Actuaries Climate Index
Actuaries Climate Risk Index

IAA Council Meeting

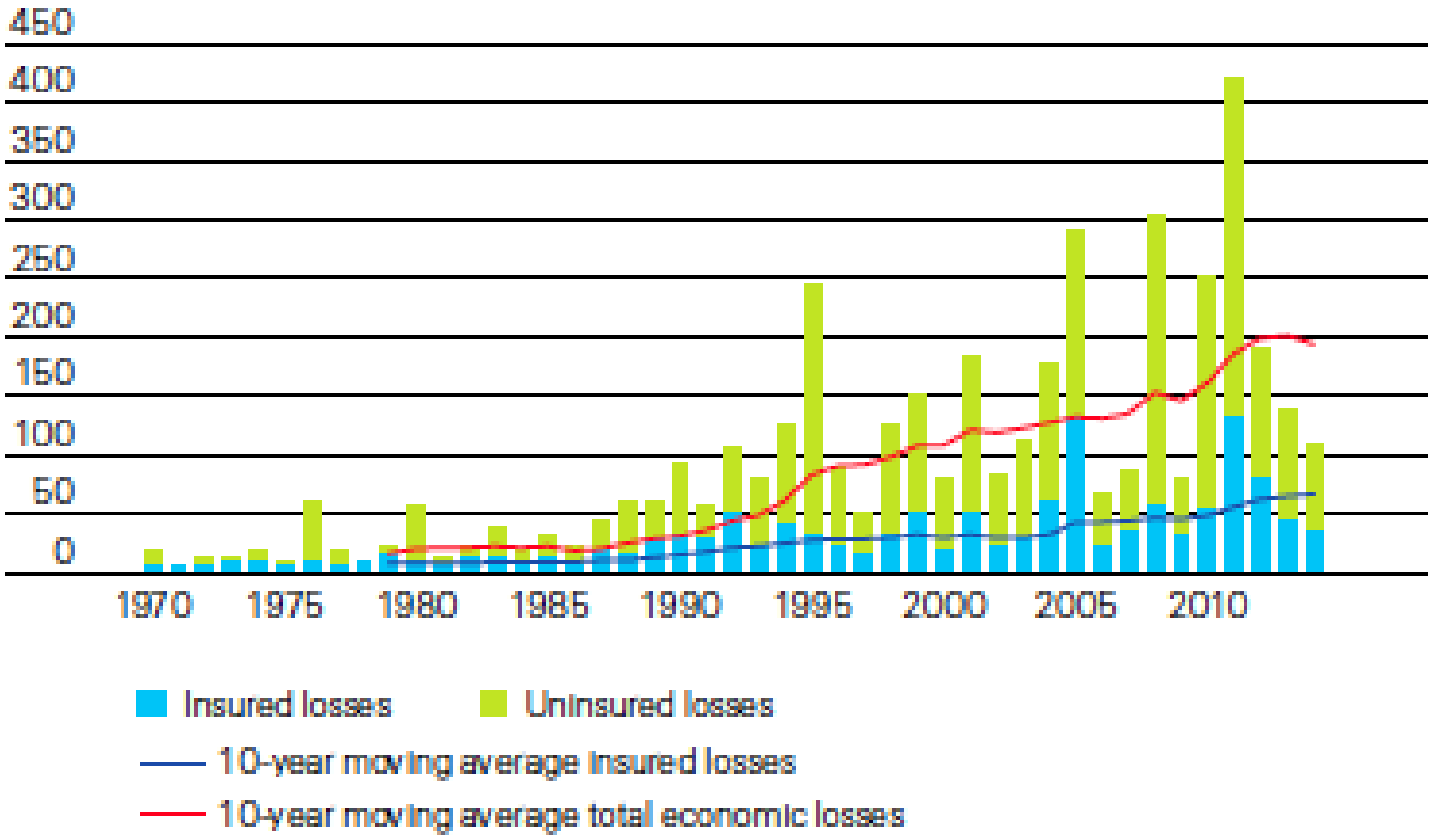
October, 2015

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

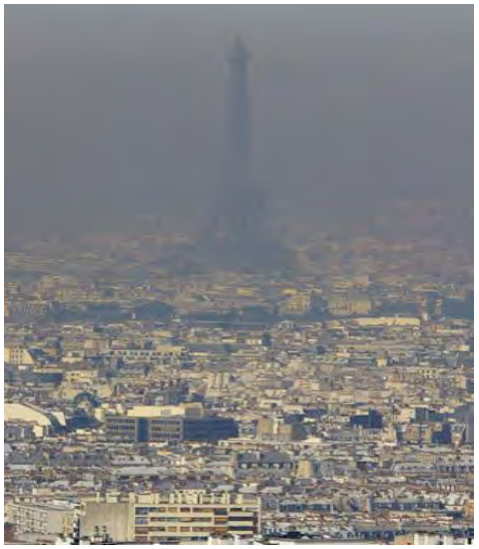
Increasing Global financial losses (US$ Billions, adjusted for inflation)



