Technical Guide
Climate Exercise 2023

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1 General framework

This document is distributed as part of the second climate change scenario analysis' exercise, organised by the ACPR in collaboration with the Banque de France and starting in July 2023. The purpose of this document is to set out the procedural requirements associated with this analysis of climate change risk in the insurance sector. This guide should therefore be read in conjunction with the document presenting the final assumptions for the exercise.

Participating insurers have the following information at their disposal to carry out the exercise:

- The presentation of the assumptions to be used for this climate exercise
- An Excel file specifying the shocks to apply according to the scenarios
- The templates for the reporting statements to be submitted
- A FAQ document that will be published on a weekly or bimonthly basis
- This document

1.1 Scope of the exercise

The participating insurance undertakings are invited to submit their data on an individual basis. The 80% target objective to reach for a representativeness of the participants' exposures, also provided in the assumptions' presentation used for this climate exercise, is broken down as follow:

- 80% of the technical provisions for life insurers, including and keeping the health activities within the scope even if they only account for a limited portion of the insurance undertakings' activity.
- 80% of the premiums for the non-life insurers, as natural disaster and health coverage are included in the scope of this exercise as a matter of priority.

The rationale for the modelling scope choice should be provided in the methodology note.

For insurance groups wishing to submit consolidated results, the scope chosen should allow for the impact of climate change scenarios on life and non-life activities to be assessed. The selected scope should also meet the criteria of representing at least 80% of its individual entities in terms of technical provisions for life insurance, and at least 80% of its non-life insurance premiums.

1.2 Regulatory and accounting framework

This exercise is based on the prudential and accounting framework applicable as of 1 January 2023. The insurers are therefore not expected to anticipate any change on this subject over the period under analysis, including those considered as part of the ongoing review of Solvency 2. However, the implications of the law on the reform of climate risk management tools in agricultural insurance, which came into effect on the 1st of January 2023, will have to be taken into account and be reflected in the technical results of the insurance bodies involved, for both short-term and long-term scenarios.

The following measures are deemed to be included in the prudential and accounting framework applicable on the 1st of January 2023:

- Transitional measures, for which authorisation is granted by the ACPR as of the 1st of January 2023 will apply until 2032, in accordance with the applicable regulations;

- The methods used to calculate the yield curve are based on the methodology set out in the delegated regulation and specified by EIOPA; the volatility adjustment and the ultimate forward rate are included in the assumptions for the exercise.

The balance sheet is valued at market value in accordance with the Solvency 2 standards. The components of the technical result correspond to those required in the profit and loss statement by class (FR.13) as defined in the National Specific Templates (NST). The requested reporting statements are not affected by the new IFRS17 standard.

1.3 Time horizon and time intervals

The exercise firstly focuses on a long-term horizon with an end-of-period date set for the 31st December 2050, in line with the time horizon over which the transition risk materialises and the physical risks tend to increase, based on a temperature rise target kept below 2°C. Then, it considers a short-term horizon, with an end-of-period date set for the 31st December 2027, in line with (i) the assumption of a sudden and accelerated materialisation of climate risks and (ii) with the strategic planning horizon of insurance companies.

The macroeconomic, financial and technical variables projected in the scenarios are available for the following years: 2025, 2030, 2035, 2040 and 2050 for the long-term scenarios (Baseline, Below 2°C and Delayed Transition) and for the 2023, 2024, 2025, 2026 and 2027 years for the short-term scenarios (Baseline and Stressed scenario).

Insurers are therefore expected to project the risk parameters to be covered for each of these time intervals.

The starting point used for the long and short-term projections is the prudential and accounting statements submitted (balance sheet and profit and loss statement) by the insurers on the 31st of December, 2022. These figures will need to be added as the starting points for all the tabs, consistently with the information provided in the regulatory statements and with the scope of the exercise.

1.4 Dynamic balance sheet assumption and insurers' management actions

As this exercise requires insurers to make business projections over a long-term horizon, participants are authorised to include management decisions in their projections, within the limits of the guidelines set out in this document.

