Climate Change: What does it mean for Actuaries?

23 November 2021

pwc

Agenda for Today's Discussion

- Climate change insurance regulatory considerations (including MAS overview) and stakeholder overview (e.g. investor preferences)
- Relevant climate change reporting standards, including TCFD
- The key climate change risks that insurers need to consider including physical and transition risks
- Climate change risk assessments and integration into risk management frameworks
- Climate change scenario testing - data, methodologies, cat model integration
- Net Zero in insurance - greenhouse gas quantification and business integration
- What does this mean for actuaries and what is our role?

Our Actuarial ESG team with you today

Steve Bochanski
Partner, Actuarial Services
PwC US
M: +1 610 633 5332
steve.bochanski@pwc.com

Graham Hall
Director, Actuarial Services
PwC US
M: +1 646 617 2453
graham.hall@pwc.com

Elise Chee
Director, Risk Assurance Sustainability Services
PwC Singapore
M: +65 9830 0157
elise.cy.chee@pwc.com

1

Climate change insurance regulatory considerations and stakeholder overview

What are the key drivers of insurers considering environmental risk?

Customers (Commercial Lines)

- Increasing demand for **environmentally-friendly insurance products, investments** and related disclosures, particularly from institutional clients
- Demand is **likely to grow across all insurance lines** (beyond catastrophe risk property coverages)

Customers (Personal Lines)

- **~73% of millennials are altering their buying habits** with the **environment** in mind[1]
- Customers will increasingly include **environmental risk** as a **consideration** when choosing an insurance company to buy protection from

Value chain partners

- Brokers and reinsurers will increasingly assess insurers' sustainability policies as part of **partnership due diligence checks**
- Insurers that do not respond to climate change adequately risk **narrower partnership opportunities** across the value chain

Internal drivers

- Corporate **vision**, **mission** and **values**
- Management **sustainability 'tone from the top'**
- **Proposition** and **business model** (e.g. environmental growth opportunities)

Employees

- 64% **of millennials consider sustainability** when deciding where to work[2]
- Research shows that **employee satisfaction** drives **higher productivity** and is positively correlated with **company performance**

Regulators and Rating Agencies

- Regulators are requiring that insurers embed **climate-related risks** within risk management framework (e.g. MAS Environmental Risk Guidelines)
- Rating agencies are starting to include **sustainability considerations** in their frameworks
- Increasingly stringent requirements from SGX on sustainability reporting with mandatory TCFD disclosures and assurance

Investors

- Institutional investors are **putting pressure on companies to act on climate change** - Blackrock, Vanguard and State Street are leaders in this space
- Companies that do not meet standards risk **potential reputational** impacts, which may increase in frequency and severity

Government's sustainability focus gives impetus to green finance development

Oct 2015
ABS release Guidelines of Responsible Financing Practices

Jan 2016
SGX introduced sustainability reporting on a 'comply or explain' basis

Jun 2017
MAS launches Green Bond Grant Scheme

Feb 2020
MAS updates Green Bond Grant Scheme to Sustainable Bond Grant Scheme

Nov 2020
MAS announces Green Finance Action Plan and US$2b public sector green investments programme (GIP)

Aug 2020
Consultation paper on Environmental Risk Management for Financial Institutions ("FIs")

Nov 2020
MAS launches Green and Sustainability-Linked Loan Grant Scheme and updates Sustainable Bond Grant Scheme to include Sustainability-Linked Bonds

Dec 2020
Finalised Guidelines on Environmental Risk Management for Financial Institutions (Insurers, Banks and Asset Managers)

Jan 2021
Proposed taxonomy and Environmental Risk Management ("ENRM") Handbook

Feb 2021
Announcement of the Singapore Green Plan 2030 - to achieve its long-term net-zero emissions goal

Aug 2021
SGX released two consultation papers on enhancing sustainability reporting.

Aug 2021
Announcement of Climate Impact X – voluntary carbon credits market led by DBS, SCB, Temasek, and SGX

Aug 2021
National Environment Agency (NEA) set up $3b multicurrency medium term note (MTN) and green bond framework

Sep 2021
Lawrence Wong, Minister for Finance, announced review of carbon tax in future budgets