Source: Swiss Re Sigma, No 2/2015, Figure 4

2003 Heat wave in France/Europe

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

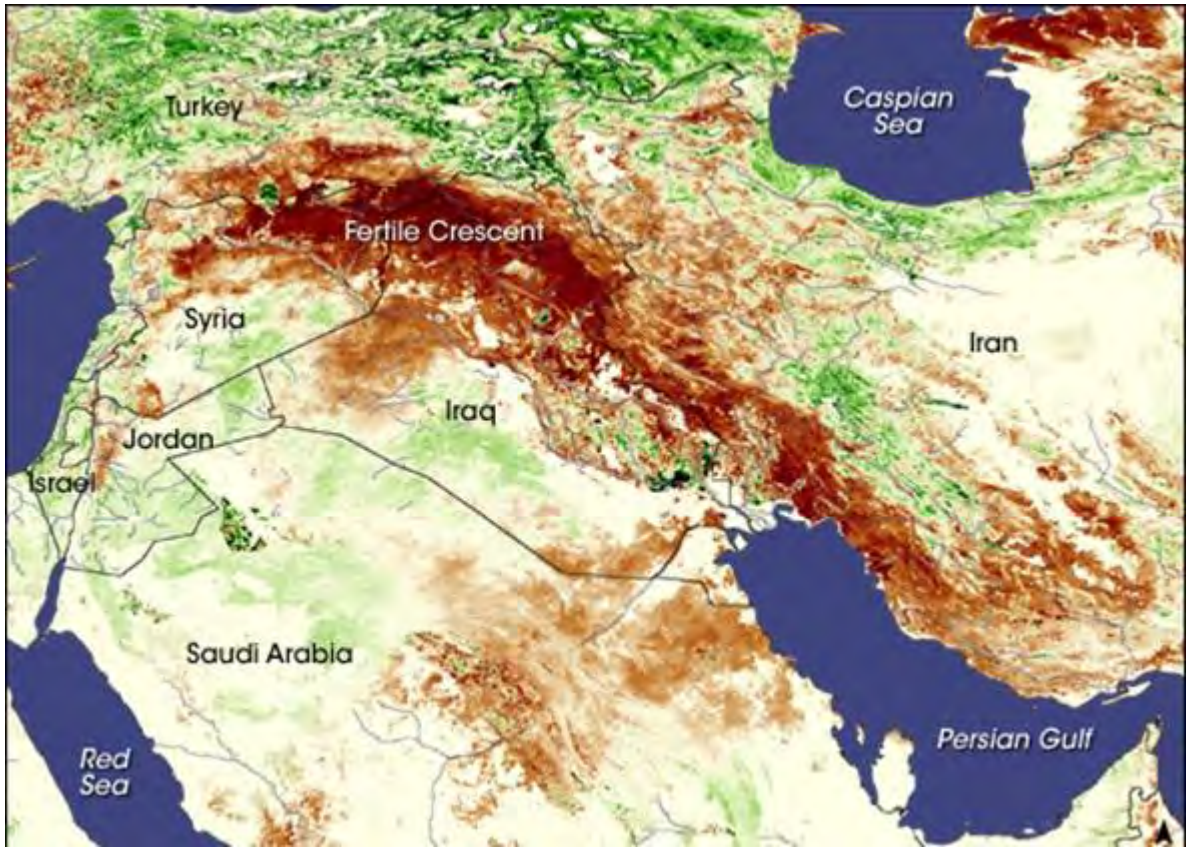


2005 Hurricane Katrina

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

Poumadère et al. 2005; Robine et al. 2008

2008 to 2012 Drought in Syria



Courtesy of NASA

http://www.slate.com/articles/technology/future_tense/2014/06/isis_water_scarcity_is_climate_change_destabilizing_iraq.html