The exercise is structured around two types of scenarios:

- **Two short-term scenarios on the period 2023-2027** (Baseline and Adverse short-term scenarios). For these scenarios, insurers carry out their projections of the considered risk parameters according to a static balance sheet assumption. This assumption implies that instruments maturing during this timeframe are renewed until 2027 with the same characteristics (coupon rate, risk profile, currency). Similarly, the composition of portfolios on the liabilities' side remains stable over this period.
- **Three long-term scenarios on the period 2023-2050** (Baseline and two adverse scenarios, Below 2°C and Delayed). For these scenarios, insurers carry out their projections of the considered risk parameters according to a dynamic balance sheet assumption. Participants will be able to adjust their investment and risk management strategies according to the climate change scenarios. **The possible management actions include a reallocation of assets (by sector, asset class, etc.), a readjustment of reinsurance cessions and deductibles, or a**

reallocation of activity (according to a geographical area or line of business). Insurance policies retained or acquired during a given financial year must however have a level of coverage comparable to that of the contracts held in the portfolios at the end of 2022. The methods used to project a dynamic balance sheet are set out in each of the sections detailing how to fill in the tabs.

The purpose of the dynamic balance sheet assumption for the long-term scenario is to determine the role of the strategic reaction of insurers in the face of the gradual materialisation of transition and physical risks. This reaction is expected to be consistent with the insurers' commitments or decisions in terms of financing granted to specific activities or sectors (for instance, a reduction in the outstanding amounts in the extractive industry sector or a commitment to align with the Paris Agreement). It is also expected that any management action implemented will be credible in the context of the stress testing exercise (deteriorated macro-economic and financial environment, changes in the offer and reaction of policyholder demand) and in terms of their validation by the management bodies.

Insurers are also required to assess the appropriateness of modifying the composition of their asset and liability portfolios in the light of the long-term relationships that may be established with customers, as well as the possible negative externalities on their reputation. All of these considerations have to be further defined by participants in the dedicated section of the methodological note.

2 Market risk

2.1 General provisions

Insurers are invited to assess the impact of the shocked long-term adverse scenarios (variant 1 Below 2°C and variant 2 Delayed transition) on their market risk for equities, bonds, derivatives and real estate assets, by applying the shocks provided in the assumption tables. The amounts for other asset classes (deposits, loans, etc.) must remain constant, and be multiplied by inflation only.

The *Asset* tab must be filled in for each maturity date:

- 2025, 2030, 2035, 2040, 2050 in the long-term scenarios (*0.Assets* for the Baseline scenario, *1. Assets* for the variant 1 scenario, *2. Assets* for the variant 2);
- and the maturities 2023, 2024, 2025, 2026 and 2027 in the short-term scenarios (*3. Assets* for the Baseline and *4.Assets* for the adverse scenario).

There is no difference between the approaches used for the short-term scenario and the one used for the long-term scenario.

Assets are valued in accordance with Solvency 2 regulations. Insurers are not expected to submit asset-by-asset data. The minimum expected granularity level is that of the type of asset broken down by activity sector. Where possible, additional segmentation may be carried out based on the country of issue of the asset. The nature of the shares (listed, unlisted) can also be specified. The application of the transparency principles to investment funds is not required.

Participants are asked to comply with the procedures set out in tab *A.Assets by CIC Country Sector* for filling out the CIC codes, sectors and countries of issue for the various asset groups.

Lastly, a table of correspondence will allow insurers to match standard NACE codes with the NACE code groups (22 sectors) used for share prices, as well as with the BICS codes (12 sectors) used for corporate spreads.

2.2 Equity

Equity market risk has been simulated using a macro-financial model that produces a single stream of future dividends by business sector for each scenario. Market prices are then derived by discounting the dividend path starting at each maturity.

For the long-term projection, the Baseline scenario of a world without physical risk or transition risk is assumed to match current prices, i.e. current share prices (end 2022) adjusted for inflation. Consequently, variations in the amounts over subsequent time horizons will reflect the inflation trajectory and a potential portfolio reallocation as part of a management action in this Baseline scenario (tab 0).

The shocks provided represent adjustments (expressed as a percentage) of the market value relative to the Baseline and according to the geographical area of issue (France, Europe excluding France, the United States and the rest of the world) that will be applied to equity investments in the adverse orderly and disorderly transition scenarios (tabs 1 and 2).

For the short-term projection, the projected balance sheet assumption is static. Baseline share prices are assumed to be current, meaning that they match current share prices (at end-2022) adjusted for inflation. The adverse price adjustments provided for the stressed scenario materialise from 2025 onwards in the context of the Financial Turmoil.

