University of Hawai‘i at Mānoa
Department of Meteorology

Information for Prospective Graduate Students

Hawai‘i Institute for Geophysics

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Department of Meteorology
University of Hawaiʻi
2525 Correa Road
Honolulu, HI 96822-2219

Telephone: (808) 956-8775
Fax/Facsimile: (808) 956-2877

Email: metdept@hawaii.edu
Web page: http://www.soest.hawaii.edu/MET

Department Chair: Bin Wang, email: wangbin@hawaii.edu

Graduate Chair: Fei-Fei Jin, email: jff@hawaii.edu

Pacific Ocean Science and Technology building

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INTRODUCTION

Thank you for your interest in graduate studies and research in our department. We are always seeking to recruit excellent students for our graduate program. Meteorology has been an academic discipline at University of Hawaiʻi at Mānoa for over 50 years. The department has built an enviable national and international reputation for research and education, offering both undergraduate (B.S.) and graduate (M.S. and Ph.D.) degree programs. Since 1965 the University has been a member of the University Corporation for Atmospheric Research, in effect, accrediting our graduate program.

Today the department has grown to have 14 full-time faculty, one part-time faculty, and approximately 35 graduate students, and it is part of one of the world's most active schools in the geosciences - the University of Hawaiʻi School of Ocean & Earth Science & Technology (SOEST). SOEST has a total about 170 faculty members who study an enormous variety of phenomena related to the physics, chemistry and biology of the solid earth, the ocean, the atmosphere. Meteorology faculty and student offices are located in both the Hawaiʻi Institute of Geophysics (HIG) building and the adjacent Pacific Ocean Sciences and Technology (POST) building.

Research has been central to the department's activities since its inception. Despite the departments's modest size, an impressive array of research projects are being pursued. Projects involving experimental work as well as computer modeling and theoretical calculations are being undertaken by our faculty and students. Our students now have thesis topics that involve study of a wide variety of atmospheric phenomena on a wide range of space and time scales. However, our unique situation as the only world-class university located in the middle of the Pacific Ocean has kept our main focus on issues relating to the weather and climate of the tropical Pacific and the Asian-Pacific regions.

Department faculty have participated in a series of field experiments on the island of Hawaiʻi and elsewhere. These experiments have generally emphasized investigations of cloud physics, and more recently, of convective and mesoscale phenomena. We helped organize and conduct the Hawaiian Rainband Project (HaRP) in 1990. Faculty and students also have participated in the Experiment on Rapidly Intensifying Cyclones in the Atlantic (ERICA) in 1989, the Convection and Precipitation/Electrification Experiment (CaPE) in 1991, the Tropical Ocean Global Atmosphere (TOGA) Coupled Ocean Atmosphere Response Experiment (COARE) in 1993, the Aerosol Characterization Experiment (ACE) in 1995, Atmospheric Investigation, Regional Modeling, Analysis and Prediction (AIR-MAP) in 2004, and Terrain-influenced Monsoon Rainfall Experiment (TiMREX) in 2008. Many students find thesis topics in the analysis of results of such specialized field campaigns, or in related modeling activities.

We are fortunate that the National Weather Service Honolulu Forecast Office is located in the HIG building, providing access to real time weather data and allowing interactions with the operational forecasters. Several of our graduate students have actually worked part-time at the forecast office. Some of the department's research activities are directly related to improving short-term weather forecasts for the Hawaiian Islands, including high resolution experimental forecasts for the entire State of Hawaii and major individual islands for the Hawaiian Island chain, and specialized forecasts for the use of astronomers operating the world renowned observatories on Mauna Kea on the Island of Hawai'i. The high-resolution experimental model output is provided to the forecasters of the National Weather Service for the preparation of graphic forecast products for the State of Hawaii, and is also used by ocean modelers to drive ocean circulation and wave models, and the US Forest Service for wildland fire risk assessment and management. Practical applications of meteorological information for the State of Hawai'i are also provided by the State Climate Office which is directed by Prof. Chu in our department and through interactions of our faculty and students with the regional office of the National Weather Service as well as other state and county agencies.

Studies of the basic physics of tropical atmospheric circulations on seasonal and longer timescales, notably the El Niño phenomenon and the Asian monsoon circulations, have a long and distinguished history in the department and in our sister Oceanography department. In 1997, our endeavors in climate studies were significantly enhanced by the advent of the International Pacific Research Center (IPRC), now located in the POST building. The IPRC is a joint Japan-US research center for the study of climate variations and long-term climate change in the Asian-Pacific region. Five Meteorology department faculty members also have appointments in the IPRC along with a similar number of Oceanography department faculty.

The remainder of this brochure provides information on our requirements for applicants and graduates (next two sections), key information about our course offerings (page 5), our faculty and their research interests (page 14), and information on financial aid possibilities for our students (page 10).

OUR STUDENTS

Our student body now consists of about 15 students pursuing the M.S. degree and 20 in our Ph.D. program. Our students come from Hawai'i, from the US mainland and from other countries. The main qualification to join our program is good performance in an undergraduate program that includes basic training in mathematics (at least through differential equations) and physics. Some of our graduate students have come to us with undergraduate degrees in atmospheric science, but many others have come with undergraduate degrees in physics, chemistry, mathematics, engineering or related subjects, and without any prior courses in meteorology.

REQUIREMENTS FOR OUR GRADUATE DEGREES

Master's Degree

Graduation with a master's degree requires completion of an acceptable thesis and a successful defense of the thesis in an oral examination.

A total of 30 official course credit hours must also be earned. This will be made up of:

1. At least 18 credits of regular course work (i.e. excluding MET 699, MET 700 and MET 765), with a minimum of 12 credits in courses numbered 600 and above.
2. 1 credit of MET 765
3. 6 credits of MET 700 Thesis Research and
4. 5 more credits either from regular courses or MET 699 Directed Research

Our core requirements include MET 600, 610, and 620, and one term of synoptic meteorology. Unless a student has completed an equivalent course elsewhere, the synoptic requirement is met with either MET 412 or MET 416. These core requirements are met by passing with a grade of B- or higher.

