Project Title:

Pacific Coastal Fog: Using data assimilation techniques to develop ecologically relevant fog data sets, phase 1

Proposal by:

Alicia Torregrosa, Physical Scientist
USGS
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Menlo park, CA 94025

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Scope & Budget:

Location: Across LCCs
Duration in months: 18
Requested Funding: $99883.95
Leveraged Funding: $95480

Briefly summarize the goals of the project, what products will result, and how the products support decision-making and conservation delivery for natural resource management within the CA LCC.

The goal of this project is to create needed coastal fog datasets. Currently the conservation community lacks useable data to quantify the regional effect of fog on the hydrologic and thermodynamic components of ecological, biological, and economic systems in California. Advective fogs air-condition CA, alter evapotranspiration rates, provide substantial moisture for coastal plants including redwoods, and modify stream temperatures. Temporal or spatial alterations in fog distribution will likely be a major driver of landscape change and impact CA water budgets and energy use. Fog in coastal California is a very complex phenomenon defined by several parameters (extent and frequency of cloud cover, thickness of cloud base, density, humidity, liquid water content, thermal properties, and air volume heterogeneity). These variations span multiple scales and processes such as land surface effects and linkages to synoptic weather and ocean patterns. The specific products that will emerge from the collaboration we are envisioning between on-the-ground natural resource managers and a multidisciplinary coalition of physical scientists are: 1) a compilation of existing fog related data from multiple sources: satellite (AVHRR, GOES, Modis, Landsat), NOAA buoy , and airport and meteorological stations, 2) USGS Open File report documenting the results of a multiday working session with climatologists, remote sensing specialists, fog modelers, statisticians, and natural resource managers, convened to review the data, examine and assess the correlations between data streams and models, specify initial parameters to be extracted from the data fusion, and define the data assimilation framework for deriving interpolations and projections, 3) an internet-based collaboration platform to share the data, and 4) a second working session to review assimilated product, discuss a longer-term strategy for operational continuity and product refinement.

For continuing 2010 CA LCC projects, describe the accomplishments and outcomes to date, why additional funds are needed, and what this proposal will add to the project.

 NEW PROJECT

Identify which National LCC Performance Measure(s), if any, your project addresses.

1. A risk and vulnerability assessment developed or refined for priority species and habitats. 2. Inventory and monitoring protocols developed or refined to capture data on fish and wildlife populations and their habitats to detect changes resulting from climate change. 3. A population and habitat assessment developed or refined to predict changes in species populations and habitats. 5. A management evaluation action evaluated for effectiveness in response to climate change and research activities conducted to address information needs in response to climate change.

List Partners

USGS; Gary Ellrod, Ellrod Consulting; Jim Johnstone, Univerity of Washington; Travis O'Brien University of California Santa Cruz; Natalie Gates, National Park Service.

Briefly describe how the project team (main PIs) provides the range of experience, expertise, and organizational capacity needed to accomplish the project. List recent and current projects (names, time-periods, PI time commitments, and total budgets). Also attach 1 page CVs for the principle investigator and/or project leaders per below under additional information.

The team has a four-part structure, a core group of physical scientists functioning as the brain trust, a core group of users who ensure the fog data products meet on-the-ground conservation needs, a science advisory group who are ready to engage in guiding the project deliverables, conduct product reviews, and long-term strategizing, and a coordinator/technical specialist who both facilitates team communication and produces the GIS layers based on specifications defined through the interactions between the brain trust, user, and science advisory groups.

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Project Description: The long term goal of this project is to advance our understanding of regional fog distributions, provide a basis for projecting climate impacts on the marine layer, and define a framework for monitoring fog response to climate change. Advective fogs air-condition CA, alter evapotranspiration rates, provide substantial moisture for coastal plants including redwoods, and modify stream temperatures. The regional effect of fog on the hydrologic and thermodynamic elements of ecological, biological, and economic systems in California have yet to be quantified –better data are needed. Temporal or spatial alterations in fog distribution will likely be a major driver of landscape change and impact CA water budgets and energy use. Fog in coastal California is a very complex phenomenon defined by several parameters (extent and frequency of cloud cover, thickness of cloud base, density, humidity, liquid water content, thermal properties, and air volume heterogeneity). These variations span multiple scales and processes and include land surface effects that are linked to synoptic weather and ocean patterns. We envision this project jump-starting a formal collaboration that leverages in-kind and other support from a community of physical and natural scientists, natural resource managers, on-the-ground conservation practitioners, and organizations responding to climate change adaptation needs

In the short term we seek LCC funding to produce a spatially explicit fog dataset in the form of GIS layers developed through data fusion and statistical analysis of existing data to meet the conservation objectives of natural resource managers. This is a difficult and challenging goal and to ensure it is "done right the first time" as Western States Climatologist Kelly Redmond insists, we propose that the products include 1) two three-day workshops with climatologists, fog/atmospheric modelers, on-the-ground conservation practitioners, remote sensing scientists, and statisticians; 2) two publications, one that documents the results of the workshops and another to place the data products into the peer-review literature, and 3) a plan for operational continuity. The 5 tasks include: 1) compile existing data, including satellite (AVHRR, GOES, Modis, Landsat), NOAA buoy data, and airport and meteorological station records, 2) organize-lead a multi-day working session to examine the compiled data, specify the initial parameters to be extracted from the data fusion, assess the correlations between static data, data streams, and models, and structure the data assimilation framework that will be used to derive data interpolation and projection (across space and time), 3) develop an internet-based platform for sharing and collaboration, 4) conduct data assimilation to generate the fog dataset, 5) organize-lead multi-day working session to review assimilated product, discuss linkages with existing and planned sensor networks, and develop a long-term strategy for operational continuity, expanded coverage, and fog dataset(s) refinement.

How project meets the CA LCC 2011 Priorities: The project supports decision-making and conservation delivery for natural resource management in the following areas:

1) Ecosystem Response and Habitat Information:

a) Models at relevant scales: The baseline historical fog data will provide essential and missing information to better understand ecosystem response and feedbacks. Fog plays a critical role in

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the distribution of plant community types such as redwoods, drought sensitive coastal endemics, and coastal shrublands. The faster rates of successional patterns that are seen in northern grassland→shrubland→ tree complexes relative to southern complexes is hypothesized to be a function of coastal California latitudinal gradient to fog effects (pers. Comm., Robert Steer, NPS I & M vegetation coordinator). Maps of fog frequency and distribution for longer time periods than are currently available and at higher spatial and temporal resolution will help public land managers and others do a better job of mapping vegetation. The project's first workshop is designed for the team's physical scientists and resource managers to work together to identify the most relevant scale(s) for fog parameters extraction given the existing data, ensuring the relevance of the data to be derived.

b) Why hotspots are hot: The steep coastal temperature and precipitation gradient seen in both historic and projected CA climatologies is largely a function of marine layer, coastal and topographic interactions. The project's baseline fog distribution and frequency maps will add an important environmental dimension to spatial models of biodiversity. Explicitly including fog data as layer in a GIS based connectivity analysis would provide higher discrimination between connectivity pathways.

2) Decision Support for Climate Adaptation

The increased knowledge about fog along the coast will support climate adaptation decisions in several ways. The spatially and temporally explicit information will help to guide conservation land acquisition and restoration and identify gaps in the climate monitoring network. The information will be used as soon as it is available for the NPS scenario planning and vulnerability assessments currently underway. The knowledge exchange that will occur at the two multi-day working sessions as the team and its science advisory group consider the project deliverables and analytic results will provide a basis for projecting climate impacts on the marine layer and strategizing operational continuity. The web-based dissemination of the fog maps either through the CNAP California Climate Change Center or other public site will provide open access information retrieval.

How the project meets CA_LCC 2011 Criteria:
1) **Applicability to Conservation and Adaptation Decisions**. The product deliverables will be immediately applicable to conservation and adaption decisions as evidenced by the attached letters of support. The historical reference of fog distribution will support public land acquisition decisions by improving the capacity to evaluate locations of unique or climatologically sensitive habitats. Fog distribution information is also crucial for making well-informed decisions regarding native plant restorations. In cases where land managers are restoring acquired land with severe ecological disturbance, information on fog frequency and location will assist in the identification of target restoration species. Fog is a driver in NPS current scenario planning and vulnerability assessments (also CA Coho task force, &others) but little information is available at biologically relevant temporal and spatial scales and extent. Climate change planning is

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occurring now in coastal NPS units and data from this project -to be disseminated through USGS data portals- will fill a current need for spatially relevant information.

