

Climate Change Risk

Ash Ruparelia

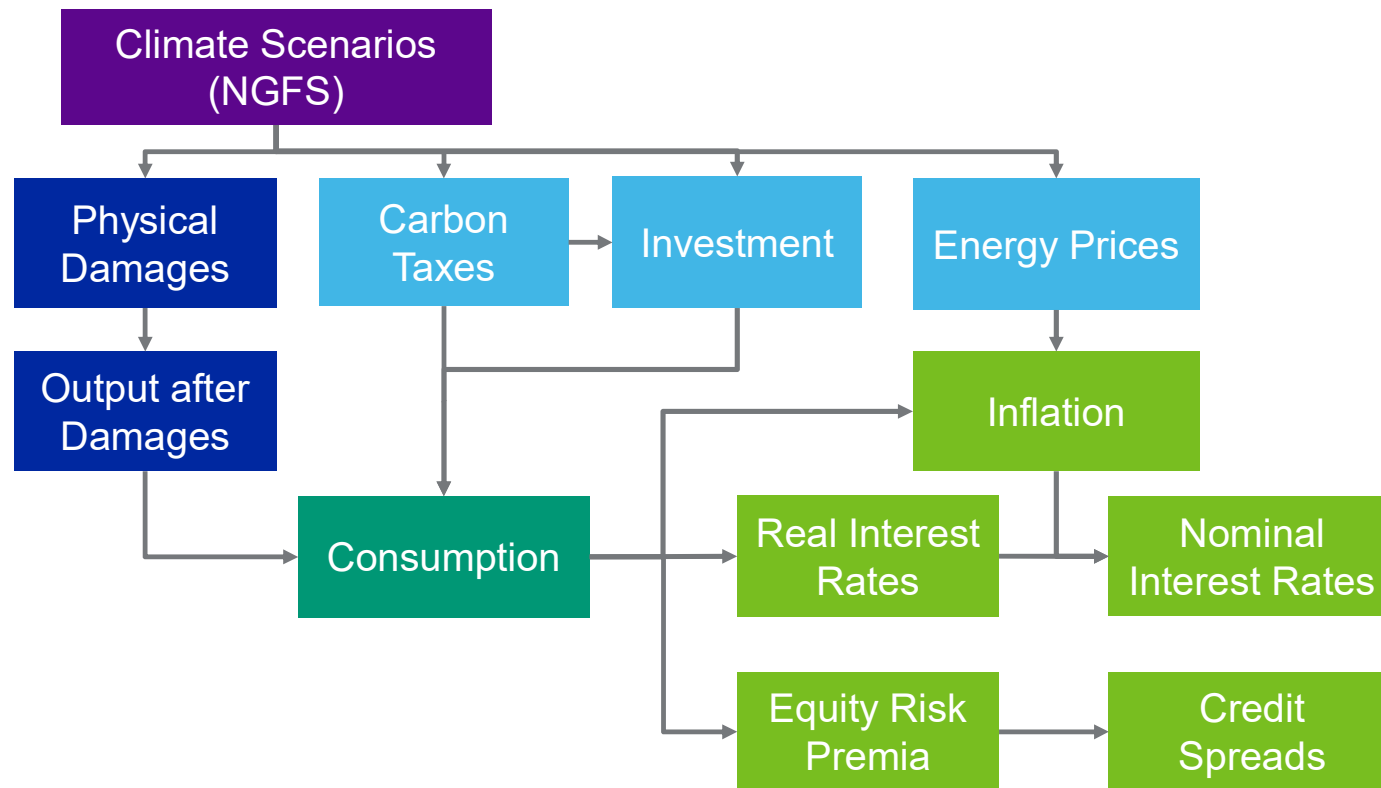
October 2022

What will be covered
in this session

- 1 **Climate Change Approach on Assets and Liabilities**
- 2 **Reflecting Climate Change in CAT Models**

