ATMO 405 Satellite Meteorology

Dr. Yi-Leng Chen HIG 342, Ph 956-2570; Email: yileng@hawaii.edu

Pre-requisites: ATMO 302; Physics 272

Two Weekly Lectures and One 3-h Lab on Fridays.

The outlines are tentative. Expect weekly lab and/or homework assignments. Students are expected to turn in all lab/homework assignments to receive a grade of D or better.

The outlines of the lab portion appears separately

Course Outlines:

1. Radiative transfer
2. Satellite orbits
   a. Geostationary satellites
   b. Polar orbiters
   c. Other satellites
3. GOES Satellite Images and Derived Products
4. GOES Cloud Drift Winds and Sounder
5. GOES-R ABI and derived products
6. Microwave Remote Sensing
7. Temperature and soundings
8. Total Precipitable Water
9. Clouds
10. Precipitation
11. Ocean Surface Winds
12. NASA Environmental Satellites, TRMM, GPM
13. COSMIC and GPS RO data
14. Applications to Synoptic Meteorology, Tropical Cyclones and Forecasting

Grading: Mid-term 25%, Final 35%, Homework, Lab and attendance 40%

References:

Kidder and Vonder Haar: Satellite Meteorology, An Introduction, Academic Press.

Wallace and Hobbs: An Introduction to Atmospheric Sciences.

Most recent and updated materials from internet.

ATMO 405L Satellite Meteorology (Fridays)

The Lab portion of this class meets once per week to go through products from various satellites and their applications. Before the class, students are required to attend weather briefings at the National Weather Service Honolulu Forecast Office on the 2nd floor of HIG. Each lab also includes discussion of current weather based on satellite data. Most of the course materials are from tutorials from internet (including COMET/UCAR modules). Students must complete all assignments to pass the course with a "D" or better."

1. GOES satellites (First five weeks)

a. Introduction to GOES (Week one)
The First of a New Generation of U.S. Geostationary Weather Satellites

b. GOES Imager (Week 1)

Individual Imager Channel Discussions and Examples
- Channel 1, visible (VIS)
- Channel 2, short wave infrared (IR)
- Channel 3, water vapor (WV)
- Channel 4, long wave/window IR
- Channel 5, low level water vapor/split window IR

c. Advanced applications and GOES 3.9 micrometer imaging (Week 2)

Derived Products
Night time Fog, Day time Reflectivity, Fire Detection, Volcanic Ash Detection, and etc.

d. Water vapor channel and satellite images interpretations with various examples (Week 3)

e. GOES sounder tutorial (Week 4)

f. GOES derived wind vectors and other applications (Week 5)

Severe Weather, Tropical Cyclones, Precipitation, Mesoscale Modeling,Winds and Cloud Heights, Satellite Climatologies, Integrated Remote Sensing,

2. Next Generation GOES-R series and products (Week 6)
http://www.goes-r.gov/
The Geostationary Operational Environmental Satellites – R Series (GOES-R) is the new generation of geostationary Earth-observing systems.

3. Data products from NOAA Polar Orbitors and Applications (Week 7 and 8)

http://www.jpss.noaa.gov/index.html (Joint Polar Satellite System Program)

The Joint Polar Satellite System (JPSS) is the Nation's new generation polar-orbiting operational environmental satellite system. JPSS is a collaborative program between the National Oceanic and Atmospheric Administration (NOAA) and its acquisition agent, National Aeronautics and Space Administration (NASA). and etc.

4. DMSP satellites and sensors (Week 9)

http://www.ospo.noaa.gov/Operations/DMSP/index.html

Since the mid 1960's, when the Department of Defense (DOD) initiated the Defense Meteorological Satellite Program (DMSP), low, earth orbiting satellites have provided important environmental information ultimately used in planning and conducting U.S. military operations worldwide. The DMSP satellites "see" such environmental features as clouds, bodies of water, snow, fire, and pollution in the visual and infrared spectra. Scanning radiometers record information which can help determine cloud type and height, land and surface water temperatures, water currents, ocean surface features, ice, and snow.

5. NASA EOS satellites (Week 10)

MODIS (or Moderate Resolution Imaging Spectroradiometer) is a key instrument aboard the Terra and Aqua satellites.

http://modis.gsfc.nasa.gov
http://terra.nasa.gov
http://aqua.gsfc.nasa.gov/

6. NASA TRMM and GPM and products (Week 11)

http://trmm.gsfc.nasa.gov/

The Tropical Rainfall Measuring Mission (TRMM) was a joint mission between NASA and the National Space Development Agency (NASDA) of Japan designed to monitor and study tropical rainfall.

https://www.nasa.gov/mission_pages/GPM/overview/index.html
Global Precipitation Measurement (GPM) is an international satellite mission to provide next-generation observations of rain and snow worldwide every three hours.

7. Ocean surface winds (Week 12)

SSM/I
http://www.fnoc.navy.mil/PUBLIC/SATELLITE/TUTORIAL/ssmi.html
http://www.ssmi.com/ssmiInfo.html

Ocean surface winds.
http://www.ospo.noaa.gov/Products/atmosphere/ascat/

8. COSMIC-1, COSMIC-2 and GPS Radio Occultation (RO) (13 week)

http://www.cosmic.ucar.edu/

The COSMIC constellation of six satellites was launched successfully from Vandenberg Air Force Base in California at 6:40 p.m. PDT (9:40 p.m. EDT) on Friday, April 14, 2006. The data set promises to lead to improved global weather forecasting, especially in data sparse regions including the oceans and near the poles.

6. Other Satellites (Week 14-15)

a. NASA/USGS LANDSAT

http://geo.arc.nasa.gov/sge/landsat/landsat.html

http://landsat7.usgs.gov/index.php

b. European Satellites and data

http://www.eumetsat.de/

b. Japanese Geostationary satellite (Himawari):

http://www.jma.go.jp/jma/jma-eng/satellite/index.html