2) **Ecosystem Response to Climate Change**. A crucial source of uncertainty about the response of coastal ecosystems to climate change can be traced to the inadequate information about current and historical contributions of fog to ecophysiological processes and water budgets. The widely used Basin Characterization Model (BCM, Flint and Flint, 2008) does not currently include fog despite the amble research evidence (Johnstone and Dawson, 2009; Williams 2007) that fog drip is important to coastal plants and fog affect on coastal stream temperatures. The BCM authors are prepared to incorporate project deliverables into the BCM algorithms to improve the accuracy of the numerical model for coastal watersheds.

3) **Breadth of Understanding**.   Fog is a complex phenomenon that drives and is driven by processes at all scales of observation. This complexity has played a part in the current lack of a historical baseline. One of the goals in assembling the project team has been to bring together experts from all the relevant disciplines so that together we can select and specify the data parameters and scales of greatest relevance to ecosystem processes.

4) **Accessibility**: The decision to develop the products as GIS layers was to enable the data to be easily incorporated into spatially explicit analyses and map-based websites.   Kelly Redmond is advising and guiding the project's online design and dissemination.

5) **Scope/Transferability**: The historical baseline of fog frequency and distribution that will be generated from this project is needed for the entire eastern Pacific coast however, unless we leverage additional funds we intend to pilot the methods along a 100-200 km stretch of the northern coast of the CA LCC (equivalent to one or two Landsat scenes). The methods will be highly transferable to other portions of the coast and we are currently actively seeking to leverage additional funding to expand beyond the spatial extent of this CA LCC proposal.

6) **Partnerships/Leveraging**: The ratio between the in-kind support that is being provided by team member and science advisor agencies/organizations and the CA LCC funding request is approximately one to one. The willingness of the partners involved and the commitment to producing a product of value to the conservation community is extraordinarily high. The coalition that the project is building to address the lack of fog data and research for the ecological community has been ready to emerge for some time. The possibility of funding from the CA LCC has proven catalytic.

7) **Timeliness and Urgency:** The data we propose to generate are very urgently as evidenced by how difficult it is to attend a climate related or natural resource meeting dealing with ecosystems in the CA_LCC boundary area, without hearing and simultaneously being unable to answer the question "what about the effect of fog?"

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Approach and Scope of Work:

The Pacific Coastal Fog project approach for the short term objective –generate a high resolution reference dataset describing fog frequency and distribution—is to generate statistical relationships between existing data streams (e.g. satellites, ocean buoys, and terrestrial stations) and then use the team's collective knowledge to select statistical relationships that have process-based plausibility and eliminate those that are statistically relevant but implausible.   These statistical correlations are then used to interpolate or extrapolate as needed to fill in or expand the spatial and temporal gaps for the longest period possible from the existing data. This approach will also simultaneously create the knowledge base to begin to address the longer term goals of projecting climate impacts on the marine layer and defining a framework for monitoring fog response to climate change.

Step 1. Compile Existing Data: Three major data streams of empirical observations to be compiled include data from satellites (GOES, AVHRR, MODIS, ASTER, and Landsat), ocean buoys (NOAA), and terrestrial monitoring stations (logs from airport flight towers and sensors deployed at meteorological stations). Part of the in-kind contributions by team members are the data streams they have already compiled such as Jim Johnstone's airport data and Gary Ellrod's algorithms for extracting relevant values from GOES data.   The storage needs for these data are significant therefore this task will also include developing a strategy for data management, metadata, and group access for collaboration purposes. The satellite data will be stacked in such a way as to be able to "drill down" through the stack at a given point in space to extract a temporally sequenced record from all relevant satellite data sources. The process will be coded as IDL scripts in the ENVI remote sensing toolbox so that all pixels in the study area-of-interest will be extractable. The point of stacking so many different satellite data sources is that each source gives different information. Landsat data are the highest spatial resolution with 30 meter pixels and GOES is the lowest with 4 km pixels. The data stream frequency is different in each of the satellites and ranges from GOES every 30 minutes to MODIS once or twice a day, depending on whether the night time passes also provide usable data, to Landsat that is at most 2 per month. The type of spectral information also varies with AVHRR and ASTER providing thermal data that will be used to discriminate top of cloud/troposphere relationships.

Step 2. Run Statistical Correlations: The empirical data will be used to run regressions, ordination-based multivariate analyses (such as CCA) to derive statistical relationships between the satellite-based observation of fog presence and; 1) synoptic weather patterns, 2) topography and topology (e.g. low cloud transport barriers and corridors), 3) ocean conditions (such as upwelling and other currents that affect regional temperature and wind conditions), and 4) local observations of height of cloud deck.

Step 3. Workshop #1:. Review and assess existing data and statistical output: The objectives for the 3-day workshop in addition to reviewing data and statistical outputs includes: 1) develop the team's common knowledge pool, 2) define "fog parameters" relevant to natural resource

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management needs, 3) document scientific rationale for accepting/rejecting statistical relationships with high correlation/confidence values, 4) discuss the development of a data assimilation framework and how best to bring in the physical process models, and 5)) outline next steps and assign lead authors and products to be published.

Step 4. Generate Initial Maps based on feedback from the workshop

Step 5. Workshop #2. Review initial data products and dissemination portal.

Products and Data Sharing:

1. Data Compilation. This product even in its raw form is in great demand as many other research groups would like to selectively pull data to address questions in other domains for example Dennis Baldocchi's group who are focusing on central valley fog. (8/2011)
2. Workshop #1: There are two products associated with the product, the collaboration among physical scientists and resource managers and a report that will be accessible on the project's website that documents the presentations made during the workshop and the decisions about parameters, spatial extent of the pilot area.(8/2011)
3. Baseline map of fog frequency and distribution. The product, a USGS data release, will be broadly disseminated in its draft form. It will be accompanied by descriptions of the methodology and recommendations about issues that need to be addressed when applying the methods to other areas along the Pacific coastal zone.(6/2012)
4. Publications in peer-reviewed journals. Several of the collaborating scientists on the team will be taking the lead on authorship of articles describing the results from their specific disciplinary perspective. This peer review is important for validating the results and addressing the long-term objectives of the research team. (in draft form 9/2012)

All dates are linked to a June 2011 project start date, later starting dates would be reflected in equivalent changes to the deliverables timeline.

 Measuring Results:
There are three results from this project to measure, the scientific accuracy of the derived fog map, the usefulness of the product to the conservation community, and the catalytic potential of this project to address longer term questions about fog. From a science perspective the products from this project are meant to reduce the uncertainty about fog effects on coastal ecosystems and therefore one of the important measures will be an accuracy assessment conducted on the historical fog distribution and frequency as mapped across the landscape. Several techniques from remote sensing science and analysis will be used such as error matrices derived using a group of sample data withheld from extrapolated results. From the perspective of the use of these products to the conservation community it is the relevance of the data and its capacity to answer ecological questions that be important. This will be measured by working closely with the natural resource managers and tracking their responses and making sure that we are addressing their concerns. From the perspective of longer term, the measure will be the funding and support we can leverage in the future.

California Landscape Conservation Cooperative 2011 Proposal Budgets

Budget Categories	CA LCC Request	Partner(s) Contribution(s) (monetary)	Partner(s) Contribution(s) (non-monetary value/in-kind)	Total	In-kind source	amount	in-kind notes
					USGS	42,000	Torregrosa
Salaries	$ 57,430.00	$ 3,000.00	$ 95,480.00	$ 155,910.00	Ellrod Consulting	14000	Gary Ellrod
Supplies	$ -	$ 1,545.00	$ -	$ 1,545.00	National Park Service	15000	Natalie Gates and 7 staff members
Overhead	$ 33,953.95	$ -	$ -	$ 33,953.95	UC Santa Cruz	5280	Travis O'Brien
Equipment	$ 3,500.00	$ -	$ -	$ 3,500.00	U Washington	7200	Jim Johnstone
Other (specify)	$ 5,000.00	$ -	$ -	$ 5,000.00	Science Advisors	12000	Redmond, Dettinger, Cayan, Duffy, others
Total	$ 99,883.95	$ 4,545.00	$ 95,480.00	$ 199,908.95			

Other:

Travel to workshop for key experts: $5000

The Nature Conservancy
Protecting nature. Preserving life.™

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nature.org
nature.org/california

Rebecca Fris
California Landscape Conservation Cooperative
3020 State University Dr. East #2007
Sacramento, CA 95819

April 11, 2011

Re: The Nature Conservancy support for CA LCC proposal titled: "Pacific Coastal Fog: Using data assimilation techniques to develop ecologically relevant fog data sets"

Dear Ms. Fris:

The mission of The Nature Conservancy is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. Given the richness of and threats to the plants and animals in California's mediterranean regions, we cannot achieve this mission alone. The information fostered by the California Landscape Conservation Cooperative (CA LCC) will help inform the on the ground conservation decisions our organization makes every day to better achieve our mission.
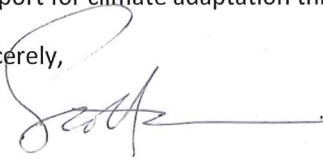
Coastal areas in California are hotspots for rare plants, fish, amphibians, and other species and long have been a target for our conservation engagements. Coastal fog plays a key role in supporting this biodiversity by providing water and shade during California's long hot and dry summers. Despite its well known importance, very little spatially explicit information exists about the extent and frequency of this highly variable phenomenon. Without an accurate characterization of the historical spatial and temporal patterns of fog, there is no way to generate reasonable predictions about how climate change will modify current fog patterns. If climate change causes more fog, it could provide some relief to coastal areas from the projected increased heat and potential droughts. However, if there will be less fog in the future, many rare plants and animals will not be able to withstand the higher evaporative demands and may lose all climatically suitable habitat. A better understanding of the historical dynamics of fog is an essential first step to developing conservation strategies to address the threat of climate change in coastal regions of California.