Recent ESG and Climate regulatory updates in Singapore

SGX Sustainability Reporting and Upcoming TCFD disclosures	MAS Env Risk Management Guidelines	Carbon Tax	Green procurement policies	TCFD ISSB	Temasek Linked Entities	Decarbonisation generally
• Comply or explain for SGX listed companies Coming up: • TCFD (climate risk disclosures) will be mandatory • Internal audit/pre-assurance ahead of mandatory external assurance	• Mandatory Environmental Risk Management for all FIs. This includes banks, insurers, Asset Management, REITS	• S$5/CO2 Tonne for large emitters • Expected to increase to S$15/CO2 tonne • Review of current carbon tax prices	• Gov will revise their procurement policies to include a requirement to assess if the vendor is "green".	• TCFD widely adopted as the best framework for climate risk • IFRS has established the International Sustainability Standards Board (ISSB) in November 2021.	• Temasek will halve their portfolio emissions by 2030 and Carbon Neutral by 2050 • Subsidiaries need to decarbonise	• General trends for serious companies to decarbonise

MAS Environmental Risk Guidelines - requirements for insurers

Governance and strategy

- Roles and responsibilities to be clearly set out for the Board and Senior Management, including approval of environmental risk management framework.
- Incorporate environmental considerations into risk appetite, strategies, business plans and product offerings

Risk management

- Identify, manage and monitor environmental risk, including monitoring of customer's risk.
- Scenario analysis and stress tests to be undertaken accordingly.
- Interdependencies between risks
- Capacity building

Underwriting

- Integrating and embedding environmental issues within underwriting policies, with increased due diligence for transactions with higher environmental risk.
- Measuring and monitoring underwriting exposures both quantitative and qualitative

Investment

- Identify, monitor, assess and manage potential and actual impact of environmental risk on investment portfolio and help shape corporate behaviour of investee companies.
- Scenario analysis and stress tests to be undertaken accordingly.

Disclosure

- Disclose, on an annual basis, the approach to managing environmental risk, including quantitative metrics.
- Reference to be taken from international reporting frameworks, e.g. TCFD

Applicable to:

All insurers, including insurers carrying on business in Singapore under a foreign insurer scheme

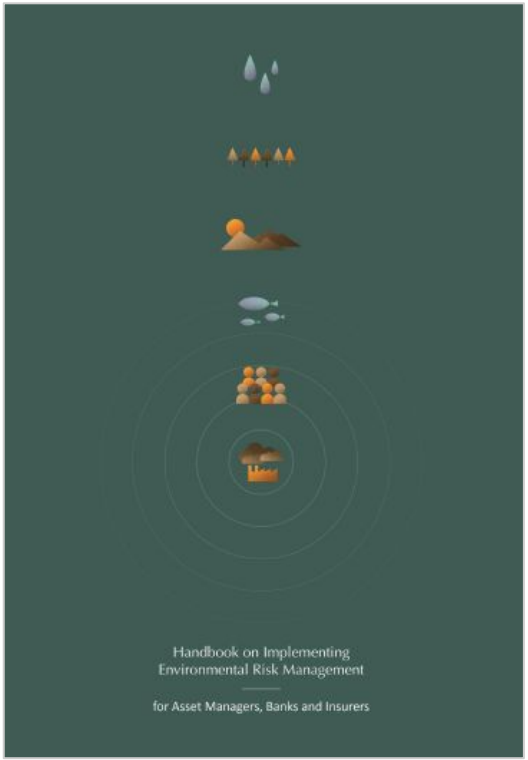
Relevant activities:

Insurers' underwriting and investment activities, and other activities that expose insurers to material environmental risk

Transition and timeline:

Insurers have 18 months to implement from Dec 2020.

MAS' handbook on implementing environmental risk management ("ENRM")



(Issued 28 January 2021 by MAS)

- **Produced as a useful reference, in line with the ENRM guidelines**
- **Supports compliance with TCFD disclosure requirements**
- **Best practices included**
- **Core chapters**

-Scope: Environmental risks, physical and transitional risks, types of risks

-Governance and strategy: Education, board consideration, board approval, senior management assessment, integrating into committee agendas

-Risk management: Policies, procedures and risk appetite, risk identification and assessment, underwriting, monitoring, scenario analysis and stress testing

-(TFCD) Disclosures: Governance, strategy, metrics and targets

Follow on from COP 26 : Expect increased focus on ESG reporting with IFRS' formation of the International Sustainability Standards Board ('ISSB')

Reporting landscape fragmented and seen as an 'alphabet soup' of choice …

Standards

CDP
CDSB Climate Disclosure Standards Board
GRI
SASB
INTEGRATED REPORTING IR

Ratings

World Benchmarking Alliance
Calvert
REFINITIV
RepRisk
S&P Dow Jone Indices
Alliance for Corporate Transparency
SUSTAINALYTICS
GGEI
FTSE Russell
MSCI
CSRHUB
MORNINGSTAR
SOCIAL VALUE INTERNATIONAL
GRESB
PI Environmental Performance Index
ISS
Bloomberg
GLOBAL100

