



Actuarial Weather Extremes

April 2021





Actuarial Weather Extremes: April 2021

Alaska Cold, Hail, and Severe Drought

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Society of Actuaries



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Alaska Cold, Hail, and Severe Drought

Overview

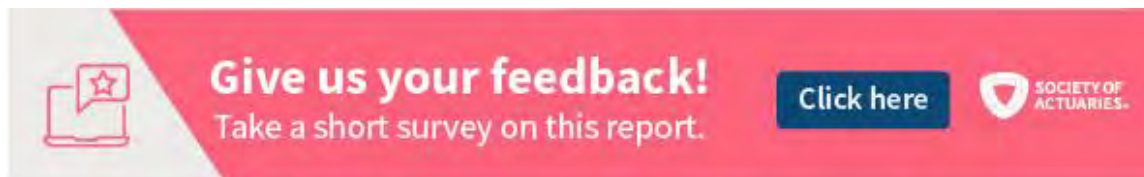
This report examines weather extremes for temperature, storms and precipitation. In Alaska, many stations reported record daily cold temperatures, both daily maximum temperatures and daily minimum temperatures. The readings were the lowest daily amounts since 1960. In the U.S. Southeast and South-Central states, severe hailstorms caused significant damage and included hail of extreme size. The U.S. Western states drought continues, and significantly, the drought is expanding and is now extreme in a very large portion of North Dakota.

Record Cold Temperatures in Alaska: As shown in Figure 1, April 8-11, 2021 was a period of extreme cold in Alaska. Not only daily low temperatures, but also daily high temperatures, had record lows for April 8-11 dates back to 1960. In addition, record monthly snowfall occurred at two stations, one of which was Fairbanks International Airport. At these two stations, the greatest snow amount for April in the years 1960-2021 occurred in April 2021.

Extreme Hail: As shown in Figures 2 and 3, significant hail occurred in Kansas, Texas, Alabama and Oklahoma. Each of these states recorded hail of 3.00 inches or larger, and in some cases 4.00 inches in size. The most extreme dates for hail activity were April 9 and the period April 23-28. Hundreds of hail events were reported during each period. April 2021 insured thunder-storm related losses were expected to be in the billions of dollars, as reported in Insurance Journal.¹

Extreme Drought: Figures 4 and 5 illustrate areas with extreme drought and small amounts of recent precipitation. The drought in the Western U.S. has been significant for the last several months. The area of extreme drought has expanded in April, and now notably includes the Northern Plains states, where North Dakota now has extreme drought across a large majority of the state.

Losses from Drought can come from losses to agriculture as well as potentially from wildfire in drought areas. This report will monitor drought related losses over the upcoming months.