As these shocks have already incorporated the discounting of all the remaining dividends in the scenario, they must be applied instantaneously at each time step.

2.3 Bonds

Bonds should be valued using both the EIOPA risk-free yield curves (with and without volatility adjustment) and the corporate and sovereign spreads that are provided. This yield curve is given for 150 years (for each scenario and time step), and the spreads are calculated at a sectoral level for France, Italy, the United Kingdom, Spain, the United States and Japan (also for each scenario and time step). Bond shocks must be applied for each maturity, mirroring the developments specified in the yield curves provided in the exercise, for each of the long-term and short-term scenarios.

2.4 Real estate

The valuation of real estate assets held must be adjusted using real estate price shocks, which are provided for the long-term scenarios only. Shocks are provided for France, broken down by administrative region, as well as for other countries/regions of the world (Europe / US / UK / Japan / Other).

3 Underwriting risk

3.1 Life and non-life technical results

For all branches, and for each one of the various scenarios, the *Non-Life Technical Result* and *Life Technical Result* tabs should be filled in as follows:

- The level of coverage offered by insurers over time must be considered on an iso-coverage basis per contract (equivalent level of coverage on existing and new contracts). At portfolio level, business management actions and termination assumptions for property damage coverage will be applied and the technical result balances will change in line with these assumptions.
- The financial balance will take into account the asset yield assumptions as defined in the considered scenario.
- Acquisition and management expenses will at a minimum increase by the amount of inflation. The search for new customers or the development of new insurance products are deemed to increase these expenses.
- Premiums ceded to reinsurers and the reinsurers' share of benefits paid take account of changes made to the reinsurance strategy over time. This strategy should be explained in the methodology note, per business line and wherever that strategy changes.
- For business lines that are affected by climate change, it is expected that loss will follow an adverse trend over the time horizon considered. The methodological note to be submitted alongside the results is expected to include a qualitative explanation – with additional quantitative information where appropriate – of the impact of the climate change on loss experience and results . These impacts will be broken down by type of climate-related hazard, especially for perils that are not covered by the natural disaster compensation scheme such as hail, frost, agricultural drought, etc.
- For business lines that are not affected by climate change, a constant level of activity may be assumed, considering inflation. A brief justification of the absence of impact of climate change on insurance activities is expected in the methodological note.
- For life insurance activities assimilated to savings, the timeline followed for the revaluation rates paid by insurers must be explained for each scenario in the methodological note, and are reported in line R0140 of the Life Underwriting Result tab.

For the short-term scenario, the Baseline follows the strategic projections derived from the insurance undertaking's business plan. The stressed variant of the short-term scenario follows the economic, financial and loss assumptions set out in the assumptions document.

3.2 Natural disasters

3.2.1 For long-term scenarios (tabs 0, 1, 2)

To assess the impact of natural disaster scenarios on insurers' damage and motor insurance business, participants in the exercise may, if they wish, call on the *Caisse Centrale de Réassurance* (CCR) for assistance. The information required to calculate the impact by peril should be sent to the following address: gtacprcc@ccr.fr, in the format specified in the associated reporting statements.

Participants are allowed to use their own loss experience projection model. The scenario considered should be close to the IPCC's RCP 4.5 scenario; deviations from this reference scenario and the

benchmark climate variables presented in Annex 2 should be described, and their impact quantified in the methodological note. In order to allow comparability and analysis of submitted data, it is recommended to use the climate benchmarks referenced in Annex 2.

Insurers that have elected to use their own model are expected to supplement the geographical projections of natural disaster-related loss experience included in tabs *0.NAT CAT* and *1.2.NAT CAT* with a breakdown of the impacts resulting from the changes in the following factors:

1) Climate hazard;
2) Inflation;
3) Exposure expressed as the number of risks insured.

Open-access resources are available in Annex 2 to help model international loss experience and take account of changes in the exposure in terms of risks insured.

