

Actuaries Climate Index

Actuaries Climate Risk Index

IAA Council Meeting

October, 2015

Caterina Lindman,

Chair of Climate Index Working Group and
member of CIA Climate Change and Sustainability Group,
IAA Resource and Environment Group, and
SOA Climate and Environmental Sustainability Committee

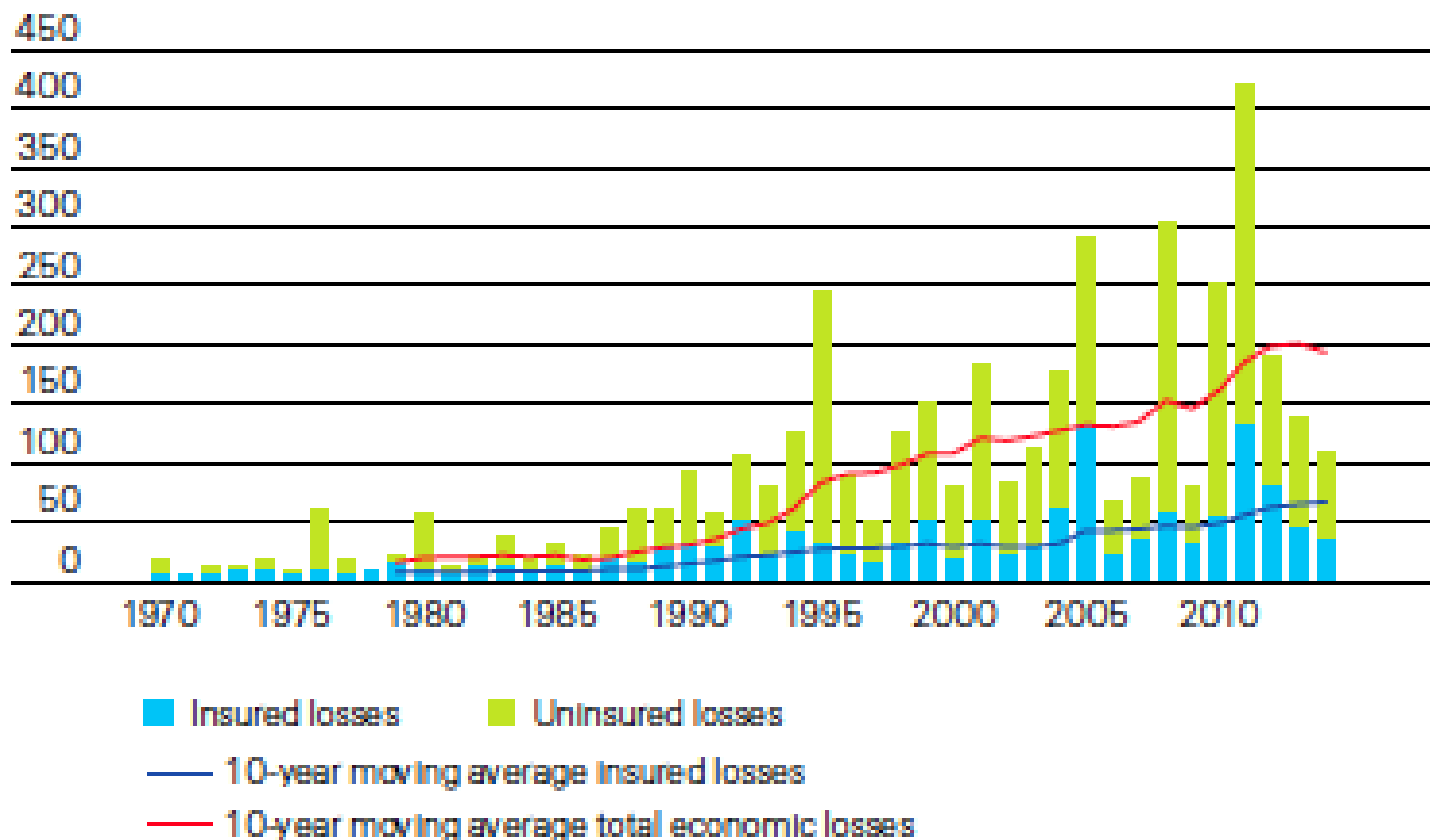


Agenda

- Overview of the Climate Change Issue
- History of ACI and ACRI
- Statistical Basis of ACI and ACRI
- Rollout of ACI and ACRI



Increasing Global financial losses (US\$ Billions, adjusted for inflation)



Total losses = insured + uninsured losses

Source: Swiss Re Economic Research & Consulting and Cat Perils.