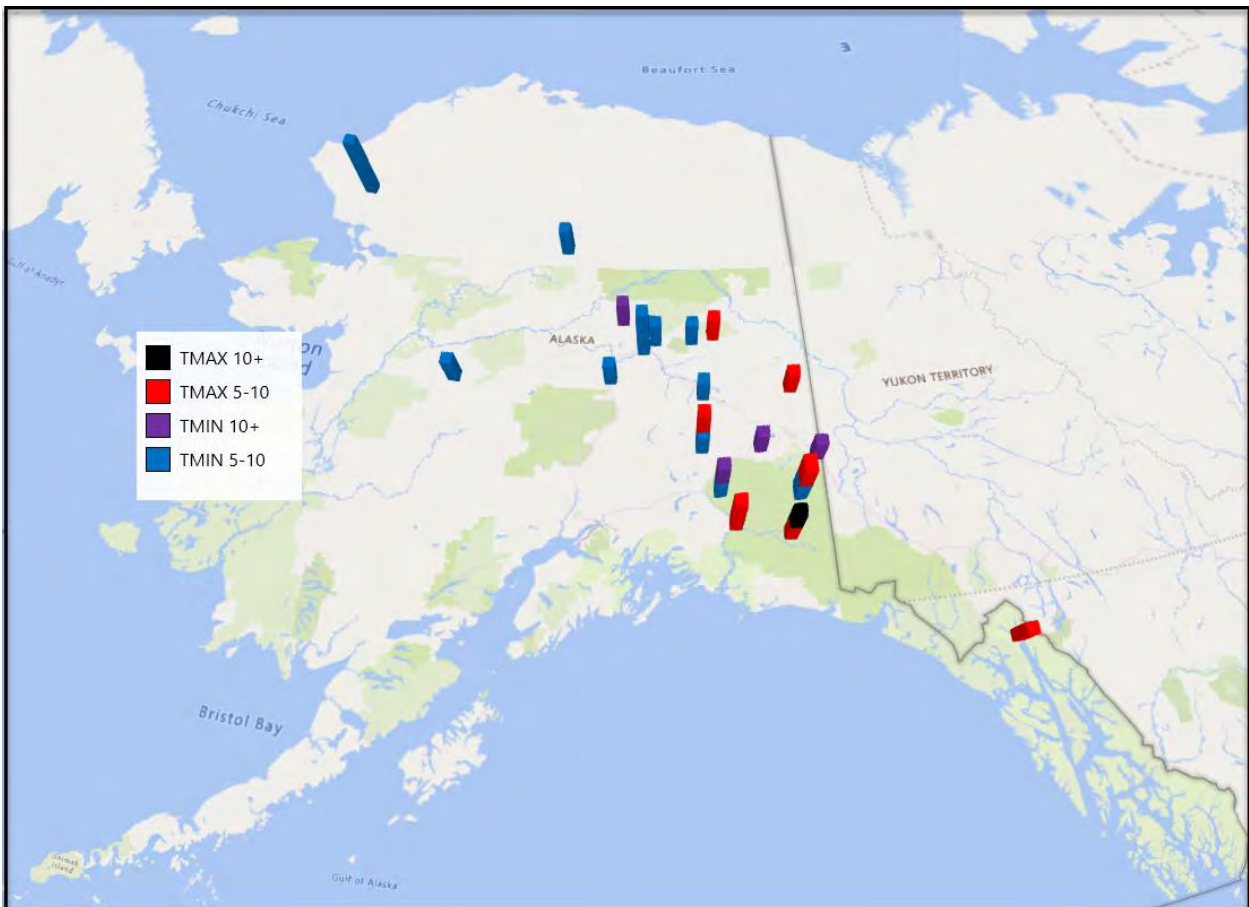
¹ Insurance Journal. May 12, 2021. [U.S. Hailstorms that Cost Insurers Billions – and Other April Natural Disasters: Aon \(insurancejournal.com\)](https://www.insurancejournal.com/news/national/2021/05/12/1477189.html)

Record Cold Temperatures in Alaska

As shown in Figure 1, the period April 8-11 was extremely cold in Alaska. Many stations were at least five and sometimes more than 10 degrees Fahrenheit less than previous daily record low temperatures. Two stations also had record monthly snowfall of 16.7 and 17.2 inches for the month of April which were 20% and 8% greater than any previous April monthly totals back to 1960.

Figure 1

GLOBAL HISTORICAL CLIMATOLOGY NETWORK (GHCN) STATIONS IN ALASKA WITH RECORD LOW DAILY HIGH TEMPERATURE (TMAX) AND DAILY LOW TEMPERATURE (TMIN) FOR DATES OF APRIL 8-11 FOR YEARS 1960-2021. THE INDICATED METRICS ARE DEGREES FAHRENHEIT BELOW PREVIOUS RECORD IN INCREMENTS 5-10 DEGREES OR 10 OR MORE DEGREES.



Source: Global Historical Climatology Network (GHCN) station data (Accessed May 5, 2021).
ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd_all.tar.gz

Extreme Hail

As shown in Figures 2 and 3, a significant number of hail events were reported in Kansas, Texas, Alabama and Oklahoma. Each of these states recorded hail of 3.00 inches or larger, and in some cases 4.00 inches in size. The most extreme date for hail activity was April 9, where over 300 events of hail being reported of 1.00 inch in size or larger. The other significant period was April 23-28, also with over 300 hail events being reported. The late April hailstorms were expected to have led to losses above \$1 Billion. ² For the full month of April 2021, insured thunderstorm related losses were expected to be in the billions of dollars, as reported in Insurance Journal. ³

Figure 2
NUMBER OF HAIL EVENTS WITH NOTED HAIL IN THE NUMBER OF HUNDREDTHS OF AN INCH OF HAIL BY STATE IN APRIL 2021. (FOR EXAMPLE, KANSAS HAD 38 EVENTS WITH 1.00 INCH OR GREATER, AND 1 EVENT WITH 3.00 INCHES OR GREATER.)