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

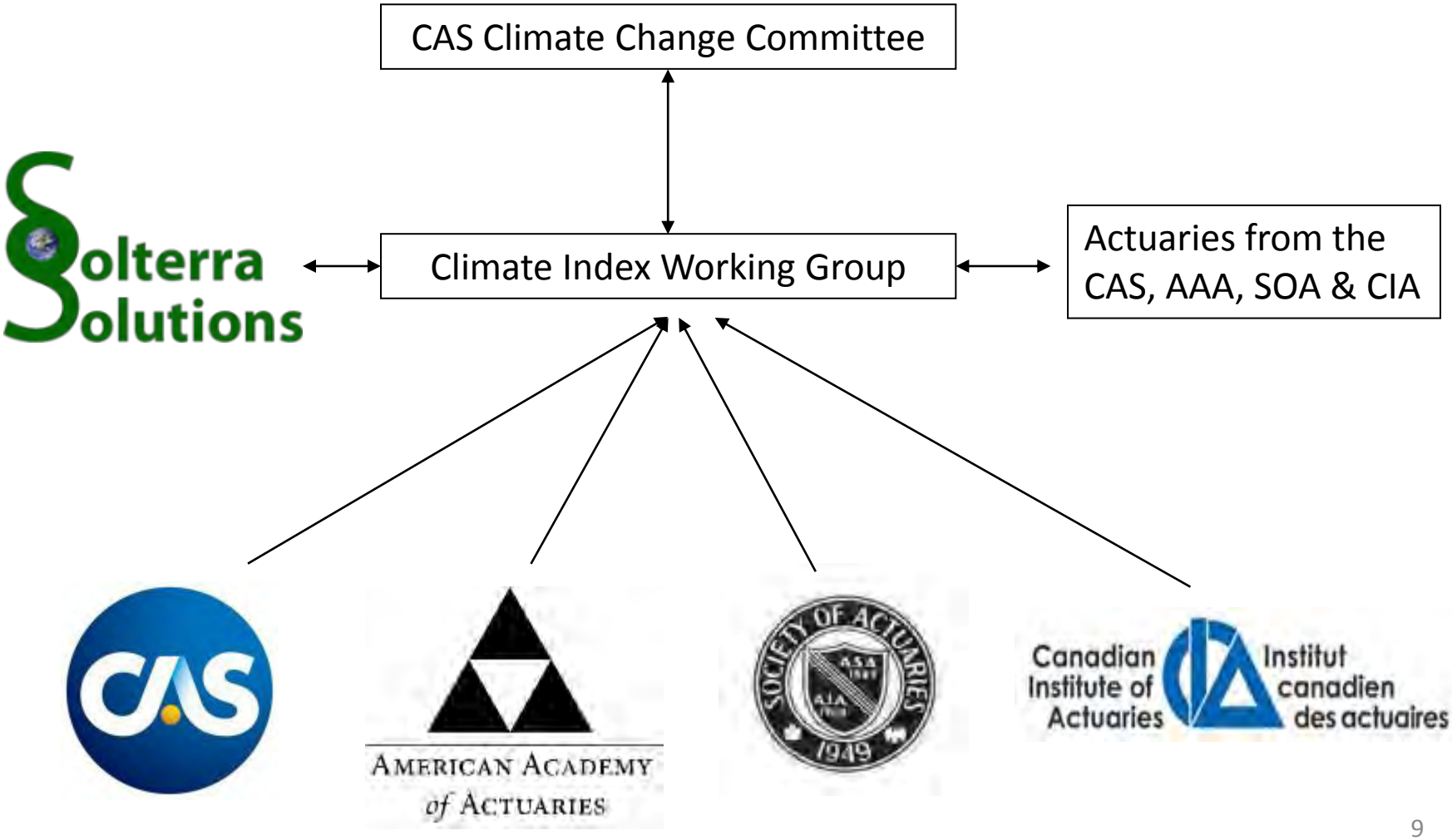
ACTUARIES CLIMATE INDEX
INDICE CLIMATIQUE ACTUAIRES

Citizens' Climate Lobby

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



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.,

$$X' = (X - X_{ref}) / \sigma_{ref}(X) = \Delta X / \sigma_{ref}(X)$$

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:

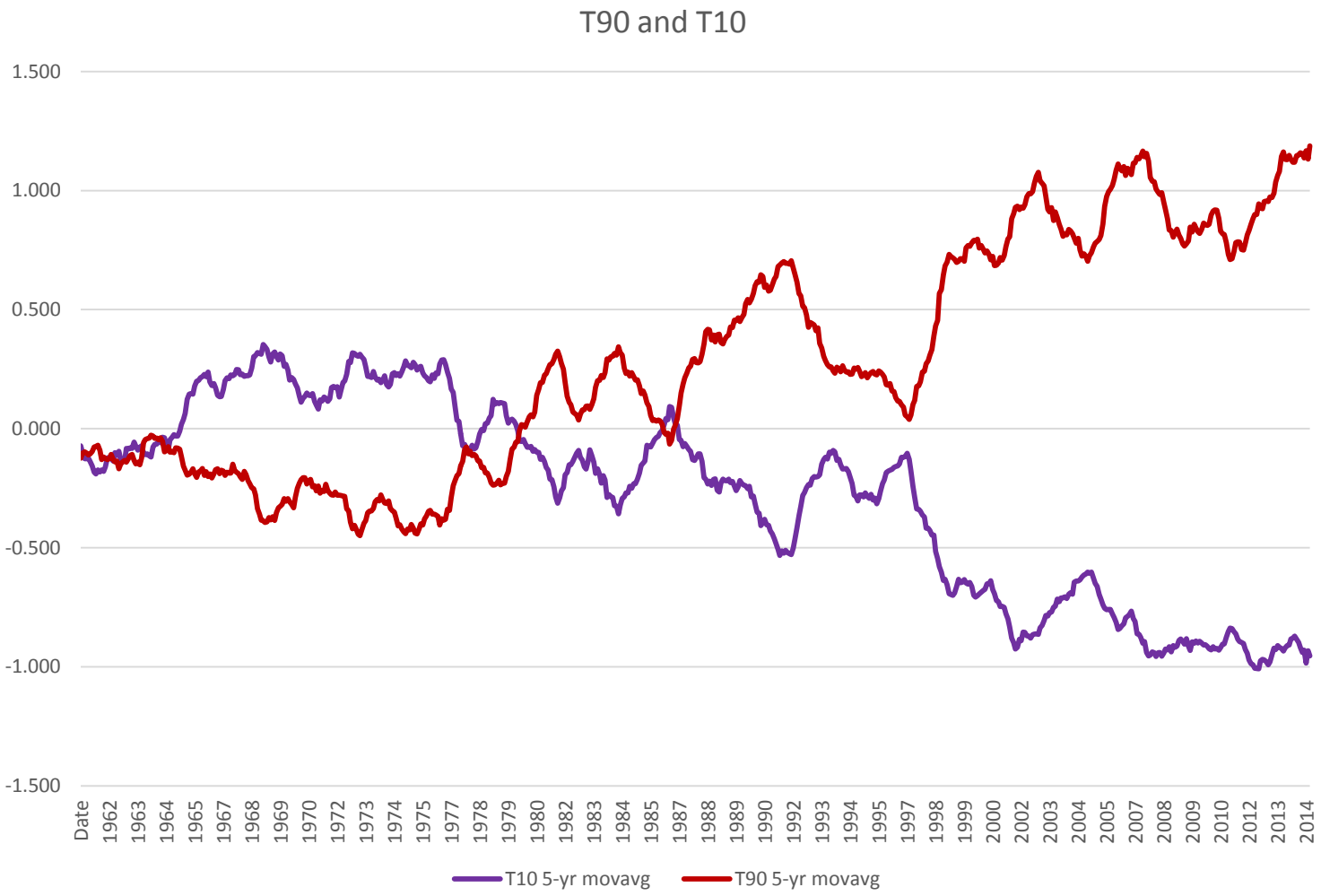
- TX90 = 90%ile warm days
- TN90 = 90%ile warm nights
- TX10 = 10%ile cold days
- TN10 = 10%ile cold nights