Approach to Assets and Liabilities

Scenario Analysis Framework



Quantifying the impact of climate risk

Assets

Top-down Climate Pathways

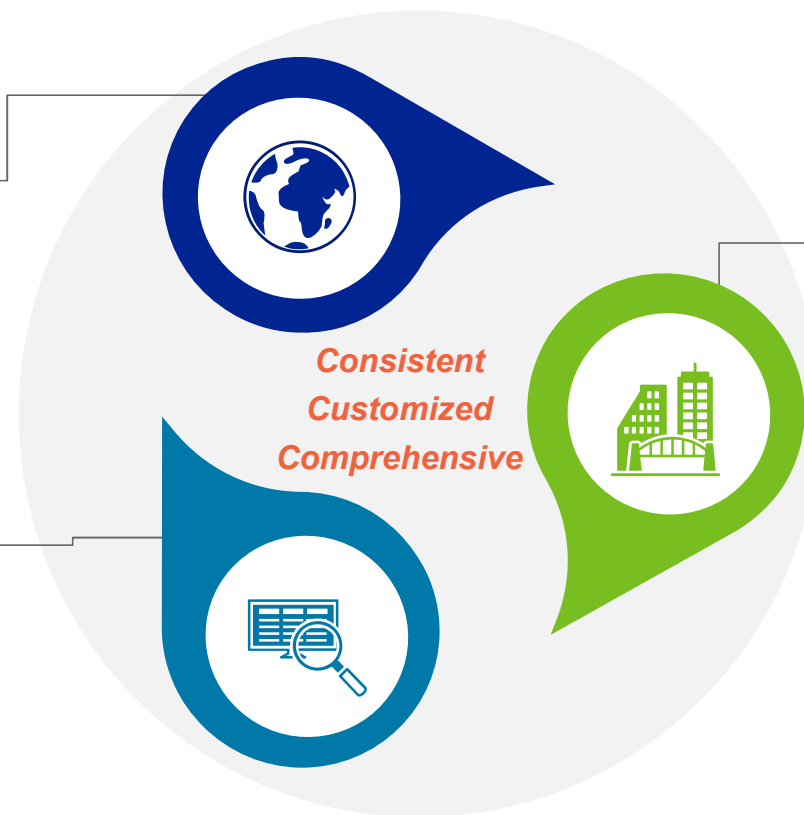
Climate scenarios translated into macroeconomic variables for your asset liability management models

- ✓ Meet regulatory requirements
- ✓ Quantify financial impact

Bottom-up Climate Asset Modelling

Climate-adjusted probability of default for each security in your portfolio for granular climate risk quantification

- ✓ Meet regulatory requirements
- ✓ Quantify credit risk impact



Liabilities

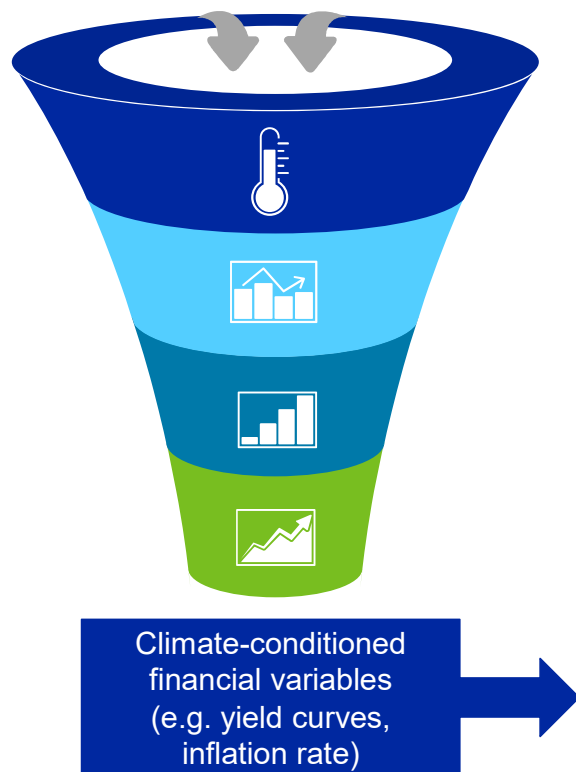
Climate Scenario Physical / Transition Risk Modelling

Climate conditioned Assumption and Nat Cat models for individual perils based on Representative Concentration Pathways at a range of time horizons

- ✓ Support pricing decisions
- ✓ Inform capital allocation

Assets | Top-down climate pathway scenarios

How does it work?