Count of Date	Column Labels															Grand Total
Row Labels	100	110	125	133	150	175	200	225	250	275	300	325	337	350	400	Grand Total
SD	7	-	2	-	-	1	-	-	-	-	-	-	-	-	-	10
MN	16	-	4	-	2	3	-	-	-	-	-	-	-	-	-	25
IA	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	3
WI	5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	8
NE	3	-	2	-	-	1	-	-	-	-	-	-	-	-	-	6
KS	24	-	4	-	4	1	2	-	2	-	1	-	-	-	-	38
GA	26	-	4	-	1	5	2	-	1	-	-	-	-	-	-	39
MO	16	-	1	-	1	2	-	-	-	-	-	-	-	-	-	20
LA	23	-	3	-	1	4	1	-	-	1	-	-	-	-	-	33
AR	19	-	3	-	2	1	-	-	-	1	-	-	-	-	-	26
KY	8	-	2	-	-	-	-	-	-	-	-	-	-	-	-	10
TN	6	-	2	-	1	1	-	-	-	-	-	-	-	-	-	10
TX	120	-	30	-	46	54	33	1	12	20	13	1	1	1	1	333
VA	19	-	6	-	2	4	-	-	-	-	-	-	-	-	-	31
MS	18	-	5	1	3	9	2	1	1	1	-	-	-	-	-	41
FL	22	-	4	-	4	5	4	-	-	-	-	-	-	-	-	39
AL	56	-	11	-	9	22	8	1	6	4	1	-	-	-	1	119
WV	2	-	1	-	1	1	-	-	-	-	-	-	-	-	-	5
NC	16	-	-	-	3	7	-	-	-	1	-	-	-	-	-	27
OK	23	1	6	-	5	19	7	-	2	12	2	-	-	-	-	77
IL	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
PA	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
MD	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
DE	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
NJ	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
WY	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
CO	9	-	-	-	3	3	-	-	-	-	-	-	-	-	-	15
Grand Total	450	1	95	1	88	143	59	3	24	40	17	1	1	1	2	926

Data Source: National Oceanic Atmospheric Administration (NOAA) Storm Prediction Center (SPC). May 2, 2021.
https://www.spc.noaa.gov/climo/reports/210401_rpts.html

² USA Today. April 29, 2021. [Texas, Oklahoma hail: Storms cause 'Billion-dollar' damage \(usatoday.com\)](https://www.usatoday.com/story/news/nation/2021/04/29/texas-oklahoma-hail-storms-cause-billion-dollar-damage/7337940002/)

³ Insurance Journal. May 12, 2021. [U.S. Hailstorms that Cost Insurers Billions – and Other April Natural Disasters: Aon \(insurancejournal.com\)](https://www.insurancejournal.com/news/national/2021/05/12/462144.htm)

Figure 3
NUMBER OF REPORTED HAIL EVENTS BY DATE AND BY U.S. STATE IN APRIL 2021.

Count of Loc Col	AL	IL	KS	MO	OK	TX	MS	TN	KY	FL	GA	MN	IA	AR	LA	WV	NC	VA	NE	WI	SD	PA	MD	DE	NJ	WY	CO	Grand Total
210405	-	-	-	-	-	-	-	-	-	-	-	18	3	-	-	-	-	-	-	1	10	-	-	-	-	-	-	32
210406	-	-	28	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	5	1	-	-	-	-	-	-	-	35
210407	-	-	-	2	-	-	-	-	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-	7
210408	-	-	-	1	-	27	1	6	10	2	1	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	54	
210409	44	1	1	17	48	61	36	4	-	3	-	-	-	19	17	5	21	25	-	-	-	-	-	-	-	-	302	
210410	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
210411	-	-	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	
210412	-	-	-	-	-	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32	
210413	-	-	-	-	1	13	-	-	-	-	-	-	-	1	6	-	-	-	-	-	-	-	-	-	-	-	21	
210414	-	-	-	-	-	12	2	-	-	-	-	-	-	-	4	-	5	-	-	-	-	-	-	-	-	-	23	
210415	2	-	-	-	-	33	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	36	
210416	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	
210418	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	
210419	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	
210421	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	2	4	2	-	9	
210423	1	-	-	-	7	61	1	-	-	-	1	-	-	3	-	-	-	-	-	-	-	-	1	2	4	2	74	
210424	72	-	-	-	-	-	-	-	-	5	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	113	
210426	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	4	-	-	-	-	-	1	10	
210427	-	-	9	-	-	12	-	-	-	-	-	2	-	-	-	-	-	-	1	2	-	-	-	-	-	15	41	
210428	-	-	-	-	-	21	82	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	105	
Grand Total	119	1	38	20	77	333	41	10	10	39	39	25	3	26	33	5	27	31	6	8	10	1	2	4	2	1	15	926