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

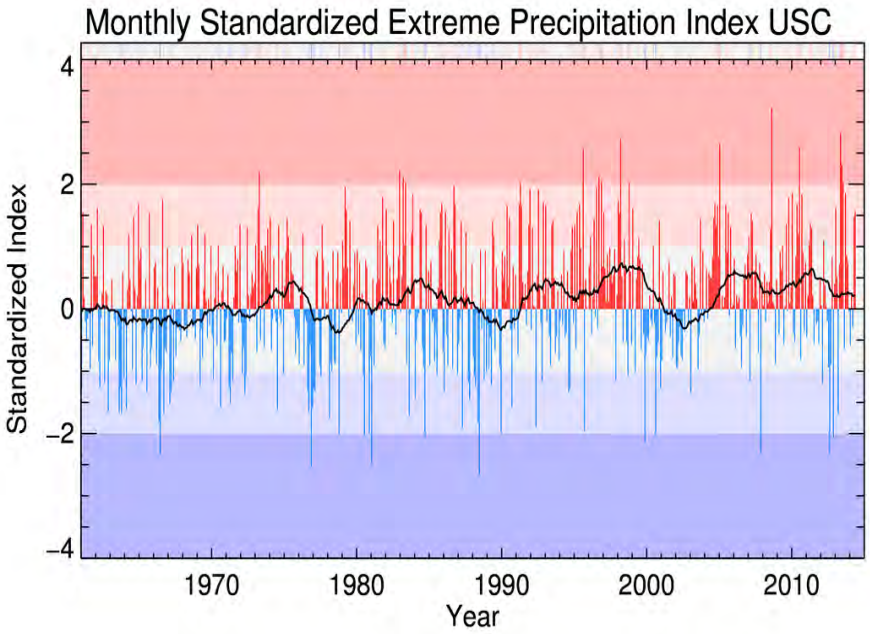
- Standardized anomaly : $T90' = \Delta T90 / \sigma_{ref}(T90)$

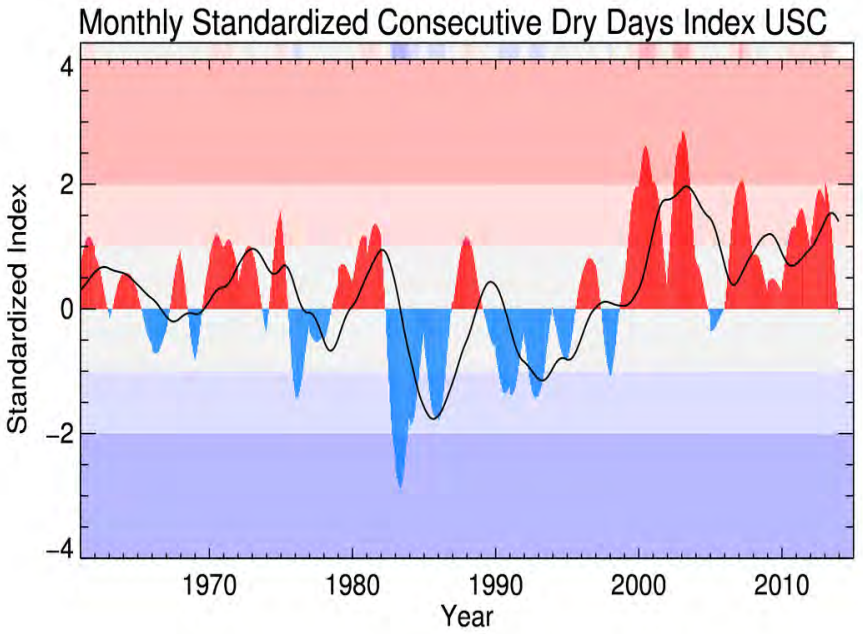
* Produced as part of the CLIMDEX project by the Climate Change Research Centre, at The University of New South Wales, Australia.

