



# Insurance, Critical Data & Resilience

Attribution Science. Foreseeability of Loss,  
Adaptive Design & Cost Benefit Analysis

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# ATTRIBUTION SCIENCE

- ‘Probabilistic event attribution’ is the science of seeking to determine the extent to which anthropogenic climate change has altered the probability or intensity of a particular weather event or class of weather events, with an assignment of statistical confidence.

# Changes in attribution science: Design impacts

- **What's New ?** Changes in attribution science improve statistical certainty of the relationship between certain extreme weather events and other climate changes and anthropogenically sourced atmospheric greenhouse gas concentrations;
- **Sufficiency of 'certainty' for decision taking differs between science best practice and legal applications**
- **Impact:** change in scientific certainty impacts the negligence analysis in a court of law; the change may also impact other statutory liability
- **Practical Implications & Outcomes:**
  - Actions required to satisfy obligations of duty will change.
  - Retrospective analyses and assumptions that the past will predict the future may no longer meet the standard of care.

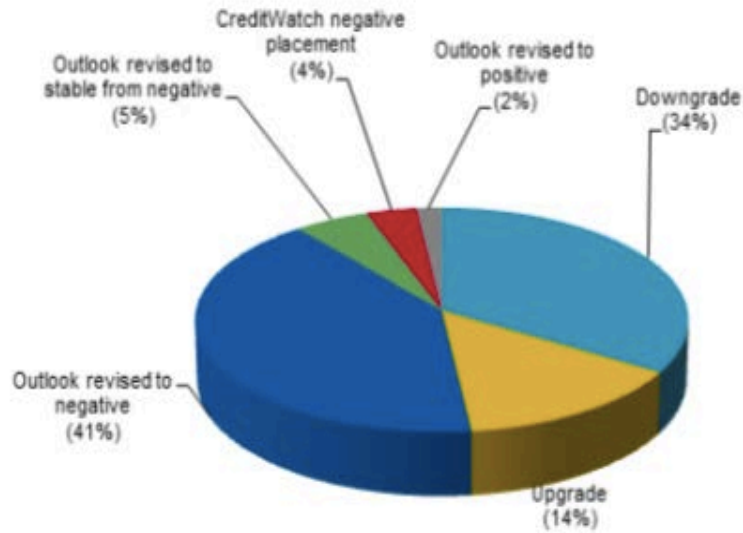


# Attribution science

- Why would '*attribution science*' matter to an insurer ?
  - Facility design criteria are applied in the context of required performance and reliability standards
  - Performance and reliability are affected by environmental conditions
    - Weather;
    - Extreme events; and
    - Changes over time
    - Climate change
  - Impacts design criteria !
  - Impacts Professional and Operator Duties
  - Impacts Government Duties

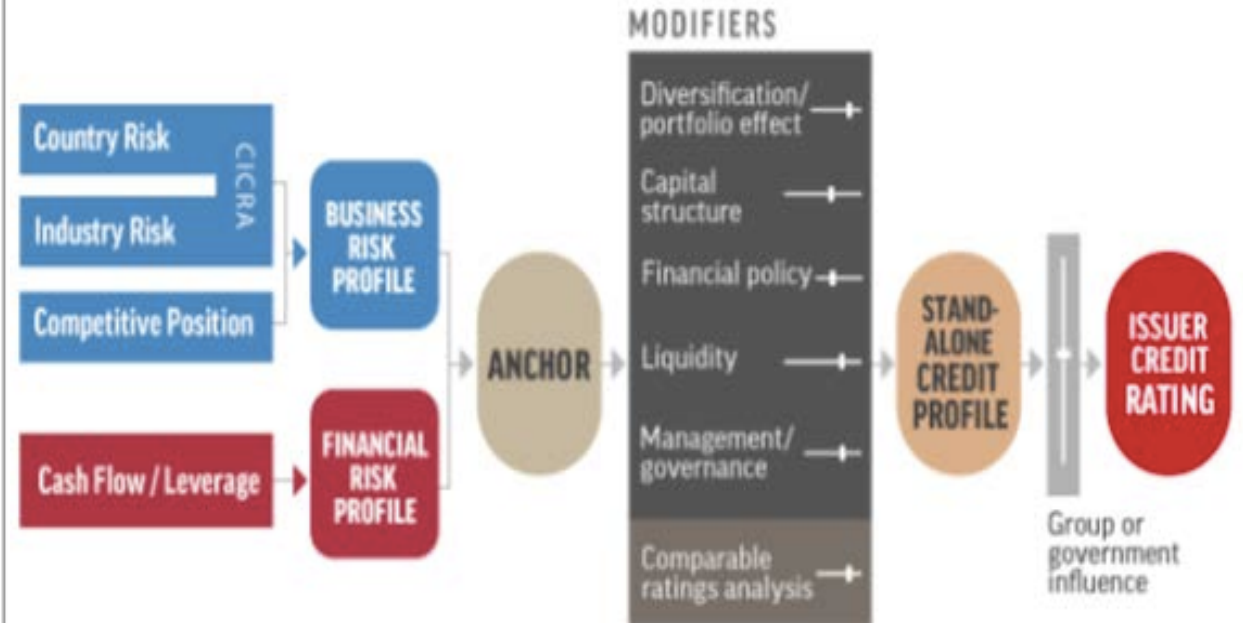
# Climate Change Tests Resilience Of Sovereign & Corporates' Creditworthiness

Rating Actions Related To E&C Risk



© Standard & Poor's 2015.

