

## Cloud Physics

Fall 2022

### Lecturer

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### Lecture Contents

1. Cloud Microphysics  
nucleation, vapor diffusion, collection (coalescence, aggregation, riming), breakup, fallout, ice enhancement, melting
2. Cloud Dynamics  
buoyancy, entrainment, in-cloud rotation
3. Rayleigh-Bénard Convection  
laboratory experiments, linear stability analysis, Lorenz equations
4. Representation of Cloud Processes in Numerical Models  
explicit representation (bin and bulk), implicit representation (cumulus parameterization)
5. Recent Issues in Cloud Physics

### References

1. Cloud Dynamics, 2nd edition, R. A. Houze, Jr., 2014, Academic Press, 432 pp.
2. An Introduction to Clouds, U. Lohmann, F. Luond, and F. Mahrt, 2016, Cambridge University Press, 391 pp.
3. Physics and Chemistry of Clouds, D. Lamb and J. Verlinde, 2011, Cambridge University Press, 584 pp.
4. A Short Course in Cloud Physics, 3rd edition, R. R. Rogers and M. K. Yau, 1989, Pergamon Press, 293 pp.
5. Microphysics of Clouds and Precipitation, H. R. Pruppacher and J. D. Klett, 1997, Kluwer Academic Publishers, 954 pp.
6. Cloud and Precipitation Microphysics, J. M. Straka, 2009, Cambridge University Press, 392 pp.
7. Atmospheric Convection, K. A. Emanuel, 1994, Oxford University Press, 580 pp.
8. Fluid Mechanics, 6th edition, P. K. Kundu, I. M. Cohen, and D. R. Dowling, 2016, Academic Press, 921 pp.
9. Bénard Cells and Taylor Vortices, E. L. Koschmieder, 1993, Cambridge University Press, 337 pp.
10. Atmospheric Chemistry and Physics, 3rd edition, J. H. Seinfeld and S. N. Pandis, 2016, Wiley, 1120 pp.

### Grading

mid-term exam: 30%

final exam: 30%

homework: 30%

term-paper presentation: 10%

\* homework: solving problems, reading and summarizing articles

Problems and articles will be given in the class.