Students must obtain a minimum GPA of 3.0 for the courses counted as our core. As well, students must maintain a GPA of at least 3.0 for the courses they take in the MS program.

Doctoral Degree

The PhD student exhibits a higher level of independence and originality of thought than that required of the MS student.

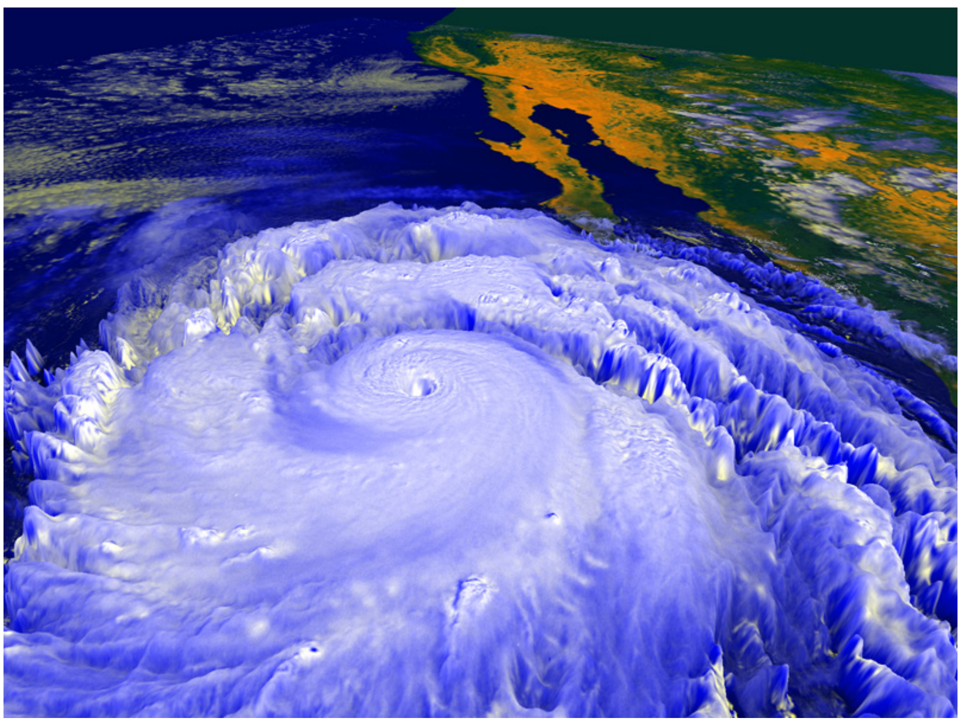
Students must satisfy several requirements in order to graduate with a PhD degree. Each student is required to pass at least 8 graduate level courses numbered 600 and above with a grade of B- or higher. These courses will be in dynamic, synoptic, physical, tropical meteorology, oceanography or other closely related fields. At least five of these courses must be completed at the Mānoa campus. At the discretion of the Graduate Chair, a student may be awarded credit for up to three relevant graduate courses taken elsewhere. The courses taken either here or elsewhere need to cover the core requirements MET 600, 610, 620 and one of MET 412 or MET 416. A student must pass each of these core courses with a grade of at least B-. A student must obtain a minimum 3.0 GPA in the core courses taken at Mānoa . A student must also maintain a GPA of at least 3.0 for all the courses taken in the PhD program at Mānoa.

After these 8 courses are successfully completed, but no later than the 24th month in the PhD program, each student must pass a two-part comprehensive examination. The purpose of this exam is to ascertain the student's comprehension of the broad field of meteorology and so to insure that the student is well prepared for PhD research. The first part of the comprehensive examination is a set of written exercises completed on a single day. Within three (3) to seven (7) days after the written exam, this is followed by an oral examination.

No later than 12 months after successful completion of the comprehensive examination, each student is required to submit a written research prospectus for approval to his/her dissertation committee.

A PhD student must also successfully complete two semesters of MET 765 during his/her PhD studies (so MET 765 taken before the student was admitted to the PhD program cannot be counted towards satisfying this requirement).

Finally, the student must complete an acceptable PhD thesis and successfully defend it in a public final oral defense.



Hurricane Linda at its peak approaching Baja California on September 11, 1997.

COURSE OFFERINGS

All are 3-credit lecture courses, except as noted.

MET 302 Atmospheric Physics

Energy and thermodynamics, statics and stability, physical processes of cloud formation, radiation and earth-atmosphere heat balance, kinetic theory, optical effects. Prerequisite: MATH 242, Physics 272 or consent of instructor.

MET 303 Introduction to Atmospheric Dynamics

Scalar and vector development of basic laws of hydrodynamics, equations of motion, kinematics, divergence and vorticity, viscosity and turbulence, introduction to numerical weather prediction, general circulation. Prerequisite: MET 302, MATH 244 or consent of instructor.

MET 305 Meteorological Instruments and Observations

First and second order measurement systems. Response of wind, temperature and recording instruments. Discussion of advance system including radar. Planning of field programs. Prerequisite: PHYS 152-152L or PHYS 272-272L or consent of instructor.

MET 310 Global Environmental Change

Global environmental change problems such as carbon dioxide and the greenhouse effect, acid rain, chlorofluorocarbons and the ozone layer, global deforestation and the effect on climate, etc. Pre: one environmentally oriented science course. (Cross-listed as OEST 310 and OCN 310)

MET 310L Global Environmental Change Laboratory

Laboratory course to supplement MET 310. Quantitative aspects of global environmental change will be addressed through problem solving and computer modeling. A-F only. Pre: MATH 242 or MATH 242A, PHYS 170/170L, CHEM 161/161L; or consent. Co-requisite: 310 or consent. Fall only. (Cross-listed as OEST 310L and OCN 310L)

MET 320 Programming for Meteorologists

Scientific programming in Fortran 77, graphics software and meteorological applicationsand second order measurement systems. Response of wind, temperature and recording instruments. Discussion of advance system including radar. Planning of field programs. Prerequisite: MET 302 (or concurrent) and MATH 241; or department approval.