Corporate Criteria Framework





# Why Do Insurers Care ?

- Liability Exposure: historical analogy – RCRA, CERCLA, Asbestos, Pharmaceutical, etc.
- Common law Negligence
  - Duty
  - Breach
  - Causation
    - Cause in fact
    - Proximate cause
  - Damages



# Foreseeability

## Study of the impact of climate change on civil engineering standards:

- See work of Prof. Costa Samaras at <https://www.cmu.edu/cee/adaptation/>
- <https://www.cmu.edu/cee/prospective/graduate-degree/masters/ms-concentrations/climate-change-adaptation-for-infrastructure.html>

## American Society for Civil Engineers (ASCE)

- See <https://www.asce.org/climate-change/committee-on-adaptation-to-a-changing-climate/>

## American Institute for Chemical Engineers (AIChE) -

see <https://www.aiche.org/chenected/2017/11/paic-climate-task-force-attribution-observed-climate-change>



## Cost / benefit analysis

- Integration of attribution science forecasts;
- Increased expected physical forces over the useful life of the structure;
- Changes structural requirements to meet same performance / reliability criteria;
- Balance uncertainty of forecasts with risks –
- Adaptive Design ...

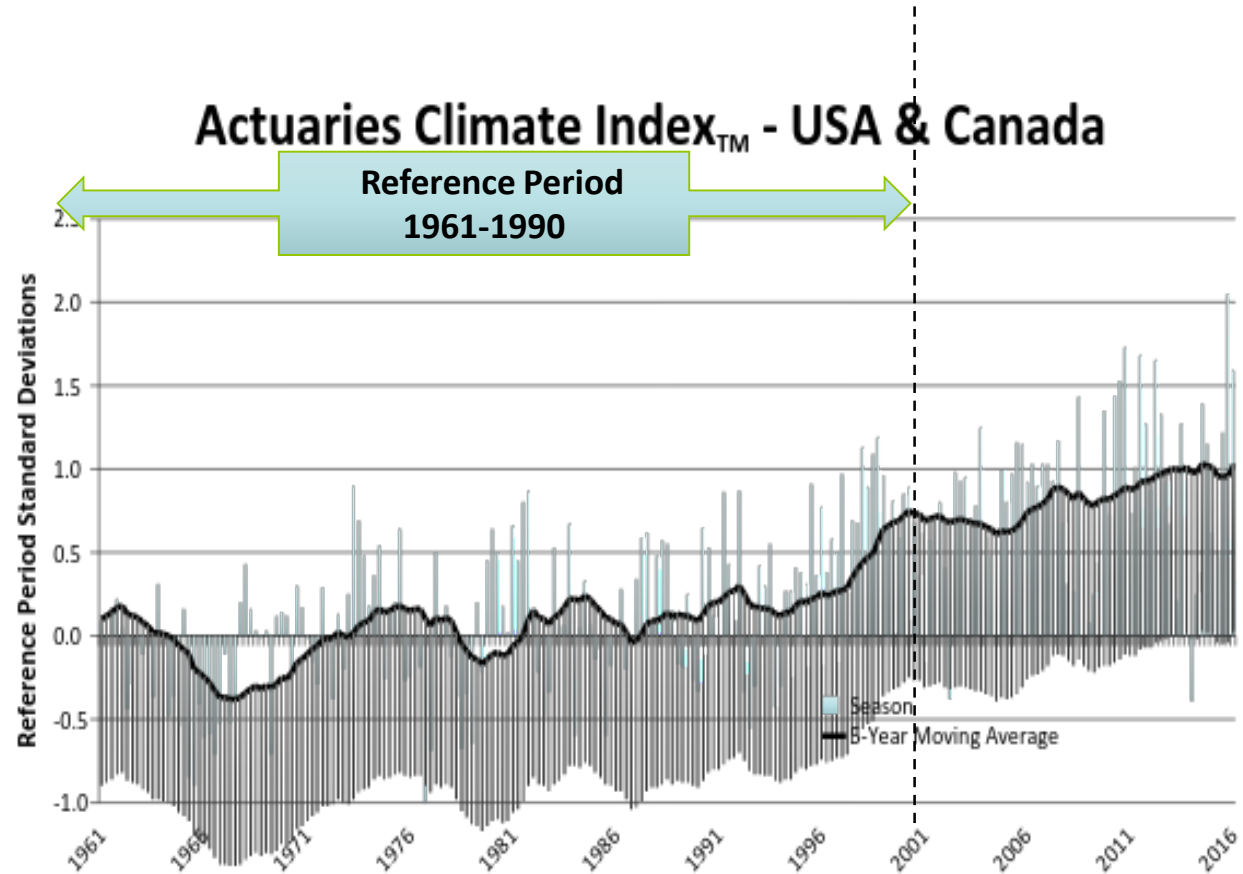




# Adaptation: how much?

- The magic question ... how much additional resilience is required to meet performance and reliability standards ?
- Cost benefit analyses must be modified to reflect science, including attribution science
- Must set outer bounds on statistical variability tolerance in engineering calculations basis
- Use ADAPATIVE DESIGN to 'manage' uncertainty in the future \*\*\*\*\*
- Basic design approach starts at the same place – but changes in science cause changes in design... analytic process is the same ... but inputs and outputs are different !

# The Actuarial Climate Index – A Great Start ... !





Attribution  
Science &  
Adaptive Design

*Real Data*  
*Real Decisions*  
*Real*  
*Resilience<sup>SM</sup>*