The analyses and products described in the proposal titled: "Pacific Coastal Fog: Using data assimilation techniques to develop ecologically relevant fog data sets" will help to make the logical next step in understanding fog. If the team is able to develop and demonstrate a repeatable methodology to map historical fog patterns over time around Point Reyes, this methodology could be applied to the entire coastline of California. With this information, we would be able to:

1. Include fog frequency as a proxy for vegetation diversity and a target for conservation action in ecoregional plans and conservation action plans;
2. Incorporate fog frequency as a climatic variable for parameterizing species distribution models; and
3. Explore the relationship of fog with other climatic variables and landscape characteristics to try to determine how fog will respond to various future scenarios of climate change.

The Nature Conservancy supports the goals of this proposal, and anticipates that its products could be immediately useful to us in our on-the-ground conservation work in the North and Central, and South Coast ecoregions. Thank you for your consideration of this proposal, and your important focus on ecosystem responses and decision support for climate adaptation through the California Landscape Conservation Cooperative.

Sincerely,

Scott Morrison, Ph.D.
Director of Conservation Science

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April 8, 2011

Alicia Torregrosa,
U.S. Geological Survey,
Western Geographic Science Center

RE: Support for Application by the U.S. Geological Survey for funding from the
        Landscape Conservation Cooperative to conduct the Pacific Coastal Fog Data
        Assimilation: Phase 1.

Dear Alicia,

With this letter, Midpeninsula Regional Open Space District would like to express full
support for the funding application by the U.S. Geological Survey and partners to the
California Landscape Conservation Cooperative for the Pacific Coastal Fog Project. The
Fog Project products will provide essential information that will advance our on-the-
ground conservation objectives. MROSD values the opportunity to support the project
and participate in the planned workshops that will gear the products to our needs.

Spatial and temporal fog patterns significantly influence species distributions and
ecological dynamics of California coastal ecosystems. The District owns over 8,000
acres of San Mateo County Coastland with a diverse range of plant and animal species,
many of which are rare, threatened, or endangered. A historical reference of fog
distribution and framework for long term fog monitoring system would greatly improve
our ability to evaluate locations of unique or climatologically sensitive habitats, and
develop more informed strategies for land management and future land acquisitions.
Such products are particularly urgent given potential changes to fog patterns caused by
climate change.

Fog distribution information is also crucial for making well-informed decisions regarding
native plant restorations. In cases where the District has acquired land with severe
ecological disturbance, lack of information on fog frequency and location has made
identifying target restoration species challenging. Products delivered from the California
Landscape Conservation Cooperative funded project would be of immediate use in
determining the restoration objective for a disturbed site by selecting an appropriate
nearby reference site that has similar fog patterns.

The District recognizes the importance of securing funding to complete this project. We hope that the California Landscape Conservation Cooperative considers this request favorable and recognizes the immense long-term conservation benefits that will emerge upon project completion.

Sincerely,

Kirk Lenington, Senior Resource Planner

Coastal Conservancy

April 11, 2011

Debra L. Schlafmann
California Landscape Conservation Cooperative
3020 State University Dr. East # 2007
Sacramento, CA 95819

RE: Support for Application by the U.S. Geological Survey for funding from the Landscape Conservation
Cooperative to conduct the *Pacific Coastal Fog Data Assimilation: Phase 1.*

Dear Ms. Schlafmann,

The State Coastal Conservancy enthusiastically supports the U.S. Geological Survey's request for $98,600
in funding from the California Landscape Conservation Cooperative to conduct the proposed project
"Pacific Coastal Fog Data Assimilation: Phase 1." Coastal land managers have increasingly come to
understand that with predicted climate change crucial information is needed to better understand the
effect of fog on coastal ecosystems. The Conservancy has followed a number of developments in fog
studies on the coast, and is impressed both with the caliber of the team members' previous work and
their willingness to contribute their in-kind support. There are many questions we need answered
about fog, including its contributions to maintaining water supplies for watersheds during the dry
season, the dynamics of fog with respect to increasing or reducing fire risks, and the role of intercepted
fog in vegetation succession, among others. As a community, we need improved indicators that can
capture the important but varying effects future changes in fog will produce on our landscape.

The Conservancy feels that the deliverable from this first phase of the project, a historical fog baseline, is
an important first step towards establishing a longer term strategy for understanding potential changes
in fog along the coast. USGS, working within the LCC's broad suite of physical science experts working
with conservation and natural resource specialists, can ensure the scientific rigor and product usability
that will be one of the keys to the project's success.

We look forward to helping where we can and, through this project, hope to be able to apply a better
and deeper understanding of the past, present, and future role of fog in California.

Sincerely,

Amy Hutzel
Program Manager
San Francisco Bay Area Conservancy

CC: Alicia Torregrosa, U.S. Geological Survey, Western Geographic Science Center

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California State Coastal Conservancy

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Employment History

10/01 – present -- Physical Scientist -- U.S. Geological Survey, Menlo Park, CA

8/98 –9/2001 -- Research Scientist -- CSU Monterey Bay/NASA Ames Research Center

2/93 - 8/98 -- GIS Coordinator -- Thomas Reid Associates (TRA), Palo Alto, CA

8/85 – 7/92 -- Interpretive Specialist   -- Oakland Museum, CA

1/86 – 7/86 – Docent Education and Training – Monterey Bay Aquarium, CA

8/85 – 7/92 -- Natural History Education Director -- Oakland Museum, CA

6/79 -12/84 -- Coordinator of Biology Public Programs -- Lawrence Hall of Science

Education

- San Francisco State University, Ecology and Systematics M.A. Spring 2000
  Thesis: Predicting species occurrence by merging Canonical Ordination with GIS.

- Stanford University Center for Conservation Biology research intern, 1993

- University of California, Berkeley. BA Biology, Marine Ecology. 1978

Languages and other skills

Fluent in Spanish and French (spoken and written), river rafting guide, sea kayaking enthusiast, Certified UC Research Scuba Diver.

Awards

2002, U.S. Geological Survey, *Special Thanks for Achieving Results* (STAR) Monetary Award

1997 US Fish and Wildlife Service, Certificate of Merit (1997) for Headwaters Park Analysis.

1993   California State University Chancellor's Pre-Doctoral Scholarship.

1992, 1993 "Distinguished Achievement in Major Field" Graduate Student Award, San Francisco State University.

Publications

Torregrosa, A. and Woodward, A., 2010. Integration Models In: Miller, D.M., Finn, S.P., Woodward, A., Torregrosa, A., Miller, M.E., Bedford, D.R., and Brasher, A.M., 2010, Conceptual ecological models to guide integrated landscape monitoring of the Great Basin: U.S. Geological Survey Scientific Investigations Report 2010-5133, 134 p.

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Saito, K., Langley, P., Grenager, T., Potter, C., Torregrosa, A., & Klooster, S. A. (2001) Computational revision of quantitative scientific models. *Proceedings of the Fourth International Conference on Discovery Science* (pp. 336-349). Washington, D.C.: Springer-Verlag.

Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Christopher Potter, Steven Klooster, Alicia Torregrosa, (2001) "*Finding Spatio-Temporal Patterns in Earth Science Data*", *KDD Workshop on Temporal Data Mining*.

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Note name change from Galo to Torregrosa

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 http://gis.esri.com/library/userconf/proc96/TO50/PAP004/P4.HTM

Galo, A.T., 1995. Drawing Lines on the map: Conservation Biology and GIS.
 Proceedings of the ESRI 15th Annual Conference, Palm Springs.

