from the participants.

In the final session, the outcomes of the breakout groups were summarized and reported to the full group of workshop participants. Feedback and discussions helped to draw final conclusions or raise important tasks that require further attention. The final recommendations that resulted from the breakout groups and discussions are:

- Reduce the influence of diverging emissions scenarios by focusing research onto the mid-21st century.

- Measures of confidence and uncertainty must become a comprehensive component in the communication between scientists and end users.

- Students and researchers need training opportunities for communicating with the public (in particular explaining the significance of the scientific knowledge).

- Support is needed for the formation of transdisciplinary research teams that can adapt flexible research tasks.

- Natural resource managers, decision makers and academic researchers should engage in two-way communication.

These results provide a basis for the planning of future communications among climate scientists, ecologists, resource managers, and related environmental impact research groups. Furthermore, the success of this workshop structure is encouraging. It demonstrates that communications barriers due to experts' jargon, missing background knowledge or misconceptions of basic research methods, can be effectively reduced through these types of interactions. Decision makers (from governmental agencies, non-profits) should be invited as full and equal participants in order to bring the basic scientific information and the scientific understanding of the end-users decision problem closer together.
Students and researcher repeatedly expressed the need for more opportunities to learn and practice communicating science to non-academic users. Universities could play an integral role in this process. Faculty members could work with the leadership of the Climate Science Center on establishing new activities (e.g. through summer schools, communication workshops).

To improve the structure of the workshop it is suggested to provide even more time for breakout groups. Furthermore, workshop organizers (or an assigned group of participants) should have sufficient time to review the sessions, discussions, and feedback from participants in order to increase the quality of the breakout activities. The final discussions, summaries and workshop conclusions need more preparation time. Elements of moderation by the session chairs or workshop organizers can help to avoid redundancy in the discussions, and keep the discussions concise and focused towards the main goals.

Appendices

A.1 List of presentations

- *Enhanced warming with elevation: Projections and observational evidence.*
  Henry Diaz, NOAA, ESRL Boulder, CO.

- *Temporal solar radiation change at high elevations in Hawai'i*.
  Ryan Longman, Dept. Geography, University of Hawai'i at Mānoa

- *Regional precipitation extremes in Hawaii under non-stationary climate conditions: Statistical modeling and dynamical downscaling.*
  Pao-Shin Chu, Dept. Atmospheric Sciences, University of Hawai'i at Mānoa

- *Better understanding and quantifying the association between large-scale climate and the variability in rainfall on the main Hawaiian Islands*.
  Kevin Trick, Hawai'i Pacific University

- *Development of statistical methods to estimate future baseline and low-flow characteristics of ungauged streams in Hawai'i.*
  Maoya Bassiouni, Pacific Islands Water Science Center, U.S. Geological Survey

- *Observed and projected changes in Hawai'i's climate.*
  Thomas Giambelluca, Dept. Geography, University of Hawai'i at Mānoa

- *Biotic Impoverishment & Climate Change: Global Causes of Forest Decline?*
  Dieter Mueller-Dombois, Dept. Botany, University of Hawai'i at Mānoa

- *Developing the revised HI-GAP land cover map and Hawaiian Islands habitat quality map.*
  Jim Jacobi, Pacific Island Ecosystems Research Center, U.S. Geological Survey

- *Modeling climate-driven changes to dominant vegetation in the Hawaiian Islands.*
  Tamara Wong, Dept. of Geography and Environmental Sciences, University of Hawai'i at Hilo

- *Using ecosystem service modeling to support ridge-to-reef management and conservation in Hawaii and the Pacific***.**
  Kirsten Oleson, Dept. Natural Resources and Environmental Management, University of Hawai'i at Mānoa

- *Future coral community projections for the Hawaiian Islands.*
  Erik Franklin, Hawaii Institute of Marine Biology, University of Hawai'i at Mānoa

- *A practical approach to mapping shoreline change under future sea level rise scenarios.*
  Tiffany Anderson, SOEST, University of Hawai‘i at Mānoa

- *Are recent population trends in Hawaiian forest birds linked to climate change?*
  Eben Paxton, USGS Pacific Island Ecosystems Research Center

