SIO 217a Atmospheric and Climate Sciences I: Atmospheric Thermodynamics

Fall 2012 Peer-Reviewed Term Projects

Concept: Although peer review has long been a central feature of the working lives of research scientists, it has rarely found its way into the classroom. In our term projects, just as in the case of real research journals, you will be asked to respond to criticisms of reviewers and then revise your work accordingly. The peer review mechanism allows the student authors to address the defects in their reviews, as pointed out not by an authority figure or an examination but by their own peers. As an important side benefit, you will gain experience with the peer review process itself and come to appreciate its strengths and weaknesses in evaluating scientific papers.

This year the term projects will be on cloud parcel modeling. Each group will consider a different sensitivity study and will provide a "review" of the key scientific points. The format of your paper will be 3 pages (excluding references, figures, tables) that include:

1) Introduction: a brief summary of how your topic affects atmospheric convection.
2) Description of the model, its assumptions, and its possible shortcomings.
3) Physical significance of the model parameters you are varying.
4) Conclusions you draw from your modeling study, with as much physical insight as the modeling results allow. (For example, "As the initial water vapor content of the parcel is increased, more latent heat is available and a more vigorous vertical development above the condensation level is observed".)

The starting point for research is the text (Curry and Webster, Ch. 6 and 7) and Chapter 12 from Pruppacher and Klett (posted on the course website). We will also provide you with a simple cloud-parcel code that implements the model from Pruppacher and Klett. The projects differ in the physical processes that each group will study (with the same model), so that even with little familiarity with scientific programming you can calculate the evolution of an air parcel.

To run the model, you will need to install the R programming language (http://www.r-project.org/) on your computer. R is a free software project that is becoming widely used in scientific analysis. Once you have installed R, you should be able to run the cloud model posted on the course website, and it should produce several plots (as PDF files) that you can compare to the plots posted on the website. As soon as your installation passes this sanity check, you are ready to start your modeling study! Consult the annotated printout of the code on the website for hints on where to make the changes needed for your assigned topic.

The term project will involve submitting a complete (short) manuscript for evaluation by peers, followed by preparing a presentation and submitting a revised manuscript. Each project will be completed by a team of 3 to 5 people. Final manuscripts will be posted to the class website, so please make sure that you leave time for careful proof-reading.

For both submissions of the manuscript, each team will email a single PDF file including all text, figures, and references for the written report to the class and the instructors (max. length: 3 pages of single-spaced text) reviewing your modeling results. Your manuscript should be understandable by scientists who are non-specialists, i.e. not just other members of the class. The reports will be handed out for review on the same day they are handed in. Written reviews will be due by email to the instructor. Earlier submission before the deadline is fine. They will be redacted (reviewer's identifying information removed) and returned to authors by email. Each team will give an in-class, oral presentation of approximately 5-8 min/person (maximum). Each member of the team should give part of the presentation. Please prepare and submit your presentation as a Powerpoint or PDF file.

The due dates for these parts are given below:
Topic assignments, groups meet to assign reading/writing and running models: Oct 26
Plots of your results for instructor feedback: Nov 9 (5:00pm)
Completed projects (with text) due for peer review: Nov 16 (12:30pm)
Peer review comments due: Nov 26 (12:30pm)
Oral presentations: Dec 3 (12:30pm)
Final revised version and responses to peer comments due to editor: Dec 5 (12:30pm)

Grades will be based on oral presentations, peer comments, responses to review, and the final revised manuscript. Peer comments are provided and graded individually, manuscript and responses are graded as a team, and presentations are graded both individually and as a team. Participation in team assignments is a privilege, so please take your group assignments seriously. For the final exam, all students are responsible for knowing the material in all the papers presented.

Topics for ROAST 2012:

- Vary initial parcel humidity (0%, 25%, 50%, 75%, 95%)
- Vary lapse rate of the atmosphere (stable, conditionally stable, unstable)
- Change the ambient temperature profile to include a temperature inversion. How does the inversion affect the maximum height reached by the parcel?
- Add entrainment rate dependence (REQUIRES code modification; see section 12.7 and Eqn 12-25) and study the effect of different rates of entrainment.

Suggested points to include in your discussion:

What are the assumptions of the model about the process(es) you are studying? How does this affect your conclusions?

What is the physical significance of the changes you are making to the code? Are the model results consistent with your expectations?

Your discussion can make reference to the figures produced by the model, or you may find that you can make your points more clearly with figures or tables of your own design. The model produces a file with a time series of the most important variables, which you can read into whichever analysis package (or spreadsheet software) you are most comfortable with.

You and your readers will find it helpful if your discussion uses the relevant meteorological concepts you have learned in class, such as atmospheric stability, dry and moist adiabats, convective condensation level, convectively available potential energy, etc.