ATMO 611 – Satellite Data Applications Syllabus FALL 2017

Instructor: Dr. Jennifer Griswold
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Office Hours: After Classes (Tues-Thur 10:30-11:30pm) or By Appointment (HIG 341)

Class CRN: 78742
Class Times: Tuesday-Thursday 9:00 AM - 10:15 AM
Class Location: HIG 310
Course Web address: http://jenniferdsmallphd.com/ATMO_611.htm

Optional Materials

1) Qu, J. J., Gao, W., Kafatos, M., Murphey, R. E., and Salomonson, V. V., eds., 2012. *Earth Science Satellite Remote Sensing Vol 1. Science and Instrument*s, Tsinghua University Press, Beijing, and Springer-Verlag GmbH Berlin. p. 1099.
2) Trauth, M. H., Sillmann, E., Gebbers, R. and Marwan, N., 2007. *MATLAB Recipes for Earth Sciences*. Berlin, Springe. p. 288.
3) Trauth, M. and Sillmann, E., 2012. *MATLAB and Design Recipes for Earth Science: How to Collect, Process and Present Geoscientific Information*. Berlin, Springer. p. 303.

Course Description

After completing this course you will understand the principles and practices of satellite remote sensing as used in the atmospheric sciences, specifically clouds, aerosols, precipitation, ocean and land cover datasets. Students will develop skills to enable them to select suitable data sources related to their research and thesis interests. These skills include data manipulation, analysis, and visualization using Matlab. During this course they will have the opportunity to work on a research related literature review and group-based projects to increase their ability to utilize satellite data sets in their research/thesis work. You will need to spend time working on lab assignments and a course project using Matlab (or the programming language of your choice, see Dr. Griswold if using something other than Matlab). Use office hours for assistance and guidance.

Basic Course and Classroom Conduct

1. Cell phones/iPods/etc. will remain off while in class or you will be asked to leave class.
2. Dropping the class is your responsibility. If you forget to drop the class formally, you will receive an F grade.
3. Cheating will result in a failing class grade.

Assessments:

Student success will be evaluated throughout the semester. TEN lab assignments worth (50%) will allow students to learn how to use ten different satellite data sets and practice specific data analysis and graphing techniques while allowing continual assessment of their skills by the instructor. The semester long paper and presentation (40%) allows for students to assimilate multiple techniques to answer a question related to the Earth's atmosphere and climate using data acquired and provided during the course. Attendance and participation in class is also essential (10%).