MET 402 Applied Atmospheric Dynamics

Advanced concepts in dynamics: vorticity, cyclogenesis, jet streams, fronts, mesoscale circulation. Prerequisite: MET 303 or consent of instructor.

MET 405 Satellite Meteorology (Lecture and Labs)

Orbital elements, ephemerides, viewing geometry; radiation, satellite sensors; interpreting satellite data; applications to synoptic meteorology and forecasting. Prerequisite: MET 302 or consent of instructor.

MET 406 Tropical Meteorology

History; tropical clouds and hydrometeors; typhoons; monsoons; local and diurnal effects.
Prerequisite: MET 303 or consent of instructor.

MET 412 Meteorological Analysis Lab (Lab)

Technique of portraying and analyzing atmospheric structure and weather systems in middle and high latitudes; modern methods of forecasting extratropical systems. Prerequisite: MET 303 (or concurrent); or consent of instructor. (alternate years)

MET 416 Tropical Analysis Lab (Lab)

Techniques of portraying and analyzing atmospheric structure and weather systems in tropical and equatorial regions; forecasting tropical systems.
Prerequisite: MET 303 (or concurrent); or consent of instructor.

MET 495 Undergraduate Thesis

Capstone course for senior Meteorology majors. Undergraduate thesis project includes literature review, experiment or research design, data collection and analysis, technical writing of a final thesis and an oral presentation of the paper. Prerequisite: MET 302/303 (or concurrent); or consent of the instructor.

MET 600 Atmospheric Dynamics I

Governing equations for moist atmospheric motions, approximations, basic theoretical models, boundary layer dynamics, atmospheric waves, quasi-geostrophic theory for mid-latitudes. Prerequisite: MET 303 and MATH 402 or MATH 405 or consent of instructor.

MET 601 Atmospheric Dynamics II

Overview of dynamic meteorology, numerical weather prediction, geophysical fluid instabilities, approximate dynamical systems, atmospheric general circulation, stratospheric dynamics. Prerequisite: MET 600 or consent of instructor. (alternate years)

MET 606 Cumulus Dynamics

Dynamics of convective systems: tornadoes, waterspouts, squall lines. Interactions with synoptic scale. Prerequisite: MET 620 or consent of instructor (alternate years).

MET 607 Mesoscale Meteorology

Scale analysis. Observational and theoretical aspects of mesoscale circulation systems. Prerequisite: MET 600 or consent of instructor (alternate years).

MET 610 Tropical Climate and Weather

Climate and general circulation of the tropics; El Niño and Southern Oscillation; intraseasonal oscillation; tradewinds; tropical weather systems; energy balance; typhoons. Prerequisite: MET 303 or consent of instructor.

MET 614 Tropical Cyclones

Lecture class covering fundamentals of tropical cyclone structure, motion, and impacts on society. Observations from satellites, aircraft, ships and buoys, and numerical simulations focusing on storm structure and track. Some forecasting exercises. Repeatable one time. Prerequisite: MET 600/610 or consent of instructor. (alternate years)

MET 616 Monsoon Meteorology

Synoptic components of monsoons, regional and temporal variability, numerical models, research exercises. Prerequisite: MET 610 or consent of instructor (usually offer alternate years).

MET 620 Physical Meteorology

Molecular kinetics, atmospheric thermodynamics, cloud physics, precipitation processes, atmospheric electricity, scattering and absorption of solar radiation, absorption and emission of infrared radiation, radiative transfer. Prerequisite: MET 302 or consent of instructor.

MET 631 Statistical Meteorology

Probability; frequency distributions of atmospheric variables; linear models; time series analysis (frequency and time domain); principal component analysis; statistical weather forecasting and verification. Prerequisite: MATH 371 (usually offered alternate years).

MET 632 Advanced Statistical Methods in the Geosciences

Methods for numerous multivariate analyses will include singular spectrum, extended empirical orthogonal function, singular-value decomposition, canonical correlation, discriminant and cluster analysis. Other advanced topics such as wavelet, statistical downscaling, and Bayesian analysis will also be included. Prerequisite: MET 631 or consent. (usually offered every three years)

MET 665 Small-Scale Air-Sea Interaction

Observations and theory of small-scale processes which couple the atmosphere and ocean boundary layers, including introduction to turbulence theory and parameterization of turbulent fluxes. Prerequisite: MATH 402 and MATH 403 (or their equivalents) and either OCN 620 or MET 600; or consent of instructor. (Cross-listed as OCN 665). (alternate years)

MET 666 Large-Scale Ocean-Atmosphere Interactions

This lecture/seminar course introduces physical oceanography and meteorology students to the state-of-the-art theories and observations of large-scale ocean-atmosphere interaction, as well as conveying the fundamental understanding that has been developed during the past 30 years. Emphasis will be on phenomena such as El Niño/Southern Oscillation, the North Atlantic Oscillation, the Pacific Decadal Oscillation, and global climate change. Prerequisite: MET 600 or OCN 620; or consent of instructor. (alternate years)

MET 699 V Directed Research (variable credits)

Prerequisite: consent of instructor.

