

AT745 Course Outline

An Introduction to Global Atmospheric Modeling

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Emphasis is on physical parameterizations, especially:

- Big picture of global atmospheric model design
- Turbulence, including boundary-layer turbulence, surface fluxes, etc.
- Boundary layer clouds, including both stratocumulus and shallow cumulus clouds
- Deep convective clouds
- Stratiform clouds above the boundary layer, including microphysics, cloud fraction, etc.
- Gravity-wave momentum transfer
- Current trends

These topics will be covered in a general way, but students will also investigate how these processes are parameterized in specific global models. General topics to be covered include:

- What is parameterization? Simulation versus understanding.
- Reynolds averaging
- Energetics of convection
- Higher-order closure
- PDF-based parameterizations
- Testing parameterizations
- Coupling parameterizations
- Resolution-dependence of parameterizations
- Super-parameterization

In addition, we will discuss some topics that are off to the side a bit. These include:

- Conditional symmetric instability

- The MJO
- Convectively coupled tropical waves

Each student will “adopt” a particular model for the semester. Suggested models include:

- ECMWF
- CAM5
- GFS
- GFDL AM2 or AM3
- UKMO/Hadley Centre
- MPI (Max Planck Institute, Hamburg)
- MIROC 5
- NICAM
- SP-CAM

Students will make in-class presentations on selected aspects of their models, including both formulation and (related) simulation quality.