Principles and Guidelines

PRI Principles for Responsible Investment — An investor initiative in partnership with UNEP Finance Initiative and UN Global Compact
UNEP FINANCE INITIATIVE
PSI Principles for Sustainable Insurance
UNEP FINANCE INITIATIVE PRINCIPLES FOR RESPONSIBLE BANKING
Sustainable Stock Exchanges SSE Initiative

IFRS responded to the call for globalisation of sustainability standards …

Announced the consolidation of bodies and creation of new international standards setter :

CDSB Climate Disclosure Standards Board
VALUE REPORTING FOUNDATION

ISSB

Published two prototypes:

1. Climate related disclosures
2. General sustainability disclosure requirements

Why is this important? What does this mean for you?

- Global standards set the foundation for comparable and transparent ESG reporting.
- Recognised framework assists investors to make better informed decisions and close the gap on disclosure demands from stakeholders.
- Prototypes means the Board is on track for first climate standard in 2022.

What can happen next? What should you do?

- Review impact of climate risk and commitments at next reporting cycle.
- Continue to improve quality of climate disclosures.
- Going forward, auditors would be assessing risk of material misstatements in financial statements caused by climate related impact.

What is the TCFD?

The Task Force on Climate-related Financial Disclosures (TCFD) issued guidance for climate risk disclosure for all sectors, and specific recommendations for certain sectors (not applicable to Telecommunications)

01
Insufficient disclosure

The TCFD is an advisory body set up by the G20 to address concerns around insufficient disclosure of climate-related risks and opportunities for businesses.

02
Led by industry leaders

The TCFD is chaired by Michael Bloomberg and consists of 32 industry leaders, including representatives from Blackrock and Unilever

03
Informed investment decisions

The TCFD recommendations aim to enable better understanding of exposures to climate risks and opportunities.

04
Progress

The Task Force released a monitoring report in in 2020, highlighting the progress made in companies' climate risk disclosure over the past year. In 2021 the TCFD issued proposed guidance on climate-related metrics, targets, and transition plans. An additional report specific to the insurance industry, "Insuring the Climate Transition", was issued in January 2021.

While the guidelines are still relatively new, TCFD has quickly become the industry standard for how companies should orient around climate risk, and how they should disclose on it publicly

Nearly 2,600 organizations have announced support for the guidelines, including global financial firms responsible for assets in excess of $150 trillion

TCFD has four disclosure components

The organization's **governance** around climate-related risks and opportunities

The actual and potential impacts of climate-related risks and opportunities on the organization's businesses, **strategy**, and financial planning where such information is material

The structures and processes used by the organization to identify, assess, and manage **climate-related risks**

The **metrics and targets** used to assess and manage relevant climate-related risks and opportunities where such information is material

Overview of sought disclosures

Disclosures are generally qualitative information (narrative) with supporting quantitative information, i.e., scenario analysis results and in the Metrics & Targets section)

Governance

Disclose the organization's governance around climate-related risks and opportunities.

Recommended disclosures

- Describe the **board's oversight** of climate-related risks and opportunities.
- Describe **management's role** in assessing and managing climate-related risks and opportunities.

Strategy

Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.

Recommended disclosures

- Describe the **climate-related risks and opportunities** the organization has identified over the **short, medium, and long term.**
- Describe the **impact** of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning.
- Describe the **resilience** of the organization's strategy, taking into consideration different **climate-related scenarios, including a 2°C or lower scenario.**

Overview of sought disclosures (continued)

Disclosures are generally qualitative information (narrative) with supporting quantitative information, i.e., scenario analysis results and in the Metrics & Targets section)

Risk management

Disclose how the organization identifies, assesses, and manages climate-related risks.

Recommended disclosures

- Describe the organization's processes for **identifying and assessing** climate-related risks.
- Describe the organization's processes for **managing** climate-related risks.
- Describe how processes for identifying, assessing, and managing climate-related risks are **integrated into the organization's overall risk management.**

Metrics and targets

Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

Recommended disclosures

- Disclose the **metrics** used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process.
- Disclose **Scope 1, Scope 2**, and, if appropriate, **Scope 3** greenhouse gas (GHG) emissions, and the related risks.
- Describe the **targets used by the organization to manage** climate-related risks and opportunities and performance against targets.