Insurers whose business is affected by natural disaster scenarios are invited to fill in the *0.NAT CAT* and *1.2.NAT CAT* tabs as follows:

- The number of risks insured, the insured values, the premiums for the financial year and the loss experience must be filled in for the year under assessment, changes being assumed to be gradual from one year to the other (no instant shock at the end of the period);
- The premiums to be reported in these tabs correspond to written premiums;
- Premiums and claims are gross of reinsurance deductions;
- The number of risks insured is preferably defined as the number of contracts (per period);
- The insured values correspond to the current amounts, adjusted for inflation and changes in the number of insured risks;
- As the *0.NAT CAT* tab is used for the NIESR Baseline scenario, with no climate risk materialising, the projected climate-related loss experience follows inflation and the evolution of the exposure in terms of risks insured;
- Given the inertia in the evolution of physical risk, the trajectory tested is identical for both long-term stressed scenarios, and the associated natural disaster (hereafter referred as NAT CAT) loss experience is reported in the *1.2.NAT CAT* tab;
- The inflation assumptions to be used in the climate-related loss experience projection are those assigned to the Baseline scenario for the *0.NAT CAT* tab, and the ones associated with the Delayed Transition scenario for the *1.2.NAT CAT* tab;
- Only the claims included in the legal natural disaster compensation scheme should be reported in these tabs;
- Changes in the loss experience linked to natural disasters that are outside the scope of the natural disaster compensation scheme (hail, non-cyclonic storms, etc.) that are consistent with the IPCC's RCP 4.5 scenario should also be included. Loss experience outside the scope of the natural disaster compensation scheme, modelled independently of the CCR results, should be reported in the dedicated ministerial categories within the *Non-Life Technical Results* tabs for the long and short-term scenarios. The assumptions for these disasters' development will be specified in the methodological note.

For the quantitative assessment of unaffordability risk, the *1.2.NAT CAT* tab should be filled in as follows:

- The "Number of risks terminated after exceeding the threshold" variable corresponds to the number of contracts for which the $\frac{Basic\ \text{``property damage''} premium}{Total\ insured\ value\ (expressed\ in\ thousands\ of\ \text{\euro})}$ ratio exceeds an inaccessibility threshold defined in the corresponding Excel file;
- These contracts correspond to terminations at the policyholder's initiative due to the unaffordable cost of the insurance cover offered;
- Contracts for which the indicator exceeds the inaccessibility threshold are identified and removed from the portfolio only at the end of each time step in the projection horizon, i.e. in 2025, 2030, 2035, 2040 and 2050;
- The "Total insured value" variable is understood as the sum of real estate and securities insured values;
- The thresholds to be applied are segmented by department and by type of property (house or apartment). Other properties that cannot be classified according to these two categories (house/apartment) are not included in the scope of the assessment;
- The assessment covers only the departments located in mainland France;
- The thresholds are projected according to the inflation trend defined for the Delayed Transition scenario, using those of the long-term Delayed Transition scenario to fill in the *1.2.NAT CAT* tab, and the change in GDP per capita using both the GDP assumptions of the Delayed Transition scenario and the demographic projections provided by INSEE[1].

For insurers that are unable to apply the proposed methodology, due to the unavailability of the information required to carry out the exercise, or due to the costs associated with the material and human resources needed to conduct the assessment according to this methodology, it is nevertheless suggested that they take part in the exercise using assumptions that are similar to those of the climate exercise. The alternative methodology used to assess the reaction of insured demand to increases in property and casualty insurance premiums, as well as the ability of applicants for coverage to take out insurance cover at the prices offered, should be explained in the methodological note. In addition, the methodology should be used to generate a variable consistent with the "Number of risks terminated following threshold being exceeded", which will be reported in the submission.

A specific *1.2.NAT CAT_Q95* tab has been added for reporting extreme weather event-related loss estimates. It corresponds to a 95th percentile projection of the damage associated with the RCP 4.5 scenario trajectory. Only the evolution of loss experience of perils that are covered by the natural disaster compensation scheme and exposures under this assumption is required, and there is no need to recalculate balance sheet and underwriting result items accordingly.

If the CCR is not solicited for the French scenarios, and in the context of the international scenarios, insurers are requested to specify in their methodological note how this 95th percentile is calculated. More specifically, whether the variability considered is that of the NAT CATmodel using the same input climate variables or whether the variability of the input climate variables is also considered (the latter solution being preferred), refer to the Climate Impact Explorer's approach on this matter.

