Experiments in atmospheric sciences

Lecturer – Nili Harnik, harnik@post.tau.ac.il

Teaching assistant- Abigail Bodner
Abigail.bonder@gmail.com

Electronics Technitian- David Shtivelman

Much of the preparation work was done as part of a graduate level course, by the following people:

Vered Silverman, Kerem Mezuman, Yael Hillman, Daria Dubrovin, Kasem Slalha, Shay Halazy, David Shtivelman, Ahhron Dvir, Ron Yellin

Course structure:

8 labs, 4 hours each.

Each lab has a detailed instructions file with preparatory questions. The students must answer these prior to the lab, and submit a report two weeks after completion of the lab.

Final exam

Labs:

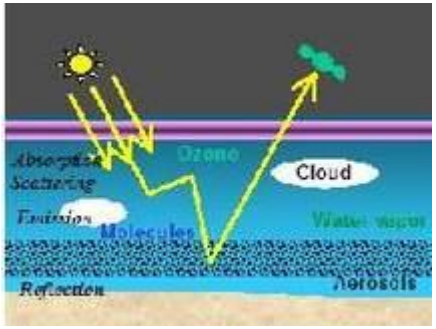
1) Radiative transfer. 2) Remote sensing. 3) Climate.

4) Balanced vortex. 5) General circulation 6) Convection.

7) Rossby waves. 8) Atmospheric electricity-VLF

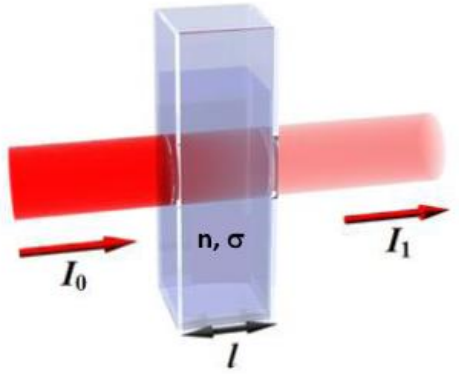
Following is a brief description of the different labs

Radiative transfer Lab:

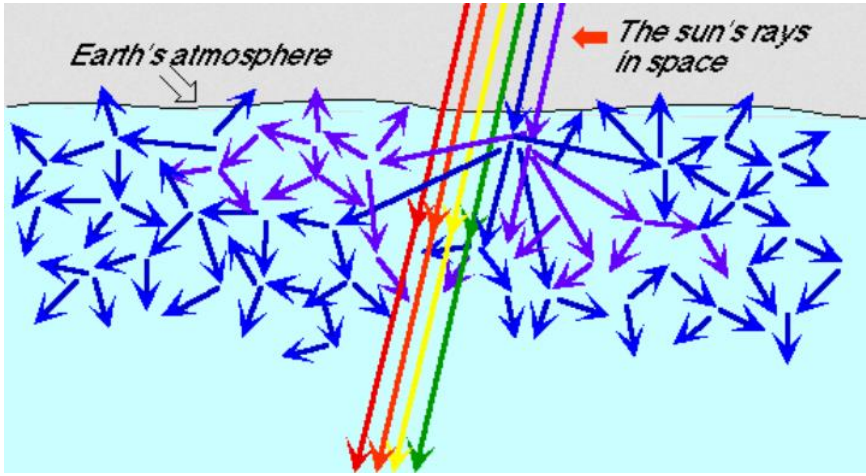


What happens to the solar radiation as it traverses the atmosphere?

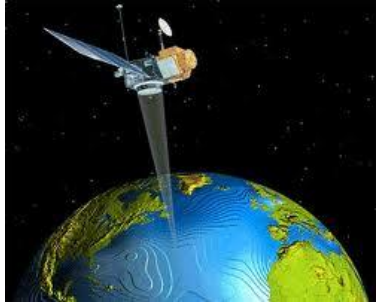
Experiments use a spectraphotometer and a light source, dyed water samples at different concetrations, and very diluted solutions of polystyrene microspheres, to demonstrate:

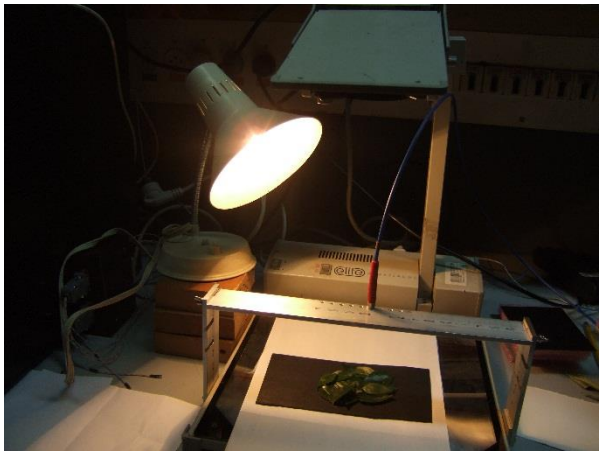


1) Beer-Lambert law
2) Rayleigh and Mie scattering



Remote sensing Lab:
Demonstrate some basic principles of remote sensing.

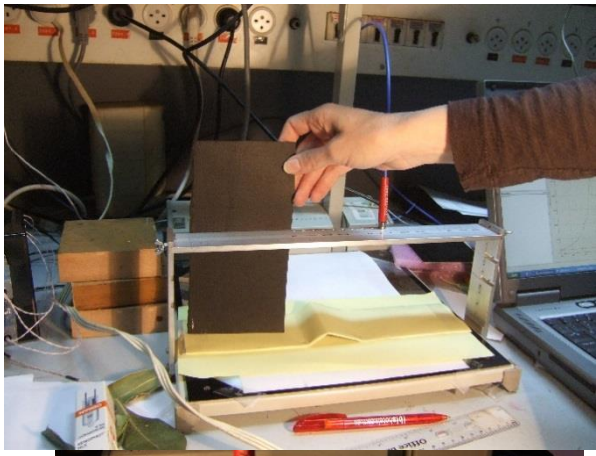


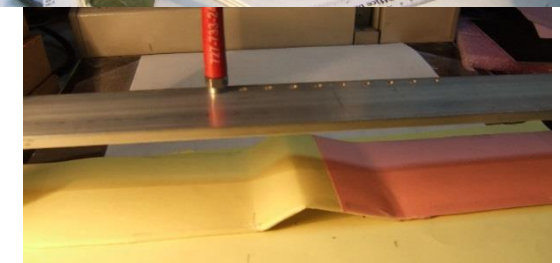


Experiments use a spectraphotometer with optical fiber sensor, a viewgraph lamp as light source, and a remote sensing setup allowing sensing from different distances.

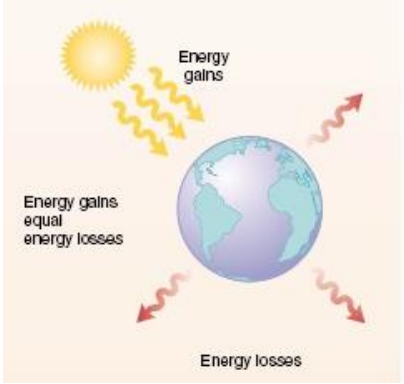
Demonstrate:

- Effects of spot size on resolution.
- Topographic correction using a metal “topography strip”
- Normalized Difference Vegetation index to remotely determine vegetation health



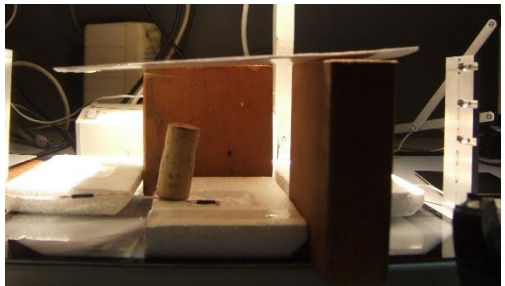


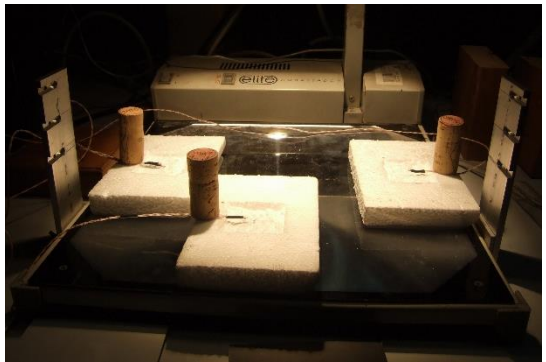
Climate lab:

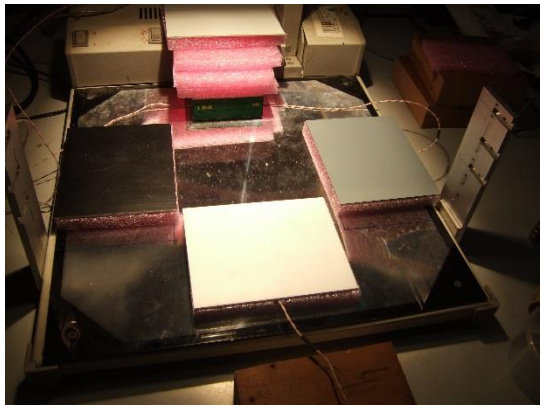


The basic principle of the Earth's energy balance, including energy conservation and black body radiation.

Use a viewgraph lamp as light source, to heat up three metal slates colored black, white and gray. Monitor temperature and try to deduce albedo ratios from equilibrium temperature and simple radiative balance equations.







Geophysical Fluid Dynamics labs:

The four dynamics labs are based on the experiments from Weather in a Tank, for which we purchased the following rotating tank system: http://paoc.mit.edu/labguide/apparatus.html

We perform the following four experiments, which are based on experiments from the Weather in a tank projects page:

Balanced vortex

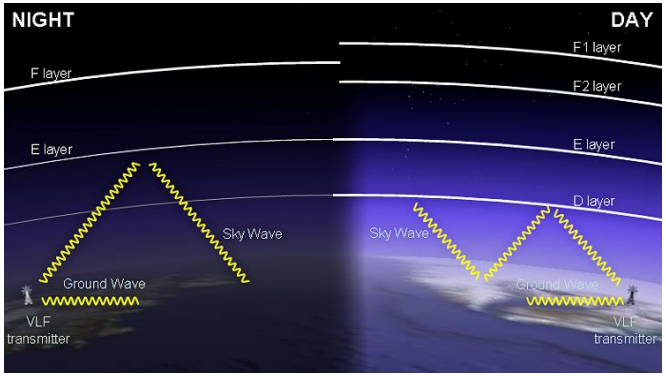
General Circulation

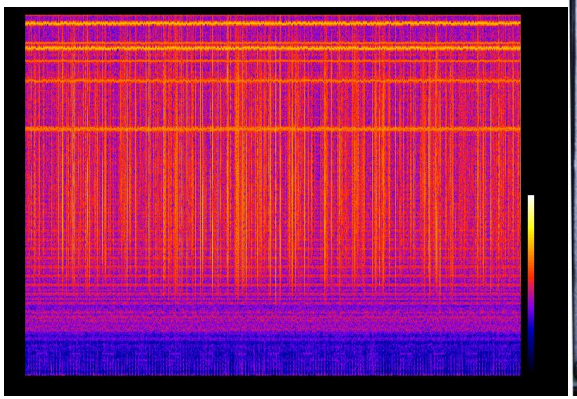
Convection

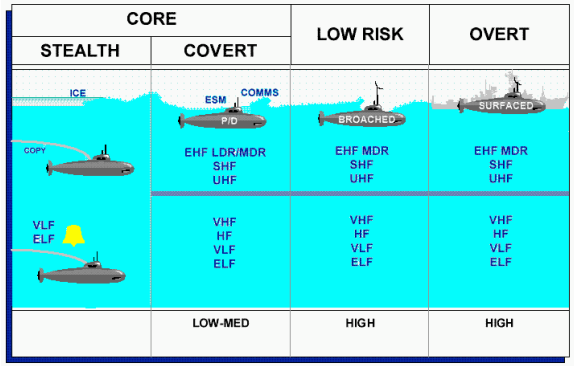
Rossby waves

Atmospheric electricity lab-

We use a Very Low Frequency (VLF) sensor to measure signals which indicate lightening events, reflections from the ionosphere, and the communication between submarines.







Communication Capabilities for Submarine Operations