2003 Heat wave in France/Europe

- At least 15,000 people died in France alone
- 70,000 died across Europe
- Elderly, women, infirm



2005 Hurricane Katrina

- Over 1,800 deaths
- African-American, elderly, poor, infirm,
- 5 years later people still in trailers
- Lasting economic, social impacts



2008 to 2012 Drought in Syria



Courtesy of NASA



Mark Carney, Chair of the Financial Services Board, Governor of Bank of England

3 Main risks of Climate Change:

- Physical Risks
- Liability Risks
- Transition Risks

Response: Climate Disclosure Task Force

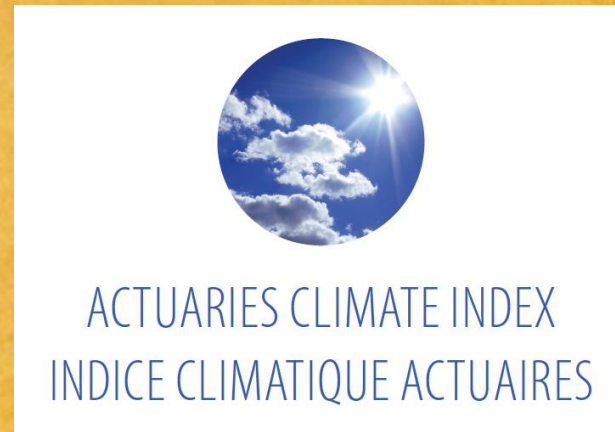
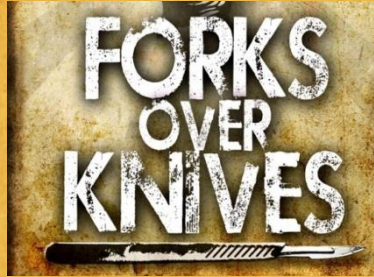
- Information on carbon intensity of different assets
- Clear, consistent, reliable, comparable, efficient

<http://www.bankofengland.co.uk/publications/Pages/speeches/2015/844.aspx>



Signs of Hope

Carbon Disclosure Task Force



Actuaries Climate Index - Goals

- Create an objective index that measures changes in climate over recent decades
- Educate the insurance industry and the general public on the impact of climate change
- Easy to understand, but not simplistic
- Promote our profession



Climate Index Development Structure



CAS Climate Change Committee

Climate Index Working Group

Actuaries from the CAS, AAA, SOA & CIA



ACI Basics

- Initial focus US and Canada
 - Hope to gradually add other parts of world where good data is available – Mexico, Europe, Australia...
 - Publish index and related information on a website
- Six variables we are planning to use, all by 2.5° grid (275km x 275km at equator), summarized by 12 regions and by country :
 - Temperature (highs and low separately),
 - Precipitation, Drought
 - Wind,
 - Sea level
- Focus on measuring frequency and intensity of extremes rather than averages
 - Express changes as standardized anomalies, e.g.,
$$X' = (X - X_{\text{ref}}) / \sigma_{\text{ref}}(X) = \Delta X / \sigma_{\text{ref}}(X)$$



Extreme Temperatures Indices

Global Historical Climatological Network (GHCN)
– global, land station-based, gridded dataset, daily
from 1950-present (GHCN-Daily)

GHCNDEX indices* based on the above:

- TX90 = 90%ile warm days
- TN90 = 90%ile warm nights
- TX10 = 10%ile cold days
- TN10 = 10%ile cold nights