3.2.2   For short-term scenarios (tabs 3 and 4)

Requested information for short-term scenarios is of the same nature as in the long-term scenarios, concerning the number of risks insured, insured values, written premiums and NAT CAT loss experience

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[1] *Résultats détaillés des projections de population 2021-2070 pour la France – Scénario central | Insee*

(all perils combined). However, loss experience projections are expected only for drought and flood perils.

For the Baseline scenario, climate-related loss experience correspond to the projections made by insurers as part of their five-year business plan.

For the stressed scenario, loss experience is modelled by taking into account the following elements:

- For drought risk: the projected loss experience in 2023 and 2024 must reflect the drought event observed in 2022, adjusted for inflation and changes in the number of insured risks;
- For flood risk: from 2025 onwards, projections must incorporate the impacts of the Serre-Ponçon dam burst, the geographical scope[2] of which is defined in the assumptions used for this climate exercise. The CCR can also be called upon for this projection.

3.2.3   Qualitative survey on climate risk insurability

A qualitative questionnaire, which is not included in the submission template, is provided to participating insurers for them to provide additional information on the insurability of climate risk and on any management actions implemented as a way to manage this risk.

The answers to the various survey items should be explained in the methodological note.

No	Questions
1	What system of governance is implemented within your organisation to manage climate risk?
2	Explain the risk mitigation measures considered in terms of underwriting to address the physical risks associated with climate change (premium increases, reduction of coverages, changes in upper limits and deductibles, exclusions, etc.).
3	In terms of pricing, what is the degree of risk-sharing set for products in relation to their exposure to natural disaster risks? Is pricing segmentation carried out according to the location of the risks underwritten? If so, specify the current segmentation and any changes planned in the medium (0-10 years) and long term (>10 years).
4	Are any measures (advice and/or support measures, financial compensation for undertaking risk mitigation work, etc.) either already in place or planned in order to help policyholders face the physical consequences of climate change? If so, explain them and indicate the expected impact of implementing these measures.
5	Are there any plans for changes to risk transfer mechanisms in order to mitigate the physical risks associated with climate change? Which reinsurance strategy is envisaged for the medium (0-10 years) and long term (>10 years)?
6	Describe the risk tolerance limits defined by your organisation, and in particular, the criteria (location, loss thresholds, etc.) used to exclude physical risks from your portfolio.
7	If a zoning system that maps the physical risk to each geographical has been designed within your organisation, specify the methodology and data used.
8	Are you anticipating the emergence of areas considered "uninsurable" due to climate change and the associated risks? If so, specify which areas and the methodology used.

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[2] Municipalities of the Hautes-Alpes, located on the south-eastern limit of the department, would be affected in the event of the rupture of this dam and the dams located downstream.

3.3   Health

Insurers assess the impacts of climate change on their health insurance activities based on the Drif, Roche, Valade and Drif, Messina, Valade reports on the increase in vector-borne diseases and urban pollution. The impact of these scenarios is assessed on the basis of assumptions concerning changes in life tables and healthcare costs broken down by geographical area and population age group provided by AON.

The *Health_Disease*, *Health_Pollution* and *Health_Drought_Flood* tabs are to be filled in for each scenario and timeframe considered. Premiums, claims expenses and number of insured people are to be provided for the year under assessment (and not for the entire period under consideration since the previous time step), with year-on-year changes assumed to be gradual from one assessed year to the next.

Insurers are invited to provide information on the evolution of premiums and claims, as well as insured values, at the level of granularity specified in the scenarios (regions for vector-borne diseases, conurbations for pollution). Where information on the location of insured persons is not available, data may be provided for France as a whole.

Insurers are authorised to modify the geographical allocation of their portfolios from 2025 onwards, using objective population movement criteria to be explained in the methodological note. These criteria should be consistent across all the scenarios tested. Any changes in portfolio typology (average age of policyholders, etc.) or contract characteristics (deductible levels, etc.) should also be included in the methodological note.

Information should also be provided by business line (healthcare expenses, disability and death) in the *Non-Life Technical Results* and *Life Technical Results* tabs.

Within these tabs:

- The amounts to be reported are those for the year currently under assessment. Year-on-year changes are assumed to be gradual and annual (no sudden shock every 5 or 10 years);
- The "Insured values" line corresponds, for business lines relating to healthcare expenses and other personal injury protection (including incapacity and disability) insurance, to the number of people insured;
- Premiums ceded to reinsurers and the reinsurers' share of benefits paid take into account the changes made to the reinsurance strategy over time. This strategy should be explained in the methodological note.

