ERTH 460 Geological Remote Sensing (even Spring Semesters)

Lectures (TTh 3:00 - 4:15, POST 708) and *Labs (W 1:30-4:20, POST 733)*

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Date	***Lab*** or Lecture (SLO*)
Week 1	Class Organization, Overview and Examples of Remote Sensing (1) The nature of light (generation and propagation of radiation; 1, 3, 5) ***ENVI familiarization, Contrast Enhancements, Band Combinations, Subsampling (2)***
Week 2	The passage of light from source to the sensor (how much radiation is available for us to measure, and the composition of that radiation; 1, 3, 5) The reflection of light from the target (interaction of radiation with matter; 1, 3, 5) ***Digital Image Processing I: Spatial Resolution and Spatial Filters (2)***
Week 3	The spectral reflectance properties of some common targets (the spectral fingerprints of Earth surface materials; 1, 3, 5) Data Collection I: Satellite Platforms and Orbits (1, 3, 5) ***Digital Image Processing II: Band Ratios, NDVI, Density Slices (2)***
Week 4	Data Collection II: Signal Collection, Data Depth, Image File Types (1, 3, 5) Image Co-Registration, Resampling, Geo-coding, and UTM (1, 3, 5) ***Digital Image Processing III: Resampling, Co-Registration, Geo-Registration (2)***
Week 5	Intro to GPS (1, 3, 5; Rob gone) Using a hand-held GPS, in-class exercise (2; Rob gone) ***GPS Mapping (2; Rob gone)***
Week 6	How well do remote sensing data capture real-world variability, spatially, spectrally, radiometrically, and temporally? (1, 3, 5) Thermal remote sensing I: basic physics (heat, temperature, energy, and blackbody Radiation; 1, 3, 5) ***Digital Image Processing IV: Scatter Plots (2)***
Week 7	Thermal Infrared II: useful parameters that can be derived from thermal infrared data (emissivity, temperature; 1, 3, 5) The effect of the atmosphere on the quality of a remotely sensed measurement (1, 3, 5) ***Digital Image Processing V: Image Classification (2)***
Week 8	Image Classification (1, 2, 3, 5) **MID-TERM EXAM #1** ***Digital Image Processing VI: Reflected and Emitted Energy (2; Scott gone)***
Week 9	Principal Components (1, 2, 3, 5) Hyperspectral remote sensing (1, 3, 5) ***Digital Image Processing VII: Principal Components, Decorrelation Stretches (2)***
Week 10	***SPRING BREAK !!!!!***

Week 11	Attend LiDAR talk, Saunders 443B Detecting wildfires and volcanic eruptions from space (1, 2, 3, 5) ***Distribute Data Sets for Big Island project, Intro. to Hawaiian Volcanic Products (2)***
Week 12	Introduction to Synthetic Aperture Radar (SAR) (1, 3, 5) Geological applications of SAR data (1, 3, 5; Rob gone) (1, 3, 5; Rob gone) ***Digital Image Processing VIII: DEMs, Cross-Sections (Rob and Scott gone; 1)***
Week 13	Digital Elevation Models and Interferometric SAR (InSAR) Large-scale Topographic Change from InSAR (1, 3, 5) ***Work on Big Island project (Scott gone)***
Week 14	Small-scale Topographic Change from InSAR (1, 3, 5) **MID-TERM EXAM #2** ***Work on Big Island project***
Week 15	Components of a space mission (how spacecraft work to support remote sensing Missions; 1, 2, 5) *no class, but Preliminary Big Island projects due (start of Big Island field trip) (4)* ***Big Island Field Trip (1, 3, 5)***
Week 16	Terrestrial remote sensing missions, EOS and SIR-C (guest: Pete Mouginis-Mark) Air Photos, parallax, distorsion (1, 3, 5) ***Digital Image Processing IX: Pan-sharpening, Hyperspectral Data (2)***
Week 17	High spatial resolution data, orthorectification (1, 2, 3, 5) **FINAL PROJECT DUE (4)** NO EXCEPTIONS!!!!

This course is partially supported by the Hawai‘i Space Grant Consortium and the Dept. of Geology & Geophysics; computer support kindly provided by Pat Townsend, Chad Morita, Skyler Kimura, and Ross Ishida

Labs are due at the beginning of the following lab – no late labs will be accepted, sorry.
The Big Island project is due twice. The first version, which will require the most work, is due on Thursday April 19 (before we get on the plane). The final version is due on Friday, May 4 at 4:00 pm – no late projects will be accepted, sorry.

Grading:		
	homework	5%
	midterms	15% each
	lab assignments	40%
	Final project	25%

There is no reasonably-priced text that we have found. Instead we will provide you with xeroxed chapters from relevant books and journal articles (don’t tell the copyright police).

<u>Useful Textbooks</u>:

Jensen JR (2000), <u>Remote Sensing of the Environment</u>. Prentice Hall, Inc., New Jersey, 544 pp.
Drury SA (1986), <u>Image Interpretation in Geology</u>. Allen & Unwin, London, 243 pp.
Avery TE, Berlin GL (1992) <u>Fundamentals of Remote Sensing and Airphoto Interpretation</u> Macmillan Pub. Co., New York, 472 pp.
Ray RR (1960), Aerial photographs in geologic interpretation and mapping. US Geol Surv Prof Pap <u>373</u>:230 pp.

<u>Remote Sensing Journals</u>:

International Journal of Remote Sensing
Remote Sensing of the Environment
IEEE Transactions on Geoscience and Remote Sensing

Title IX: 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) 956-299 t9uhm@hawaii.edu

***SLOs - Student Learning Objectives**

The Geology & Geophysics Dept. has decided that the following Student Learning Objectives are key goals for any G&G student:

1. Students can <u>explain the relevance</u> of geology and geophysics to human needs, including those appropriate to Hawaiʻi, and be able to discuss issues related to geology and its impact on society and planet Earth.
2. Students can <u>apply technical knowledge</u> of relevant computer applications, laboratory methods, and field methods to solve real-world problems in geology and geophysics.
3. Students <u>use the scientific method</u> to define, critically analyze, and solve a problem in earth science.
4. Students can <u>reconstruct, clearly and ethically</u>, geological knowledge in both oral presentations and written reports.
5. Students can <u>evaluate, interpret, and summarize the basic principles</u> of geology and geophysics, including the fundamental tenets of the sub-disciplines, and their context in relationship to other core sciences, to explain complex phenomena in geology and geophysics.

CLOs – Course Learning Objectives: In this course students will learn how electromagnetic radiation (light, heat, etc.) interact with the surface of the Earth and other planets, and how the reflected, re-emitted, scattered energy from these interactions can be collected and interpreted. They will also gain hands-on experience in manipulating these data with state-of-the-art software. They will create a map of a location and then go there in person to assess which aspects of the area they interpreted correctly and which areas they didn't, and why.

ILOs – Institutional Learning Objectives: Students will gain *specialized knowledge* of how energy interacts with planetary surfaces and how those interactions provide knowledge about those surfaces. They can then *apply this knowledge to broader aspects of the physical and natural world*. Students will *think critically* as they process and interpret remotely-sensed data to create geologic maps. Some of the data and derived images are important aspects of studying climate change and in turn, are the basis for *better stewardship of our natural world*. While in the field ground-truthing their maps, they will *grow personally* as they learn how to navigate with GPS and interpret real surfaces from image data.

If you have a disability and related access needs, the Department will make every effort to assist and support you. For confidential services students are encouraged to contact the Office for Students with Disabilities (known as "Kōkua") located on the ground floor (Room 013) of the Queen Lili'uokalani Center for Student Services.