Galo, A. T., P. B. Rich and J. J. Ewel 1991. Effects of forest edges on solar radiation
 regimes of tropical ecosystems. Proceedings of the American Society of
 Photogrammetry and Remote Sensing. pp. 98-108.

Edwards, S. & A.T. Galo. 1991. Rare plants of the East Bay Regional Parks. The Four
 Seasons. 9: 1 pp. 1-17.

Horton, T. M., V.T. Parker and A.T. Galo. 1991. The invasion of mixed evergreen forest
 into stands of chaparral in Marin County, CA. Proceeding of the Ecological Society of
 America. pp. 234-236.

Kramer, K.T and A.T. Galo. 1990. San Francisco Bay-Delta Public Education Display.
 In: Computer-Aided Environmental Education. ed. W.J. Rohwedder. pp. 117-128.

Presentations

Madej, M.A., Torregrosa, A., and Woodward, A.W., 2010, *"Synthesizing Vital Signs
Data from Klamath and San Francisco Bay Area Networks: Analysis of Linkages and
Trends in Climate, Stream Flow, Vegetation, Salmon, and Ocean Conditions",* 60 minute
Webinar for ~ 300 participants, November 5, 2010.

Torregrosa, A., Hanser, S., Tumbusch, M., and Bedford, D., 2009, Phenological
assessment in the Owhyee Uplands: integrating climate drivers and ecological response at
local to regional scales, Proceedings of the American Geophysical Union Annual
Meeting, December 2009.

2009 "Energy Related Current Projects and Capacities of the Western Geographic
Science Center" USGS Integrated Science Workshop on Energy, April 14.

Torregrosa, A., Woodward, A., Miller, D., Denn., Bedford, D, and Finn, S., 2009,
Linking Plot to Landscapes: A Synthetic Framework for Monitoring Change in the Great
Basin Ecosystem, in Brady, S.R., ed., 2009, Proceedings of the Second All-USGS
Modeling Conference, February 11–14, 2008—Painting the Big Picture: U.S. Geological
Survey Scientific Investigations Report 2009–5013, 70 p., available only online at
http://pubs.usgs.gov/sir/2009/5013/.

Torregrosa, A., Aiello, D., and Woodward, A., 2009, A Knowledge Management
Approach for Complex Regional Ecosystem Modeling., in Brady, S.R., ed., 2009,
Proceedings of the Second All-USGS Modeling Conference, February 11–14, 2008—
Painting the Big Picture: U.S. Geological Survey Scientific Investigations Report 2009–
5013, 70 p., available only online at http://pubs.usgs.gov/sir/2009/5013/.

Alicia Torregrosa   atorregrosa@usgs.gov
USGS Pacific Geographic Science Center   650.329.4091

2008 "Phenological Analysis for the Interdisciplinary Owyhee Project" US Geological Survey Phenology Meeting, Tucson, AZ, Oct 29.

2008 "Multiscale, multidiscipline integration model for Great Basin" at the Annual GBILM Science Meeting, Oct 2.

2007 Organized Ecosystem Mapping Session and presented "U.S. Geological Survey Ecosystem Mapping Initiative" Association of American Geographers. April 18.

2006 "Modeling the Nation's Ecosystems," invited speaker to the USGS Western Executive Leadership Team. May 15

2005, 2004 "Watershed Management." Army Corps of Engineers in-house training sessions. Sacramento, CA.   (Invited speaker) September 14, 2004, August 5, 2005.

2005   "A Local Example of Collaborative GIS for Land Use Planning: The San Francisquito Watershed." American Planning Association Annual Conference (invited speaker.) San Francisco, CA. March 23

2004 "Testing biodiversity conservation analysis for public consumption." Ecological Society of America Annual meeting, Portland, Oregon. August 3. Torregrosa, A., Crist, P., Stoms, D., and Barker, K.,

2004 "NatureServe Vista: a hands-on session with the biodiversity land use planning software." International Association for Landscape Ecology Annual Conference. (with David Stoms, UC Santa Barbara.) April 2.

2004 "Parcel Attribute Analysis: Integrating socioeconomic data into decision and planning support systems" USGS Fifth GIS Workshop, Denver, March 1-5. Torregrosa, A., Bernknopf, R., and Dinitz, L.,

2004 "Seventh Order Topographic-Bathymetric Watershed Delineation." Association of American Geographers Annual Meeting, Philadelphia, Penn., March 13–19, 2004. Torregrosa, A., Peltz-Lewis, L., Kapellas, J., Wittner, E., and Christopher, R.,

2003 "What is a Butterfly worth? The challenge of estimating the economic value of biodiversity." USGS Public Evening Lecture and Film Series. November 23, 2003. Torregrosa, A., Bernknopf, R.,

2000   Environmental Modeling "Pine" Workgroup Results. As a workgroup leader at the GIS/EM4 conference, presented results of the weeklong workgroup sessions at the final Town Hall session. 4th International Conference Integrating GIS and Environmental Modeling, Banff, Canada

2000   Vegetation dynamics of the Sierra Buttes, CA: Mapping CCA results using GIS. San Francisco State University Master's thesis public seminar.

1999   Merging Regional Remote Sensing and Simulation Modeling NASA Land Surface Hydrology Investigator Meeting, Baltimore, Maryland.

1997   An Introduction to Dynamic Segmentation Santa Clara Valley Water District 4 session class instructing employees on the use of the Arcview-based decision support tool.

1996   Dynamic Segmentation and EIR analysis , ESRI Annual User's Conference. San Diego, Ca. (url: http:// www.esri.com/library/userconf/proc96/TO50/PAP004/P4.HTM)

1995   Natomas Basin Data Conversion or How we use ArcCAD, Silicon Valley ArcCAD user's Group,

1995   Drawing Lines on the Map, Conservation Biology on GIS (TRA, 1995, ESRI Annual User's Conference) An on-line computer based presentation to an audience of 200, showing examples of the use of GIS as a planning resource. Redlands, Ca.

1994   Grasslands Land Use Guidance, Los Banos City Council Chambers. An interactive, computer-based presentation to city planners highlighting conservation biology principles for proposed changes to general plan. Recommendations adopted.

1991   Changes in the Light Environment of a Regenerating Tropical Forest , American Society of Photogrammetry and Remote Sensing, Annual Conference and Los Alamos Laboratories, Environmental Division, invited speaker.

1991   The Invasion of Mixed Evergreen Forest Into Stands of Chaparral in Marin County, CA. Horton, T. M., V.T. Parker and A.T Galo Poster session at the Ecological Society of America Annual Conference, San Antonio, Texas.

1990   Hierarchy Theory and the Coastal Scrub Community, Graduate Student Meetings at Rancho Santa Ana sponsored by the CA Botanical Society.

1987   Docent training presentations, Monterey Bay Aquarium.

1985 Beyond the Blackboard, teacher training workshops sponsored by the Smithsonian Institute.

1981,82,83 Pohnpei Upward Bound Teacher Training Sessions 5-6 week intensive team training sessions held in Pohnpei. Micronesia for high school teachers.

1982, 83   UC Berkeley co-instructor for Education 197: Teaching in the non-traditional setting.

1982, 83, 90,92 Expanding Your Horizons : Science Careers for girls workshops sponsored by Mills College.

1981, 82   Introduction to Research SCUBA Diving UCB teaching assistant.

1980   Women Aloud , radio broadcast producer and developer of 5 one-hour segments aired on KALX, FM 90.7 with a collective of 5 other women.

Project Details

Science Impact Program: Science for Sage-grouse Conservation (USGS Western Geographic Science Center, May 2004 –2007). Co-PI with USGS biologist and Stanford Law School faculty, to create an information dissemination system that integrates risk assessments and GIS models to provide science to land use managers implementing conservation strategies across the semi-arid western U.S. The project is now nested within the USGS Integrated Landscape Monitoring 2006 Science Thrust: Great Basin Pilot.

USGS ArcGIS Beta-tester (2003- 2004) One of 7 beta-testers providing feedback to ESRI during the development of version 9.0.

NatureServe Decision Support System Science Design Team, (USGS, WGSC,Sept. 2001 - present) Integrated socioeconomic analysis into the biodiversity land use planning software application VISTA including development of a conceptual framework based on parcels as an analysis unit, algorithms to estimate land value and summarize land costs, and scenarios of potential land use change to beta test the software. Conducted needs assessment workshops with Bridger-Teton Forest Service planners to begin development of version 2.0.

INCLUDE- Integrated-Science and Community-Based Values in Land Use Decisionmaking (USGS, WGSC,Sept. 2001 - 2005) Technical advisor for the San Francisquito Creek

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Watershed INCLUDE project. Activities included disseminating USGS science at technical advisory meetings, providing GIS mapping and analysis support, developing an interactive mapping website, and contributing to the Santa Clara Basin Working group to develop indicators of watershed health.