4   Balance sheet and solvency projections

4.1   Balance-sheet projections

A simplified balance sheet must be submitted for each time step and each scenario.

The simplification methods used in the exercise must be explained in the methodological note submitted by insurers. Items that are not subjected to a market risk shock or a management action may follow inflation trends.

4.2 Solvency

4.2.1 For short-term scenarios (tabs 3 and 4)

For short-term scenarios (Baseline and Stressed Variant), simplified items relating to the Solvency Capital Requirement (SCR), the Minimum Capital Requirement (MCR) and the capital available and eligible to cover the SCR and MCR must be reported in the Solvency tabs.

For the SCR calculation, participants are invited to use the approach used for the production of their regulatory statements (Standard Formula, partial or complete use of internal model).

Simplifications may be adopted for the calculation of capital requirements and its risk sub-modules, particularly in years when the impacts of shocks are deemed to be the least material (such as over the 2023-2024 period for insurers with little exposure to drought risk). These simplifications will have to be documented in the methodological note accompanying the submission.

4.2.1 For the long-term scenarios (tabs 3 and 4)

In the absence of SCR calculations, an alternative method must be used to determine the risk margin. Articles 61 and 62 of the "Guidelines on valuation of technical provisions" published by EIOPA outlines several options for this calculation. The "Method 4" described in this document provides that an approximation for the risk margin can be made by considering it as a percentage of the best estimate. Participants are encouraged to apply a percentage based on historical values of their respective prudential reports.

5 Automated checks

Automated checks have been implemented in tab *C.Automatic checks* to ensure the exhaustiveness and consistency of data entered in the template.

Participants are invited to submit a report without "Warning" status in any of these checked fields or, where applicable, to provide the reason for the failed status in the "Explanation" column.

6 Timetable and procedures

Here are the procedures to be followed at each step of the climate exercise schedule.

July - September: Q&A phase

Participants to the exercise may submit to the ACPR any questions they have in relation to these documents. Questions should be sent to the following email address: 2771-CLIMAT-ASSURANCE-UT@acpr.banque-france.fr. Questions received before 5pm on Monday will usually be answered by the ACPR by the following Monday, and within a fortnight at the latest.

In order to obtain the most accurate answer from the ACPR, participants are asked to provide all the following elements using the corresponding Excel file:

- Name of the insurance company;
- Contact details of the person submitting the question (e-mail address or telephone number);
- Date on which the question is submitted;

- The document concerned by the question: Scenarios and main assumptions (Word), Reporting statements (Excel) or Technical guide (Word);
- The page number and section concerned (if related to a Word file);
- The tab, row and column name concerned (if related to an Excel file);
- The question;
- A comment section for any clarifications the participant deems necessary.

November 2023: alignment phase

Participants will be required to submit the Asset List tabs for all long-term scenarios, in order to assess the consistency of the strategies implemented by the insurers. This information should be sent to the dedicated address and is expected before November 30, 2023.

December 2023: submission of quantitative and qualitative results and submisson of the methodological note accompanying these results

Submissions, including an Excel file and a methodological note, must be sent by e-mail to the dedicated address by December 31, 2023.

They must first have been approved internally at an appropriate hierarchical level.

7   Methodological note

The methodological note should supplement quantitative reports. It must outline the results and explain the assumptions and simplifications used to obtain them, as well as their impact on the results. Management actions (especially on the assets' side in terms of investment reallocation, and on the liabilities' side in terms of pricing, reinsurance and deductible policies) must also be explained. The content of this methodological note will particularly be useful during the validation phase and during any bilateral exchanges that may take place in the course of this exercise.

This methodological note should cover at least the following elements:

- A brief description of the organisation and governance adopted at company level to carry out the exercise;
- A description of the business and contracts of the organisation, as well as of the scope covered by the exercise and changes in coverage levels for the various branches;
- The approach retained for the implementation of the exercise, the valuation principles and the main assumptions, approximations and simplifications used;
- Information on the strategies considered by the entity, detailing the management actions implemented, their chronology, their credibility and the quantification of their impact;
- Information on governance, planned policies and management of physical risks arising from climate change (see survey on the insurability of climate risk);
- A summary of the main results;
- A presentation of quantitative and qualitative submissions.

