# SWS 6932 Landscape Hydrology

**3 credits | Fall semester | Every year**
**T 3, R 2-3**

**Course Objectives**: Landscape hydrology considers larger spatial scales (> 100 $km^2$) and integrates surface and subsurface processes. We apply quantitative hydrologic principles and modern techniques within parsimonious model frameworks to study problems of societal relevance. Students will develop a suite of research tools to analyze coupled hydrologic and environmental changes. The course will center around two main themes:

1. Characterizing "landscapes", including not just traditional "watersheds" but also springsheds, wetlandscapes, lakesheds, airsheds, cities, and entire regions of anthropogenically modified land use and land cover (such as intensive agriculture), and
2. Understanding natural stochasticity by incorporating a probabilistic approach to consider mean behavior and variability in both time and space. Observed statistical properties of hydrologic data will be related to their physical generation processes.

**Prerequisites**: Basic understanding of hydrologic principles, from either subsurface or surface hydrology coursework; familiarity with statistical concepts from at least one graduate-level statistics course.

**Instructor**
James W. Jawitz, Professor
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**Teaching Assistant**
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**Student Evaluation and Grading Procedures**: There will be no formal examinations. There will be 5 quantitative assignments to illustrate the analysis methods learned in class, 5 short writing assignments based on assigned readings, and a final project (5+5+1 = 11 total assignments). Quantitative and reading/writing assignments alternate weekly for the first 10 weeks of the semester, with the final 5 weeks devoted to the final project. All homeworks/writings will be due 1 week from the date assigned.

| Course components | Points |
|---|---|
| Class participation | 10 |
| Assignments 1, 2, and 3 (9 each) | 27 |
| Assignments 4 and 5 (12 each) | 24 |
| Individual project, including in-class presentation | 19 |
| Written comments on reading assignments | 20 |
| Total points | **100** |

A>90>A->87>B+>84>B>81>B->78>C+>75>C>72>C->69>D+ >66>D> 63>D->60>E

Assignments 1-3 can be re-submitted following corrections. Not all assignments have equal weight. Late submissions will be penalized 10% per day. Class 'participation' entails regular, on-time attendance, and active engagement during lectures and discussions of the assigned readings.

Students are strongly encouraged to use scripts/codes for computational problem solving. This is good scientific practice for both documentation and reproducibility. I will be using R in RStudio, but Matlab and Python are also good choices.

## Course Schedule

| Week | Topic | Assignment Due Dates |
|---|---|---|
| **1** | **1. Regional water and solute budgets** | |
| | Landscapes + hydrology | |
| | Probabilistic representation of hydrologic data | |
| | Relative significance of water budget components | |
| **2** | Spatial variability in hydrologic variables | |
| | Temporal trends in water budget components | Writing 1: 2 September(WED) |
| **3** | Water transfers and vulnerability | |
| | Solute budgets at the landscape scale | HW 1: 10 September |
| **4** | **2. Partitioning rainfall into E and Q** | |
| | Partitioning incoming water and energy | |
| | Predicting water availability under variable climate | Writing 2: 16 September(WED) |
| **5** | Effects of land cover change | |
| | **3. Hydroclimatic forcing** | |
| | Poisson rainfall | HW 2: 24 September |
| **6** | Human influence or climatic variability? | Writing 3: 1 October(THUR) |
| **7** | Indices of extreme events | |
| | Long-wave nonstationarity | HW 3: 8 October |
| **8** | **4. Hydrologic response** | |
| | Runoff pdfs, flow duration curves and beyond | Writing 4: 14 October(Wed) |
| **9** | Linear reservoir and convolution | |
| | Goodness of fit | HW 4: 22 October |
| **10** | Lorenz inequality and Gini coefficient | |
| | Regression models | Writing 5: 29 October(THUR) |
| **11** | **5. Biogeochemical response** | |
| | Lagrangian travel time pdfs | |
| | Landscape-scale controls | HW 5: 5 November |
| **12** | **6. Landscape filtering** | |
| | Spectral power | |
| | Atmospheric deposition | |
| **13** | **7. Landscape size distributions** | |
| | Cities, lakes, wetlands: Power law universality? | |
| **14** | **8. Human population distribution** | |
| | Diffusion of information and people | |
| | Water body networks and migration | |
| **15** | **Final project presentations** | |