Week	Date	Topic	Background Reading	LAB ASSIGNMENT DUE	
1	8/22		King et al., 1992		
	8/24	Dr. Griswold Away on Field Work – Reading Assignments	Savtchenko et al., 2004		NO LAB Due
2	8/29		Platnick et al., 2003		
	8/31	Dr. Griswold away on Field Work – Reading Assignments	Baum and Platnick, 2006		NO LAB Due
3	9/5	Introduction to Remote Sensing	Review King &		
	9/7	Survey of Satellites we will be covering	Savtchenko		
		Lab 0: Project Description Review	for Week 4		NO LAB Due
4	9/12	Term Project Outline – Previous Projects - Brainstorming	Review Platnick &		**Potential**
	9/14	Introduction to MODIS Instrumentation	Baum and Platnick	Work on	**Project**
		Lab 1: Introduction to MODIS, Matlab and File Types	For Week 5	Lab1	**Topic Due**
5	9/19	MODIS Products (L2 vs. L3) and Data Access	Stephens et al., 2002		
	9/21	Introduction to MODIS Cloud Products	Stephens et al., 2008	Work on	
	9/22	LAB 2: Global and Regional Cloud Properties	For Week 6	Lab 2	Lab 1 Due
6	9/26	Introduction to CloudSat/CALIPSO Cloud Products and Data	Kaufman et al., 1997		
	9/28	CALIPSO "Curtains" and Analysis	Remer et al., 2008	Work on	
	9/29	LAB 3: Case Studies using CALIPSO "Curtains"	For Week 7	Lab 3	Lab 2 Due
7	10/3	Introduction to MODIS Aerosol Products	Herman et al., 1997		**Lit Review**
	10/5	MODIS Aerosol Products Continued	Li et al., 2009	Work on	**Due**
	10/6	LAB 4: Regional MODIS Aerosol Changes & Trends	For Week 8	Lab 4	Lab 3 Due
8	10/10	Introduction to TOMS and OMI Satellites	Kacenelenbogen et al., 2014		
	10/12	Introduction to Absorbing Aerosol Index and Aerosol Index	Winker et al., 2013	Work on	
	10/13	LAB 5: Comparison of AAI, AI, Optical Depth and Thickness	For Week 9	Lab 5	Lab 4 Due
9	10/17	Introduction to CALIOP Aerosol	Justice et al., 2002		**Outline of**
	10/19	CALIOP Aerosol identification	Wolfe et al., 1998	Work on	**Objectives &**
	10/20	LAB 6: Cloud Aerosol Interactions - CALIPSO and CALIOP	For Week 10	Lab 6	Lab 5 Due
10	10/24	Introduction to Land Surface Products	Esaias et al., 1998		
	10/26	MODIS Fire, Burned Area and other Useful Datasets	Fu et al., 1994	Work on	
	10/27	LAB 7: Mapping Land Use Changes and Fires	For Week 11	Lab 7	Lab 6 Due
11	10/31	Intro to Ocean Products: Temperature & Topography	Kummerow et al., 1998		**Data**
	11/2	Mapping El Niño	Kummerow et al., 2000	Work on	**Analysis**
	11/3	LAB 8: Mapping Major El Niño Events	For Week 12	Lab 8	Lab 7 Due
12	11/7	Introduction to TRMM Satellite	Hoffman et al., 1997		
	11/9	TRMM Data Products	Alder et al., 2003	Work on	
	11/10	LAB 9: Precipitation Trends and Patterns	For Week 13	Lab 9	Lab 8 Due
13	11/14	Introduction to GPCP Data Set			**Abstract**
	11/16	Daily, Monthly, and Climatological Precipitation		Work on	**Summary**
	11/17	LAB 10: Comparison between TRMM and GPCP Data Sets		Lab 10	Lab 9 Due
14	11/21	Work on Projects (Catch up on Labs) – No Regular Class			
	11/23	**THANKSGIVING**		**Enjoy the Holiday**	
15	11/28	**Work on Final Projects in Class – Help from Dr. Griswold**			
	11/30	**Work on Final Projects in Class – Help from Dr. Griswold**			
	12/1				Lab 10 Due
16	12/5	Final Project Presentations			
	12/7	Final Project Presentations			
17	12/12	Final Project Presentations (IF NEEDED)		**Final Papers Due**	

***Dark Shading for Project indicates component must be turned in via email. Light shading are guidelines for when you should complete different sections to stay on track.**

Semester Project – Semester Long Investigation Using Multiple Satellite Data Sets
This course has a semester long project which culminates in a paper and oral presentation at the end of the semester. Each student will choose a minimum of three distinct satellite data sets to investigate and scientific question related to the weather and/or climate of a specific region on earth. More specific details will be given with the assignment. The project will involve a literature review, data description, methods or analyzing the data, results and conclusions. The format will be similar to that of a manuscript for submitted for publication.

Lab Assignments – 10 Separate Assignments.
Each week students will learn about new satellite data products from MODIS (L2 and L3 cloud, aerosol, land and ocean), CloudSat, CALIPSO, TRMM, GPM, and GPCP. Students will have the opportunity to investigate other data sources such as GOES or Reanalysis Data from NCAR and MERRA for meteorological properties such as winds and vertical velocities for their individual semester projects (guidance will be given if needed for data sets not covered in lectures).

Extra Credit -- ** There will be no extra credit offered to any individuals. No exceptions. **
I may give out extra credit work, but if I do, it will be available for *all* students in the class.

Grading
Grading for this course is straight forward. There are two types of assignments listed below:

Lab Assignments	50%
Research Paper & Oral Presentation	40%
Attendance, In-Class Discussion	10%
Total	100%

Grading will not necessarily be "on a curve." There is no expectation of what the average grade should be, nor what the grade distribution should look like. If everyone were to demonstrate outstanding understanding of all the material, then everyone deserves a grade of A (and I would be very happy to give each one of them)! I therefore encourage you to discuss the course material with each other to get the most out of the class.

