AMERICAN ACADEMY OF ACTUARIES ANNUAL MEETING PUBLIC POLICY FORUM NOVEMBER 5-6 CAPITAL HILTON WASHINGTON, D.C.



P/C Breakout Session:

Climate Risk/Flood Insurance

ANNUAL MEETING PUBLIC POLICY FORUM

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American Academy of Actuaries

Today's Presenters

- Lisa Slotznick, moderator
 - VP Casualty, American Academy of Actuaries
- Steve Jackson
 - Assistant Director for Research, American Academy of Actuaries
- Andy Neal
 - Chief Actuary, National Flood Insurance Program



Actuaries Climate Index and Actuaries Climate Risk Index

Steve Jackson, Ph.D. Assistant Director for Research (Public Policy) American Academy of Actuaries

Actuaries Climate Index (ACI)

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ACI—Sponsors

- Actuaries Climate Index (ACI) Sponsors
 - American Academy of Actuaries
 - Canadian Institute of Actuaries
 - Casualty Actuarial Society
 - Society of Actuaries
- www.ActuariesClimateIndex.org



ACI—Background

- An educational tool providing information about weather trends in the United
 States and Canada
- □ Retrospective analysis of data as opposed to a forecast of future trends
- Updated quarterly using publicly available data from the National Oceanic and Atmospheric Administration and the Permanent Service for Mean Sea Level
- Covers rainfall, temperature, dry spells, wind speed, and sea level



ACI—Background (cont'd)

- □ Breaks North America into 12 regions, and analyzes each region separately
- Breaks time into monthly units
- Spans the period from 1961 to the present (with a reporting lag of 6 to 12 months)
- Uses 1961–90 as a reference period



ACI Components—Climate Regions



Region

Region Name Central Arctic CAR Northeast Atlantic NEA Northeast Forest NEF Northern Plains NPL Northwest Pacific NWP Alaska ALA Central East Atlantic CEA Central West Pacific CWP Midwest MID Southeast Atlantic SEA Southern Plains SPL Southwest Pacific SWP

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ACI—Components

□ Covers rainfall, temperature, dry spells, wind speed, and sea level

- Frequency of temperatures above the 90th percentile (T90)
- Frequency of temperatures below the 10th percentile (T10)
- Maximum rainfall per month in five consecutive days (P)
- Annual maximum consecutive dry days (D)
- Frequency of wind power above the 90th percentile (W)
- Sea level changes (S).



ACI—Recent Index Findings

- Latest press release: August 29, 2019.
- "The increase in average winter values is one factor driving the ACI's five-year moving average to new highs. The moving average increased by 0.08, from 1.02 to 1.10..."
- □ Based on data through the winter of 2019.
- "Since last quarter, the ACI moving average increased by the largest amount in the post-reference period, making this five-year period the greatest outlier so far in terms of frequent extreme weather and sea level change."



ACTUARIES CLIMATE INDEX United States and Canada Combined Seasonal and Five Year Average Values

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Three Foundational Documents on the ACI Website



actuariesclimateindex.org

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Actuaries Climate Risk Index (ACRI)

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ACRI—Status Update

- Research update describing version 1.0 of ACRI under review by the sponsoring actuarial associations
- Estimates relationships between the ACI's weather metrics and weatherrelated losses; derives ACRI from those estimates
- ACRI 1.0 will focus only on the United States due to data limitations for Canada
- □ ACRI 1.0 Research Update expected publication 4Q 2019 1Q 2020



Losses by Weather Categories, 1961 - 2017



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Weather-related Losses Combined, 1961 - 2017

TOTAL Losses from Weather Categories Combined USA Total, Billions of 2018 \$ 1961 - 2017 Source: Sheldus





Statistical Approach to ACRI

- 1) Combine losses from all weather categories
- 2) Fit exponential model of Losses to Set of ACI weather metrics using OLSQ:
- 3) Losses(\$) = A * T90^a * T10^b * Precip^c * Wind^d * Exposure^e
- 4) Use a pooled, cross-section for Region-Months
- 5) Correct for Heteroskedasticity by adjusting covariance matrix (MacKinnon and White)
- 6) ACRI for a region-month equals (predicted losses) (average, exposure-adjusted predicted losses during reference period)



ACRI Losses with Confidence Intervals

ACRI Losses by Region, with Confidence Intervals
(in billions)

		Intrinsic,	Extrinsic,	Intrinsic,	Extrinsic,
	1991-2016	Lower	Lower	Upper	Upper
		Limit	Limit	Limit	Limit
USA	\$23.78	\$15.72	\$2.42	\$35.98	\$45.15
SEA	\$22.42	\$14.82	\$10.90	\$33.91	\$33.94

- ACRI Best Estimate: ~\$1 billion per year in the USA, mostly from the South East Atlantic region
- ACRI (USA) 90% confidence Interval, intrinsic uncertainty: ~\$0.5 billion ~\$1.5 billion per year
- Intrinsic 90% confidence interval: uses 90% confidence interval for predicted losses to produce ACRI estimates, capturing uncertainty of parameter estimates
- ACRI (USA) 90% confidence interval, extrinsic uncertainty: ~\$0.0 billion ~2.0 billion
- Extrinsic 90% confidence interval: based on standard errors of 30 estimates of ACRI with synthetic data sets, drawn from pool of actual observations with replacement, capturing uncertainty due to sampling.



ACRI: Conclusion

- While others find likely large losses due to changes in weather by end of 21st Century, but little loss yet when controlling for changes in exposure, we find small increases in loss likely already occurred, 1991 2016 (~5% of total weather-related losses)
- We also find substantial uncertainty in these estimates.
- Challenges inspiring us to version 2.0







Risk Rating 2.0

American Academy of Actuaries Annual Meeting November 6, 2019



Pre-Decisional – Agency Deliberative Process

Note: At the presenter's request, slides from this portion of the program are not available for distribution.



Questions



To stay up-to-date with Risk Rating 2.0, and for the latest details, please visit <u>www.fema.gov/nfiptransformation</u>.



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Thank You



Discussion

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