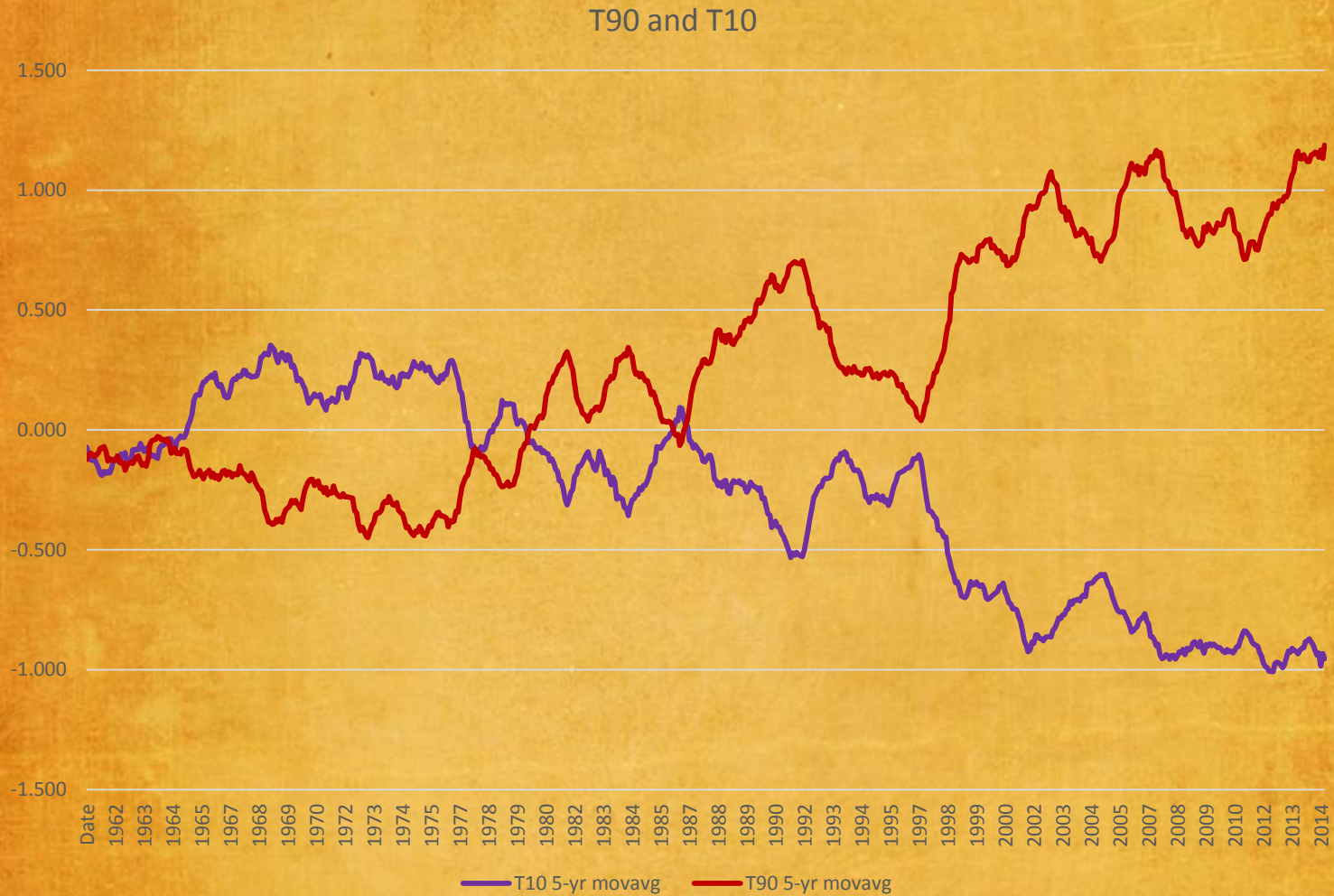
The average of % anomalies relative to the 1961-1990 reference period for T90 and T10:

- Standardized anomaly : $T_{90}' = \Delta T_{90} / \sigma_{ref}(T_{90})$

* Produced as part of the CLIMDEX project by the Climate Change Research Centre, at The University of New South Wales, Australia.

