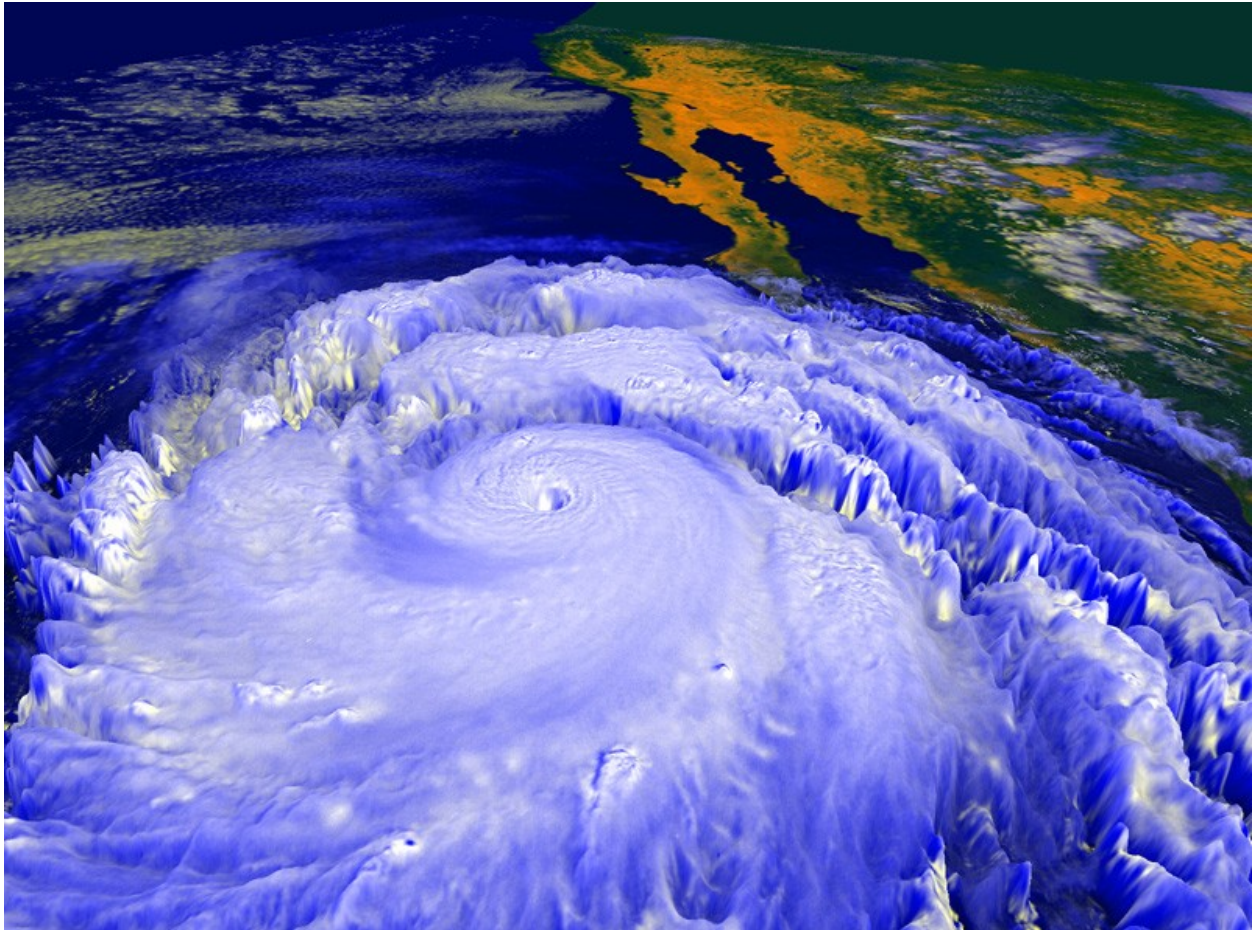


UNIVERSITY OF HAWAI'I DEPARTMENT OF METEOROLOGY

Information for Prospective Undergraduate Students

Revised March 2012



DEPARTMENT OF METEOROLOGY
School of Ocean & Earth Science & Technology
University of Hawai'i
2525 Correa Road
Honolulu, HI 96822-2219