NASA Ecosystem Modeling Group (CSUMB/NASA Ames, 1998 - present). As part of the CASA global biogeochemical flux modeling team developed data-mining techniques to test hypotheses about spatio-temporal relationships between global climate anomolies and simulated ecosystem responses, developed new algorithms to interpret satellite data, compiled, integrated and managed data layers; and presented results at conferences and NASA investigator workshops.

GIS Coordinator -- Thomas Reid Associates (TRA), Palo Alto, CA
Responsible for all GIS products and analyses for high profile projects, CA Natural Communities Conservation Program, Headwaters Forest, Nevada (Spring Mountain) Biodiversity Initiative, and local hydrology projects; long-range planning and implementation; system administration and budget oversight; in-house staff training and supervision; and technical assistance to clients.

Headwaters Forest (TRA, 1997 - 1998). As a consultant for the CA Resources Agency, provided GIS support for on-going negotiations for the Headwaters Forest Acquisition and the Pacific Lumber Habitat Conservation Plan/EIR. Tasks included: identification of data discrepancies, reconciliation of data from all sources and development of "interpretation guidelines" for all dynamic data; development of economic/biological benefit-cost analysis, habitat quality surrogates, and spatio-temporal optimization studies. See http://www.ceres.ca.gov/headwaters/hcp_maps/overview. html for reports and other graphics.

Santa Clara Valley Water District (SCVWD) Environmental Impact Assessment (TRA, 1994 - 1998) Generated algorithms and methodologies to perform regional impact analyses; supervised the development of a dynamic segmentation structure for more than 500 miles of channel into which to integrate 20 years of data; collaborated with biologists to develop resource maps; created and tested ArcView based decision making tool to implement BMPs (Best Management Protocols), determined standards and implemented quality assurance and control protocols for meta-data development, data acquisition and exchange, on going documentation, archiving and distribution.

Sacramento County Planning Department (TRA, 1995-1996) Developed GRID based analysis and quantified the current and projected biological and economic resources for the feasibility study of the Vernal Pool Habitat Conservation Plan for Sacramento County. Included working closely with County staff and other consultants to assess and acquire data, and produce tabular and graphic displays for public presentation.

CA Grasslands Land Use Guidance (TRA, 1993-1994) Developed an interactive computer based presentation to explain to city planners the consequences of continued urban development into their wetland complex. Integrated multi-species resource data,

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telemetry data of waterfowl movements, socio-economic studies, parcel data, aerial photos and ground based photos; subroutines were programmed in AML for instant access.   The council adopted the conservation recommendations.

Natural Communities Conservation Program (TRA, 1993 - 1994) Performed spatial analysis of Coastal Sage Scrub habitat models under a contract with USFWS and CDFG. Included close collaboration with agencies to acquire and convert data from a variety of sources in various projections, development of analytical methodology for various combinations of habitat and linkage criteria and creation of AMLs to automate spatial analysis within GRID.

Nevada Biodiversity Initiative (Stanford University, 1993) As a research associate, developed an algorithm in ARC/INFO GRID to input statistical output from a vegetation analysis (CANOCO) into the raster based topo-physiographic model, also collected vegetation data. This model was used to predict endangered species occurrences in the Spring Mountain National Recreation Area west of Las Vegas.

Geo-referenced vegetation analysis of Sierra Buttes, California. (SFSU, 1993) Master's thesis project to examine importance of scale to vegetation analysis. GIS layers included field data (I collected plant species abundance/distribution and tree biomass data for 560 sites), GPS point data for plots, DEMs topographically corrected solar insolation grid, ER2 photos, soils, timber harvesting, hypsography, hydrology, and derivates. Analysis programs included CANOCO, TWINSPAN and other multivariate statistics.

Natural Areas Research Project (SFSU Multidisciplinary GIS Center, 1991) Developed an analysis to test the species/area curve hypothesis for 5 natural areas of San Francisco. Project included leading team in acquisition of GPS points to delineate natural areas, coordinating with botanists to develop plant lists for the area and use of SAS for statistical analysis of results.

Surface Model of Light Environments (La Selva Biological Research Station, 1990) Photographed 360 fish eye views of the canopy in recently logged 10 hectare tropical forest patch to quantify the seasonal and diurnal changes in solar flux that would be experienced by the experimental plots of regenerating plant assemblages arranged within the patch. The photos were scanned and digitized to quantify adjacent tree canopy cover and provide data points to a TIN surface model of the light environment.

Natural History Education Director -- Oakland Museum, CA
Worked with designers, curators and content specialists to develop temporary and permanent exhibits; developed and implemented education programs; hired and supervised 8 contract teachers; developed new classes and workshops for the public; assisted in docent training, wrote funding proposals; instigated collaborative museum-wide interdisciplinary programs, and served as liaison between the Museum and community organizations, school groups, park districts and state organizations.

Exploring the Estuary (Oakland Museum, 1986) Designed prototype and tested initial releases of an interactive computer based public education information program about the San Francisco bay and delta that is now used by teachers throughout California. This early desktop GIS project used FILEVISION to superimpose attribute data onto spatial map data. The initial project was a team effort with the Aquatic Habitat Institute (AHI now known as SFEI) and involved software and GUI design training for AHI staff.

Coordinator,Biology Public Programs -- Lawrence Hall of Science
Developed Biology Outreach Programs including: The Science Shuttle ('79-'84), Youth and Seniors: An Intergenerational Science Program ('81-'84), and the NSF funded Pohnpei (Micronesia) Upward Bound ('81-'84). Responsibilities included: conducting needs assessments, developing and testing exhibits and curricula, hiring, training, and supervising teachers and volunteers, and conducting workshops and teacher training.

System Administration

 (TRA, 1993 - 1998) Acquired and installed Sun Sparcstation 20 with Solaris to run ARC/INFO and integrated the unix system with a Novell based network of PCs running AutoCAD, ArcView and other software. Configured PPP, PC-NFS and cable modems, expanded and upgraded the system as needed. Developed AML programs and spreadsheet macros to automate and facilitate GIS and database tasks, implemented protocols for system administration, system back-ups, data acquisition and meta-data documentation.   Provided technical assistance for staff and clients.

Gene-Hua Crystal Ng

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345 Middlefield Rd, MS 973   Email: gng@usgs.gov
Menlo Park, CA 94040

Education:

Ph.D. Massachusetts Institute of Technology, Cambridge, MA
Civil and Environmental Engineering (Hydrology), *September 2008*
Title: Probabilistic Estimation and Prediction of Groundwater Recharge in a Semi-Arid Environment
Advisors: Dennis McLaughlin and Dara Entekhabi

B.A. Harvard University, Cambridge, MA
Applied Mathematics, *June 2003*
Honors: *magna cum laude*
Senior Thesis Title: Determining U.S. Black Carbon Emissions Using an Inverse Method
Thesis Advisor: Daniel Jacob

Research and Technical Experience:

Mendenhall Postdoctoral Research Fellow, U.S. Geological Survey
January 2010-present   *Menlo Park, CA*
Supervisors: David Bedford and David Miller
Assessing ecohydrological controls on vegetation dynamics in the Mojave Desert. Developing a numerical model that describes the coupled soil moisture and vegetation conditions in the Mojave Desert. Model uncertainty will be reduced by assimilating soil and vegetation observations. Model results will help predict how dessert ecosystems may be affected by changes in climate and land-use.

Postdoctoral Research Associate, Ralph M. Parsons Laboratory, MIT
September 2008 – December 2009   *Cambridge, MA*
Supervisors: Dennis McLaughlin and Dara Entekhabi
Investigated data assimilation applications to chaotic geophysical systems such as the atmosphere and ocean. Demonstrated the role of model dynamics on the performance of ensemble Kalman-based estimation filters. Identified interactions between sampling errors and dynamical behavior that are relevant for large dimensional systems.

Graduate Research Assistant, Ralph M. Parsons Laboratory, MIT
September 2003 – September 2008   *Cambridge, MA*
Supervisors: Dennis McLaughlin and Dara Entekhabi
Developed statistical approach (using data assimilation/ inverse method) to combine unsaturated zone chemical and physical data and model simulations for groundwater recharge estimation. Demonstrated approach using data from the semi-arid Southern High Plains region in Texas. Used results to identify vegetation, soil, and meteorological controls on episodic recharge. Incorporated general circulation model climate predictions with recharge model to examine recharge impacts under possible climate change scenarios. Investigated data assimilation methods appropriate for large-scale non-linear problems.