MET 700 V Thesis Research (variable credits)

MET 702 Numerical Weather Prediction (Lectures and Lab)

Fundamental methods and techniques in numerical prediction: time differencing, spatial finite differencing, spectral methods, numerical stability, explicit and implicit methods. Modern operational and research forecast models. Hands-on laboratory includes simple to complex operational and research. Prequisite: MET 600 or OCN 620, MATH 407 or 408, or consent of instructor. (alternate years)

MET 704 Climate and Climate Variability

Physical basis of climate, numerical climate models, paleoclimatic indicators, modern instrumental climate records, assessment of human impact on climate, predictions of future climate. Repeatable one time. Prerequisite: MET 600 or OCN 620, or consent of instructor. (alternate years)

MET 706 Tropical Climate Dynamics and Modeling

Overview of current progress in tropical climate dynamics with a particular focus on large-scale atmosphere-ocean interactions; introduction of basic numerical techniques for students to construct and run intermediate tropical atmosphere and ocean models. Prerequisite: MET 600.

MET 708 General Circulation of the Atmosphere

Theory, observations, large-scale analyses, and global model simulations that describe characteristic large-scale circulation of the Earth's atmosphere. Includes zonally averaged climatology, asymmetric features of the general circulation, and El Nino - Southern Oscillation phenomenon. Repeatable one time. Prerequisite: MET 600.

MET 752 Special Topics in Meteorology

Concentrated studies on selected atmospheric problems. Repeatable. Prerequisite: MET 600 or consent of instructor.

MET 765 Seminar in Meteorology (1 credit)

Participation in departmental seminars, and presentation of a seminar on a literature review of a specific topic or the student's own research results. Repeatable. Prerequisite: consent of instructor.

MET 800 V Dissertation Research (variable credits)

Many of our students also take courses in Oceanography (OCN), Mathematics (MATH), Geology and Geophysics (GG), and other departments. Particularly useful courses include MATH 407 (Numerical Analysis), GG 312 (Geomathematics), OCN 620 (Physical Oceanography) and OCN 660 (Ocean Waves). More details about available courses can be found the University of Hawaiʻi at Mānoa catalogue or online at http://www.catalog.hawaii.edu.

APPLICATIONS

Your academic qualifications will be evaluated by our faculty and appropriate recommendations are made to the **Graduate Division** after receipt by the Graduate Division of the following:

1. Application form;
2. One official copy of transcripts directly from the registrar of each institution attended;
3. Official GRE (GEN) scores (required of all doctoral applicants; strongly recommended for M.S. applicants);
4. Official TOEFL score report (Foreign applicants); and
5. Application fee.

You will be notified as soon as action is taken on your application by the Graduate Division.

Application deadlines:

Semester	U.S. Applicants	International Applicants
Fall	March 1	January 15
Spring	September 1	August 1

University of Hawaii Graduate Division Admissions Office:

Spalding 354
2540 Maile Way
University of Hawaii
Honolulu, HI 96822
Tel: 808-956-8544
Email: admissions@grad.hawaii.edu
Web: www.hawaii.edu/graduatestudies

Please also submit the following to the **Department of Meteorology**:

1. Interest statement;
2. Three letters of recommendation from former professors or employers;
3. Curriculum vitae (one page).

In order to provide you with the most appropriate academic guidance for your individual needs, we request a brief statement describing your interest in meteorology. Your one-to-two page interest statement should explain why you have chosen to continue your education in meteorology. It should also briefly state your work experience and career plans, as well as any specialization preferences you wish to express.

FINANCIAL SUPPORT FOR GRADUATE STUDENTS

Most, but unfortunately not all, our graduate students receive some form of financial assistance. Most commonly support is provided by a graduate research assistantship (GRA) which is formally an appointment as a researcher working 20 hours per week, and normally funded by federal research grants obtained by individual faculty members. Often the work conducted for the GRA is directly related to the student's thesis topic. The department also has a limited number of Graduate Teaching Assistantships (GTAs) which are 20 hour per week appointments with duties involving undergraduate instruction. All graduate teaching assistants serving in any capacity are under the direction and supervision of a regular member of the faculty. The duties of a GTA will generally fall within one or more of the following categories: assisting a faculty member in grading, advising, and the administrative duties associated with a course or courses; teaching a laboratory or discussion section of a course; or teaching a classroom section of a multi-section course under the supervision of a faculty member responsible for the course.

Students with 20-hour per week GRA or GTA appointments receive free tuition. A very small number of additional tuition waivers may be available for some students who do not have GRA or GTA appointments.

In addition, some students obtain their own funding through external fellowships, such as those awarded to outstanding students by the National Science Foundation.

Eligibility for Appointment as a Graduate Assistant

Only full-time classified graduate students admitted to and enrolled in a graduate program for an advanced degree (M.S. or Ph.D.) are eligible for a graduate assistantship. Certificate, post-baccalaureate unclassified, and non-degree seeking students are not eligible.

To be eligible for a graduate assistantship, an applicant or continuing student must:

a. have a superior scholastic record and an adequate background;
b. maintain a minimum grade point average of 3.0 or higher;
c. be in good academic standing - students on probation are not eligible for appointment nor are students admitted conditionally due to low grades;
d. posses the experience or qualifications required to perform the duties of the assistantship to which he or she is to be appointed;
e. Non-native English speakers who wish to be appointed to a graduate teaching assistantship must demonstrate proficiency in English. Typically, this requires a high TOEFL (Test of English as a Foreign Language) score or equivalent indication of competence in written and spoken English.

How are GRA and GTA Appointments Made?

Academic achievement as well as the motivation and goals of the student applicants are among the factors considered in the awarding of assistantships. At the conclusion of its competition, the department or program submits the names of the candidates for graduate assistantships to the Graduate Division, where each candidate’s academic record is reviewed to confirm eligibility. When the Graduate Division has approved the appointment, the department notifies the student of the final offer of appointment in an official letter.

The student should send a letter to the Department Chair and the faculty member by whom he/she has been contacted formally accepting the offer.

All appointments are subject to the availability of funds.