2

Climate change risk assessments and integration into risk management frameworks

Climate risks and opportunities

Climate changes risks and opportunities are typically considered across the following categories:

Transition risks as a result of transition to a low carbon economy

Policy and legal
- Increased carbon policy/pricing of GHG emissions
- Enhanced emissions-reporting obligations
- Mandates on and regulation of existing products and services
- Exposure to litigation

Technology
- Substitution of existing products and services with lower emissions options
- Unsuccessful investment in new technologies
- Costs to transition to lower emissions technology

Market
- Changing customer behavior
- Uncertainty in market signals Increased cost of raw materials

Reputation
- Shifts in consumer preferences
- Stigmatization of sector
- Increased stakeholder concern or negative stakeholder feedback

Physical risks resulting from changes in the climate

Acute
- Increased severity of extreme weather events, e.g.
  - Floods
  - Wind storm
  - Storms and cyclones
  - Wildfire
  - Storm surge
  - Hail

Chronic
- Changes in precipitation patterns
- Changes in extreme variability in weather patterns
- Rising mean temperatures
- Rising sea levels

Opportunities

Resource efficiency
- More efficient resource use
- Move to more efficient buildings and modes of transport

Energy source
- Use of lower emission energy sources
- Use of supportive policy structures
- Use of new technologies
- Participation in carbon markets

Products and services
- Development/expansion of low emission goods and services
- Climate adaptation and insurance risk services

Markets
- Access to new markets
- Use of public sector incentives

Resilience
- Resource substitution/diversification
- Renewable energy programs, efficiency initiatives

General industry approach to climate change risk management and scenario testing

Risk assessment

In the marketplace, we observe insurers conducting a **comprehensive risk assessment** of the risks to its business from climate change. This typically covers both transition risks and physical risks. Such a risk assessment may include:

a. High/Medium/Low assessment of the business across risks types, investments, products and key assumptions

b. Isolating the top 5 risks to the business and measuring their impact accordingly

This risk assessment is used to inform the scenario testing exercise.

Scenario testing

Insurers may perform scenario testing exercises after completion of the risk assessment; these typically focus on three specific areas of an insurer's business:

1. **Asset portfolio**
   – Calculate the impact of climate change on the investments held under different climate change scenarios and time horizons
2. **Underwriting portfolio**
   – Stress the key assumptions and processes used to understand and manage accumulations and exposure
3. **Operational impact**
   – Assess the operational impact of extreme/intensifying weather events on corporate locations and employee homes

Where possible, companies may seek to **leverage existing scenario testing framework** to streamline this process.

Business integration

Insurers may assess how the results of the risk assessment and scenario testing exercise integrate into the business, specifically considering:

a. Governance framework

b. Risk management processes

c. Business strategy

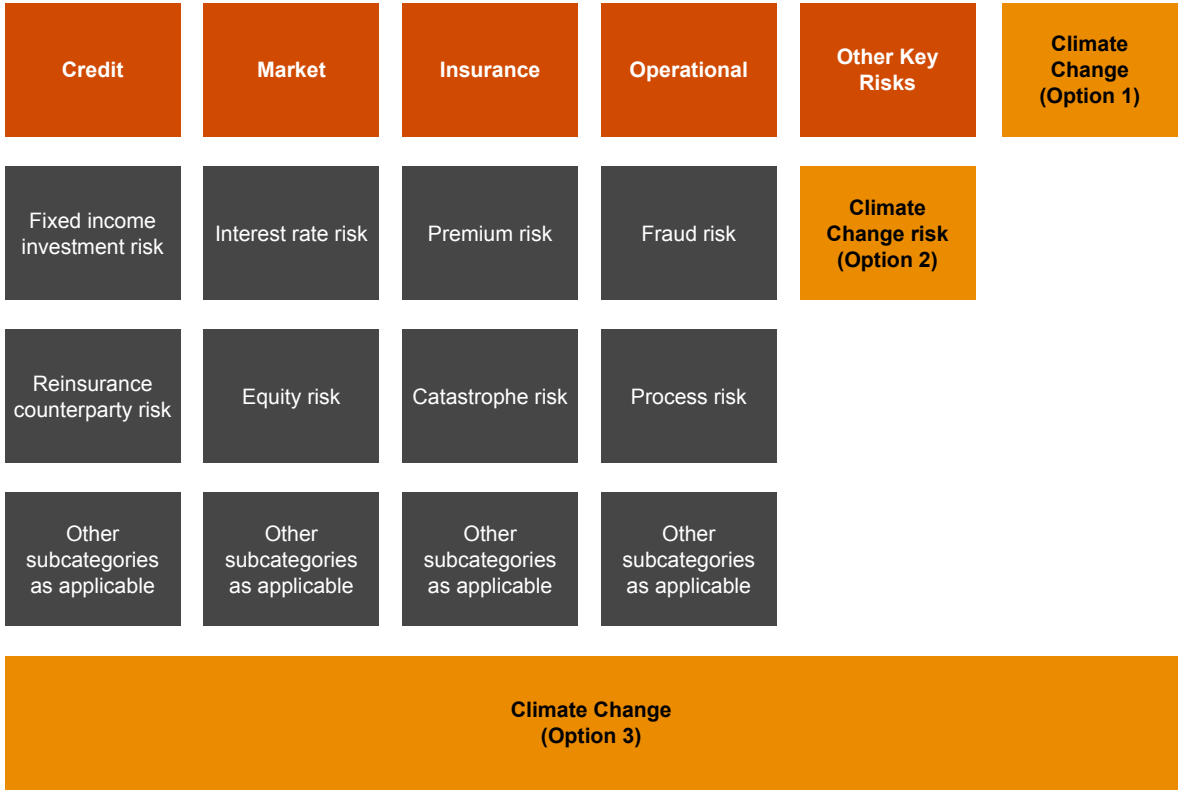
d. Integration into ESG or other disclosures