Key steps

- 1. Understand Climate Pathway Scenarios**
 - » Help you understand the temperature paths (NGFS)
- 2. Interpret Economic Implications**
 - » Assist you interpreting macroeconomic variables
- 3. Determine Financial Basis Stresses**
 - » Calculate financial basis variable for each climate path
- 4. Expand into Insurers ALM Scenario Variables**
 - » Translate climate-aligned scenarios into ALM financial variables

Inputs into your asset liability management (ALM) models

Key benefits

- ✓ **Impact assessment:**
analyze financial impact from climate change from macroeconomic view
- ✓ **Regulatory compliance:**
Incorporate climate scenarios into internal assessments (e.g. ORSA) and regulatory reporting

Assets | Bottom-up climate adjusted credit risk metrics for corporates

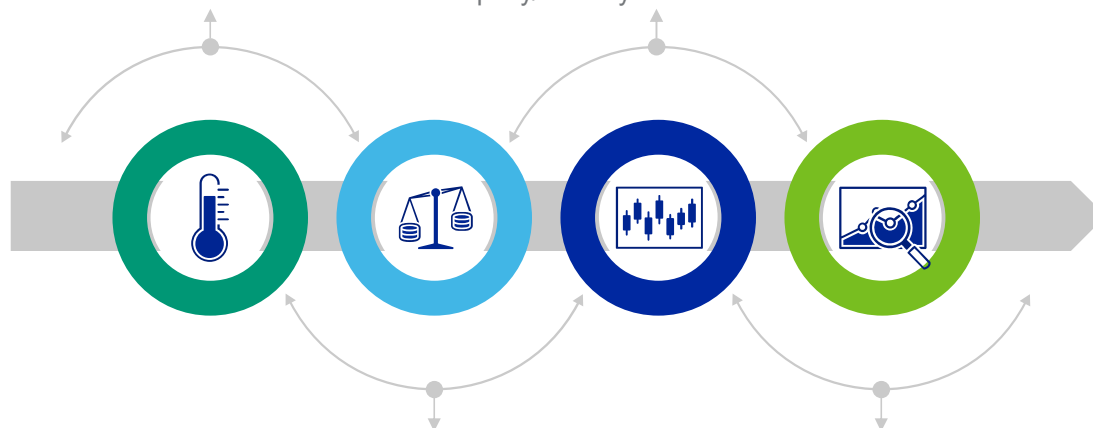
We support “bottom-up” line by line assessment of the impact on asset portfolios from physical and transition risk—for a wide range of credit instruments

1. Select climate scenarios

Help you select the appropriate temperature paths (NGFS)

3. Calculate climate-adjusted PDs

Quantify distance-to-default for specific company/security due to climate risk



2. Determine financial impact to specific company/security

Cash flows and business risk impacted by physical and transition risk
Capital/Collateral/Risk Premium impacted by changes in asset valuation

4. Generate portfolio view of climate impact on credit risk

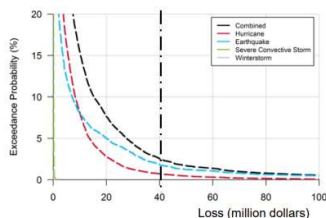
Aggregate quantified credit risk for comprehensive portfolio understanding

Key benefits

- ✓ **Detailed credit risk projections:**
analyze financial impact security by security
- ✓ **Regulatory compliance:**
Detailed reporting of climate risk on investment portfolio



Liabilities | Climate-conditioned physical risk modelling



- Probabilistic modeling of climate impacts on P&C portfolios
 - **Robust science across event sets** and the lifecycle of each event built on climate change conditioning
 - **Quantifying financial impact** of peril-related exposure



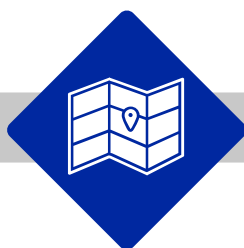
1. Identify climate scenarios

- » Select and tailor the appropriate temp. paths and time horizon based on IPCC RCPs



2. Select relevant baseline Nat Cat models

- » Leverage existing model for a specific peril (e.g. inland flood) as baseline



3. Adjust stochastic event set to climate scenarios

- » Project range of outcomes due to different climate scenarios



4. Analyze damages and quantify financial losses

- » Calculate loss statistics (av. annual loss, 200-year return period loss) under each scenario