Note: the points and percentages given are approximations and may vary slightly

Grade Structure

Letter	Percentage
A+	> 100.00
A	93.50-100.00
A-	90.00-93.49
B+	86.50-89.99
B	83.50-86.49
B-	80.00-83.49
C+	76.50-79.99
C	73.50-76.49
C-	70.00-73.49
D+	66.50-69.99
D	63.50-66.49
D-	60.00-63.49
F	59.99 and below

Adjustment of letter grade: One can receive an **upward** adjustment of letter grade for a number of reasons (e.g. very strong improvement during the semester, notable participation during class, exceptional effort). Under no circumstances will a reduction in letter grade be given, and these adjustments are made after the normal grades are assigned and therefore affect no one else's letter grade.

Dropping the Course
You are responsible for managing your courses. If you need to drop without a "W" grade check the deadlines on the Manoa Website (last day to drop courses/switch sections without a "W" grade is August 28th). Keep track of when you can still withdraw from the course for in-person restricted withdrawal (October 10th). You will need a signature from me on the "Drop Form" if you drop the class after that date.

Title XI Statement:
The University of Hawai'i is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking. If you or someone you know is experiencing any of these, the University has staff and resources on your

campus to support and assist you. Staff can also direct you to resources that are in the community. Here are some of your options:

As members of the University faculty, your instructors are required to immediately report any incident of potential sex discrimination or gender-based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and your instructors cannot guarantee confidentiality, you will still have options about how your case will be handled. Our goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need.

If you wish to remain ANONYMOUS, speak with someone CONFIDENTIALLY, or would like to receive information and support in a CONFIDENTIAL setting, use the **confidential resources available here**:

http://www.manoa.hawaii.edu/titleix/resources.html#confidential

If you wish to directly REPORT an incident of sex discrimination or gender-based violence including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence or stalking as well as receive information and support,

contact: Dee Uwono Title IX Coordinator (808) 96-2299 t9uhm@hawaii.edu.

Student Learning Objectives (SLOs): Upon completion of the course, the student will be able to:

1. Develop and understanding and appreciation for the history of remote sensing
2. Describe the history and functionality of the MODIS Sensor
3. Understand the differences between L2 and L3 datasets
4. To use MatLab to access and modify various types of data formats including NetCDF and HDF
5. Describe MODIS Cloud Products and their strengths and limitations
6. Extract relevant MODIS Cloud Products for data analysis and research use
7. Describe the CloudSat/CALIPSO satellite and data products and their strengths and limitations
8. Extract and Utilize relevant cloud data products from the CloudSat/CALIPSO datasets
9. Develop an understanding of cloud processes and cloud properties as seen from space
10. Explain the differences and similarities between sensors and datasets
11. Describe MODIS Aerosol Products their strengths and limitations
12. Extract relevant MODIS Aerosol Products for data analysis and research use
13. Describe TOMS and OMI sensors and their data product strengths and limitations
14. Extract relevant TOMS and OMI data for analysis and research use
15. Describe the CALIOP Lidar Aerosol measurements and classification system
16. Extract relevant Aerosol data from the CALIOP datasets for analysis and research use
17. Develop and understanding of aerosol global distribution by type and region
18. Describe the differences and similarities of aerosol datasets
19. Describe the various land surface data sets including MODIS Fire, GFED, Burned Area Index
20. Extract relevant land surface products for analysis and research use
21. Describe ocean temperature and topography measurements and sensors
22. Extract relevant ocean data for analysis and research use
23. Use ocean data to investigate questions related to El Niño and Sea Level Rise
24. Describe the TRMM sensor and products including strengths and limitations
25. Extract relevant precipitation data from the TRMM sensor for analysis and research use
26. Describe the GPCP dataset and its strengths and limitations
27. Extract precipitation data in various temporal formats from GPCP for analysis and research use
28. Compare and contrast the TRMM and GPCP precipitation data sets
29. Utilize cloud, aerosol and land surface products in concert to answer relevant atmospheric science questions
30. Utilize cloud, aerosol and precipitation products to answer relevant atmospheric science questions