Ways to implement the risks of climate change into ERM framework

Option 1: Recognize climate change risk is a key risk similar to insurance, market and credit risks

Option 2: Recognize climate change could fit into a company's risk management framework as a new sub-risk category under an existing key risk category

Option 3: Recognize climate change affects financial risks as well as non financial risks such as operational risk



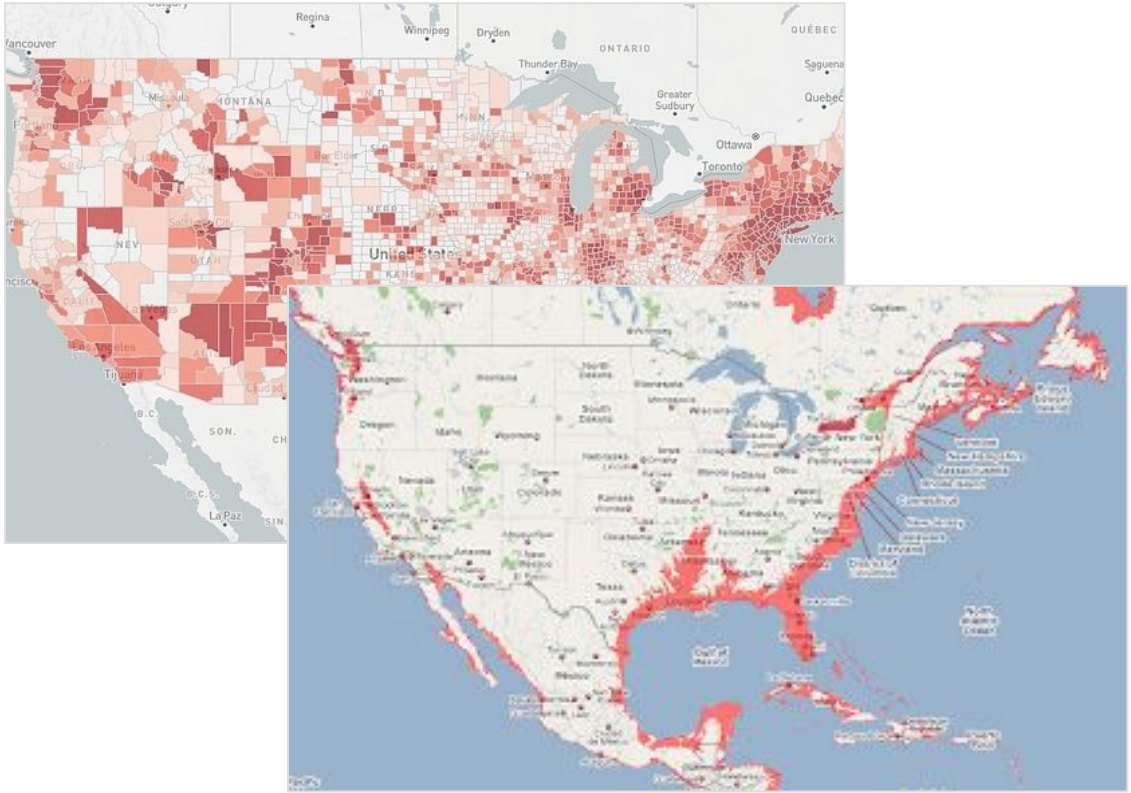
3

Climate change scenario testing & CAT model adaptations

Key considerations for the integration of climate change into underwriting operations and scenario testing

Companies should consider the following questions:

- How do I expect climate change to **affect my key risk metrics in different locations** and what calculation mechanism should I use to assess this?
- What would my **current exposures look like when adjusted** to take into account the effect of climate change in a 2C or 4C global warming scenario at different time horizons?
- How should I **adjust my underwriting/ pricing today** to allow me to transition to my target portfolio incorporating climate change factors?
- How should I incorporate expected climate related change into my **reinsurance strategy** and reinsurance credit risk analysis?