Field Sampler, Soil Moisture Experiment 2005 (SMEX05)
June 2005   *Ames, IA*
Assisted with ground sampling, collected theta probe and volumetric soil moisture measurements.

Undergraduate Research Assistant, Atmospheric Chemistry Research Group, Harvard
April 2002 – May 2003   *Cambridge, MA*
Supervisor: Daniel Jacob
Used an inverse model to estimate black carbon emissions in the U.S. from observed atmospheric concentrations.

Intern, EcoBolivia (local environmental non-governmental organization)
Summer 2000   *La Paz, Bolivia*
Researched local environmental problems in the Amazonian region of Bolivia. Helped local school officials create environmental science curricula covering relevant issues.

Teaching Experience:
English as a Second Language Teacher, Somerville ESL Program
January 2008 – June 2009   *Somerville, MA*
Taught beginner's English class as part of a community ESL program for adults and young adults.

Teaching Assistant, Department of Civil and Environmental Engineering, MIT
Fall 2006   *Cambridge, MA*
1.070: Introduction to Hydrology, Professor Dara Entekhabi. Assisted with a primarily undergraduate hydrology course covering surface processes, groundwater, unsaturated zone, contaminant transport, and probabilistic risk analysis. Taught weekly review sessions and held office hours for students. Designed and graded bi-weekly assignments including conceptual and computational (MATLAB) problems. Assisted with additional lab component for course and graded lab reports on transport processes.

Math and Science Tutor
Fall 2000 – Spring 2001   *Cambridge, MA*
Tutored high school students in calculus and physics.

Refereed Publications:

1. Ng, G.-H. C., D. McLaughlin, D. Entekhabi, and B. R. Scanlon (2010), Probabilistic Analysis of the Effects of Climate Change on Groundwater Recharge, *Water Resour. Res.*, 46, W07502, doi:10.1029/2009WR007904.
2. Ng, G.-H. C., D. McLaughlin, D. Entekhabi, and B. Scanlon (2009), Using data assimilation to identify diffuse recharge mechanisms from chemical and physical data in the unsaturated zone, *Water Resour. Res.*, 45, W09409, doi:10.1029/2009WR007831.
3. Y. Zhou, D. McLaughlin, D. Entekhabi, and G. C. Ng (2008), An ensemble multiscale filter for large nonlinear data assimilation problems, *Monthly Weather Review*, 136, 678-698.

Submitted or In Final Preparation:

4. Ng, G.-H. C., D. McLaughlin, D. Entekhabi, and A. Ahanin (2010), The role of model dynamics in EnKF performance for chaotic systems, submitted to *Tellus A*.

Contributed Presentations:

1. Ng, G.-H. C., D. McLaughlin, D. Entekhabi, and B. R. Scanlon, Identifying land-surface controls on diffuse recharge: What we can learn by integrating model simulations and unsaturated zone data (invited talk), *CUAHSI Biennial Science Meeting 2010*, Boulder, CO.
2. Ng, G.-H. C., D. McLaughlin, D. Entekhabi, and B. R. Scanlon, Probabilistic predictions of groundwater recharge under climate change scenarios in a dryland cotton region of the southern High Plains (poster), *Toward Sustainable Groundwater in Agriculture 2010*, San Francisco, CA.
3. Ng, G.-H. C., D. McLaughlin, and D. Entekhabi, The affect of nonlinear dynamics on Ensemble Kalman Filter divergence for atmospheric data assimilation (poster), *American Geophysical Union Fall Meeting 2009*, San Francisco, CA.
4. Ng, G.-H. C., D. McLaughlin, and D. Entekhabi, Causes of EnKF Divergence with Atmospheric Models (poster), World Meteorological Organization *The 5th WMO Symposium on Data Assimilation 2009*, Melbourne, Australia.
5. Ng, G.-H. C., D. McLaughlin, D. Entekhabi, and B. R. Scanlon, Probabilistic prediction of recharge under future climate change scenarios (poster), *American Meteorological Society Annual Meeting 2009*, Phoenix, AR.
6. McLaughlin, D., G.-H. C. Ng, D. Entekhabi, and B. R. Scanlon, Data-conditioned predictions of groundwater recharge under climate change scenarios (poster), *American Geophysical Union Fall Meeting 2008*, San Francisco, CA.
7. Ng, G.-H. C., D. McLaughlin, D. Entekhabi, and B. R. Scanlon, Inference of hydrologic and plant interactions from unsaturated zone chemical and physical data (poster), *American Geophysical Union Fall Meeting 2008*, San Francisco, CA.
8. Ng, G.-H. C., D. McLaughlin, D. Entekhabi, and B. R. Scanlon, Soil and vegetation parameter estimation using chemical and physical unsaturated zone data (poster), *American Geophysical Union Fall Meeting 2007*, San Francisco, CA.
9. Ng, G.-H.C., D. McLaughlin, D. Entekhabi, and B.R. Scanlon, Assimilation of chemical and physical measurements for estimation of recharge rates (oral presentation), *American Geophysical Union Fall Meeting 2006*, San Francisco, CA.

Awards and Honors:
Outstanding Student Paper Award, AGU Fall Meeting, *2006*
Martin Family Society of Fellows for Sustainability, MIT, *2005*
Clemens Herschel Award for excellence in hydraulics, Harvard University, *2003*
John Harvard Scholarship, Harvard University, *1999-2003*
Dean's Summer Research Award, Harvard University, *2002*
Harvard College Research Program Grant, Harvard University, *2002*
David Rockefeller Center for Latin American Studies Travel Grant, Harvard University, *2000*
Bhumi Travel Grant, Harvard University, *2000*

Skills:
Computer Skills: MATLAB, FORTRAN, C, UNIX/LINUX
Languages: Mandarin Chinese (proficient speaking), Spanish (proficient speaking and writing)

Professional Membership:
American Geophysical Union

Service:
Reviewer for:
Advances in Water Resources
Environmental Research Letters
Monthly Weather Review

Biographical Information for Gary P. Ellrod

Narrative Summary

GARY P. ELLROD was a research meteorologist with NOAA's Satellites and Information Service (NESDIS) in Camp Springs, Maryland from 1983 until his retirement in February 2006. While in that position, he specialized in the use of satellite data in the assessment of hazards to aviation and general weather forecasting such as fog, turbulence, icing, and convective storms. Prior to that, Gary served as an aviation and marine forecaster with the National Weather Service, as a satellite analyst with NESDIS, and as a severe storms research scientist at the University of Wisconsin-Madison, and the University of Wyoming. While serving with the Air Force in the late 1960's, he flew tropical storm reconnaissance missions in the Western Pacific. His awards include the National Weather Association (NWA) Research Achievement Award (2006, 1990), a Dept. of Commerce Silver Medal (1992) for developing techniques to detect fog, turbulence, and other hazards using weather satellites, a Bronze Medal (1999) for training activities such as distance learning through the multi-agency COMET program, and an Air Medal (1968) for typhoon reconnaissance flights in the Western Pacific. Gary received degrees in meteorology from the Pennsylvania State University (B.S., 1965) and the University of Wisconsin (M.S., 1972). During his career, he has written articles for publications such as: *Weather and Forecasting*, the *Bulletin of the American Meteorological Society*, *Journal of Applied Meteorology*, the *Journal of Geophysical Research*, *Geophysical Research Letters*, *Journal of Volcanology and Geothermal Research*, the *National Weather Digest*, and the *ICAO Journal*. He was lead author of a chapter on Clear Air Turbulence for the multi-volume *Encyclopedia of Atmospheric Science*. His research has been cited in publications such as the *Wall Street Journal*, *Aviation Week and Space Technology*, and *Science News*, and he has been interviewed on BBC Radio. Gary has served as Councilor for the NWA (2000 - 2002), and was chairman of the NWA Remote Sensing Committee (2003 – 2005). Gary was a member of the NOAA Disaster Assessment Team for Hurricane Hugo (1989). He was co-chair for the Committee for Earth Observation Satellites (CEOS) volcanic hazards team during the Disaster Management Support Project (1997 – 2002). This team evaluated the current remote sensing of volcanic hazards worldwide, and recommended improvements to participating space agencies. He served on the Federal Aviation Administration's Oceanic Weather Product Development Team (2005-2006). Within NESDIS, Gary was co-chair of the Image, Cloud, Aerosol Project Oversight Panel (ICAPOP) (1997 – 2006). ICAPOP has assisted in the transition of numerous satellite research projects into operational products for use by NWS forecasters, broadcast media, research scientists, and the general public. He has conducted numerous satellite training workshops for the COMET program, and international workshops for the WMO. He is currently Chief Editor for the National Weather Digest, a scientific publication of the NWA.