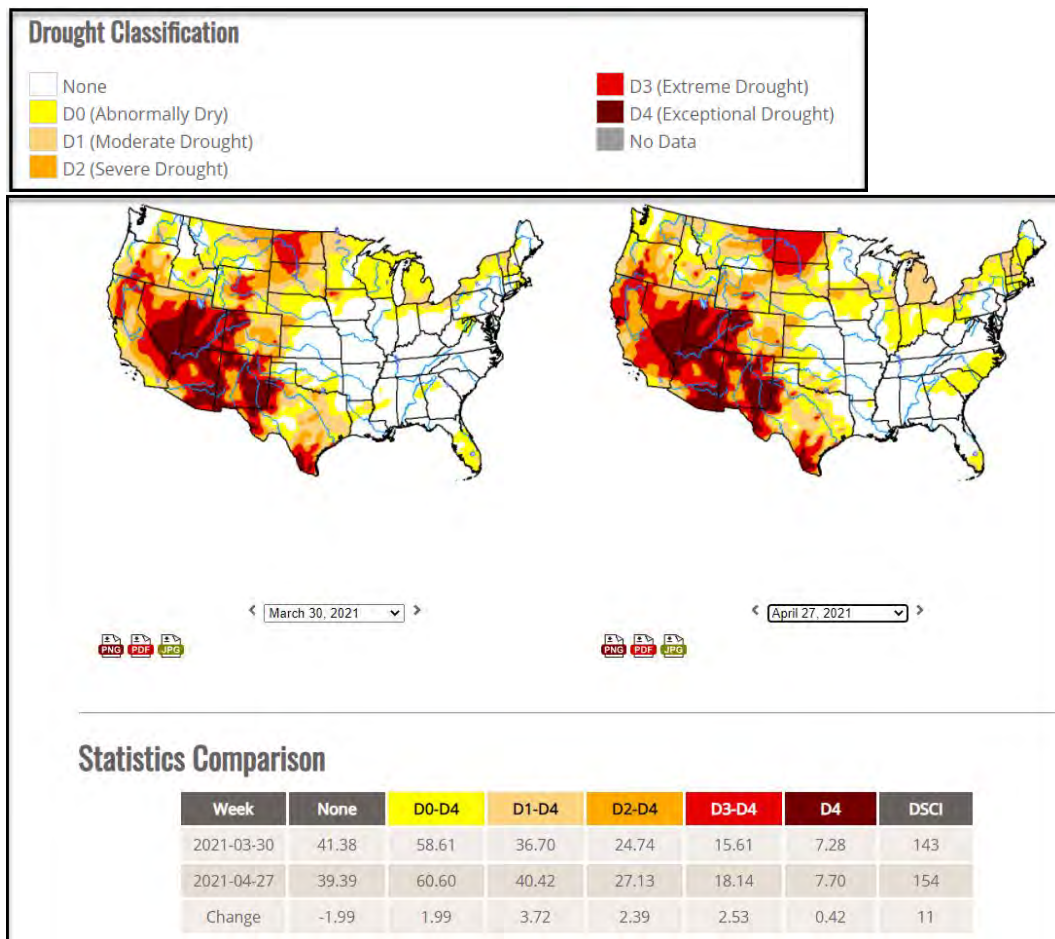
Data Source: National Oceanic Atmospheric Administration (NOAA) Storm Prediction Center (SPC). May 2, 2021.
https://www.spc.noaa.gov/climo/reports/210401_rpts.html

Severe Drought Expanding Beyond Western U.S. States

Figure 4 shows that the severe drought conditions in the western half of the U.S. are expanding. Notably, a very large percent of North Dakota is now in D3 (Extreme Drought) condition. As the Statistics Comparison shows, all Drought Classification levels (D0-D4) increased in area in the period March 30, 2021 to April 27, 2021. As reported in Yale Climate Connections, drought had caused over \$1 Billion of damages during the first four months of 2021.⁴

Supporting the Drought conditions, Figure 5 shows GHCN stations where April 2021 was among the five highest (1-5) and five lowest (58-62) monthly precipitation examples, looking at the months of April in the period 1960-2021. In April 2021, the Western U.S. states had many stations which had their driest April in this period (blue squares).

Figure 4
COMPARISON OF DROUGHT CONDITIONS IN THE CONTINENTAL U.S. IN LATE MARCH AND LATE APRIL 2021.



Source: [Compare Two Weeks | U.S. Drought Monitor \(unl.edu\)](#)

[Permission | U.S. Drought Monitor \(unl.edu\)](#)

The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC.