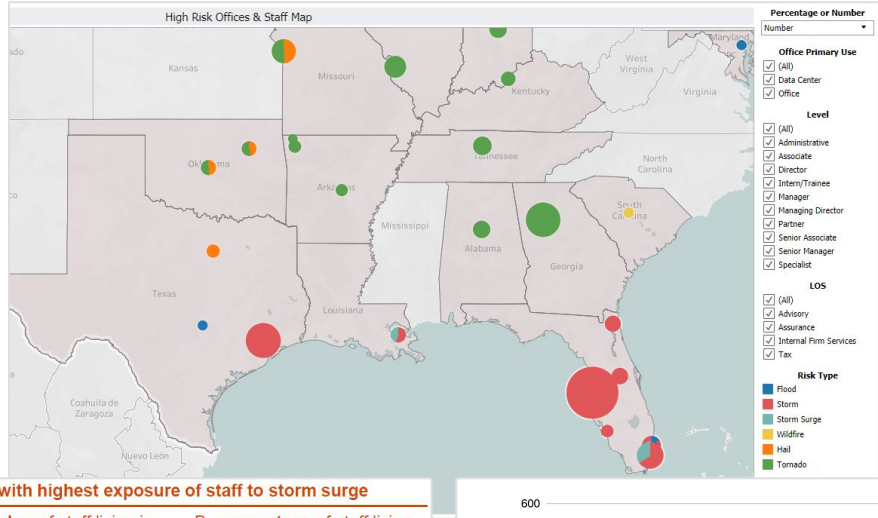
Operational stress testing approach

Our recommended operational stress testing approach

1. Use peril risk scoring datasets to assess **office locations** at High/Medium/Low risk of different perils
2. Use peril risk scoring datasets to calculate the **number of employees** at High/Medium/Low risk of different perils within each US zip code
3. Using climate change data trend forward these risk scores to **understand how risk levels change** under different time horizons and climate change scenarios
4. Reassess **operational resiliency and business continuity plans** under different climate scenarios

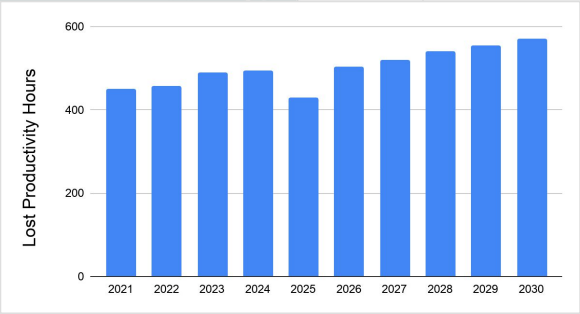
Flood **Storm** **Storm Surge**

Tornado **Wildfire** **Hail**



Cities with highest exposure of staff to storm surge

By **number** of staff living in high risk locations		By **percentage** of staff living in high risk locations	
1. Tampa, FL	238	1. Miami, FL	70%
2. Miami, FL	191	2. St Petersburg, FL	50%
3. Jersey City, NJ	172	3. Hoboken, NJ	50%
4. New York City, NY	141	4. Jersey City, NJ	39%
5. St Petersburg, FL	120	5. Brandon, FL	29%



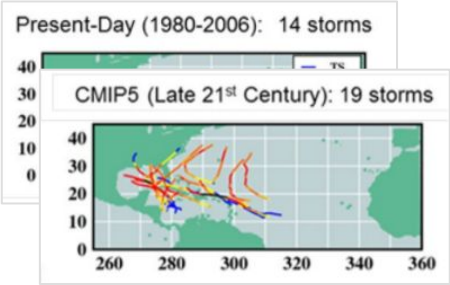
Physical risk example: Deep dive on changes to hurricane manifestations due to climate change

- Catastrophe models used by most insurers today are calibrated to generate losses expected over a 1-5 year time horizon (depending on the model/peril) and do not allow for the effect of climate change on the frequency and severity of weather events
- Hurricanes are subject to three primary climate change related influences:
  1. Warmer sea surface temperatures could intensify tropical storm wind speeds, potentially delivering more damage if they make landfall. This could result in more category 4 and 5 landfalling storms,
     and lead to hurricane windspeeds increasing by up to 10%.
  2. Sea level rise is likely to make future coastal storms more damaging, as storm surge events occur more frequently as hurricanes push sea water inland.
  3. Hurricane are expected to track north more frequently due to expanding tropics because of higher global average temperatures.