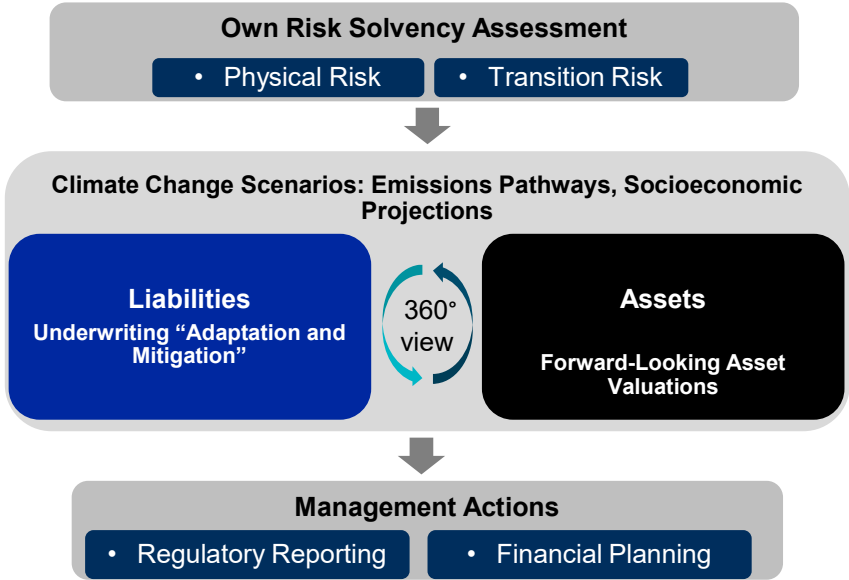
Key benefits

- ✓ **Pricing:**
accurately price risk given climate change impacts
- ✓ **Capital Allocation:**
inform capital allocation and ensure adequate reinsurance purchases
- ✓ **Business Planning:**
Support longer term portfolio strategy with understanding of evolving climate change risks

Balance Sheet Impact | ORSA and Stress Testing

Climate Change Risk Use Case

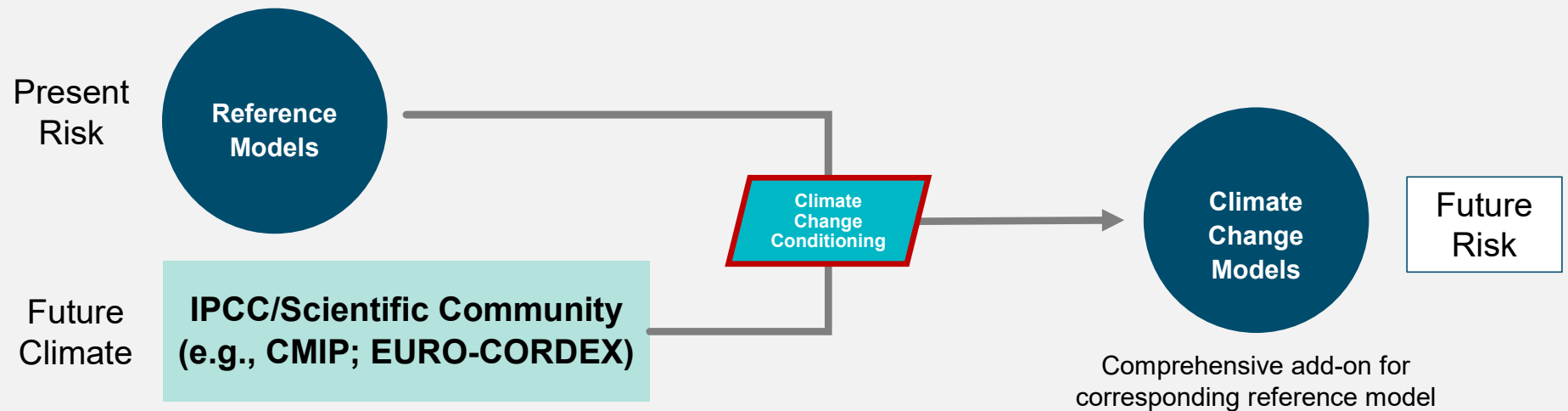
Reporting and Disclosures



| Standard | Jurisdiction | TCFD-aligned | Industry metrics | Business impact |
|-----------|--------------|--------------|------------------|-----------------|
| ISSB | Global | Yes | Yes | |
| GRI | Global | | | Yes |
| EFRAG | EU | Yes | | Yes |
| SEC, NAIC | US | Yes | | |