Research Achievements
(Since 1995)

Developed techniques for optimum detection of volcanic ash using IR data from GOES-M through GOES-P without the aid of a 12 micrometer band.

Helped to demonstrate the tremendous potential of GOES-R data in future operational volcanic ash and sulfur dioxide detection by the use of MODIS research satellite data.

Aided in channel selection for GOES-R and NPOESS in the analysis of volcanic hazards, fog, and aircraft icing.

Developed improvements to an operational objective turbulence index based on numerical model data to help account for turbulence near upper level ridges.

Completed enhancements to GOES aircraft icing detection techniques that allow effective use by the Air Force.

Developed a new in-flight icing product that uses Sounder cloud top heights to show vertical extent of icing conditions. Completed extensive verification of the products.

Developed an enhanced nighttime low cloud product from GOES that helps distinguish hazardous low clouds and fog ("IFR" conditions) from other cloud types (scheduled to become operational in the NWS by 2007).

Evaluated the impact of the loss of a 12 micrometer IR channel on GOES (M-P) Imagers in the detection of hazardous volcanic ash. This work revealed that although there would be some deterioration in GOES ash detection capability, it would still be possible to warn aircraft of ongoing volcanic eruptions.

Developed an improved three-band IR volcanic ash product from GOES that is in use at some Volcanic Ash Advisory Centers and operational aviation units worldwide.

Provided GOES Sounder products that show the potential for hazardous thunderstorm wind gusts (available via the Internet and AWIPS).

Campus: Fresno -- May 4, 2006

CSU to confer honorary doctorates on Sam F. Iacobellis, James McClatchy
The California State University and California State University, Fresno
will confer honorary doctoral degrees on aerospace industry innovator Sam
F. Iacobellis and press freedom advocate James McClatchy during
Commencement ceremonies Saturday, May 20.
Honorary doctorates - the CSU's highest commendation - are conferred in
recognition of the recipients' achievements, visionary leadership and
civic commitment.
Iacobellis, who will receive the honorary Doctor of Science degree, is a
widely recognized leader in the aerospace industry and pioneered the B1-B
bomber. McClatchy, who will receive the honorary Doctor of Humane Letters
degree, has devoted his life to newspapers and is highly respected for his
efforts on behalf of freedom of press in all the Americas.
Fresno State President John D. Welty said the two have made an impact on
Fresno and the entire Central California region. They also have partnered
with Fresno State to improve its service to the San Joaquin Valley, he
said.
Iacobellis, a graduate of Fresno State, is the retired vice president and
deputy chairman of Rockwell International Corporation and president of
Rockwell's North American Aviation Operations. At Rockwell, he became the
"Father of the B-1B" - the Air Force supersonic bomber used in Afghanistan
and Iraq.
He holds patents on original concepts in engine design and turbo-molecular
vacuum pumping.
Iacobellis went from working on his parents' ranch in rural Fresno County
to earning a bachelor's degree in mechanical engineering in 1952 at Fresno
State.
He completed a distinguished career with numerous honors and achievements
including the 2001 Howard Hughes Memorial Award and the San Fernando
Valley Engineering Council's Engineer of the Year Award in 1976. He is a
registered professional engineer in California in the field of mechanical
and nuclear engineering and is a member of Sigma Tau, a national honorary
engineering fraternity.
Iacobellis was the 1982 recipient of the Outstanding Alumnus for the
College of Engineering at Fresno State. He said then that his Fresno State
experience was "excellent preparation for launching an engineering
management career with a major high technology diversified corporation."
His leadership and strong commitment to higher education also led him to
chair the highly successful "Decade of Excellence" campaign in the College
of Engineering at Fresno State.
McClatchy was born into a California newspaper family and has been a
reporter, editor and publisher most of his life. Headquartered in
Sacramento, After completion of its purchase of the Knight Ridder
newspaper chain, the McClatchy Company expects to operate 32 daily
newspapers and 50 community publications with a combined circulation of
3.2 million, making McClatchy the second largest newspaper company in
daily circulation.

Over the decades, McClatchy newspapers' many honors have included 13 Pulitzer Prizes, five of which were gold medals for public service.
Born in Sacramento, McClatchy was reared in Fresno, and currently resides in the Sacramento area. He is a graduate of Stanford University and Columbia University School of Journalism. He is a veteran of Air Force service in the Korean War. He is a director and officer of numerous education and conservation organizations in California.
A member and past president of the Inter-American Press Association, he is a long-time defender of free speech in Latin America, and also was decorated by the French government for service to French-American relations. He was honored by Columbia University for service to inter-American causes. He organized the 1994 Hemisphere Conference on Free Speech in Mexico, which issued the Declaration of Chapultepec, signed by individuals and heads of state, setting out principles describing the role of a free press in a democracy.
McClatchy also is founder and president of the Central Valley Foundation, which supports education for the children of immigrants throughout the Valley. He has established an endowment to support the classics and bilingual education programs at Fresno State and is one of the major contributors to the Phebe Conley Memorial Endowment.
This is the 14th year honorary doctorates have been awarded by the CSU system and Fresno State. A campus committee composed of faculty and administrators considered nominees for the honor and recommended the candidates to Welty, who then made the recommendations to the CSU Board of Trustees.
Last year honorary doctorates were presented to Sister Ruth Marie Nickerson, former president and CEO of Saint Agnes Medical Center, and Richard A. Johanson, founder of Johanson Transportation Service in Fresno.
Contact: Shirley Melikian Armbruster, (559) 278-5292 or (559) 593-1815

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[Sacramento] [San Bernardino] [San Diego] [San Francisco] [San Jose] [San
Luis Obispo] [San Marcos] [Sonoma] [Stanislaus]

Ellrod Weather Consulting (EWxC), LLC

Gary P. Ellrod, CCM

Experience: More than 35 years as a research meteorologist and weather forecaster, mostly with the National Oceanic and Atmospheric Administration (NOAA). (Complete biography)

Main Interests: Satellite meteorology (multi-spectral image interpretation), aviation meteorology (detection of hazards such as fog, turbulence, volcanic ash and aircraft icing), Weather analysis and forecasting (special event forecasting), forensic meteorology (expert testimony and turbulence investigations), and technical report editing and writing.

Current Status: Retired from NOAA/NESDIS, residing in Granby, CT

Special Credentials: Certified Consulting Meteorologist (AMS CCM certificate #646, 2008)

Education:
Bachelor of Science, Meteorology, Pennsylvania State University (1965)
Master of Science, Meteorology, University of Wisconsin-Madison (1972)

Awards:
   Fujita Research Achievement Award, National Weather Association, 2006
   U.S. Department of Commerce Silver Medal, 1992
   U.S. Department of Commerce Group Bronze Medal, 1999

Papers Published in: *Bulletin of the American Meteorological Society (BAMS), AMS Weather and Forecasting, Journal of Applied Meteorology, Journal of Geophysical Research-Atmospheres, Geophysical Research Letters, National Weather Digest, Pure and Applied Geophysics, ICAO Journal* (Detailed Publications List)

Research Cited in: Science News, Aviation Week and Space Technology, Wall Street Journal

Professional Memberships: American Meteorological Society, National Weather Association, American Geophysical Union

Training Experience: Developed training materials for the Cooperative Program for Meteorological Education and Training (COMET) Satellite Meteorology classes and MetEd online courses; conducted VisitView teletraining on satellite fog detection; and participated in several International WMO workshops on aviation weather and satellite meteorology

Recent Projects:
Evaluation of state of the art turbulence diagnostics at the Aviation Weather Center (Sponsored by COMET)
Updated tutorial on volcanic ash detection using remote sensing techniques.
Chief Editor, National Weather Digest (2008-2010)
Banded snow event in western Connecticut, Tri-State Weather Conference, April 2009
Improvements to an Operational Clear Air Turbulence Diagnostic Index, AMS 14th Aviation, Range and Aerospace Conference, Atlanta, Ga, 21 January 2010

Web pages:
   Examples of aviation weather products I helped develop while at NOAA's Center for Satellite Applications and Research
   I currently manage the NWA Remote Sensing Committee Web pages

CURRICULUM VITAE

James A. Johnstone

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Appointments

2/2010 – present. **Visiting Scientist**, Joint Institute for the Study of the Atmosphere and Ocean (JISAO) and the Climate Impacts Group, University of Washington, Seattle, WA.

1/2009 – 12/2009. **Postdoctoral Researcher**, Department of Environmental Science, Policy, & Management. University of California, Berkeley, CA.

Education

University of California, Berkeley, CA. Ph.D. Geography, 2008. Dissertation: Climate variability of Northern California and its global connections. Thesis co-chairs: John Chiang, Todd Dawson.