GRA and GTA Stipends

Graduate assistants are given appointments for either 9-months (typically mid-August to mid-May) or 11-months. In each case the actual payments are made in twelve monthly installments. The University of Hawaiʻi sets a scale each year of stipend. The scale currently allows annual stipends (for 20-hour per week appointments) between $13,296 and $22,140 for 9-months or $15,552 to $25,902 for 11-months. The exact amount offered to each student may depend on the student's experience, ability and assigned responsibility. The placement is also contingent on availability of funds. An up-to-date schedule of stipends (as well as additional information about tuition and fees) is available at:

http://www.hawaii.edu/graduatestudies/financial/html/financial.htm

It is often possible, but not guaranteed, that graduate assistant appointments can become full time (40 hours per week) for one or two months during the summer, leading to a somewhat increased total annual stipend.

LIST OF CURRENT GRADUATE FACULTY

Our graduate students benefit from the expertise of the 13 full-time professors and one half-time researcher with appointments in the Meteorology Department and four cooperating graduate faculty with appointments in other departments. All these faculty members can serve as faculty advisors for graduate students. In addition, scientists in the other departments and institutes in SOEST provide a wealth of local expertise in the geosciences. Detailed statements of research interests by each faculty member and lists of their publications are given in the next section.

Professor

Gary M. Barnes, Ph.D., University of Virginia. Mesometeorology, hurricanes, boundary layer meteorology. email: gbarnes@hawaii.edu

Steven Businger, Ph.D., University of Washington. Mesoscale and synoptic meteorology, satellite meteorology, storm structure and dynamics. email: businger@hawaii.edu

Yi-Leng Chen, Ph.D., University of Illinois. Mesoscale meteorology, heavy rainfall. email: yileng@hawaii.edu

Pao-Shin Chu, Ph.D., University of Wisconsin-Madison. Climate variability and natural hazards, tropical cyclones, climate prediction. email: chu@hawaii.edu

Kevin Hamilton, Ph.D., Princeton University. Dynamical meteorology, climate dynamics. email: kph@hawaii.edu

Fei-Fei Jin, Ph.D., Academia Sinica (China). Dynamical meteorology, climate dynamics. email: jff@hawaii.edu

Tim Li, Ph.D., University of Hawai'i. Tropical meteorology, climate dynamics, atmosphere-ocean interactions. email: timli@hawaii.edu

Duane E. Stevens, Ph.D., Harvard University. Atmospheric dynamics, numerical weather prediction. email: dstevens@hawaii.edu

Bin Wang, Ph.D., Florida State Unversity. Climate dynamics, geophysical fluid dynamics, tropical meteorology. email: wangbin@hawaii.edu

Yuqing Wang, Ph.D., Monash University (Australia). Atmospheric dynamics and physics, climate modeling, tropical meteorology. email: yuqing@hawaii.edu

Shang-Ping Xie, Ph.D., Tohoku University (Japan). Large-scale ocean-atmosphere interaction, climate dynamics. email: xie@hawaii.edu

Associate Professor

Thomas A. Schroeder, Ph.D., Purdue University. Mesometeorology -- severe local storms, flash flood meteorology, interactions of island with synoptic environments. email: tas@hawaii.edu

Assistant Professor

Vaughan T.J. Phillips, Ph.D., Manchester University (UK). Physical meteorology, cloud and aerosol physics, cloud modeling. email: vaughanp@hawaii.edu

Assistant Researcher

Jingxia Zhao, Ph.D., UCLA. Atmosheric chemistry and physical meteorology. email: jingxiaz@hawaii.edu

Cooperating Graduate Faculty

H. Annamalai, Ph. D., Indian Institute of Technology. (Associate Researcher of the International Pacific Research Center) Tropical climate dynamics, climate variability and prediction. email: hanna@hawaii.edu

Antony D. Clarke, Ph.D., University of Washington. (Researcher, Oceanography) Marine aerosols, biogeochemical cycles, optical properties. email: tclarke@soest.hawaii.edu

Barry J. Huebert, Ph.D., Northwestern University. (Professor of Oceanography) Atmospheric chemistry. email: huebert@hawaii.edu

Axel Lauer, Ph.D., Institute of Meteorology, Free University of Berlin, Germany. (Assistant Researcher, International Pacific Research Center) Aerosols, Clouds, Atmospheric Chemistry, Climate Modeling. email: lauera@hawaii.edu

John N. Porter, Ph.D., University of Hawai‘i. (Associate Researcher, Hawai‘i Institute of Geophysics & Planetology) Satellite and ground-based optical sensing of atmospheric aerosols. email: johnport@hawaii.edu

FACULTY INTERESTS AND RECENT PUBLICATIONS

H. Annamalai

My research interests center around understanding the mechanisms responsible for the mean, intraseasonal and interannual variability of the Asian summer monsoon, and elucidating the role of El Niño-induced regional SST anomalies in the tropical Indian Ocean on the local and remote climate variability. Towards these goals, I diagnose a variety of observational/analyzed data sets to develop hypotheses, and then use a range of models (simple linear model to GCMs) to understand the processes involved. Recent focus also includes understanding the response of the monsoon and Indian Ocean climate system to global warming.

- H. Annamalai, K.P. Hamilton, and K.R. Sperber, 2007: South Asian Summer Monsoon and its relationship with ENSO in the IPCC AR4 Simulations. J. Climate, 20, 1071-1092.
- H. Annamalai, H. Okajima and M. Watanabe, 2007: Possible role of Indian Ocean SST on Northern Hemisphere Circulation during El Niño. J. Climate, 20, 3164-3189.
- H. Annamalai, P. Liu and S.P. Xie, 2005: Southwest Indian Ocean SST Variability: Its local effect and remote influence on Asian Monsoons. J. Climate, 18, 4150-4167
- H. Annamalai, J. Potemra, R. Murtugudde, and J.P. McCreary, 2005: Effect of preconditioning on the extreme climate events in the tropical Indian Ocean. J. Climate, 18, 3450-3469.
- H. Annamalai, and K.R. Sperber, 2005: Regional heat sources and the Active and Break phases of boreal summer intraseasonal (30-50 day) variability. J. Atmos. Sci., 62, 2726-2748.

