EAS 6145 **SPRING 2013**

Syllabus

REMOTE SENSING OF THE ATMOSPHERE AND OCEANS

Instructor: Prof. Irina N. Sokolik

Office 3104, phone 404-894-6180

isokolik@eas.gatech.edu

Meeting Time: Mondays&Wednesdays: 4:35-5:55 PM

Meeting Place: L1175

Office Hours: Wednesdays (by appointment)

What this course is about:

This course provides a foundation for understanding the physical principles of remote sensing of the atmosphere and oceans. The course is designed as a collection of lectures and computer modeling laboratories. The lectures focus on the fundamentals of the interactions between electromagnetic radiation and atmospheric gases, aerosols and clouds, and ocean surfaces, covering the spectrum from the ultraviolet through the microwave and considering passive and active remote sensing techniques. The labs provide hands-on experience in using remote sensing data for various applications in atmospheric and oceanic sciences. Topics to be covered include aerosol and cloud property retrievals, ozone and air pollution characterization, vertical temperature and humidity profile retrievals, precipitation, sea ice characterization, and retrievals of ocean color and sea surface temperature. The main goal ***of the course is to provide a broad conceptual framework for physical understanding the capability and various applications of remote sensing in studying the atmosphere and oceans.***

How this course is organized:

- The course is designed as a collection of lectures, computer modeling laboratories and a class research project.
- The lectures focus on the fundamentals of the interactions between electromagnetic radiation and atmospheric gases, aerosols and clouds, and ocean surfaces, covering the spectrum from the ultraviolet through the microwave.
- The labs provide hands-on experience in using remote sensing data for various applications in atmospheric and oceanic sciences. The labs include data from current NASA's satellites and selected international space missions.

➢ **Lectures:**

Lectures are developed to provide the most critical material and to complement the textbook.

Lecture notes will be posted (in PDF format) at the course website:
http://irina.eas.gatech.edu (see under Teaching)

➢ **Computer Modeling Laboratories**

will be posted at the course website and available on-line. All labs will require a written report – due in one week after the lab.

➢ **Class Research Project**

Goal is to perform an analysis and interpretation of remote sensing data in a well-defined problem. The plan of a research project must be prepared by a student but discussed with and approved by the instructor. Try to select a topic of your class project as close as possible to your research. Research projects will be presented in class.

Grading:

Mid-term exams (2)	30%
Computer modeling labs	40%
Research project	30%

Required/additional/advanced reading:

Each lecture will provide information regarding the required, additional and advanced reading.

Required text:

1) Lecture notes and handouts
2) Selected chapters from:

   Stephens G., ***Remote Sensing of the Lower Atmosphere: An Introduction.***
   Oxford Univ. Press, 1994.

   Liou, K.N., ***An introduction to atmospheric radiation.***
   Academic Press, Second Edition, Chapter 7, 2002.

Recommended introductory text:

Petty G.W., ***A First Course in Atmospheric Radiation.***
Sundog Publishing. Second Edition, 2006.
http://www.sundogpublishing.com/

Course topic outline

1. Basics of remote sensing: introductory survey
2. The nature of electromagnetic radiation:
   Polarization. Stokes' parameters.
   Radiation laws. Blackbody emission. Brightness temperature.
3. Emission and reflection from the ocean and land surfaces
4. The composition and structure of the atmosphere. Properties of atmospheric gases, aerosols and clouds.
5. Absorption/emission by atmospheric gases and effects on remote sensing.
6. Scattering/absorption by aerosols and clouds and effects on remote sensing.
7. Principles of passive remote sensing using extinction and scattering. Scattering as a source of radiation. Multiple scattering.
8. Applications of passive remote sensing using extinction and scattering:
   Sensing of ozone in the UV region
   Ocean color
   Sensing of clouds and aerosols

9. Principles of passive remote sensing using emission. Radiative transfer with emission.

10. Applications of passive remote sensing using emission:

    Sensing of sea surface temperature (SST)

    Sensing of precipitation

    Sensing of clouds

11. Principles of sounding by emission:

    Sounding of the temperature profile

    Sounding of trace gases and air pollution

12. Principles of active remote sensing: Radars and lidars

13. Applications of radars:

    Sensing of clouds and precipitation

14. Applications of lidars:

    Sensing of water vapor and trace gases

    Sensing of aerosols and clouds