Web Page <http://www.soest.hawaii.edu/MET>
Weather Server <http://weather.hawaii.edu>



INTRODUCTION

Thank you for your interest in undergraduate studies in our department. We are always seeking to recruit excellent students for our undergraduate program. Meteorology has been an academic discipline at University of Hawai‘i at Manoa 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. The B.S. degree qualifies graduates for professional appointment to either the civilian or military and federal weather services. 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, approximately 40 undergraduate and 35 graduate students, and it is part of one of the world’s most active schools in the geosciences - the University of Hawai‘i 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 Hawai‘i Institute of Geophysics (HIG) building and the adjacent Pacific Ocean Sciences and Technology (POST) building. The Department's program in tropical meteorology is recognized as one of the three best in the world, fostered by the peculiar advantage and challenge presented by our mid-Pacific location. The quality of our program attested to by generous support of our research by federal agencies, our international student body, and the significant leadership of national and international science planning activities provided by many of our faculty.

Department faculty have participated in a series of field experiments on the island of Hawai‘i and elsewhere. These experiments have generally emphasized investigations of cloud physics, and more recently, of convective and mesoscale phenomena, including tropical cyclones. 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 (AIRMAP) 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 students have 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 use by 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. The Department maintains an online weather server (<http://weather.hawaii.edu>). Practical applications of meteorological information for the State of Hawai‘i are also provided by the State Climatologist Office, which is directed by Prof. Chu (<http://www.soest.hawaii.edu/MET/Hsco/index.html>), in our department and through interactions of our faculty and students with the local office of the U.S. Forest Service.

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 US-Japan 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 current undergraduates (pages 4-6), key information about our course offerings (pages 7-9), our faculty and their research interests (page 10).

Department of Meteorology Office:

Tel: (808) 956-8775, Fax (808) 956-2877

Email: metdept@hawaii.edu

Undergraduate Advisor: Dr. Yuqing Wang

Email: yuqing@hawaii.edu

Department Chair: Dr. Bin Wang

Email: wangbin@hawaii.edu

SOEST Director of Student Services:

Dr. Leona Anthony

Email: leonaa@hawaii.edu, (808) 956-8763



UNDERGRADUATE PROGRAM

The **Bachelor of Science (B.S.)** in meteorology is designed to prepare a graduate for professional employment as a meteorologist, and meets the requirements specified by the federal meteorological agencies. A new graduate may be commissioned as a meteorological officer in the Air Force or Navy or appointed to a meteorological internship in the National Oceanic and Atmospheric Administration (NOAA). A few of our graduates have made careers in computer science (e.g., the former Director of the University's Computing Center).

In addition to the fundamental courses in mathematics, physics, chemistry, theoretical meteorology, instruments and observations, and analysis, students may complete their meteorological requirements in a number of ways, and may emphasize, for example, tropical meteorology, climatology, statistics, or computer applications. Forty-three credit hours are required in the major field selected from among not only meteorology courses but also from appropriate courses offered in engineering, geography, geology and geophysics, information sciences, mathematics, oceanography, physics, and soil science. Thoughtful advising promotes the advantage of the program's flexibility, while preserving academic standards. Whenever possible, we utilize courses taught in other departments, eschewing duplication and broadening the educational experience. Total: 124 credit hours for B.S. degree.

APPLICATION INFORMATION

To obtain application forms and related information about the University of Hawai'i, please visit <http://www.hawaii.edu/admrec/> for complete details. An on-line catalog is available at www.catalog.hawaii.edu.

Incoming freshmen (and some transfer students) **are required to take placement exams** for Math and Chemistry. The schedule for placement exams is provided in the UH Schedule of Classes booklet. Mandatory advising is required.