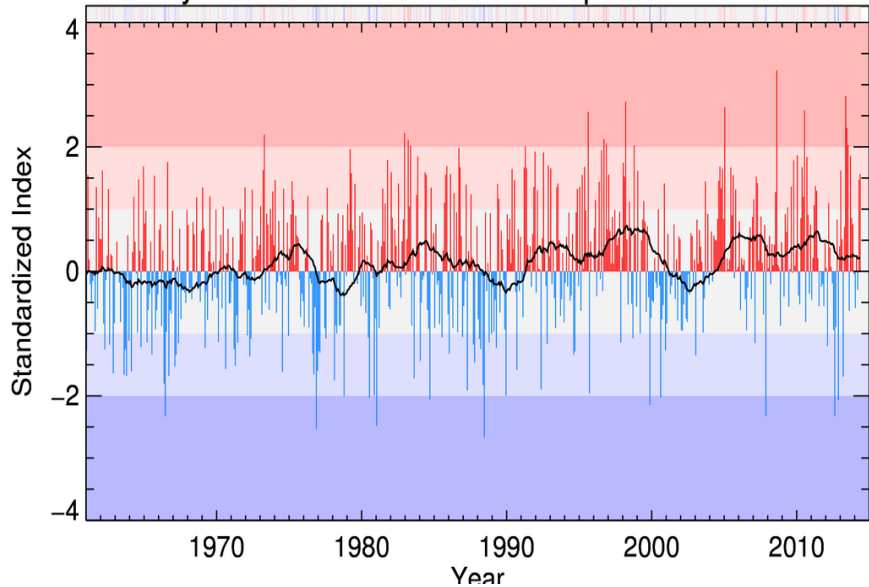


ACI T90 and T10, US and Canada

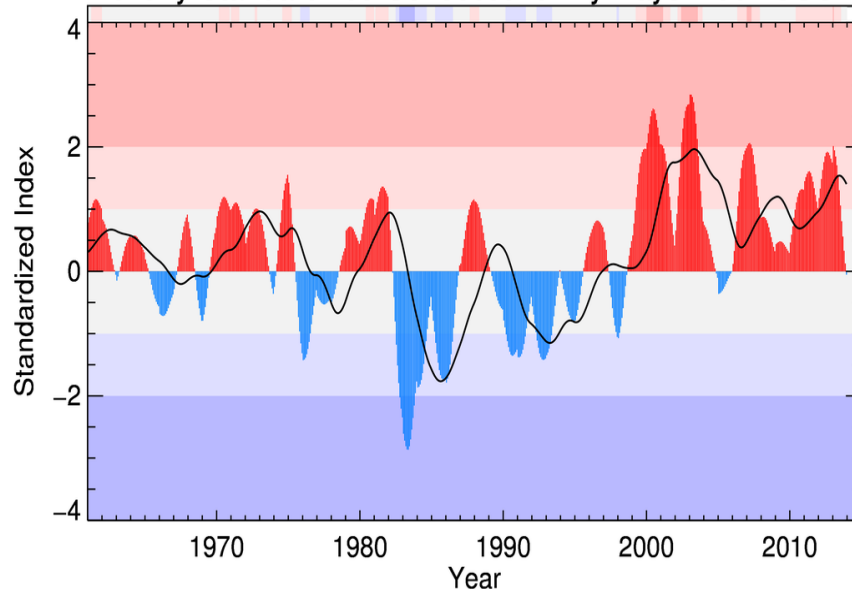


Other ACI Components

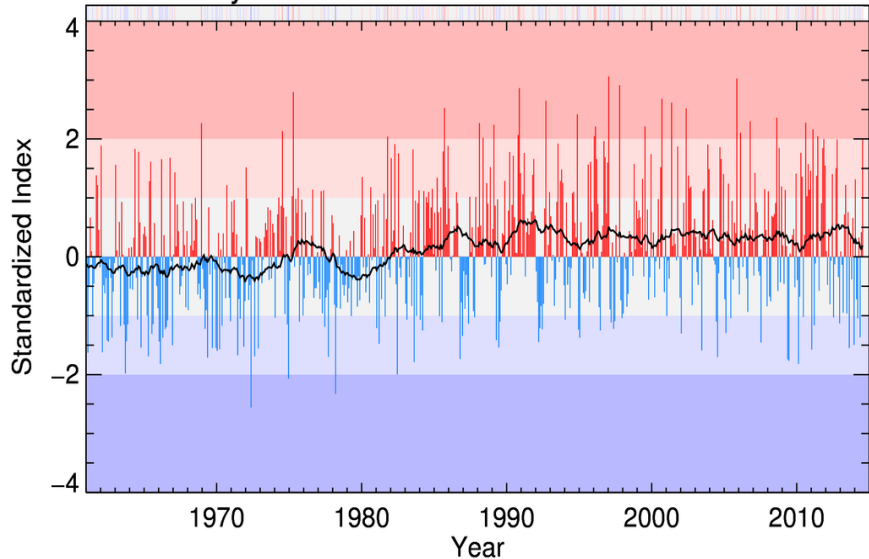