Reflecting Climate Change in CAT Models

Climate Change Models

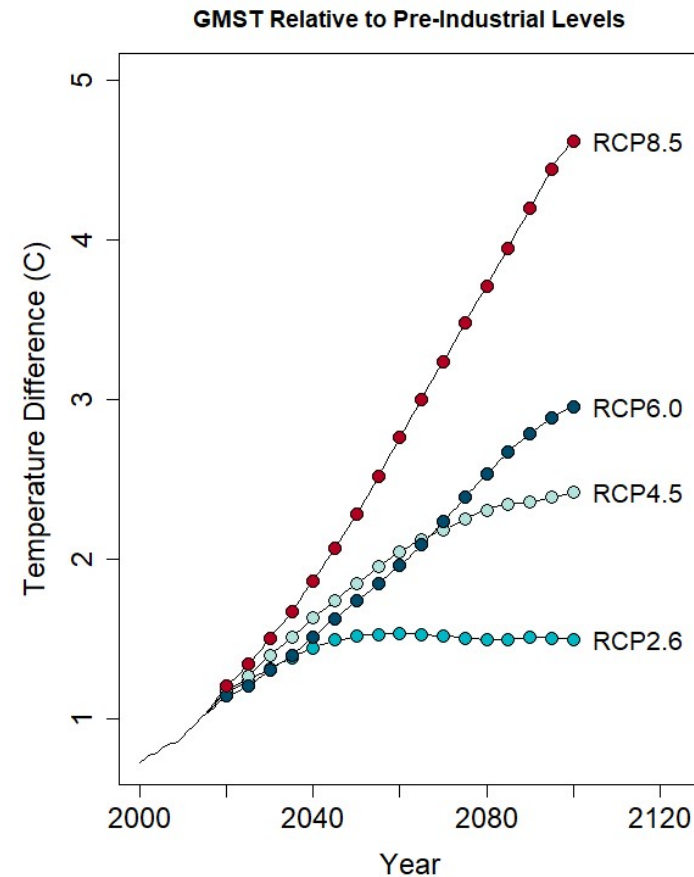


- Climate change conditioning driven by robust science
- Probabilistic modelling of climate change impacts (EP Curves etc.)
- Delivered within established risk management approach & software

IPCC: Intergovernmental Panel on Climate Change | CMIP: Coupled Model Intercomparison Project

Full Range of RCPs and Time Horizons

- Representative Concentration Pathways (RCPs) are pathways not snapshots
- Rate of climate change varies:
 - By time along each RCP
 - Between RCPs
- climate change models aim to capture:
 - RCP2.6, RCP4.5, RCP6.0, RCP8.5
 - From 2020-2100 in 5 year intervals
 - Total of 68 RCP/Time Horizon conditioned views
- Select region-perils (e.g. NAHU) also have user-defined choices for which physical variables are conditioned



Mapping RCPs & Time Horizons to GMST increase scenarios

- The wide range of RCPs & time horizons in the Climate Change Models can be mapped to existing and future use-cases and regulatory requirements:

Operational Business Decisions

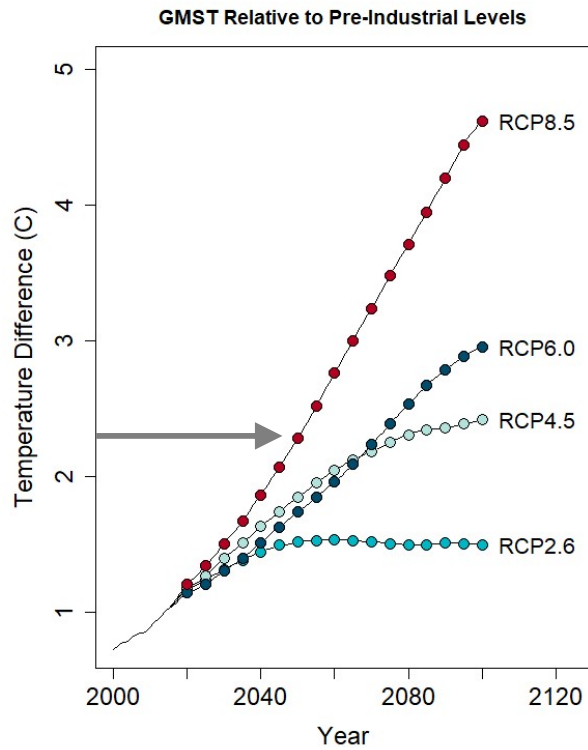
- Pricing adequacy
- Business planning
- Capital stress testing