- H. Annamalai, and P. Liu, 2005: Response of the Asian summer monsoon to changes in El Niño properties. Quart. J. Roy. Meteorol. Soc., 131, 805-831.
- H. Annamalai, S.P. Xie, J.P. McCreary, and R. Murtugudde, 2005: Impact of Indian Ocean sea surface temperature on developing El Niño. J. Climate, 18, 302-319.
- H. Annamalai, and R. Murtugudde, 2004: Role of the Indian Ocean in regional climate variability. Earth's Climate: The Ocean-Atmosphere interaction. Geophysical Monograph Series, 147, 213-246 pp, American Geophysical Union.
- H. Annamalai, R. Murtugudde, J. Potemra, S.-P. Xie, P. Liu, and B. Wang, 2003: Coupled dynamics over the Indian Ocean: Spring initiation of the zonal mode. *Deep Sea Research II*, 50, 2305-2330.
- S.P. Xie, H. Annamalai, F. Schott and J.P. McCreary, 2002: Structure and mechanism for south Indian Climate variability, J. Climate, 15, 864-878.

Gary M. Barnes

My interests include hurricane structure and energetics, moist convection and severe convective storms in the tropical and the mid-latitudes, mesoscale convective systems, mixing in cumulus clouds, and the interaction of convective clouds with the boundary layer. Research has been primarily with observations; emphasis is on aircraft data. Recent focus is on the use of GPS dropsondes in several hurricanes including Bonnie (1998), Guillermo (1997), Humberto (2001).

- Sitkowski, M and G. M. Barnes, 2009: Low-level thermodynamic, kinematic and reflectivity fields of Hurricane Guillermo (1997) during rapid intensification. In press Mon. Wea. Rev.
- Patla, J., D.E. Stevens and G. M. Barnes, 2009: The influence of TUTT cells on tropical cyclone motion in the northwest Pacific Ocean. In review for Wea. Forecasting.
- Barnes, G. M., 2008: Atypical thermodynamic profiles in the lower cloud and subcloud layers of hurricanes. Mon. Wea. Rev., 136, 631-643.
- Schneider, R. S., and G. M. Barnes, 2005: Low-level kinematic, thermodynamic and reflectivity fields associated with Hurricane Bonnie (1998) at landfall. Mon. Wea. Rev., 133, 3243-3259.
- Lyman, R. E., T. A. Schroeder, and G. M. Barnes, 2005: The heavy rain event of 29 October 2000 in Hana, Maui. Wea. and Forecasting, **20**, 397-414.

- Wroe, D. R., and G.M. Barnes, 2003: Inflow layer energetics of Hurricane Bonnie (1998) near landfall. Mon. Wea. Rev., **131**, 1600-1612.
- Daida, S. K., and G. M. Barnes, 2003: Hurricane Paine (1986) Grazes the High Terrain of the Baja California Peninsula. Wea. and Forecasting, **18**, 981-990.
- Barnes, G. M., 2003: Typhoon - paragraph in World Book Encyclopedia, page 540.
- Croxford, M., and G. M. Barnes, 2002: Inner core strength of Atlantic tropical cyclones. Mon. Wea. Rev., **129**, 127-139.
- Barnes, G. M., and P. B. Bogner, 2001: Comments on "Surface observations in the hurricane environment". Mon. Wea. Rev., **129**, 1267-1269.

Steven Businger

Over thirty years of experience in observational meteorology and mesoscale numerical weather prediction with emphasis on better understanding the evolution and structure of destructive atmospheric storms including, frontal cyclones, hurricanes, and severe thunderstorms. A recurring focus of my work has been on cyclogenesis in cold air masses (polar lows) and in subtropical airmasses (kona lows). Recent research has focused on the structure of the inflow layer of tropical cyclones and the development of a hurricane balloon instrument platform. Most of my papers can be downloaded at http://imina.soest.hawaii.edu/MET/Faculty/businger/ .

- Businger, S., R. Johnson, and R. Talbot, 2006: Scientific insights from four generations of Lagrangian smart balloons in atmospheric research. *Bull. Amer. Meteorol. Soc*, in press.
- Caruso, S. and S. Businger, 2006: Synoptic climatology of subtropical cyclogenesis. *Wea. and Forecasting*, 20, 193-205.
- Cherubini, T., S. Businger, C. Velden, and R. Ogasawara, 2006: Assimilation of satellite derived winds in mesoscale forecasts over Hawaii. *Mon. Wea. Rev.*, **134**, 2009-2020.
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Yi-Leng Chen

My research interests are in the following areas: island effects on weather and climate over the Hawaiian islands and adjacent waters from data analyses, assimilation of unconventional data in the initial conditions of regional models, and high- resolution numerical modeling including summer trade-wind weather, high-wind and heavy-rainfall events, and regional climate. The daily high resolution model output is also used for other applications including evaluating fire danger and planning for wildfire mitigation and suppression over the Hawaiian islands. I am also studying the processes related heavy monsoon rainfall over Taiwan and southern China during the early summer rainy season. Heavy rainfall problems of Taiwan and the Hawaiian Islands are similar. They both are in a subtropical flow regime with orographic influences. In addition, I am also interested in studying tropical cyclone development over the Western Pacific and the interactions of tropical cyclones with island terrain and the upper-level flow.

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- Yang, Y. And Y.-L Chen, 2003: Circulations and rainfall in the lee side of the island of Hawaii. *Mon. Wea. Rev.*, **131**, 2525-2542.