Monthly Standardized Extreme Precipitation Index USC



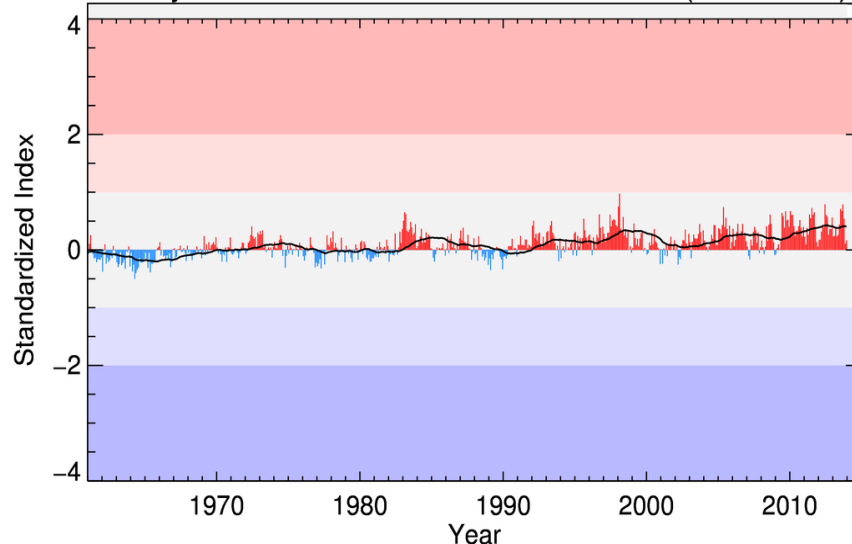
Monthly Standardized Consecutive Dry Days Index USC



