

Cloud Physics

Fall 2009

Lecturer

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Lecture Contents

Rayleigh-Bénard Convection
Cloud Microphysics
Cloud Dynamics
Representing Cloud Processes in Numerical Models
Aerosol-Cloud Interaction
Thunderstorms

References

1. Cloud Dynamics, R. A. Houze, Jr., 1993, Academic Press, 573 pp.
2. A Short Course in Cloud Physics, 3rd Edition, R. R. Rogers and M. K. Yau, 1989, Pergamon Press, 293 pp.
3. Microphysics of Clouds and Precipitation, H. R. Pruppacher and J. D. Klett, 1997, Kluwer Academic Publishers, 954 pp.
4. Atmospheric Convection, K. A. Emanuel, 1994, Oxford University Press, 580 pp.
5. The Representation of Cumulus Convection in Numerical Models, Meteorological Monographs, Vol. 24, No. 46, K. A. Emanuel and D. J. Raymond, Ed., 1993, American Meteorological Society, 246 pp.
6. Fluid Mechanics, 4th Edition, P. K. Kundu and I. M. Cohen, 2008, Academic Press, 872 pp.
7. Bénard Cells and Taylor Vortices, E. L. Koschmieder, 1993, Cambridge University Press, 337 pp.
8. Hydrodynamic Stability, P. G. Drazin and W. H. Reid, 1981, Cambridge University Press, 527 pp.
9. Human Impacts on Weather and Climate, W. R. Cotton and R. A. Pielke, 1995, Cambridge University Press, 288 pp.
10. Atmospheric Chemistry and Physics, J. H. Seinfeld and S. N. Pandis, 2006, Wiley-Interscience, 1203 pp.

Grading

mid-term exam: 30%

final exam: 30%

homework: 40%

Homework: Solving Problems

Problems will be given in the class.

Homework: Reading and Summarizing Articles

1. Historical Review (p. 1-9) in *Microphysics of Clouds and Precipitation*, H. R. Pruppacher and J. D. Klett, 1997, Kluwer Academic Publishers, 954 pp. (9/7)
2. Cloud Microphysics and Dynamics (p. 179-259) in *Historical Essays on Meteorology 1919-1995*, American Meteorological Society, 617 pp. (9/14)
3. Lorenz, E. N., 1963: Deterministic nonperiodic flow. *J. Atmos. Sci.*, **20**, 130-141. (9/21)
4. Riemer, N., and A. S. Wexler, 2005: Droplets to drops by turbulent coagulation. *J. Atmos. Sci.*, **62**, 1962-1975. (10/12)
5. Hallet, J., and S. C. Mossop, 1974: Production of secondary ice particles during the riming process. *Nature*, **249**, 26-28. (10/19)
6. Lin, Y.-L., R. D. Farley, and H. D. Orville, 1983: Bulk parameterization of the snow field in a cloud model. *J. Clim. Appl. Meteor.*, **22**, 1065-1092. (10/26)
7. Morrison, H., and W. W. Grabowski, 2007: Comparison of bulk and bin warm-rain microphysics models using a kinematic framework. *J. Atmos. Sci.*, **64**, 2839-2861. (11/2)
8. Andrejczuk, M., W. W. Grabowski, S. P. Malinowski, and P. K. Smolarkiewicz, 2006: Numerical simulation of cloud-clear air interfacial mixing: Effects on cloud microphysics. *J. Atmos. Sci.*, **63**, 3204-3225. (11/9)
9. Rotunno, R., and J. Klemp, 1985: On the rotation and propagation of simulated supercell thunderstorms. *J. Atmos. Sci.*, **42**, 271-292. (11/16)

* 1, 6: 2-page summary, 2: 3-page summary, 3, 4, 5, 7, 8, 9: 1-page summary