

## Historical High-Impact Weather and Climate Events - Colorado, Utah, and Wyoming

Description of the online database at <http://wwa.colorado.edu/climate/extremes/database/>

Jeff Lukas ([Lukas@colorado.edu](mailto:Lukas@colorado.edu)), Adam McCurdy, William Travis, Klaus Wolter  
Western Water Assessment, CIRES, University of Colorado Boulder

July 2016

### Overview

In this database, we have tried to capture significant historical weather and climate events as defined by their actual impact on society (damages and/or fatalities) or their *potential* impact (especially for tornadoes) if the event were to recur today, and/or occur in a more densely settled area. For each event, we provide a brief summary of the event, and links to sources with further description of the event, including technical summaries from the NWS and USGS and media coverage.

### Event Selection

The sources described below were reviewed for weather- and climate-related events which stood out as the most significant in each state's history. The types that were considered were: floods, winter storms, tornadoes, hail, droughts, high winds, cold waves, landslides, and wildfires. While we did not use explicit thresholds for inclusion, such as damage, fatalities, or other metrics of severity (except for droughts, see below), events which caused \$ millions in damage and/or multiple fatalities, and/or were Presidentially declared disasters, were more likely to be included. Ultimately, the criteria were subjective. We tried to be inclusive of all of the types of events, with at least one event of each type listed for each state. However, there are more floods listed for each state than any other event type, which we believe is reflective of the widespread nature of high flood hazard in our region. Since societal exposure (e.g., population and infrastructure) to hazards has increased over time, and reporting of events and impacts has improved, the more recent events are more likely to be represented in the database, even if there is no trend in the underlying meteorological phenomenon (as with tornadoes).

### Drought Selection

For the purposes of this database a high-impact drought was defined as starting when the statewide summer Palmer Drought Severity Index PDSI (June-Aug) drops to -3.0 or lower. The drought does not end until a summer PDSI of greater than zero is recorded.

### Inflation Calculation

To adjust the original damage estimates to mid-2016 dollars, the BLS CPI Inflation Calculator was used for events after 1913: <http://data.bls.gov/cgi-bin/cpicalc.pl>. For events prior to 1913, inflation factors from R. Sahr (<http://oregonstate.edu/cla/polisci/sahr/sahr>) were used.

### Primary Sources of Information

*State hazard mitigation plans:* We consulted State multi-hazard mitigation plans for all three states. The plans varied widely in the types and number of events described, and the level of detail about specific events, but all documents contained some roster of previous events.

- Utah - <https://sites.google.com/a/utah.gov/utah/>
- Colorado- <http://www.dhsem.state.co.us/sites/default/files/2013%20Colorado%20Natural%20Hazard%20Mitigation%20Plan%20-%20Final.pdf>
- Wyoming- [http://wyohomelandsecurity.state.wy.us/mitigationplanning/Final\\_Wyoming-State-Mitigation-plan\\_012516.pdf](http://wyohomelandsecurity.state.wy.us/mitigationplanning/Final_Wyoming-State-Mitigation-plan_012516.pdf) [main plan];  
<http://wyohomelandsecurity.state.wy.us/library/2014mitigationplan/MITIGATIONDRAFTAppendix.pdf> [appendices with more historical event information]

*Wyoming Climate Atlas:* The atlas is created by the Wyoming State Climate Office and aims to bring together the wide range of climatic and weather data from a variety of sources across the state.

<http://www.wrds.uwyo.edu/sco/climateatlas/>

*WRDS Flood History Database:* The Water Resources Data System (WRDS) at the University of Wyoming compiled a detailed flood history for the state of Wyoming from 1895-2002. Information for individual events varied significantly and included some combination hydrologic data, return intervals, damages, fatalities, and event description. All events are sorted by county and further geographic information is frequently provided in the form of a town, river, or area. When accessed, the site contained 309 entries with many duplicates (if an event occurred in multiple counties it was listed multiple times). We copied information into a .csv file and removed duplicate entries. This document served as the basis for flood events in Wyoming and was supplemented with events and information from additional documents.