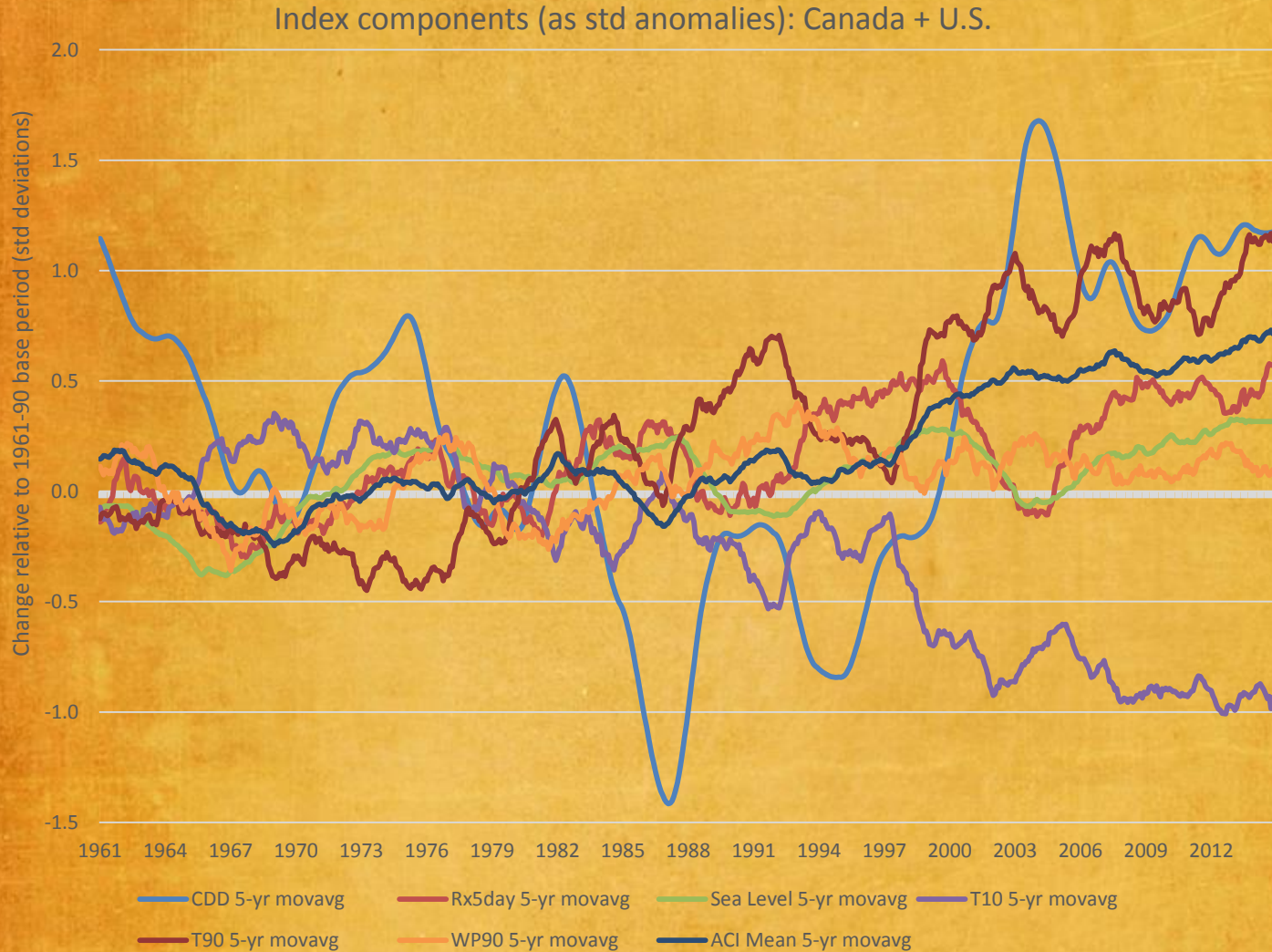
Monthly Standardized Extreme Wind Index USC



Monthly Standardized Sea Level Index USC (76 stations)