A proposal for a standard outline to articulate these various elements is provided in the annex. However, participants in the exercise are invited to provide the ACPR with any additional information they deem useful in understanding the results of the exercise.

Annex 1: Standard outline for the methodological note

Organisation and governance arrangements adopted for the exercise

- Brief description of the organisation's structure;
- Organisational arrangements made for the exercise according to the size of the insurance undertaking (for an insurer belonging to a group, it should be indicated whether the climate exercise is carried out or steered by the head office or in a decentralised manner at the level of the undertaking);
- Governance arrangements for the exercise:
    - Structure and description of the team in charge of the exercise (if applicable, indicate the contribution of consultants and the nature of their contribution).
    - Number of full-time equivalents required in addition to the insurer's usual process that are involved in the calculation phase and duration of implementation of each phase of the exercise.
    - Level of validation of results / internal communication of results.
- Methodology developed for the exercise: integration into the regular process used by the entity for its calculations, or development of an *ad-hoc* tool: as far as possible, inclusion of (i) a description of the differences with the process previously put in place in the context of Solvency 2 prudential requirements and (ii) the information regarding potential new tools which had to be put in place specifically for the purposes of the exercise, if applicable.

Activity, scope and materiality

- Description of the insurance undertaking's activity and contracts (type of contracts, type of policyholders);
- Scopes of the exercise, either modelled and not, and scopes that have been subject to simplifying procedures (amount of technical provisions for each of these scopes) accompanied with the nature of these simplifications;
- Materiality of the various scopes, modelled or not (e.g. amount of technical provisions and underlying risks).

Approach adopted for the exercise

- Overview of the valuation and projection models used, their assumptions, their interrelationship and their main functions;
- General description of the importance of expert opinion and its implications in the process of producing results;
- Implementation of scenarios (in particular if it is necessary to reflect the effect of the scenarios on variables that are not directly described in the specifications of the exercise);
- Description of the process used to assess the quality of the approximations and simplifications adopted.

Quantitative results submitted

- For the quantitative submission, provide a description of any fields that are not filled in, or, if the field is defined with an insufficient level of precision, a description of the assumptions used to fill in the field.

- Summary of the main results:
  - For each scenario:
    - Analysis and general assessment of the results delivered, particularly in comparison with the situation at end-2022 (main mechanisms involved);
    - Analysis of the complex effects induced by specific features of the concerned insurer (e.g. an exposure to a specific risk);
    - Description of the main absorption mechanisms in scenarios;
    - Description of "Other..." categories if relevant to the analysis.
  - Description, if applicable, of other risk factors to which the insurer is significantly exposed but which are not tested in the exercise;
  - Any point of concern raised by the exercise, as well as a description of the follow-up expected by insurers.
- Detailed management actions implemented for strategic asset reallocation over the long-term horizon.

Qualitative survey on natural disaster insurability

The information requested in the qualitative survey on the insurability of climate risk (section 3.2.3) should be explained in this section.

Problems encountered in implementing the exercise and suggestions for improvement

- Description of the main challenges encountered in the course of the exercise (whether they be operational, methodological, organisational, etc.)
- Suggestions for improvements:
  - Relevance of the scenarios to your organisation's risk profile (i.e. are the scenarios and identified risks representative and suited for your most significant exposures)? How would you rate the level of coverage of your exposure in the scenarios (high/medium/low)? Please provide an explanation of your rating.
  - Would you have benefited from additional variables for the scenarios to better reflect the inherent risks to your business?

Other topics

Free-form section to discuss additional topics useful to better understand the results.

Annex 2: Additional information and resources for non-life insurance loss

1. Variables of reference for modelling climate risk hronic variables of reference

When modelling their international non-life loss experience, participants are asked to ensure the consistency of the models they use with the trajectories of specific climate variables provided on the Climate Impact Explorer platform developed by Climate Analytics. The primary climate variables are obtained by adjusting and harmonising the projections from models participating in the ISIMIP project (see below for a description of this project), thus providing an overview of both the median projections in the literature and their variability.

It is allowed to conform to a RCP 6.0 trajectory, since RCP 4.5 modelling solutions may not be available; when possible, it is however better to conform to a RCP 4.5 trajectory in order to facilitate alignment with the CCR projections for the French territory.