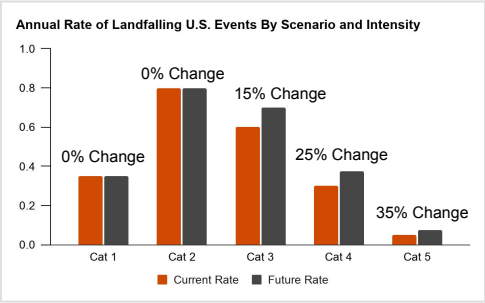
How can the results of catastrophe models be adjusted to allow for climate change impacts: “Bottom up adjustment” (1 of 2)

AIR has used a subsampling method to adjust the frequency of landfalling **hurricanes** and create a new collection of simulated hurricane seasons to reflect a future climate.

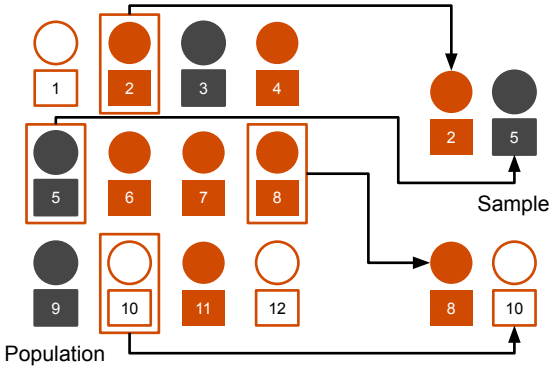
1 Analyze literature to understand climate impacts on frequency and severity of landfalling events under different climate scenarios



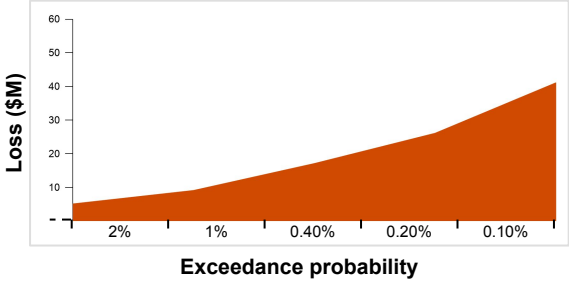
2 Use literature review to create landfalling event frequency targets



3 Subsample by extracting seasons from the existing catalog that are likely to occur in a warmer climate, to hit landfalling frequency targets



4 Recalculate aggregate loss statistics using pre simulated parent loss catalogue

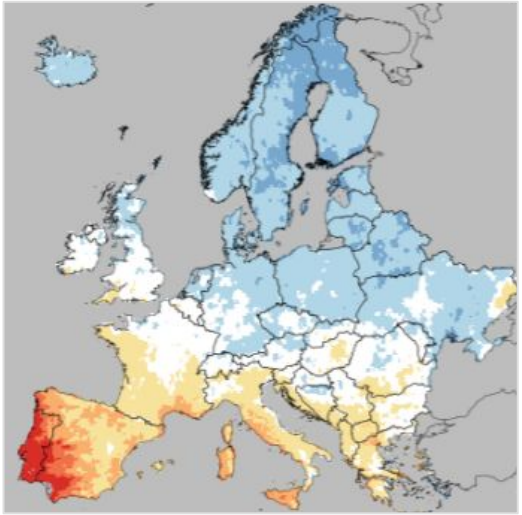


Lead to an aggregate increase in modeled losses by 20% by 2050

How can the results of catastrophe models be adjusted to allow for climate change impacts: “Bottom up adjustment” (2 of 2)

RMS reweights the simulated years in its Year Loss Table (“YLT”) for **European Flood** based on the seasonal change in the 95th percentile of daily maximum precipitation under climate change scenarios

1 Derive projections of changes in the annual seasonal 95th percentiles of daily maximum precipitation under different climate scenarios and time horizons



2 Reweight the years in the YLT such that the projected future distribution of precipitation for the scenario is suitably matched by the modeled distribution across the corresponding reweighted set of simulated years

Event ID	Rate	Mean	Sdi	Sdc	Exposure
1	.10	500	500	500	10,000
2	.10	300	400	800	5,000
3	.50	200	300	400	4,000

3 Recalculate aggregate loss statistics using pre simulated parent loss catalogue

	2050		2090	
	AAL	RP 200	AAL	RP 200
Lower Bound (RCP2.6)	+34%	+31%	+33%	+31%
Upper Bound (RCP8.5)	+75%	+66%	+264%	+161%

How can the results of catastrophe models be adjusted to allow for climate change impacts: “Top down adjustment”