| Global Mean Surface Temperature (GMST) increase relative to pre-industrial (1880-1900) levels | | | | | | | | | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | Year | | | | | | | | | | | | | | | | |
| | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 |
| RCP2.6 | 1.2 | 1.2 | 1.3 | 1.4 | 1.4 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| RCP4.5 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 2.0 | 2.0 | 2.1 | 2.2 | 2.3 | 2.3 | 2.3 | 2.4 | 2.4 | 2.4 |
| RCP6.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 2.0 | 2.1 | 2.2 | 2.4 | 2.5 | 2.7 | 2.8 | 2.9 | 3.0 |
| RCP8.5 | 1.2 | 1.3 | 1.5 | 1.7 | 1.9 | 2.1 | 2.3 | 2.5 | 2.8 | 3.0 | 3.2 | 3.5 | 3.7 | 3.9 | 4.2 | 4.4 | 4.6 |

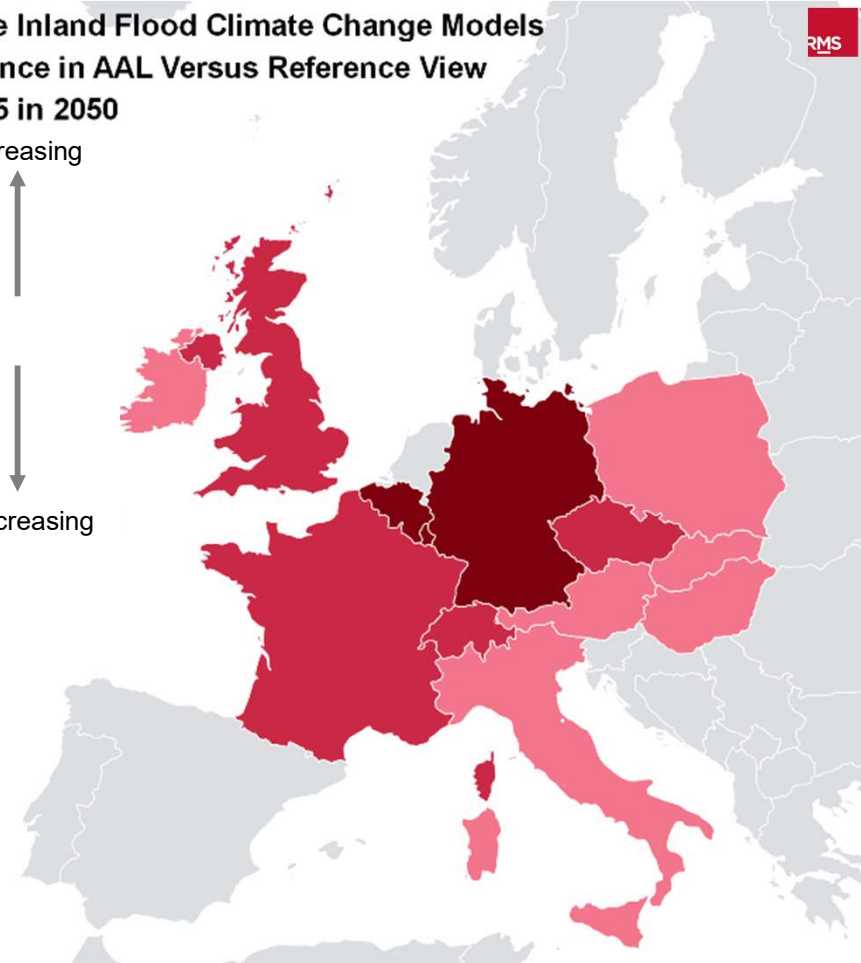
Provided in the RMS Climate Change Model documentation



European Flood: Future Climate Impacts



Europe Inland Flood Climate Change Models
Difference in AAL Versus Reference View
RCP8.5 in 2050





Better, faster decisions

Thank You

SEAC/ACSW Annual Meeting

© 2022 Moody's Corporation, Moody's Investors Service, Inc., Moody's Analytics, Inc. and/or their licensors and affiliates (collectively, "MOODY'S"). All rights reserved.