Pao-Shin Chu

My areas of research include: climate variability and natural disasters (hurricane, drought, wild land fires), climate change detection in the tropics, evaluation and improvement of climate prediction from statistical and dynamical models. In general, both statistical and dynamic methods will be used for understanding tropical climate variations on various time scales. Emphasis is placed on Hawai‘i and other tropical Pacific Islands, East Asia, and South America.

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- Dolling, K., P.-S. Chu, and F. Fujioka, 2008: Natural variability of the Keetch/Byram drought index in the Hawaiian Islands. *Int. J. Wildland Fire*, 133, 17-27.
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Antony D. Clarke

My research activities focus upon the physical chemistry of the atmospheric aerosol in remote regions. Particular interest is in the size distribution of the aerosol and the role of natural and anthropogenic sources responsible for its properties. This is prompted by concern over the role of aerosol on global biogeochemical cycles and potential effects of aerosol on radiative transfer in the atmosphere including the indirect impact aerosol has on cloud properties. These issues are of importance to understanding global fluxes of atmospheric species, ocean-atmosphere chemical interactions, radiation and climate, satellite optical retrievals, etc.

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Kevin Hamilton

I am interested primarily in the large-scale circulation of the atmosphere and its relation with climate and atmospheric composition. Particular interests include the tropical quasi-biennial oscillation, the interaction of the large-scale flow in the atmosphere with relatively small-scale gravity waves, simulation of the atmospheric mesoscale (including tropical cyclones) within high resolution global models, and spontaneous decadal-scale variability in the atmosphere.

- K. Hamilton and W. Ohfuchi (editors), 2008. *High Resolution Numerical Modelling of the Atmosphere and Ocean.* Springer Publishing. 298 pp. doi10.1007/978-0-387-49791-4.
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Barry J. Huebert

One of our most exciting interests is the air-sea exchange (ASE) of gases. Our group has developed a method for rapidly measuring the rate at which dimethylsulfide is released from the ocean to the atmosphere; we are using it to study the factors controlling ASE. We are also trying to understand the formation, transformation, and removal of particles from the marine atmosphere, so that these processes can be realistically represented in climate models. We do this, in part, large field programs, such as ACE-Asia (http://saga.pmel.noaa.gov/aceasia/), PASE, and VOCALS (http://www.eol.ucar.edu/projects/vocals/), in which we measure aerosol chemistry from aircraft in remote locations. We have a two decade-long sampling program at the Mauna Loa Observatory, to assess the delivery of continental nitrate to the central Pacific and measure the concentration of carbonaceous aerosols in the free troposphere, and have done two recent experiments studying absorbing aerosols in Asia.

- Howell, S. G., A. D. Clarke, Y. Shinozuka, V. Kapustin, C. S. McNaughton, B. Huebert, S. Doherty, and T. Anderson, 2006: Influence of relative humidity upon pollution and dust during ACE-Asia: size distributions and implictions for optical properties. *J. Geophys. Res*., **111**, doi:10.1029/2004JD005759.
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Fei-Fei Jin

General research interests include topics on the dynamics of large-scale atmosphere and ocean circulations and climate, with main foci on (i) El Niño theory and predictability, (ii) theory and predictability of low frequency flow, (iii) stochastic dynamics and ensemble-mean dynamics for scale interactions.

- Jin, F.-F., L.-L. Pan and M. Watanabe 2006: Dynamics of Synoptic eddy and low- frequency flow (SELF) interaction. Part I: A closure. *J. Atmos. Sci*.**, 63**, 1677- 1694.
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Tim Li

General research interests are in climate dynamics, atmosphere-ocean interactions, tropical meteorology, and numerical weather prediction. The current research topics include: (i) theory and modeling of tropospheric biennial oscillation (TBO), (ii) El Nio dynamics and the monsoon-ENSO interaction, (iii) tropical intraseasonal oscillations (ISO), (iv) origin and dispersion of tropical synoptic waves and wave- mean flow interaction, (v) tropical cyclone genesis and intensity change, and (vi) satellite data assimilation.

- Wu, B., T. Zhou, and T. Li, 2008: Seasonally evolving dominant interannual variability mode over the East Asia. J. Climate, in press.
- Li, T., F. Tam, X. Fu, T. Zhou, and W. Zhu, 2008: Causes of the Intraseasonal SST Variability in the Tropical Indian Ocean, *Atmosphere-Ocean Science Letters*, 1, 18-23.
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- Hong, C.-C., T. Li, LinHo, J.-S. Kug, 2008: Asymmetry of the Indian Ocean Dipole. Part I: Observational Analysis. *J. Climate,* 21*,* 4834–4848.
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Vaughan T.J. Phillips

Research interests mostly concern cloud physics and the aerosol-cloud interaction in climate change. Current and recent areas of investigation include: (1) the aerosol-cloud interaction in climate change and its representation in the parametrisation of deep convection global models; (2) assessment of dominant physical pathways for the nucleation of cloud particles from aerosols in storms and cloud ensembles; (3) heterogeneous ice nucleation and its representation in a realistic empirical fashion for global and cloud models; (4) the microphysical pathways for production of precipitation in deep convection and stratiform cloud; (5) the impact of dimensionality on simulations of cloud systems, especially their dynamics; and (6) electrification of storms. I participated in the Tropical Cloud Systems and Processes (TCSP) field experiment of NASA last summer, and am studying the effects of heterogeneous ice nucleation on the convection in hurricanes observed in TCSP.

My approach for tackling these areas of uncertainty has been oriented towards modeling. I am experienced in creating cloud models of varying levels of complexity, such as double-moment bulk microphysics schemes and spectral microphysics models that resolve particle size distributions.