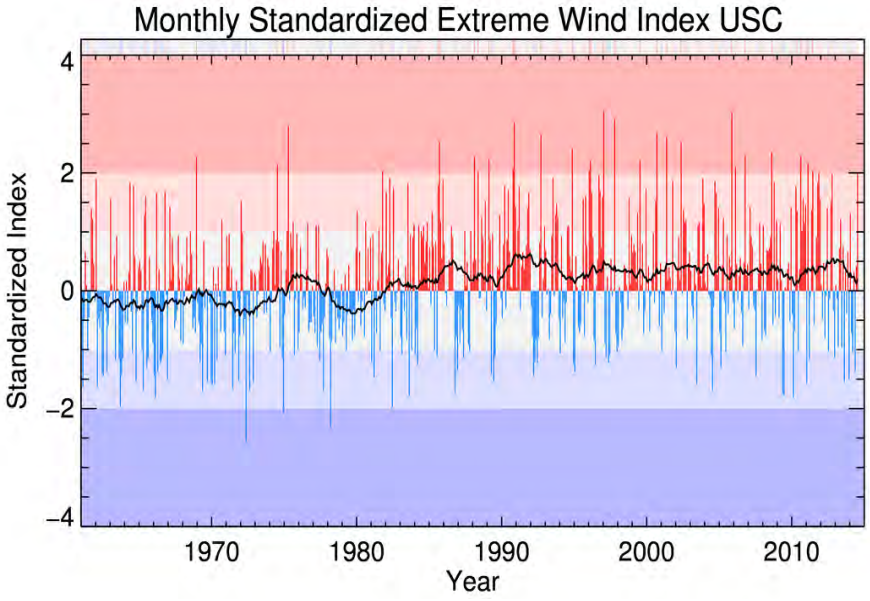
ACI T90 and T10, US and Canada

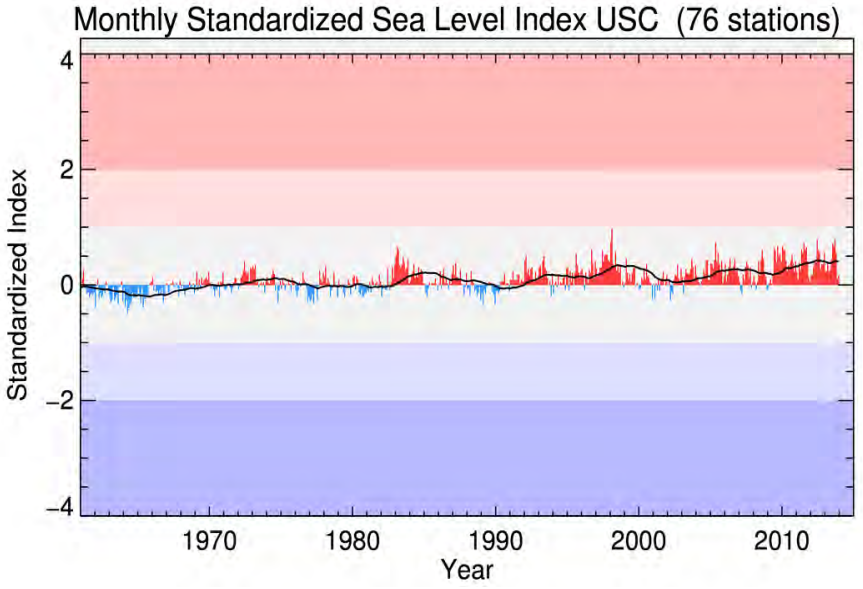


Other ACI Components

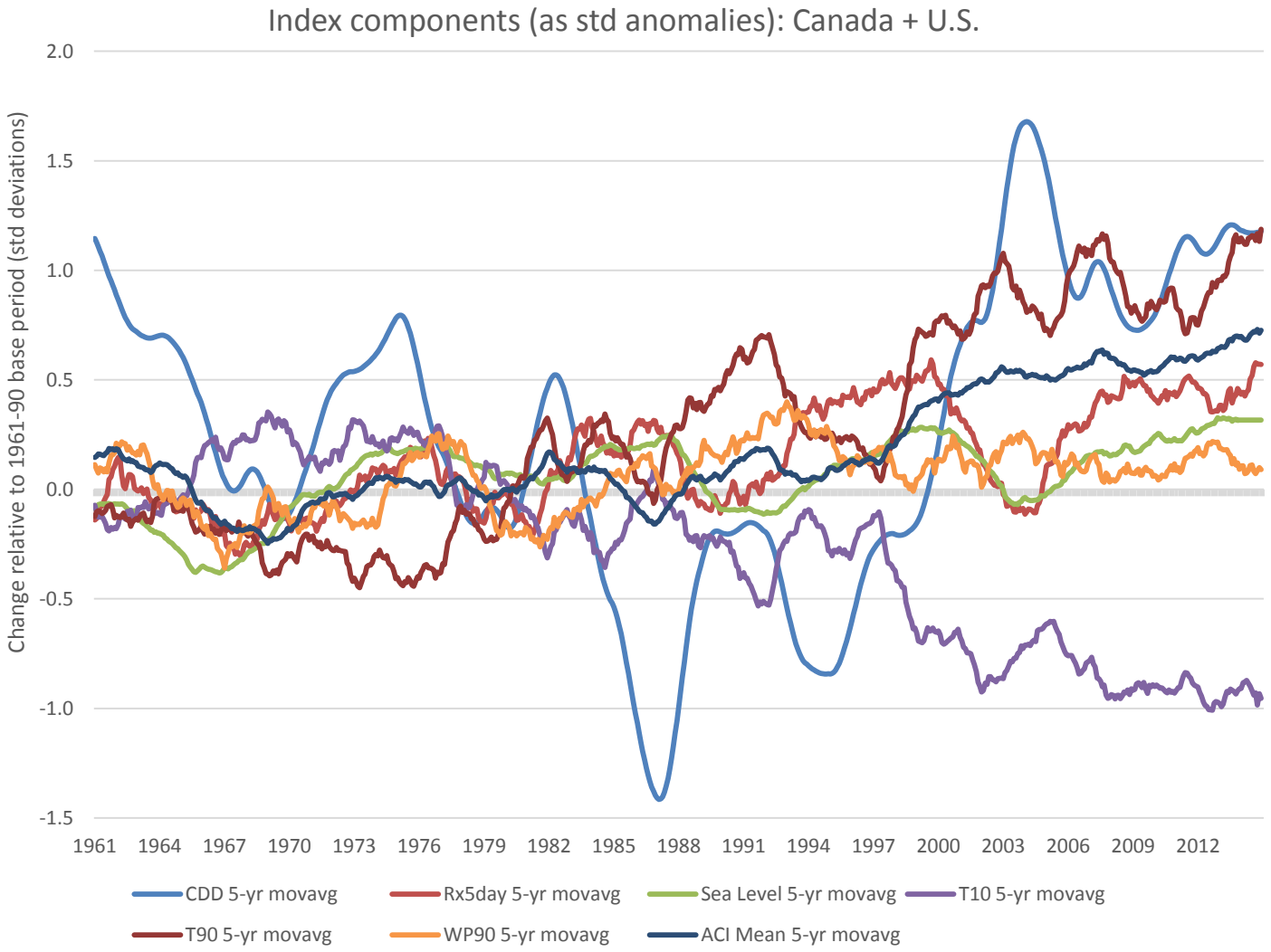