CREDIT RATINGS ISSUED BY MOODY'S CREDIT RATINGS AFFILIATES ARE THEIR CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES, AND MATERIALS, PRODUCTS, SERVICES AND INFORMATION PUBLISHED BY MOODY'S (COLLECTIVELY, "PUBLICATIONS") MAY INCLUDE SUCH CURRENT OPINIONS. MOODY'S DEFINES CREDIT RISK AS THE RISK THAT AN ENTITY MAY NOT MEET ITS CONTRACTUAL FINANCIAL OBLIGATIONS AS THEY COME DUE AND ANY ESTIMATED FINANCIAL LOSS IN THE EVENT OF DEFAULT OR IMPAIRMENT. SEE APPLICABLE MOODY'S RATING SYMBOLS AND DEFINITIONS PUBLICATION FOR INFORMATION ON THE TYPES OF CONTRACTUAL FINANCIAL OBLIGATIONS ADDRESSED BY MOODY'S CREDIT RATINGS. CREDIT RATINGS DO NOT ADDRESS ANY OTHER RISK, INCLUDING BUT NOT LIMITED TO: LIQUIDITY RISK, MARKET VALUE RISK, OR PRICE VOLATILITY. CREDIT RATINGS, NON-CREDIT ASSESSMENTS ("ASSESSMENTS"), AND OTHER OPINIONS INCLUDED IN MOODY'S PUBLICATIONS ARE NOT STATEMENTS OF CURRENT OR HISTORICAL FACT. MOODY'S PUBLICATIONS MAY ALSO INCLUDE QUANTITATIVE MODEL-BASED ESTIMATES OF CREDIT RISK AND RELATED OPINIONS OR COMMENTARY PUBLISHED BY MOODY'S ANALYTICS, INC. AND/OR ITS AFFILIATES. MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND PUBLICATIONS DO NOT CONSTITUTE OR PROVIDE INVESTMENT OR FINANCIAL ADVICE, AND MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND PUBLICATIONS ARE NOT AND DO NOT PROVIDE RECOMMENDATIONS TO PURCHASE, SELL, OR HOLD PARTICULAR SECURITIES. MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND PUBLICATIONS DO NOT COMMENT ON THE SUITABILITY OF AN INVESTMENT FOR ANY PARTICULAR INVESTOR. MOODY'S ISSUES ITS CREDIT RATINGS, ASSESSMENTS AND OTHER OPINIONS AND PUBLISHES ITS PUBLICATIONS WITH THE EXPECTATION AND UNDERSTANDING THAT EACH INVESTOR WILL, WITH DUE CARE, MAKE ITS OWN STUDY AND EVALUATION OF EACH SECURITY THAT IS UNDER CONSIDERATION FOR PURCHASE, HOLDING, OR SALE.

MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS, AND PUBLICATIONS ARE NOT INTENDED FOR USE BY RETAIL INVESTORS AND IT WOULD BE RECKLESS AND INAPPROPRIATE FOR RETAIL INVESTORS TO USE MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS OR PUBLICATIONS WHEN MAKING AN INVESTMENT DECISION. IF IN DOUBT YOU SHOULD CONTACT YOUR FINANCIAL OR OTHER PROFESSIONAL ADVISER.

ALL INFORMATION CONTAINED HEREIN IS PROTECTED BY LAW, INCLUDING BUT NOT LIMITED TO, COPYRIGHT LAW, AND NONE OF SUCH INFORMATION MAY BE COPIED OR OTHERWISE REPRODUCED, REPACKAGED, FURTHER TRANSMITTED, TRANSFERRED, DISSEMINATED, REDISTRIBUTED OR RESOLD, OR STORED FOR SUBSEQUENT USE FOR ANY SUCH PURPOSE, IN WHOLE OR IN PART, IN ANY FORM OR MANNER OR BY ANY MEANS WHATSOEVER, BY ANY PERSON WITHOUT MOODY'S PRIOR WRITTEN CONSENT.

MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND PUBLICATIONS ARE NOT INTENDED FOR USE BY ANY PERSON AS A BENCHMARK AS THAT TERM IS DEFINED FOR REGULATORY PURPOSES AND MUST NOT BE USED IN ANY WAY THAT COULD RESULT IN THEM BEING CONSIDERED A BENCHMARK.