- *The effects of climate change on avian malaria and Hawaiian forest birds*.
  Wei Liao, University of Wisconsin-Madison

- *Changing climate and the altitudinal range of avian malaria in the Hawaiian Islands - an ongoing conservation crisis on the Island of Kaua‘i.*
  Rick Camp, Hawai‘i Cooperative Studies Unit, University of Hawai‘i at Hilo

Short presentations by

- **Lucas Fortini**, USGS, Pacific Islands Climate Change Cooperative, Honolulu, HI
- **David Beilman**, Dept. Geography, University of Hawai‘i at Mānoa
- **Victoria Keener**, East-West Center, Honolulu, HI
- **Matthew Widlansky**, International Pacific Research Center , University of Hawai‘i at Mānoa
- **Oliver Elison Timm**, Department of Atmospheric and Environmental Sciences, University at Albany

A.2 List of participants

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A.3 Evaluation summary and example questionnaire:

Agreement	strongly disagree	disagree	undecided	agree	strongly agree	sample	average score
Score	**0**	**25**	**50**	**75**	**100**	size n	
a)	2	6	4	6	1	19	**47**
b)	3	7	3	5	0	18	**39**
c)	0	7	4	5	2	18	**53**
d)	3	9	4	2	0	18	**32**
e)	1	0	3	9	5	18	**74**
f)	2	2	2	4	7	17	**68**
g)	1	4	4	3	5	17	**60**
h)	0	5	2	7	3	17	**62**

Category (see questionnaire for exact question)

(a) Climate information is sufficient.

(b) Climate data lack adequate description.

(c) Firm understanding of which climate drivers are important.

(d) I am able to quantify uncertainty.

(e) We need transdisciplinary research.

(f) Basic theoretical research is important.

(g) I have/know evidence for climatically forced changes.

(h) Regional climate change is not trustworthy, yet.

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Participant Questionnaire

(1) Last name First name Affiliated agency or institution, if applicable

(2) What is your research background and main area of expertise?

(3) Will you attend the breakout sessions on Day 2, July 23: (YES) / NO

(4) If YES, what is your preferred breakout group if available? Please circle below:
(a) Research methods in regional climate change: Current status, limits, and future directions
(b) Research methods in regional ecosystem changes: Current status, limits, and future directions
(c) Exchange of information between two research disciplines: formats, metadata, communication
(d) No preference

(5) What are high priority questions in your field that would be beneficial to discuss?

Rectifying different climate modelling strategies to better predict ecosystem response.

(6) Contribute your recommendations for future research strategies, collaborations, and communications:

(7) Last name First name Affiliated agency or institution, if applicable

Day 1 Synthesis

(8) In your opinion, what are the key challenges in better understanding regional climate change and environmental response in Hawai'i? In synthesizing our combined knowledge?

Contrasting climate models; uncertainties of biological response rates

(9) What are particularly suitable and high priority questions and methods to address these challenges?

Fine scale (space and time) paleo-records of ecosystem response.

(10) Please rate your degree of agreement to the following statements: from 1 to 5, where numbers are:
(1) completely disagree (2) partly disagree (3) not sure (4) partly agree (5) completely agree

(a) I can find all climate information I need for my own research / professional work. 1 (2) 3 4 5

(b) I have not been able to make progress in my work due to missing data description. 1 (2) 3 4 5

(c) I know exactly the climate drivers that I need in my research / professional work. 1 2 (3) 4 5

(d) I know exactly how to quantify uncertainty from input climate to the end product 1 2 (3) 4 5

(e) Transdisciplinary research is the only way to solve environmental research problems (1) 2 3 4 5

(f) Basic research is still needed to develop the theoretical foundations in my discipline (1) 2 3 4 5

(g) I have knowledge of one or more studies that have convincingly demonstrated the dynamic ecosystem response to past climatic changes in Hawaii. 1 (2) 3 4 5

(h) Regional climate change scenarios must undergo a significant improvement before we can trust them and build our research/work on those scenarios. 1 (2) 3 4 5

Mahalo for your contributions!