Standardized ACI, US and Canada

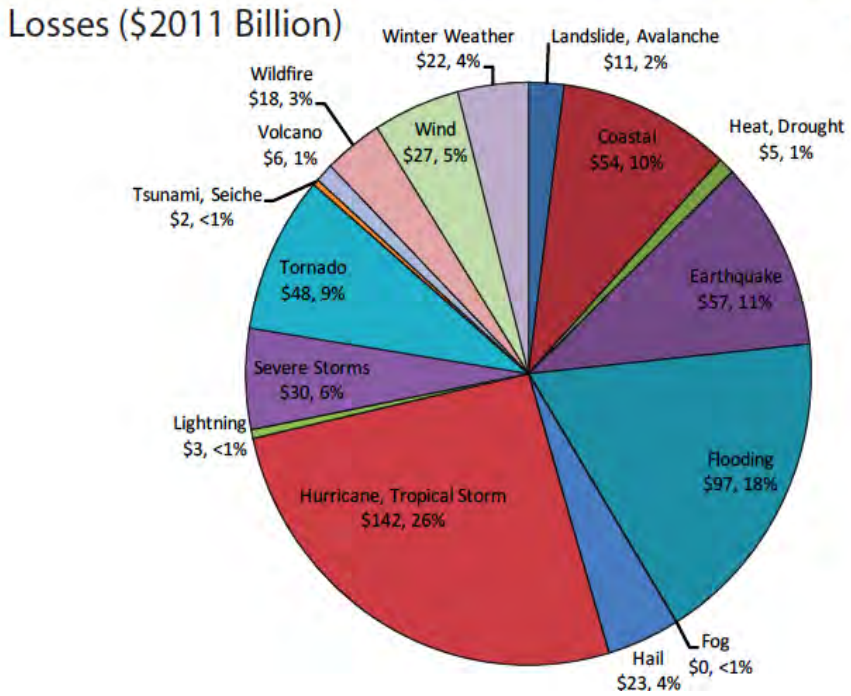


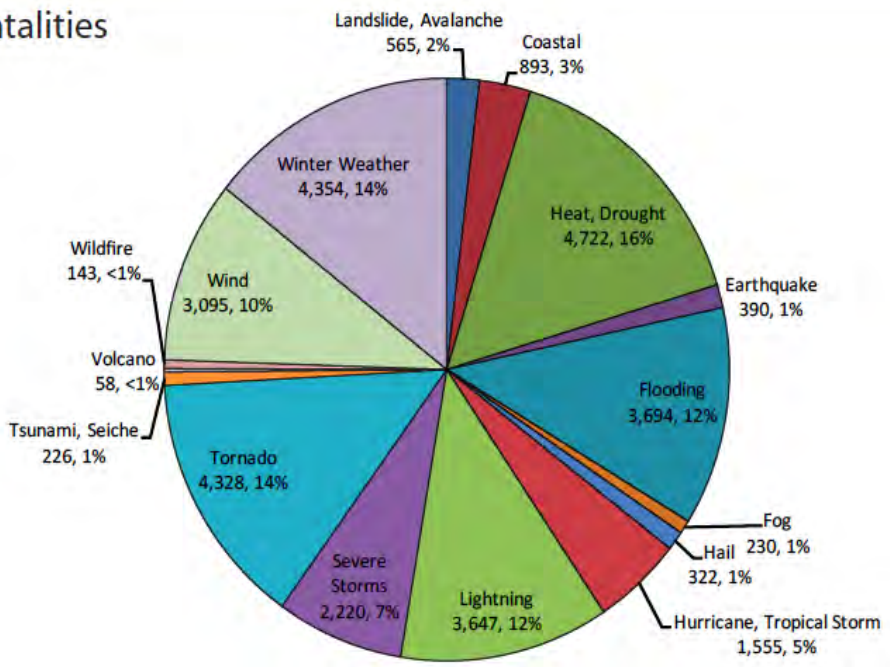
Actuaries Climate Risk Index

- 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