⁴ Yale Climate Connections. May 13, 2021. [April 2021: Ninth-warmest April on record, NOAA and NASA report » Yale Climate Connections](#)

Figure 5

GHCN STATIONS WHERE APRIL 2021 MONTHLY PRECIPITATION RANKED AMONG FIVE HIGHEST (1-5) AND FIVE LOWEST (58-62) AMOUNTS RECORDED FROM AMONG APRIL TOTALS DURING THE PERIOD 1960-2021.




Source: Global Historical Climatology Network (GHCN) station data (Accessed May 5, 2021).
ftp://ftp.ncdc.noaa.gov/pub/data/gHCN/daily/gHCNd_all.tar.gz



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Rough Assessment of the Losses Caused by the Recent Extreme Weather

Economic and insured losses are often difficult to estimate in the immediate aftermath of an extreme weather event. With the passage of time, the extent of the losses gradually becomes clearer.

April 2021 Hailstorms Southeast U.S. and South-Central U.S.

The late April hailstorms were expected to have led to losses above \$1 Billion.⁵ For the full month of April 2021, insured thunder-storm related losses were expected to be in the billions of dollars, as reported in Insurance Journal.⁶

Western U.S. Drought

As reported in Yale Climate Connections, drought had caused over \$1 Billion of damages during the first four months of 2021.⁷

Data

Snow, Precipitation and temperature data used in this report was obtained from the **Global Historical Climatology Network** (“GHCN”) weather database, which provides daily weather observations from over 100,000 weather stations worldwide, covering over 180 countries. The database is publicly available through the National Oceanic and Atmospheric Administration (NOAA) via the following FTP site:

ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd_all.tar.gz

Filename: [ghcnd_all.tar.gz](#)

National Weather Service Storm Prediction Center Reports

SPC: https://www.spc.noaa.gov/climo/reports/210401_rpts.html

This page will show all Tornado, Wind, and Hail reports for 4/1/2021

Select the “210402 Reports” button at the top to move to the next day

Acknowledgments

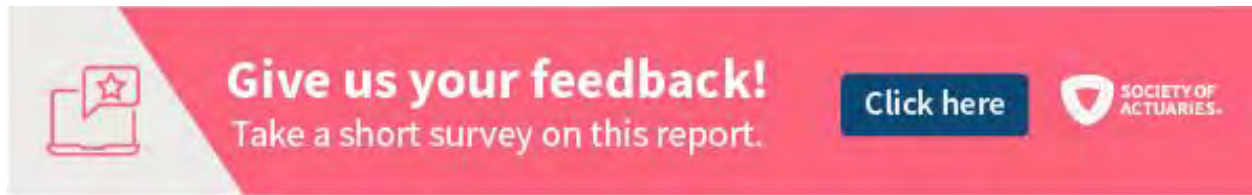
The authors wish to thank Matthew Self, ASA for the monthly hailstorm data and analysis that were used for this report.

⁵ USA Today. April 29, 2021. [Texas, Oklahoma hail: Storms cause 'Billion-dollar' damage \(usatoday.com\)](#)

⁶ Insurance Journal. May 12, 2021. [U.S. Hailstorms that Cost Insurers Billions – and Other April Natural Disasters: Aon \(insurancejournal.com\)](#)

⁷ Yale Climate Connections. May 13, 2021. [April 2021: Ninth-warmest April on record, NOAA and NASA report » Yale Climate Connections](#)


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The banner features a red background with a white diagonal stripe on the left. On the white stripe is a red icon of a laptop with a star in a speech bubble. The main text is in white and blue. A dark blue button with white text is on the right, followed by the Society of Actuaries logo.

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With roots dating back to 1889, the [Society of Actuaries](#) (SOA) is the world's largest actuarial professional organizations with more than 31,000 members. Through research and education, the SOA's mission is to advance actuarial knowledge and to enhance the ability of actuaries to provide expert advice and relevant solutions for financial, business and societal challenges. The SOA's vision is for actuaries to be the leading professionals in the measurement and management of risk.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

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Relevance: The SOA provides timely research on public policy issues. Our research advances actuarial knowledge while providing critical insights on key policy issues, and thereby provides value to stakeholders and decision makers.

Quantification: The SOA leverages the diverse skill sets of actuaries to provide research and findings that are driven by the best available data and methods. Actuaries use detailed modeling to analyze financial risk and provide distinct insight and quantification. Further, actuarial standards require transparency and the disclosure of the assumptions and analytic approach underlying the work.

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