Current students at the University of Hawai'i need to contact the Meteorology Undergraduate Advisor for a Curriculum Transfer Request (CTR) form to transfer from your current degree program to a Bachelor of Science degree in Meteorology.

Undergraduate Advisor: Yuqing Wang

Phone: (808) 956-5609

Email: yuqing@hawaii.edu



BASIC REQUIREMENTS (24 credit hours)

CHEM	161+161L	General Chemistry I and Lab
CHEM	162	General Chemistry II
PHYS	170-170L	General Physics I and Lab
PHYS	272-272L	General Physics II and Lab
MATH	241	Calculus I
MATH	242	Calculus II

MET	406	Tropical Meteorology (alternate S)
MET	412	Meteorological Analysis Lab (alternate S)
MET	416	Tropical Analysis Lab (alternate S)
MET	495	Undergraduate Thesis
OCN	363	Earth System Science Databases
MET	600	Atmospheric Dynamics I
OCN	620	Physical Oceanography

REQUIRED COURSES (29 credit hours)

MET	101L	Introduction to Meteorology Laboratory
MET	200	Descriptive Meteorology
MET	302	Atmospheric Physics (S)*
MET	303	Introduction to Atmospheric Dynamics (F)
MET	305	Meteorological Instruments & Observations (alternate F)
MET	402	Applied Atmospheric Dynamics (S)
MET	412	Meteorological Analysis Laboratory (alternate S) †
MET	416	Tropical Analysis Meteorology (alternate S) †
ICS	111	Introduction to Computer Science I or
MET	320	Programming for Meteorologists
MATH	243	Calculus III
MATH	244	Calculus IV

Colleges of Arts and Sciences:

GEOG	300	Introduction to Climatology
GEOG	301	Atmospheric Pollution
GEOG	303	General Geomorphology
GEOG	402	Agricultural Climatology
GEOG	412	Environmental Impact Assessment
ICS	211	Introduction to Computer Science II
ICS	311	Algorithms
ICS	442	Analytical Models & Methods
MATH	311	Introduction to Linear Algebra
MATH	371	Elementary Probability Theory
MATH	373	Elementary Statistics
MATH	402	Partial Differential Equations I
MATH	403	Partial Differential Equations II
MATH	405	Ordinary Differential Equations
PHYS	274	General Physics III
PHYS	274L	General Physics III Lab
PHYS	400	Applications of Mathematics in Physical Sciences

REQUIRED ELECTIVES (15 credit hours)

selected from the following courses**)

School of Ocean and Earth Science and**Technology:**

GG	312	Geomathematics
MET	310	Global Environmental Change (F)
GG	455	Hydrogeology
MET	405	Satellite Meteorology (alternate F) †

† Students planning careers with federal meteorological agencies should take at least two courses from 405, 412, and 416.

*Some classes are only offered spring (S) or fall (F) semester or alternate years. Check class schedule!

**Including but not limited to and with the approval of the undergraduate advisor.

College of Engineering:

CEE	424	Applied Hydrology
CEE	626	Surface-Water Hydrology

Department of Tropical Plant and Soil Sciences:

TPSS	460	Soil Plant Environment
------	-----	------------------------



POSSIBLE COURSE SEQUENCE

FALL SEMESTER	YEAR	Upper	SPRING SEMESTER	YEAR	Upper
	1	Division		1	Division
Math 241	4	4	Math 242	4	4
Chem 161+161L	4	0	Chem 162	3	0
English 100 (FW)	3	0	Physics 170 + 170L	4	0
FG*	3	0	Language 101	3	0
DA/DH/DL*	<u>3</u>	<u>0</u>	DS	<u>3</u>	<u>0</u>
Total:	17	4		17	4

FALL SEMESTER	YEAR		SPRING SEMESTER	YEAR	
	2			2	
Math 243	3	3	Math 244	3	3
Met 200 + 101L	4	3	DB	3	0
Phys 272 + 272L	4	4	Met 302	3	3
Language 102	3	0	FG	3	0
DA/DH/DL	<u>3</u>	<u>0</u>	DS	<u>3</u>	<u>0</u>
Total:	17	10		15	6