- Lee, S. S., L. J. Donner, V. T. J. Phillips, and Y. Ming, 2008: "Examination of aerosol effects on precipitation in deep convective clouds during the 1997 ARM summer experiment", Q. J. R. Meteorol. Soc. in press.
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- V. T. J. Phillips , P. J. DeMott, and C. Andronache, 2008: "An empirical parameterization of heterogeneous ice nucleation for multiple chemical species of aerosol", J. Atmos. Sci., in press.

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- Phillips, V.T.J., A. Pokrovsky, and A. Khain, 2006: The influence of time-dependent melting on the dynamics and precipitation production in maritime and continental storm-clouds. J. Atmos. Sci. in press.
- Sherwood, S., V.T.J. Phillips, and J.S. Wettlaufer, 2006: Small ice crystals and the climatology of lightning. Geophys. Res. Lett., 33, L05804, doi:10.1029/ 2005GL025242.
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John N. Porter

Atmospheric aerosols affect a variety of processes including climate change, human health, satellite retrievals of surface properties, cloud microphysical properties and atmospheric chemistry. Our research has employed lidar, satellite and sun-sky radiance measurements to study aerosols and their direct and indirect effects. Custom instrumentation and software is often used in these efforts to allow for improvements in measurement technology. One of our most recent efforts will involve the use of a state of the art scanning lidar to measure three dimensional wind fields within the boundary layer.

- Lienert, B.R., J.N. Porter and S.K. Sharma, 2003: Aerosol size distributions from genetic inversion of polar nephelometer data, *J. Atmos. Oceanic Tech.*, **20**, 1403- 1410.

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Thomas A. Schroeder

My research interests include mesoscale circulations, tropical meteorology and tropical cyclones. I have focused on weather and climate of Hawaii and severe weather and its impacts upon society. To this end I helped found and currently direct the Pacific El Niño Southern Oscillation (ENSO) Applications Center which provides experimental climate forecasts and applications information to a number of U.S.-affiliated Pacific Islands.

- Cao, J., T. Giambelluca, D. Stevens and T. Schroeder, 2006. Inversion variability in the Hawaii trade wind regime. *J. Climate*, in press.

- Chowdhury, M.R., P.S. Chu and T. Schroeder, 2006. ENSO and sea-level variability a diagnostic study for the U.S. Affiliated Pacific Islands. *Theoretical and Applied Climatol.*, in press.
- Zhang,Y., Y-L Chen, T. Schroeder, and K. Kodama, 2005. Numerical simulations of sea breeze circulations in northwest Hawaii. *Wea. Forecasting*, **20**,.827-846
- Lyman, R., T. Schroeder and G. Barnes, 2005. The heavy rain event of 29 October 2000 in Hana, Maui. *Wea. Forecasting*, **20**, 397-414.
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Duane E. Stevens

I am interested in the geophysical fluid dynamics of circulations in the atmosphere and ocean. Recent publications have treated fluid instabilities at large scales in middle latitude and at much smaller scales in the outflow layer of hurricanes. I have developed a dynamical system to investigate slowly evolving tropical circulations and applied it to the zonally symmetric Hadley circulation. I am interested in tropical waves as well as ocean/air interactions. Experimental climate forecasting techniques on seasonal to interannual time scales are an expected by-product of statistical and dynamical research.

I have also begun a set of investigations into the atmospheric and oceanic circulations around the Hawaiian Islands. The weather and climate of the Hawaiian Islands are being studied with a complex three-dimensional model which includes detailed physical processes. In order to provide initial conditions and verification data, a comprehensive climate data base with user-friendly access is being developed for Hawai'i.

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Bin Wang

My research interests are primarily in the fields of Climate Dynamics, Tropical Meteorology, and Geophysical Fluid Dynamics. My current studies deal with climate predictability and prediction, tropical intraseasonal oscillation, tropical cyclone intensity and motion, Asian-Australian monsoons and general circulation; interdecadal variability and long-term trends of the climate system, and El Niño and warm pool ocean air-sea interaction. My research approaches involve theoretical, numerical, and observational analyses. Our primary effort focuses on understanding of the fundamental physics governing the variations of weather and climate.

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- Wang, B., and Co-author, 2008: Hydrological issues in regional climate modeling of the East Asian summer monsoon. *Climate Dyn*., In press.
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Yuqing Wang

My research interests are primarily in atmospheric dynamics and physics, tropical meteorology, tropical cyclones, regional climate modeling, and development of high-resolution atmospheric and coupled ocean-atmospheric models for both tropical cyclone and regional climate studies. Recent research areas include marine boundary layer clouds; tropical cyclone formation, structure and intensity changes; diurnal cycle of clouds and precipitation in the tropics and its effect on climate variability; tropical intraseasonal oscillation; East-Asian monsoon; regional climate modeling and climate process studies, including cloud-radiation forcing, climate sensitivity and feedbacks, topographic forcing in the climate system; impacts of global change on regional climate with the focus on the extreme weather and climate events (floods, droughts, heat waves, tropical cyclones, etc.) using the nested regional climate model and the coupled atmosphere-ocean general circulation model.

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Shang-Ping Xie

My major interest is in ocean-atmosphere interaction and its role in shaping the earth climate and its variability. My recent work is on the formation and variations of the intertropical convergence zone/equatorial cold tongue complex, climate variability in the Indian, Pacific and Atlantic Oceans, and orographic effects on the Asian summer monsoon. Our analysis of new satellite observations and advanced numerical simulations carried out on Japan's Earth Simulator has uncovered new phenomena and shed light on the dynamics of the ocean, atmosphere and their interaction.

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Jingxia Zhao

My research interests include physics, chemistry and atmospheric impacts of aerosol. Particular interest is in numerical modeling of formation and evolution of stratospheric and tropospheric aerosols associated with gas-to-particle conversion. Current research focuses upon simulating size distribution, concentration, mass and surface area as well as radiative properties of volcanic aerosol clouds following major eruptions. These clouds are responsible for global stratospheric ozone depletion and some important climate consequences.

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