

Colorado State University

WR 574 – Advanced Snow Hydrology

Offered: Fall

Class: TR 9:30-10:45 MSNR250

Credits: 4 (3 lecture, 1 recitation) **Recitation:** T 12:30-13:30 NR201

Instructor: Steven Fassnacht (<steven.fassnacht@colostate.edu>; 970-491-5454; NESB B260)

Summary: This course focuses on snow processes and their relation to the hydrologic cycle. Specifically, these are cloud processes and precipitation formation, snowfall, accumulation, snow cover, canopy interception, redistribution, sublimation, snowpack metamorphosis, short-wave and long-wave radiation, and snowmelt. The course will present processes in a concept manner, discuss necessary assumptions relevant both physical and conceptual methods of modeling and techniques for measuring the different states and change rates.

Course Objectives:

- 1) perform measurement of snowpack properties
- 2) estimate the error associated with snowpack measurements
- 3) estimate the winter water balance
- 4) generate necessary assumptions and model snowpack hydrological processes
- 5) manipulate a large time series of data (~10,000 time steps)
- 6) critically assess modeling results
- 7) assess arguments in the literature, and assess how results are presented in the literature.

Grading:

Assignments 10 @ 5% 50%

Mid-Semester project 10%

End-of-Semester project 10%

Field Exercise 5%

Paper Review [25%]

- presentation: 5% [during recitation time]

- paper summaries: 2 x 5% [1 to 2-page summary of key points in each paper]

- critique: 2 x 5% [what could have been improved, done differently]

The mid-semester project and end-of-semester project will be defined at the beginning of the semester. In the past, these have been i) a definition of a research project and identification of relevant literature, and ii) a literature review.

Recommended Text:

Fassnacht, S.R., 2020. *Snow Hydrology Course Notes*. ESS-Watershed Science Program, Warner College of Natural Resources, Colorado State University, Fort Collins, Colorado USA. (available at the bookstore)

Optional Texts:

American Avalanche Association, 2016. *Snow, Weather, and Avalanches: Observational Guidelines for Avalanche Programs in the United States* (3rd ed.). American Avalanche Association, Pagosa Springs, Colorado, 136pp.

DeWalle, D.R., and A. Rango, 2008. *Principles of Snow Hydrology*. Cambridge University Press, 410pp.

Dingman, S.L., 2015. *Physical Hydrology* (3rd ed.). Waveland Press, Long Grove, Illinois, 643pp.

Doesken, N.J., and A. Judson, 1997. *The Snow Booklet: A guide to the science, climatology, and measurements of snow in the US*. Colorado Climate Center, 86pp. (available online)

McClung, D. and P. Schaerer, 2006. *The Avalanche Handbook (revised 3rd edition)*. The Mountaineers, Seattle WA.

Assignments:

The assignments will be the same as the WR474 assignments, with some additional questions. WR574 students will be added to the WR474 Canvas site where the assignments and WR474 syllabus can be found. Assignments will be submitted through Canvas.

Recitation:

The recitation time will be used to explore the literature. This will include discussions of classic and new papers on various topics of snow hydrology, of interest to the students and loosely following the lecture topics. Students will examine how papers are written and how the science is presented, including an examination of writing (e.g., Introduction versus Discussion sections) and an evaluation of tables and figures presented in papers.

- Week 1 will be an overview of the format of the hour, and a discussion on how to read papers. The instructor will lead the discussion in weeks 2 and 15.
- Weeks 3-10 will be one student leading the discussion on a new snow hydrology paper that was published in the past five years. The discussion can include: 15-minute overview of key points, 15-minute Q&A, 20-minute presentation evaluation. Each student will select several papers and send the titles and link to the instructor by earlier in week 2. Papers should not be by CSU co-authors.
- Weeks 11-14 will be a brief discussion of two papers on the same topic, the first published at least 15 years ago and the second published in the last five years. The papers should be by different authors.
- Week 15 will be an evaluate of a paper co-authored by the instructor based on a student research effort. In particular, there will be three documents: the original document (e.g., thesis), final document (accepted or published), and the reviews.