Development of Real Time Snow Drought Tracking Tools for the Western United States

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Defining Snow Drought and Why It Matters

Swings from snow drought to extreme winter rainfall make managing reservoirs, like the Oroville Dam, incredibly difficult. But what exactly is "snow drought"?

1. **Dry**, driven by precipitation deficits
   - Precipitation and snow water equivalent (SWE) below average

2. **Warm**, driven by above average temperatures
   - Precipitation above average and SWE below average
     - Both types result in below average SWE
     - Snow drought year commonly defined by April 1 SWE value
     - Lots of ambiguity in these definitions

Northern Sierra Nevada April 1 Snow Droughts

- Each dot represents an April 1 SWE measurement from 16 different manual snow courses around the Northern Sierra Nevada, 1950-2018.
- Dry snow drought = meteorological drought.
- Some years are a blend of dry + warm snow drought.

Temporal Variability of Snow Droughts

- Can miss the story of how the winter unfolded by just looking at April 1 SWE
- Track daily values throughout the year
- SWE and precipitation phase diagram
Filling a gap in snow drought tracking

- Current tools are lacking a quick look into where a given location sits in terms of classifying snow drought

[Links]
- https://www.wcc.nrcs.usda.gov/snow/
- https://app.climateengine.org/climateEngine
Snow Drought Tracker Web Application

- NRCS SNOTEL Network

Red Mountain Pass, CO

Water year 2020 phase diagram
A Tale of Two Northern Sierra Snow Drought in 2018

Mt Rose Ski Area, NV, 8801 ft. elevation

Tahoe City, CA, 6797 ft. elevation
The Great Western Snow Drought of 2015

Central Sierra Snow Lab, CA

Stampede Pass, WA

Snow Water Equivalent vs. Precipitation for CSS LAB
Daily % of Normals from 11/1/2014 to 3/31/2015

Snow Water Equivalent vs. Precipitation for STAMPEDE PASS
Daily % of Normals from 11/1/2014 to 3/31/2015

Precipitation Accumulated % of 30-Year Normal

SWE Median % of 30-Year Normal

November  December  January  February  March
Changing this feature to a single date selector
Example: time series of all December 31 SWE values in record
• Still to come in v1.0: Large river basin (i.e., HUC 6) and mountain range tracking tools

• How does SWE vary by elevation within a watershed?

• Warm snow droughts often exhibit a strong decreasing SWE anomaly signal as elevation decreases within a basin
Project development and updates

• Release of beta v1.0 Snow Drought Tracker to public by January, 2020
• Still working to incorporate basin scale analysis into v1.0 and fine tune the phase diagram and time series tools

• National Weather Service funding beginning in 2020:
  • Testing of web application by NWS and other stakeholders
  • Incorporate feedback and new features into v2.0
  • Incorporate other data sources outside of NRCS SNOTEL including the California Cooperative Snow Survey real-time daily snow pillow data

• What additional features would you like to see added?

• Link the Snow Drought Tracker to the NIDIS snow drought page:

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Thank you!
Questions?
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Mt. Rose backcountry
January 26, 2019
Photo: Dan McEvoy