All information contained herein is obtained by MOODY'S from sources believed by it to be accurate and reliable. Because of the possibility of human or mechanical error as well as other factors, however, all information contained herein is provided "AS IS" without warranty of any kind. MOODY'S adopts all necessary measures so that the information it uses in assigning a credit rating is of sufficient quality and from sources MOODY'S considers to be reliable including, when appropriate, independent third-party sources. However, MOODY'S is not an auditor and cannot in every instance independently verify or validate information received in the rating process or in preparing its Publications.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability to any person or entity for any indirect, special, consequential, or incidental losses or damages whatsoever arising from or in connection with the information contained herein or the use of or inability to use any such information, even if MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers is advised in advance of the possibility of such losses or damages, including but not limited to: (a) any loss of present or prospective profits or (b) any loss or damage arising where the relevant financial instrument is not the subject of a particular credit rating assigned by MOODY'S.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability for any direct or compensatory losses or damages caused to any person or entity, including but not limited to by any negligence (but excluding fraud, willful misconduct or any other type of liability that, for the avoidance of doubt, by law cannot be excluded) on the part of, or any contingency within or beyond the control of, MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers, arising from or in connection with the information contained herein or the use of or inability to use any such information.

NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY, TIMELINESS, COMPLETENESS, MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OF ANY CREDIT RATING, ASSESSMENT, OTHER OPINION OR INFORMATION IS GIVEN OR MADE BY MOODY'S IN ANY FORM OR MANNER WHATSOEVER.

Moody's Investors Service, Inc., a wholly-owned credit rating agency subsidiary of Moody's Corporation ("MCO"), hereby discloses that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by Moody's Investors Service, Inc. have, prior to assignment of any credit rating, agreed to pay to Moody's Investors Service, Inc. for credit ratings opinions and services rendered by it fees ranging from \$1,000 to approximately \$5,000,000. MCO and Moody's Investors Service also maintain policies and procedures to address the independence of Moody's Investors Service credit ratings and credit rating processes. Information regarding certain affiliations that may exist between directors of MCO and rated entities, and between entities who hold credit ratings from Moody's Investors Service and have also publicly reported to the SEC an ownership interest in MCO of more than 5%, is posted annually at www.moody's.com under the heading "Investor Relations — Corporate Governance — Director and Shareholder Affiliation Policy."

Additional terms for Australia only: Any publication into Australia of this document is pursuant to the Australian Financial Services License of MOODY'S affiliate, Moody's Investors Service Pty Limited ABN 61 003 399 657 AFSL 336969 and/or Moody's Analytics Australia Pty Ltd ABN 94 105 136 972 AFSL 383569 (as applicable). This document is intended to be provided only to "wholesale clients" within the meaning of section 761G of the Corporations Act 2001. By continuing to access this document from within Australia, you represent to MOODY'S that you are, or are accessing the document as a representative of, a "wholesale client" and that neither you nor the entity you represent will directly or indirectly disseminate this document or its contents to "retail clients" within the meaning of section 761G of the Corporations Act 2001. MOODY'S credit rating is an opinion as to the creditworthiness of a debt obligation of the issuer, not on the equity securities of the issuer or any form of security that is available to retail investors.

Additional terms for Japan only: Moody's Japan K.K. ("MJKK") is a wholly-owned credit rating agency subsidiary of Moody's Group Japan G.K., which is wholly-owned by Moody's Overseas Holdings Inc., a wholly-owned subsidiary of MCO. Moody's SF Japan K.K. ("MSFJ") is a wholly-owned credit rating agency subsidiary of MJKK. MSFJ is not a Nationally Recognized Statistical Rating Organization ("NRSRO"). Therefore, credit ratings assigned by MSFJ are Non-NRSRO Credit Ratings. Non-NRSRO Credit Ratings are assigned by an entity that is not a NRSRO and, consequently, the rated obligation will not qualify for certain types of treatment under U.S. laws. MJKK and MSFJ are credit rating agencies registered with the Japan Financial Services Agency and their registration numbers are FSA Commissioner (Ratings) No. 2 and 3 respectively.

MJKK or MSFJ (as applicable) hereby disclose that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by MJKK or MSFJ (as applicable) have, prior to assignment of any credit rating, agreed to pay to MJKK or MSFJ (as applicable) for credit ratings opinions and services rendered by it fees ranging from JPY125,000 to approximately JPY550,000,000.

MJKK and MSFJ also maintain policies and procedures to address Japanese regulatory requirements.