FALL SEMESTER	YEAR		SPRING SEMESTER	YEAR	
	3			3	
Met 303	3	3	Met 402	3	3
MET 310 (E)	3	3	Met 412*** (W&O)	3	3
ICS 111/MET 320	4/3	0/3	Met Elect & (O)	3	3
Upper Division Elective	3	3	Upper Division Elective	3	3
Elective	3	0			
Total:	16	9/12		12	12

FALL SEMESTER	YEAR		SPRING SEMESTER	YEAR	
	4			4	
Met 305*** (W)	3	3	Met 416*** (W&O)	3	3
Met Elective	3	3	Met Elective	3	3
Met Elective	3	3	Focus H	3	0
Elective (W)	3	0	Elective	3	0
Elective	<u>3</u>	<u>0</u>	Elective	<u>3</u>	<u>0</u>
Total:	15	9		15	6

TOTAL CREDITS:	124	UPPER DIV CREDITS:	60[^]
-----------------------	------------	---------------------------	-----------------------

[^] **Upper division credits** are from those courses numbered ≥ 300 or ≥ 200 with a college prerequisite.

* FG, FW, DA, DB, DH, DL, DS are **UH Foundation and Diversification requirements** for global and multicultural perspectives, written communication, arts, biological sciences, humanities, literatures, and social sciences.

** **Focus classes** are identified by W-writing intensive, O-oral communication, E-contemporary ethical issues, and H-Hawaiian, Asian, & Pacific issues. Designations are provided in the Schedule of Classes booklet and can change from semester to semester; check with the instructors as needed for planning.

***Met 405, 406, 412, and 416 are offered every other year.

METEOROLOGY COURSE OFFERINGS AND DESCRIPTIONS

101 Introduction to Meteorology (3)

For non-science majors and prospective science teachers. Basic atmospheric physics, sun-earth-ocean-atmosphere interrelationships, major weather systems, weather forecasting, weather of Hawai'i.

101 L Introduction to Meteorology Laboratory (1) (1 3-hr lab)

Exercises with meteorological data and measurement systems. Characteristics of Hawaiian winds, temperatures, and rainfall. Pre: MET 101 (or concurrent).

200 Descriptive Meteorology (3)

Atmospheric variables, gas laws, radiation processes, thermodynamics, conservation laws, dynamic approximations, clouds and precipitation, convection, atmospheric circulations, mid-latitude and tropical weather systems, forecasting, climate. Pre: PHYS 170 and MATH 241.

302 Atmospheric Physics (3)

Energy and thermodynamics, statics and stability, physical processes of cloud formation, radiation and Earth-atmosphere heat balance, kinetic theory, optical effects. Pre: MATH 242, PHYS 272 and 200.

303 Introduction to Atmospheric Dynamics (3)

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. Pre: 302, MATH 244.

305 Meteorological Instruments and Observations (3) (2 L, 1 3-hr lab)

First- and second-order measurement systems. Response of wind, temperature, and recording instruments. Discussion of advance system including radar. Planning of field programs. Pre: PHYS 272/272L and 302.

310 Global Environmental Change (3)

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)

310 L Global Environmental Change Laboratory (2) (3-hr lab)

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

320 Programming for Meteorologists (3) (1 L, 1 3-hr Lab)

Scientific programming in Fortran 90, graphics software, and meteorological applications. Pre: 200 (or concurrent) and MATH 241; or departmental approval.

402 Applied Atmospheric Dynamics (3)

Advanced concepts in dynamics: vorticity, cyclogenesis, jet streams, fronts, mesoscale circulations. Pre: 303.

405 Satellite Meteorology (3) (2 L, 1 3-hr lab)

Orbital elements, ephemerides, viewing geometry; radiation, satellite sensors; interpreting satellite data; applications to synoptic meteorology and forecasting. Pre: 302.

