Hydrologic Model Validation of SWE and Streamflow: Noah LSM

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Introduction and Objectives

- Evaluate how well the Noah model can simulate observed snowpacks in the western U.S.
- **Our Data:**
  - ~650 *in situ* SNOTEL Stations
  - ~270 HUC8s: Small watersheds that make up 9 larger basins (HUC2s)
- **The Model:**
  - Offline Noah LSM, 0.5 degree resolution
  - Daily data for runoff, drainage, Snow Water Equivalent (SWE)
- **How do we test performance?**
  - Determine model skill for first-order snow physics
Consider the model grid size! Model values were approximated using half-degree bounding box, generally much larger than our HUC8s.
How does streamflow respond to snowpack?

Notice the magnitude differences!
Performance Indicators:

Probability of Detection (POD)

Heidke Skill Score (HSS)

Obs SWE vs Model SWE
Obs SWE vs Obs Q
Model SWE vs Model Q

Does the model simulate the same lower 20% water years as the observations?
Takeaways

- Model-produced snowpacks are generally smaller and thus underpredict observed values
- The model does fairly well in replicating “drought” years
  - Atmospheric forcing produces low-SWE years in concert with observations
  - These ‘drought’ SWE years tend to produce ‘drought’ streamflows
  - Other meteorological factors play a role, but were not investigated
- Generally, skill is reduced by model limitations
  - Half-degree resolution (fairly coarse)
  - Does not capture finer topographical features
  - Multiple HUC8s can be within the same grid cell
- Captures first-order relationship between SWE and Q
  - Although there is under/overprediction, the model’s skill is good, meaning the underlying physics are correct
  - At higher resolutions, we think the model would perform better