Standardized ACI, US and Canada



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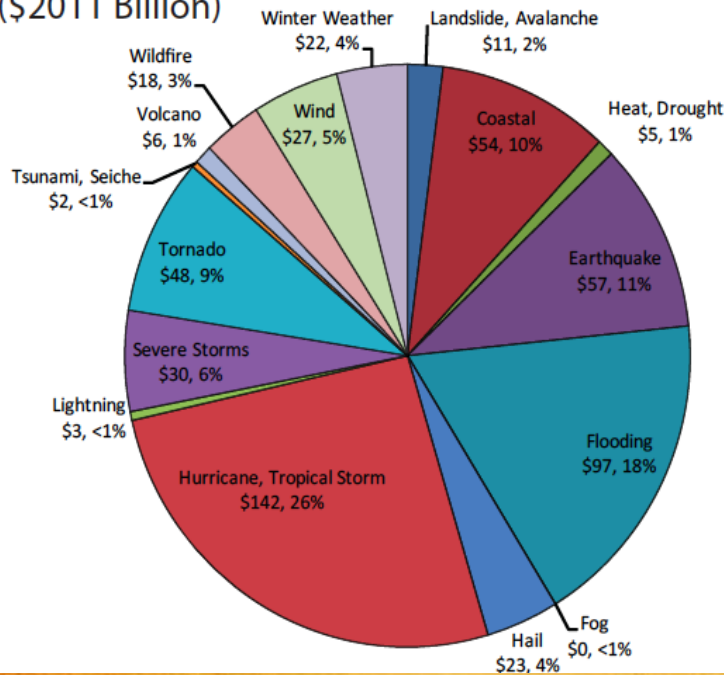
- Measure correlation of economic losses by peril to the components of the ACI.
 - Using SHELDUS data for economic losses, mortality and morbidity in the US
 - Canadian Disaster Database, compiled by Public Safety Canada
- Goal is to produce an index especially useful to the insurance industry



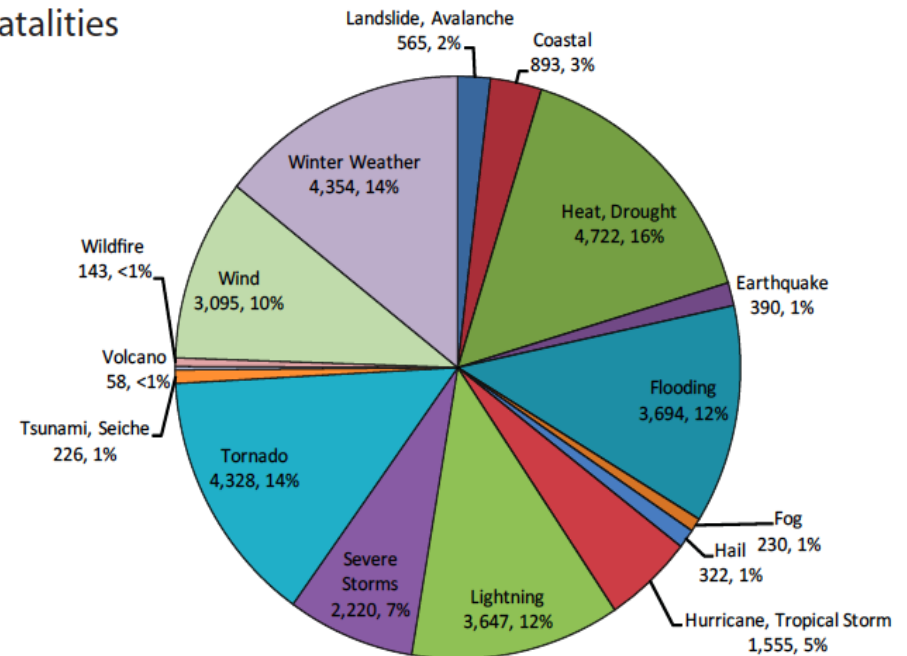
SHELDUS Data Summary 1960-2011

MONETARY & HUMAN LOSSES BY HAZARD TYPE

Losses (\$2011 Billion)