<http://wyofloods.wrds.uwyo.edu/FloodHistories.html>

*NOAA NCDC Storm Event Database:* The Storm Event database

(<https://www.ncdc.noaa.gov/stormevents/>) contains records of events which “cause loss of life loss of life, injuries, significant property damage, and/or disruption to commerce” or are considered meteorologically significant or rare. The database contains events from 1950-present. From 1950-1954 the database only contains tornados, from 1955-1995 the database includes tornadoes, thunderstorm winds, and hail events. From 1996 to present the database contains 48 event types described in detail here: <https://www.ncdc.noaa.gov/stormevents/pd01016005curr.pdf>. Additionally, the database includes event narrative from NWS observers. This database was used to find events which were estimated to cause large financial damage and to provide additional information on events identified using other resources.

*FEMA Presidential Disasters:* Database of presidentially declared disasters eligible for FEMA relief funds (<https://www.fema.gov/disasters/>). This database contains minimal information for each event and was primarily used to identify events which might be included, based on the declaration and other criteria.

*InciWeb Reports:* Incident Information System for wildfire reporting. Started in 1995, InciWeb (<http://inciweb.nwcg.gov>) provides detailed information for all active fires. This includes ignition, climate conditions, containment progress, and fire behavior. Unfortunately, InciWeb does not provide consistent historical accounts and the information for inactive fires is frequently removed. When available, InciWeb reports are used to provide detail for Presidential Disaster fires.

*Utah Weather*: Book by meteorologist Mark Eubank published in 1979, *Utah Weather* provides information and details about the weather in Utah including an almanac of historic events for each day of the year. We used *Utah Weather* to identify large events and to provide some specific information regarding the outcome of events.

*National Water Summary 1988-89—Hydrologic Events and Floods and Droughts*: Published in 1991 by the USGS, the document provides a summary of historic events for all US States and several of the territories. The report provides limited information on events, including date, area, recurrence, and very brief remarks. The recurrence interval is of limited utility due to the wide ranges used. This document served as the initial source to populate the Utah list and for postmortem accounts of other floods.

*NOAA Top Weather Events*: At the end of the 20<sup>th</sup> century several NOAA regional offices created list of Top 10 weather events in the 20<sup>th</sup> century for many states. Of our three-state region, only Utah has such a list. The list was used to provide context and background information for events and it identify important events. Not all 10 events were used (<http://www.wrcc.dri.edu/extreme-events/utah/>).

*RMIIA (Rocky Mountain Insurance Industry Association)*: Web pages listing damaging Hailstorms, Snowstorms, and Wildfires in Colorado since 1990. Accessed from <http://www.rmiia.org/>

*Urban Drainage and Flood Control District (UDFCD; Colorado) Flood History*: Excel spreadsheet accessed from <http://udfcd.org/FWP/floodhistory/ColoradoFloodHistoryNotes.xls>. The spreadsheet lists 114 flood events across Colorado; several floods have separate event listings for impacts in different basins of the same meteorological event (e.g. June 1965)

*NCAR Floods*: Web pages for individual Colorado Front Range floods 1953-1999, plus a table of the 22 most damaging Colorado floods 1864-1999. Accessed from [http://www.assessment.ucar.edu/flood/flood\\_summaries.html](http://www.assessment.ucar.edu/flood/flood_summaries.html)

*Colorado Weather Almanac*: Book by meteorologist Mike Nelson, published by Johnson Books, 2007.

### **Acknowledgements:**

We thank the following for feedback on earlier versions of the database, providing access to data and/or pointing us to sources:

Chris Nicholson and Tony Bergantino, Wyoming State Climate Office

Nolan Doesken, Colorado Climate Center

Martin Schroeder and Rob Davies, Utah Climate Center

Jim Steenburgh, University of Utah

Nezette Rydell, NOAA NWS Denver-Boulder WFO

Jan Curtis, former Wyoming State Climatologist