UNEP FI calculates scaling factors based on available scientific data to scale the AEP curve at different return periods

Projected wind speed change for lower, middle and upper percentiles (%)

Power-law relationship between wind speed and economic loss (indicated by “value of a” showing the strength in relationship)

Projected tropical cyclone frequency change for lower, middle and upper percentile (%)

Scaling factors based on change in wind speed related damage due to climate change/climate change and socio-economic change

(Ratio)

Loss amount from current AEP curve at different return periods

(Financial impact)

Future loss amount due to change tropical cyclone frequency and intensity

(Financial impact)

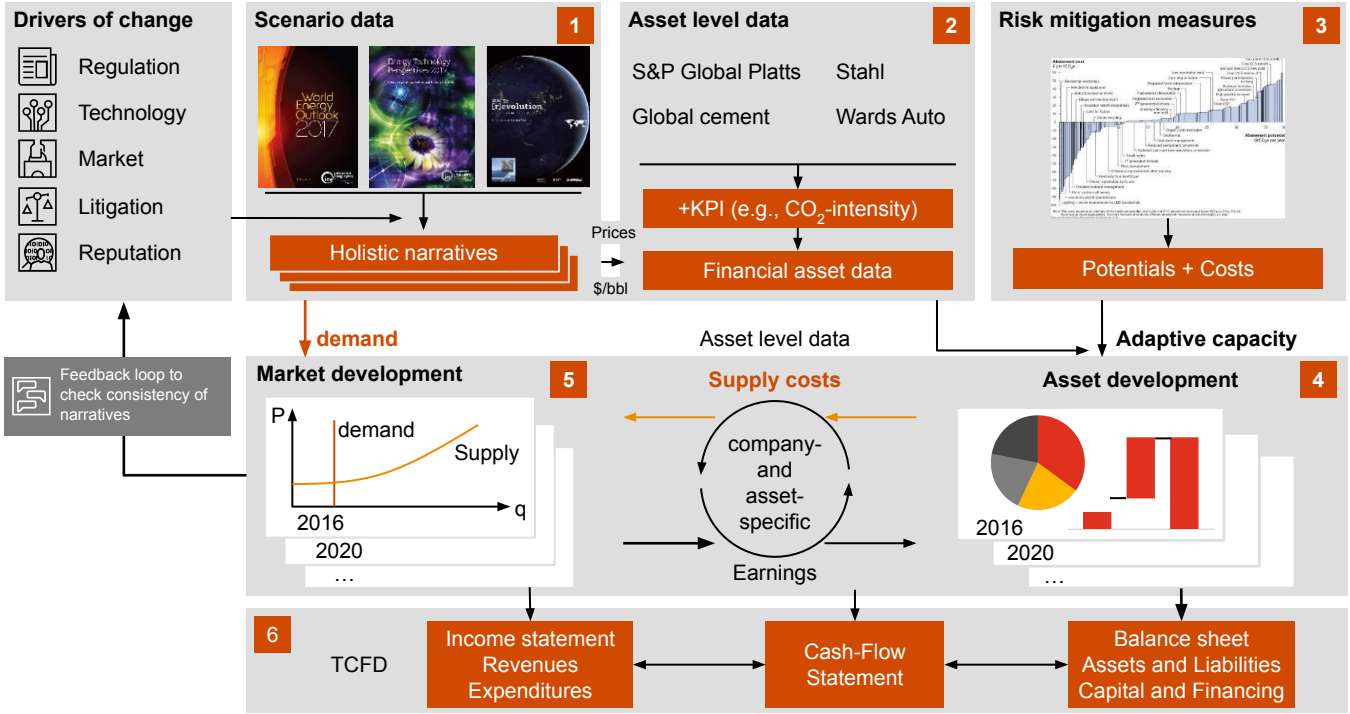
Key:

Climate data input	**Insurance data input**	Analysis and output

Diagram shows illustrative calculation logic based on frequency/intensity only, for tropical cyclones

Asset portfolio/climate change transition risk modeling approach

Example bottom-up model quantifies financial implication from climate scenarios:



1. Derive the **key risk drivers** to translate a scenario into a narrative. **Extend scenario data** with country-level and market-data information.
2. Build an **asset-level database** with financial information on individual technologies.
3. Conduct a techno-economic assessment of **risk mitigation measures** (“adaptive capacity) e.g., battery electric vehicles
4. Assumptions about **companies’ portfolio development** with and without adaptive capacities under different scenarios.
5. Calculate **financial performance** of individual assets in market models in consideration of global competitiveness.
6. Calculate **financial impacts** on company.

Thank you

pwc.com