Fatalities



Source: http://hvri.geog.sc.edu/SHELDUS/docs/Summary_1960_2011.pdf

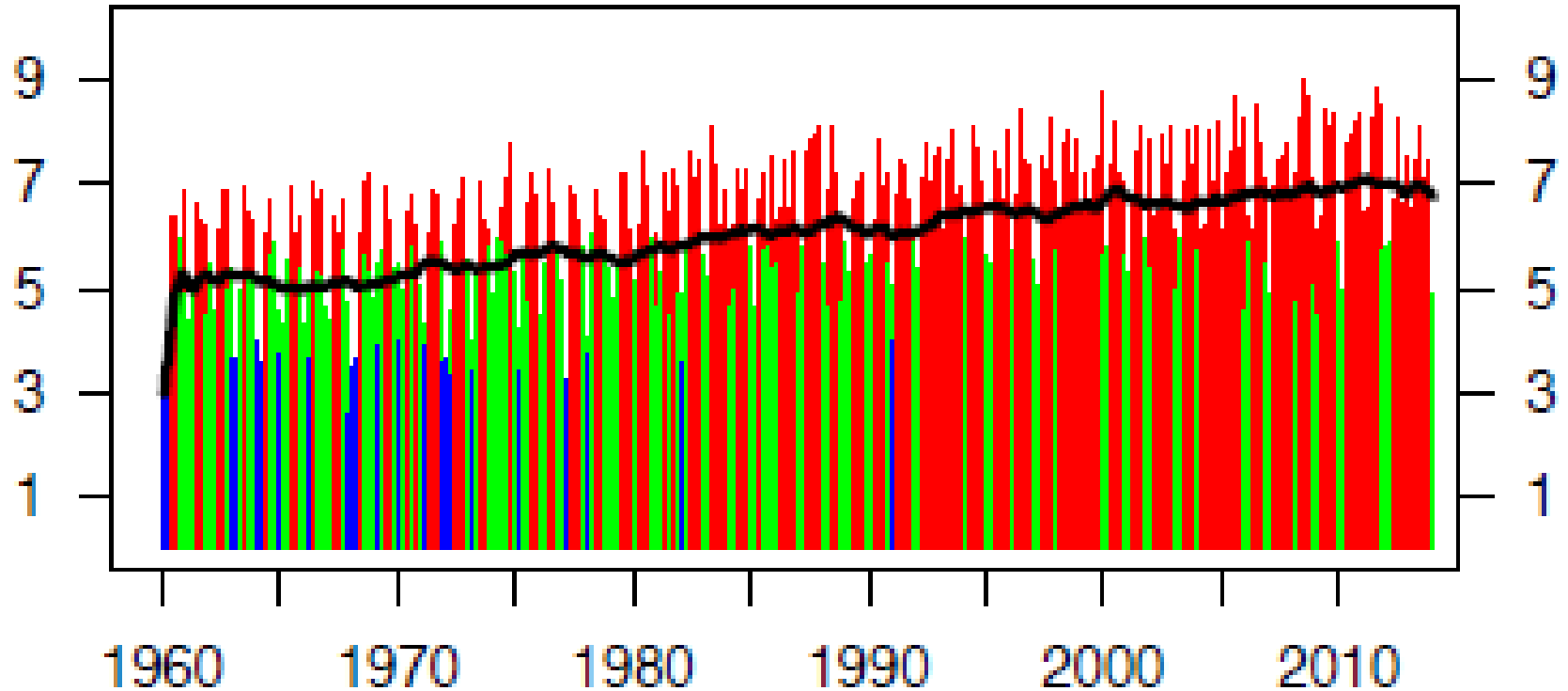


Actuaries Climate Risk Index - Methodology

- Regression analysis of damages and ACI components by region (statistically significant relationships found)
 - Mortality and morbidity vs. heat (3/12)
 - Flood damages vs. maximum 5-day precipitation (8/12)
 - Crop damages vs. consecutive dry days (1/12)
 - Wildfire damages vs. consecutive dry days (2/12)
 - Wind damages vs. wind power (7/12)
- Proxies or no index for regions with no finding of statistically significant relationships
- Create historical impacts index (HII)
 - Scale to an index ranging from 1-10



Historical Impact Index - Sample Plot



Southern Plains – Flood Damages



ACI Communication & Roll-out Schedule

- Website prototype completed by Solterra
- Website contents
 - Charts
 - Maps
 - Commentary in English and French
 - Index data available for download
 - Links to related information
- Quarterly press releases once we launch
 - Talking points
 - FAQ
 - assigned team to handle press inquiries



ACRI Roll Out

- Complete formulation of ACRI
- Create prototype website
 - Current expectation: complete by December
- Build ACRI portion of actual website
- Quarterly ACI and ACRI releases
- Periodic articles in actuarial magazines