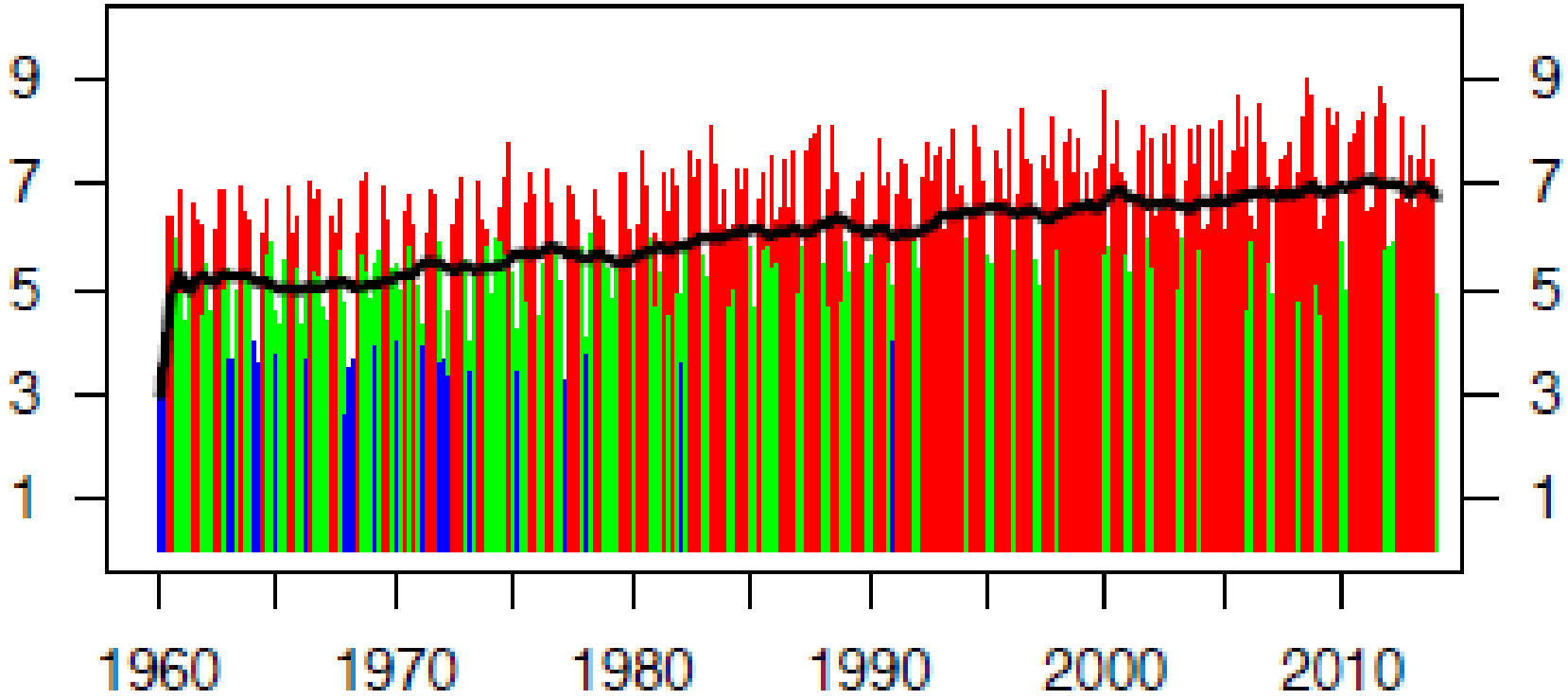


Source: http://hvri.geog.sc.edu/SHELDUS/docs/Summary_1960_2011.pdf

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