

# Colorado State University

## WR 474 - Snow Hydrology Fall 2020

**Instructor:** Steven Fassnacht

**Email:** <[steven.fassnacht@colostate.edu](mailto:steven.fassnacht@colostate.edu)>

**Office:** virtual

**Office hours:** tbd

**Class meeting time and location:** Tuesday and Thursday 9:30-10:45, MSNR 250

**Teaching Assistant:** Ella Bump

**Email:** <[ella.bumpl@colostate.edu](mailto:ella.bumpl@colostate.edu)>

**TA Office:** virtual

**Office Hours:** tbd

**Course Overview:** The focus of this course is to examine snow processes and to relate the processes to the hydrologic cycle. Physical and conceptual methods of modelling the processes will be addressed. Techniques for measuring the different states and change rates will be discussed. At the end of the semester you should be able to: 1) Understand the physics of cold hydrological processes; 2) Know methods for measuring different states and change rates of these processes; 3) Perform basic analyses of hydrometeorological data from cold regions.

**Course Objectives:** 1) Understand physical processes, 2) Apply process knowledge for computations, 3) Analyze large datasets, 4) Plot results using various methods, 5) Evaluate the graphical results, 6) Synthesize the results, and 7) Create scientific writing.

### Required 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 80523-1476. (available in the bookstore)

### Optional Text:

American Avalanche Association, 2016. *Snow, Weather, and Avalanches: Observational Guidelines for Avalanche Programs in the United States (3<sup>rd</sup> ed.)*. The American Avalanche Association, Victor ID, 104pp  
<<https://www.americanavalancheassociation.org/swag>>.

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

Dingman, S.L., 1994/2002/2008. *Physical Hydrology* (1-3<sup>rd</sup> ed.). Prentice Hall/Waveland Press, 646pp.

Doesken, N.J., and A. Judson, 1997. *The Snow Booklet: A guide to the science, climatology, and measurements of snow in the US (2<sup>nd</sup> edition)*. Colorado Climate Center, Atmospheric Science, Colorado State University, 86pp. (Online at <<http://ccc.atmos.colostate.edu/pdfs/snowbook.pdf>>)

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

### Academic Integrity:

This course will adhere to the Academic Integrity Policy of the Colorado State University General Catalog and the Student Conduct Code. For more information, see the TILT website: <<https://tilt.colostate.edu/integrity/>>. Students are expected to review the code at the beginning of the semester.

### Grading:

1) Online check-in – 2% due by August 28

2) Dataset Selection – 2% (graded out of 20) due September 4

3) Assignments – 50% (10 @ 5% each) (graded out of 50) due in Canvas Fridays at 12 pm

3) Mid-term examination #1 – 20% on October 1 on Canvas

4) Mid-term examination #2 – 20% on December 3 on Canvas

5) Field Exercise – 6% due on Dec 11 at 12 pm; the field trip is Dec 5 starting at 8 am; data submission (3%) and write-up (3%) each graded out of 30

**Data Links:**

*NWS ASOS via NCDC/NCEP*

<<https://www7.ncdc.noaa.gov/CDO/cdopoemain.cmd?datasetabbv=DS3505&countryabbv=&georegionabbv=&resolution=40>> OR <<https://www7.ncdc.noaa.gov/CDO/cdopoemain.cmd>>, last accessed January 6, 2020.

*Via Iowa State University Environmental Mesonet*

<<http://www.mesonet.agron.iastate.edu/request/download.phtml>>, last accessed January 6, 2020.

*NRCS SNOTEL:* <<https://www.wcc.nrcs.usda.gov/>>, last accessed January 6, 2020.

*USGS Hydrometric:* <<https://nwis.waterdata.usgs.gov/nwis/sw>>, last accessed January 6, 2020.

**Assignments Overview:**

Assignments comprise half of the total grade for the course. They are designed to familiarize students with the analysis, in particular using hydrometeorological data from cold regions.

Assignments are due at the start of class on the due date specified. Late assignments will not be accepted without prior arrangements (see section on making up examinations).

The first submission, prior to the actual assignment, is the selection of the study site to be used throughout the course. Students submit the site metadata for review to ensure that the station sets are acceptable. They are responsible for subsequently editing their selected and approved dataset to remove redundant data, and contend with missing data.

The first assignment is a monthly summary of the climatology and hydrology, and a summary of the land cover / land use in the vicinity of the study site. Spatial data are expected to be included, but some leeway is granted for students with no formal GIS training. Subsequent assignments examine different aspects of snow hydrology at the site in three parts:

*Part 1 – Methods (10 points):* A write-up of the computation methods/rationale used to complete Part 2. This is a brief summary of the logic and not just the spreadsheet or programming code.

*Part 2 – Results (25 points):* Substantial data analysis requiring manipulation and monthly summarization of hourly meteorological data for an entire year. Analysis can be performed using spreadsheets (i.e., EXCEL) and/or programming (i.e., R, MATLAB, etc.).

*Part 3 – Discussion (15 points):* A brief write-up of the accuracy, implications, limitations, etc. associated with the Part 2 computations.

*Writing:* Each of the above sections requires a write-up for each assignment. To facilitate the student's writing, Part 1 will be critiqued for assignments 1-4, Part 2 for 4-6, and Part 3 for 7-9.

*Notes on figures* to be included in the assignments (Part 2):

- All axes must always be labeled, including units.

- Figures should have numbers and descriptive captions below the figure (as if in a paper or report), and they should not also include a figure title because this is redundant with the caption. The figure should be cited in the text, such as, "(Figure 1)." This is in Parts 2 and 3.

- Tables should have numbers and descriptive titles above the table. The Table should be cited in the text.

- Significant figure rules always apply to final answers on calculations.
- In figures, axes should show a minimum number of digits (minimize trailing 0's).

**Exams:**

There will be two midterm exams on Canvas that will be open for 24 hours. Questions are mostly to examine the conceptual understanding of a student. Test format will include essay questions, short answer questions, and brief computation questions. The midterm exams will contain recently covered and cumulative material. The second mid-term exam is not cumulative, except for concepts that are still relevant in the second half of the semester (e.g., SWE).

**Field Exercise:**

A required field exercise will be conducted at/near Cameron Pass at the end of the semester. The trip is scheduled for a Saturday to avoid disruption of class schedules. Please notify the instructor ASAP if you cannot attend due to legitimate schedule conflicts or if you are physically unable to make the trip. Winter field gear is required, and as there is no course fee, travel to the site will occur in personal vehicles. The instructor reserves the right to hold the field trip on or near campus, depending on weather.

**Lectures:**

Lectures will be asynchronous videos.

**Canvas:**

Class information will be posted in Canvas <<https://canvas.colostate.edu>>. All assignments are due in Canvas at 12pm on Fridays, except the Dataset Selection Assignment.

**Library & Research Help:**

The CSU Libraries Help Desk provides basic research and technical assistance either in person at Morgan Library or by phone at 970-491-1841. The Libraries' Ask Us chat service <<https://lib.colostate.edu/help/ask-us>> offers after-hours help. For in-depth assistance, contact Jocelyn Boice, the librarian supporting the Ecosystem Science & Sustainability Department and this course: <[jocelyn.boice@colostate.edu](mailto:jocelyn.boice@colostate.edu)> or 970-491-3882.