University of California, Berkeley, CA. M.A. Geography, 2002. Thesis: Variability and change in the daily frequency and intensity of winter precipitation in the Western United States, 1901-1997.

University of Virginia, Charlottesville, VA. B.A. 1993. Double major in Economics and French.

University of Arizona, Tucson, AZ. 2004. Short course on wood anatomy and tree-ring microsectioning.

Research interests

Climate variability, with emphasis on the hydroclimate of California and the Western United States and global teleconnections. Historical and paleoclimate evidence of Western U.S. drought. Variability of California coastal climate and marine fog and their roles in Coast redwood growth and ecology. Stable isotope hydrology and dendroclimatology. Quasi-biennial oscillations of the troposphere.

Teaching

Graduate student instructor for a number of earth system courses, including: Introductory Meteorology, Introduction to Oceanography, Global Environmental Change, Introductory Physical Geography. Course lectures delivered on the global circulation of the atmosphere, plate tectonics.

<u>Fellowships and awards</u>
University of California Regents Fellowship. Four-year graduate research fellowship providing 2 years of full support, and two years of assistantships.

Graduate Fellowship, Berkeley Atmospheric Sciences Center. Competitive $10,000 fellowship awarded for atmospheric research.

<u>Grants</u>
Wrote and received a $30,000 research grant from the Save-the-Redwoods League (P.I. Todd Dawson) for a pilot study on fog variability and its signature in stable isotopes of Coast redwood tree-rings.

<u>Publications</u>
Johnstone, J.A. and T.E. Dawson. 2010. Climatic context and ecological implications of summer fog decline in the coast redwood region. *Proceedings of the National Academy of Sciences.* 107(10): 4533-4538.

Johnstone, J.A. 2010. A quasi-biennial signal in Western U.S. hydroclimate and its global teleconnections. *Climate Dynamics.* Published online March 20, 2010.

Roden, J.S. Johnstone J.A.., Dawson TE. 2009. Intra-annual variation in the stable oxygen and carbon isotope ratios of cellulose in tree rings of coast redwood (Sequoia sempervirens). *The Holocene.* 19:189-197.

<u>Papers in progress</u>
Roden, J.S, Johnstone, J.A., and Dawson T.E. Regional and watershed-scale coherence in the stable oxygen and carbon isotope ratio time-series in tree rings of coast redwood (*Sequoia sempervirens* D. Don). In preparation for *Tree-Ring Bulletin.*

Johnstone, J.A., Roden, J.S., and Dawson, T.E. Interannual climate signals in stable isotopes of coast redwood tree-rings. In preparation for *Geophysical Research Letters.*

Johnstone, J.A. Similar QBOs in the Arctic troposphere and the solar magnetic field. In preparation for *Journal of Atmospheric and Solar-Terrestrial Physics.*

<u>Conference Presentations</u>
Talks:
Johnstone, J.A. 2010. Coastal summer stratus in the Pacific Northwest: Climatic context and the 2009 season. Pacific Northwest Weather Workshop. Seattle, WA.

Johnstone, J.A. 2009. Fog variability in the coast redwood region from hourly to century time scales. 24th Pacific Climate (PACLIM) Workshop. Pacific Grove, CA.

Johnstone, J.A. 2008. Quasi-biennial synchrony of the extratropical troposphere and the solar magnetic field. International Workshop on Solar Variability, Earth's Climate, and the Space Environment. Bozeman, MT.

Johnstone, J.A. 2007. A hypothesis for the 1976-77 Western drought. 23rd Pacific Climate (PACLIM) Workshop. Pacific Grove, CA.

Johnstone, J.A. 2006. Decadal drought cycles in the Western United States and their possible origins. 22nd Pacific Climate (PACLIM) Workshop. Pacific Grove, CA.

Posters:
Johnstone, J.A. 2008. Decadal hydrologic regimes in the San Joaquin Basin, California. Mountain Climate Research Conference (MTNCLIM). Silverton, CO.

Johnstone, J.A., Dawson, T.E., Roden, J.S. and Brooks, P. 2006. Stable isotope indicators of environment in Coast redwood tree-rings, northern California. SIBAE –BASIN Conference: Isotopes as tracers of ecological change. Tomar, Portugal.

Johnstone, J.A. 2006. Timescale dependence of the ENSO-precipitation teleconnection in the Western United States, 1930-2004. 22nd Pacific Climate (PACLIM) Workshop. Pacific Grove, CA.

Johnstone, J.A., Dawson, T.E., Roden, J.S. 2005. Persistence of El Niño effects on stable isotope ratios in cellulose of Coast redwood tree-rings. AGU Annual Meeting, San Francisco, CA.

Johnstone, J.A. 2004. Decadal cycles of ENSO amplitude and winter precipitation in Northern California. 21st Pacific Climate (PACLIM) Workshop. Pacific Grove, CA.

<u>**Invited Talks**</u>
Johnstone, J.A. 2009. 'Summer fog variability in the coast redwood region: Pacific climate context and ecological implications'. Climate Impacts Group, University of Washington.

Johnstone, J.A. 2009. 'Summer fog variability in the coast redwood region: climatic relevance and ecological implications'. Carnegie Department of Global Ecology, Stanford University.

Johnstone, J.A. 2009. 'Historical fog variability in the coast redwood region'. Redwoods and Climate Change Workshop. Save-the-Redwoods League, Sausalito, CA, 2009.

Johnstone, J.A. 2007. The global 'biennial pulse' and the northern California water supply. US Geological Survey, Menlo Park, CA.

<u>**Professional activities**</u>
Member: American Geophysical Union, American Meteorological Society, Association of American Geographers

Reviewer: *Oecologia*, *Journal of Hydrology*, *The Holocene*, *Climatic Change*

Travis Allen O'Brien

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Ph.D Candidate
I am a graduate student in the Earth and Planetary Science Department at UCSC, and a member of the Climate Change and Impacts Laboratory. I have two main areas of focus in my research: first, I do research that looks at what sorts of climatological changes might occur in a high CO2 future, and second, I look at how these climatological changes will affect the way we experience the world around us.

Research Projects
My primary research project focuses on how fog and marine clouds might change in the next 100 years as climate changes. Changes in large-scale circulation of air in the atmosphere, changes in the ocean temperature, and changes in the amount of moisture in the air will all impact marine clouds and coastal fog--the trouble is, each of these factors influences these delicate clouds in a different way, and so it is not immediately clear how they might change in the future. In order to deal with all these interacting factors, I am employing state-of-the art computer models of the climate system to simulate how marine clouds might change in the future.

Education:

University of California, Santa Cruz	B. S. Physics	2001-2005
University of California, Santa Cruz	M. S. Earth Science	2006-2008
University of California, Santa Cruz	Ph. D. Earth Science	2008-*In Progress*

Positions Held:

2006-	Graduate Student Researcher, UCSC
2006	Research Consultant, Los Alamos National Laboratory
2004-2005	Research Assistant, UCSC
2004	Student Intern, Stanford Linear Accelerator

Recent references:

O'Brien, T. A., Sloan, L. C. Deciduous vs evergreen: does forest-type affect climate? *UCSC Graduate Research Symposium 2009,* Oral Presentation. Abstracts not available.

O'Brien, T. A., Solmon, F., Sloan, L. C., Snyder, M. A., What role did humans play in the North American drought of the 1930's? *In preparation.*

O'Brien, T. A., Hutchison, K. H., Sloan, L. C., Solmon, F., Application of ICTP

RegCM3's New Dust Model to Modern N. America: Challenges and Questions. *AGU Fall Meeting 2008, GC53A-0688*, Abstracts Online.

Sloan, L. C., Snyder, M. A., **O'Brien, T. A*.** Climate Change in California. *Community Presentation 10/10/2008.* Abstracts not available. **Oral presentation delivered by T.A. O'Brien*

O'Brien, T. A., Solmon, F., Sloan, L. C., Snyder, M. A., Dust Storms Modified the North American Climate During the 1930's Dust Bowl. *UCSC Graduate Research Symposium 2008,* Poster Presentation. Abstracts not available.

O'Brien, T. A., Solmon, F., Sloan, L. C., Snyder, M. A., Airborne Dust Modified the North American Climate During the 1930's Dust Bowl. *AGU Joint Assembly 2007,* A52A-03, Abstracts with Programs.

O'Brien, T. A., Bridges, F., Downward, L., Mitchell, J. F., Zheng, H., Evidence for magnetic "dimerons" in the anisotropic bilayer system $La_{1.2}Sr_{1.8}Mn_2O_7$: an EXAFS study. Physical Review B, **75**, 064417 (2007)*.*