406 Tropical Meteorology (3)

History; tropical clouds and hydrometeors; typhoons; monsoons; local and diurnal effects. Pre: 303.

412 Meteorological Analysis Lab (3) (2 3-hr lab)

Techniques of portraying and analyzing atmospheric structure and weather systems in middle and high latitudes; modern methods of forecasting extratropical systems. Pre: 303 or concurrent. (Alt. years)

416 Tropical Analysis Lab (3) (2 3-hr lab)

Techniques of portraying and analyzing atmospheric structure and weather systems in tropical and equatorial regions; forecasting tropical systems. Pre: 303 or concurrent.

495 Undergraduate Thesis (3)

Capstone for senior Meteorology majors. Undergraduate thesis project includes literature review, experiment or research design, data collection and analysis, technical writing of a final thesis paper and oral presentation of the paper. A-F only. Pre: 302, 303 or concurrent; Senior standing.

600 Atmospheric Dynamics I (3)

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

601 Atmospheric Dynamics II (3)

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

606 Cumulus Dynamics (3)

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

607 Mesoscale Meteorology (3) (3L)

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

610 Tropical Climate and Weather (3)

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

614 Tropical Cyclones (3)

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. Pre: MET 600/610 or consent of instructor.

616 Monsoon Meteorology (3)

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

620 Physical Meteorology (3)

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

631 Statistical Meteorology (3)

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

632 Advanced Statistical Methods in the Geosciences (3)

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 analysis, statistical downscaling, and Bayesian analysis will also be included. Pre: 631 or consent. (every three years)

665 Small-Scale Air-Sea Interaction (3)

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. Pre: 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)

666 Large-Scale Ocean-Atmosphere Interactions (3)

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. Pre: MET 600 or OCN 620; or consent of instructor. (alternate years)

699 Directed Research (v)

Pre: consent of instructor.

700 Thesis Research (v)

702 Numerical Weather Prediction (3) (2 L, 1 3-hr 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 dynamical models, with a term project. Repeatable one time.

Pre: MET 600 or OCN 620; MATH 407 or 408 or consent of instructor. (alternate years)

704 Climate and Climate Variability (3) (3L)

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.

Pre: MET 600 or OCN 620 or consent of instructor. (alternate years)

706 Tropical Climate Dynamics and Modeling (3) (3L)

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.

Pre: MET 600.

752 Special Topics in Meteorology (3)

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

765 Seminar in Meteorology (1) (1 S)

Participation in departmental seminars, and presentation of a seminar on a literature review of a specific topic or research results.

Repeatable. Pre: consent of instructor.

800 Dissertation Research (v)



FACULTY

Graduate Faculty

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

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

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

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

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

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

Tim Li, Ph. D., Hawaii. Climate dynamics and coupled atmosphere-ocean modeling. email: timli@hawaii.edu

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

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

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

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

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

Jingxia Zhao, Assistant Researcher, Ph.D., UCLA. Atmospheric 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 of Oceanography, UH-Manoa) Marine aerosols, biogeochemical cycles, and optical properties. email: tclarke@soest.hawaii.edu

Barry J. Huebert, Ph. D., Northwestern. (Professor of Oceanography, UH-Manoa) 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., Hawaii. (Associate Researcher of Hawaii Institute of Geophysics & Planetology, UH-Manoa) Satellite and ground based optical sensing of atmospheric aerosols. email: johnport@hawaii.edu

YOUR DRAFT COURSE SEQUENCE

FALL SEMESTER	YEAR 1	Upper Division		SPRING SEMESTER	YEAR 1	Upper Division
Total:				Total:		
FALL SEMESTER	YEAR 2			SPRING SEMESTER	YEAR 2	
Total:				Total:		
FALL SEMESTER	YEAR 3			SPRING SEMESTER	YEAR 3	
Total:				Total:		
FALL SEMESTER	YEAR 4			SPRING SEMESTER	YEAR 4	
Total:				Total:		
TOTAL CREDITS:				UPPER DIV CREDITS:		