Meteorology 5344, CFD I, Spring 2000
Term Project Assignment
Dr. M. Xue

Purpose To foster the development of investigative skills, critical thinking, and the communication of scientific results.

Basis The project will entail an investigation of some aspect of computational fluid dynamics using the Advanced Regional Prediction System (ARPS, see info in Homework #2) which is a general purpose nonhydrostatic weather prediction model developed at CAPS (Other models with similar capabilities can be considered with special permission). It should make use of recent scientific literature and emphasize CFD in a meteorological or related context.

Topics You are free to choose any topic you wish, though I must approve it before you begin work. A number of possibilities are listed below - please feel free to explore other topics as you desire, including those in other disciplines (e.g., hydrology, basic fluid mechanics). Your topic can be related to your thesis research but should not be taken directly from it. Original research is encouraged.

- Time integration schemes for compressible models
- Positive definite / monotonic advection for scalars
- Semi-Lagrangian advection for scalars
- Effects of computational mixing / diffusion
- Impact of subgrid-scale turbulence parameterization
- Bahaviors of lateral boundary conditions
- Radiation top boundary conditions
- Impacts of spatial resolution
- Frontal dynamics
- Baroclinic wave dynamics
- Convective and mesoscale storm dynamics
- Squall line dynamics
- Parallel plate convection
- 3D thermal convection
- Land, lake and sea breeze dynamics
- Density currents and solitary waves
- PBL dynamics and turbulence
- Mesoscale cellular convection
- Gravity wave dynamics and critical layers
- Intense vortices
- Terrain-forced flows, mountain waves, severe downslope winds
- Orographic convection
- Convective initiation
- Impacts of land surface characteristics
- One-way and two-way grid nesting, adaptive grid refinement
- Aspects of numerical versus physical stability
- Impacts of microphysical processes on cloud morphology

- Impact of cumulus parameterization on quantitative precipitation

Actual topics chosen by past students vary greatly. The following are a few examples:

A numerical study of surface friction on density currents
Elementary storm electricity in the ARPS
A study of the sensitivity of a dryline simulation to variations in surface characteristics
Simulation of a turbulent thermal with varying resolution and two turbulence models.

You get the idea.

Timeline

Jan. 20 – Feb. 14 Explore topics, review literature, and discuss ideas with me. Begin learning the ARPS by running simple experiments. I will arrange a short tutorial session on using APRS if desired.

By Feb. 16 Topics approved by me

Feb. 23 1-page proposal due. This proposal must provide a clear statement regarding the problem to be addressed, relevant questions to be examined, the methodology to be used, the relevance of the study to CFD, and perhaps anticipated results.

Apr. 5 Submit first draft of report to me. Length is restricted to 12 double-spaced pages which include at most 2 pages of figures and an abstract. The bibliography will be counted separately. Neatness is a must!

Apr. 7 Each student will receive two reports for anonymous peer review. The critiques will focus on content, scientific approach, writing style, clarity of explanation, and degree of completeness. See Review Guidelines.

Apr. 14 Submit peer reviews to me.

Apr. 17 Peer reviews distributed to authors.

Apr. 24 Response to reviewers and final version due. Your response must address, or rebut, the comments contained in the peer reviews. A point-by-point response is required.

Meteorology 5344, Spring 2000
Computational Fluid Dynamics I

Term Project Timetable and Review Guidelines

Final Timetable for Term Project

Wednesday, April 5	First drafts are due by 5:00 pm.
Friday, April 7	Each person receives 2 papers to review.
Friday, April 14	Typed reviews due bv the end of class
Monday, April 17	Reviews distributed to authors
Monday, April 24	Response to the reviews and final revised paper due by 5 pm.

Review Guidelines

Your reviews WILL BE ANONYMOUS and should be limited to one typewritten page. Begin by providing a brief summary of your general impressions (e.g., the paper was very interesting but poorly written, etc), followed by specific comments and suggestions that reference the appropriate page and paragraph number in the original manuscript. Your review should consider the points listed below, along with any others you might deem appropriate.

1. Overall - Is the paper clearly written and does it employ correct grammatical structures? Is the paper well-organized, with each paragraph containing only one principal thought that leads logically to the next?

2. Introduction/Motivation - Has the author motivated the reader by providing relevant background information and a clear indication of the project's goals and relevance?

3. Main body of report - Does the report clearly describe the methodology of the experiments, the principal findings, and any relationships between this study and others? Are the figures appropriate and clearly explained? Are the techniques used appropriate for the problem at hand? Do errors in logic exist? Are the explanations vague or ambiguous? Would you be able, after reading the paper, to explain what you've learned to someone else?

4. Summary/Conclusions - Are the results summarized in a coherent manner and tied together? Do the conclusions follow from the discussion and are they justified?

5. Rating of the Paper - Rate the paper as: excellent very good good fair poor.

Your grade for this project is based upon:

a. The first draft of your paper (which should be polished) (30%) b. Your reviews of two other papers (20%) c. Your response to the two reviews of your paper (20%) d. The final revised version of your paper (30%).