AGRO 500: Special Topics
Applications of Remote Sensing to Environmental Monitoring
Spring 2013
Professors: Dr. Dave DuBois and Max Bleiweiss

Course Credits: 3 credits

Meeting time and location: Skeen N200, 8:55 - 10:10 am Tuesday and Thursday (extra computer time is available TBA)

Office hours: immediately after class and by appointment

The goal of this course is for the students to understand the nature of remote sensing and how it is used in environmental monitoring in an experiential format. Our class will begin with traditional lectures on the physical basis for remote sensing that describes how we can probe the atmosphere and land surface using electromagnetic radiation or other means. We will cover the various types of passive and active remote sensors and how they operate. Our focus on the rest of the course will be on the manipulation and analysis of the data from these systems either through image processing or data analysis to learn more about the environment. We will be discussing passive sensing systems (optical, microwave); imaging and non-imaging, radar or radio frequency based systems, light detection and ranging or Lidar, and acoustic sounding. Most of the course will follow a hand-on approach, to analyze data and experiment with tools and collect their own data.

Objectives

1. Read literature on remote sensing; solve problems to strengthen problem solving and analytical skills
2. Gain practical hands-on experience in measuring ground truth for satellite imagery, understanding results, and interpreting data
3. Learn techniques of data analysis specific to understanding and interpreting data for the study

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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Issues</th>
<th>Book chapter</th>
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<tbody>
<tr>
<td>1-2</td>
<td>Nature of Remote Sensing</td>
<td>Electromagnetic spectrum, atmospheric components, optics of the atmosphere</td>
<td>handouts</td>
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Target interactions/types of sensing

Interaction of radiation with vegetation, soils, water surfaces. Review active vs. passive sensing

Types of sensors/satellite based

Review of satellite trajectories, swath

Satellite radiometry/ENVI part I

Review of satellite sensors in operation/introduce ENVI

ENVI part 2/Atmospheric Corrections

Second ENVI session, principles of atmospheric correction

Image processing

Image rectification, enhancements

ENVI part 3/ArcGIS part 1

Third ENVI session/first ArcGIS session

ArcGIS part 2

Second ArcGIS session/making your map

Midterm Exam

Transforms, and fourth ENVI session

Image Processing

SPRING BREAK

Applications

Urban heat island, aerosols, trace gases, wind profiling, agriculture, forestry and wildfires

Student Presentations

Final project presentations

Final Review

Review of course

Final

Textbooks

There is no required textbook although we will be pulling material from several standard books on remote sensing. Some of the material will be summaries of published papers on remote sensing from various journals. There are some recommended references from our library that will be useful and include:

• Zissis, G.J. (1993). Sources of Radiation. The Infrared and electro-optical systems handbook, Volume 1. Published by the Infrared Information Analysis Center
• Smith, F.G. (1993). Atmospheric Propagation of Radiation. The Infrared and electro-optical systems handbook, Volume 2. Published by the Infrared Information Analysis Center
• and selected peer reviewed journal articles

**Grading Criteria:** Letter grades will be assigned according to the following:

90-100% = A; 80-89% = B; 70-79% = C; 60-69% = D; <60% = F

Based on:

30% - Homework assignments and class experiment
20% - midterm exam
10% - Quizzes (drop lowest)
20% - Comprehensive Final Exam
20% - Final presentation

Our first class project will be to work with thermal images from Landsat 7. We have arranged night time passes of the satellite over Las Cruces and will be processing the data as well as collecting ground truth temperature data during the flight.

**A Short paper and Powerpoint presentation** will be required for each student. The presentation will follow the procedures and format for presenting at a conference such as the
American Meteorological Society or Air & Waste Management Association’s Annual Meeting. Each paper will include a brief literature review of a topic approved by the instructors. The review will include a statement of why the topic is important; the scientific understanding of the topic and the scientific uncertainties remaining. If you choose controversial topic, a critical evaluation of both arguments needs to be presented. The objective of this assignment is to give you experience in critical thinking and assessment and presenting the results in a clear and concise manner.

**Students with Disabilities:** If you have, or believe you have, a disability and would benefit from accommodations, you may wish to self-identify. You can do so by providing documentation to the Services for Students with Disabilities (SSD) Office located at Garcia Annex (phone: voice 646-6840, TTY 646-1918). If you are already registered with the SSD office and need accommodations please provide your “Accommodation Memo” from the SSD within the first two weeks of class. If you have a condition that may affect your ability to exit safely from the premises in an emergency or that may cause an emergency during class, you are encouraged to discuss this in confidence with the instructor and/or the Coordinator for SSD. All information will be held in strict confidence.

**Code of Conduct:** Please see the Student Code of Conduct in The Student Handbook: [http://deanofstudents.nmsu.edu/student-handbook/1-student-code-of-conduct/](http://deanofstudents.nmsu.edu/student-handbook/1-student-code-of-conduct/) Pay particular attention to “III.B. Academic Misconduct.” Academic misconduct will not be tolerated and will result in severe penalties including an F in the class.