It should be noted that the trajectories indicated in Climate Impact Explorer are given **in relative terms with respect to the 1986-2010 reference period**; the need for consistency therefore applies to the relative evolution of the chronic variables between 2020 and 2050, rather than to their absolute values.

Table 1 - Chronic climate variables entered in Climate Impact Explorer

Bias-Corrected Climate Variables

Indicator Name	Abbreviation	Unit short name in ISIMIP	Unit full name in ISIMIP	Temporal Resolution/Aggregation	Unit used in the CIE
Relative Humidity	hursAdjust	%	percent	daily --> mean	percentage points
Relative humidity is defined as the ratio of water vapour in the air to the total amount that could be held at its current temperature (saturation level). Here we consider relative humidity at 2 metres above ground. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Specific Humidity	hussAdjust	kg kg-1	kilogram per kilogram	daily --> mean	relative
Specific humidity is defined as the mass of water vapour contained in each kg of air. Here we consider specific humidity at 2 metres above ground. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Precipitation	prAdjust	kg m-2 s-1	kilogram per square metre per second	daily --> sum	relative
Precipitation is defined as the mass of water (both rainfall and snowfall) falling on the Earth's surface, per unit area and time. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Snowfall	prsnAdjust	kg m-2 s-1	kilogram per square metre per second	daily --> sum	relative
Snowfall is defined as the mass of water falling on the Earth's surface in the form of snow, per unit area and time. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Atmospheric Pressure (surface)	psAdjust	Pa	Pascal	daily --> mean	absolute
Atmospheric pressure quantifies the force exerted by the weight of the column of air situated above a given location, per unit area. Here we consider atmospheric pressure at 2 metres above ground. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Atmospheric pressure (adjusted to sea level)	pslAdjust	Pa	Pascal	daily --> mean	absolute
Atmospheric pressure quantifies the force that would be exerted by the weight of the column of air situated above a given location, per unit area. Since atmospheric pressure decreases with altitude, here we inspect the atmospheric pressure at 2 metres above ground but adjusted as if the location of interest was set at sea level. This allows for comparison of locations situated at different altitudes. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Downwelling Longwave Radiation	rldsAdjust	W m-2	Watt per square metre	daily --> mean	relative
Downwelling longwave radiation is defined as the downward energy flux in the form of infrared light that reaches the Earth's surface. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Wind Speed	sfcWindAdjust	m s-1	metre per second	daily --> mean	relative
Wind speed quantifies the velocity of an air mass. Here we consider the wind speed 10 metres above ground. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Mean Air Temperature	tasAdjust	°C	degrees Celsius	daily --> mean	absolute
Mean air temperature refers to the mean temperature of air masses near the Earth's surface (2 metres above the ground in this case). The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Daily Maximum Air Temperature	tasmaxAdjust	°C	degrees Celsius	daily --> mean	absolute
Daily maximum air temperature is defined as the peak air temperature reached in a day, in this case at 2 metres above the ground. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					
Daily Minimum Air Temperature	tasminAdjust	°C	degrees Celsius	daily --> mean	absolute
Daily minimum air temperature is defined as the lowest air temperature reached in a day, in this case at 2 metres above the ground. The data used for this variable have undergone a bias-adjustment procedure to correct for deviations between modelled and observed values over the time period where they overlap.					

Source: Climate Analytics — Climate impact explorer

The harmonisation requirements applicable to this exercise, which vary according to the perils involved, are indicated below:

- **River flooding** - It is required to ensure that the models used are consistent with the median relative change from 2020 to 2050 in the *Precipitation* variable (on average per country), in RCP 4.5 or RCP 6.0.
- **Storms (incl. Cyclonic storms)** - It is required to ensure that the models used are consistent with the median relative change from 2020 to 2050 in the *Wind Speed* (rainfall) variable (on average per country), in RCP 4.5 or RCP 6.0.
- **Marine submersions** - No constrained reference variable, but alignment with RCP 4.5 trajectory is encouraged. Discrepancies should be clarified where appropriate.

- **Subsidence** - No constrained reference variable, but alignment with RCP 4.5 trajectory is encouraged. Discrepancies should be clarified where appropriate.

Perils outside of the scope of the French NAT CAT natural disaster compensation scheme (which covers hail, forest fires, agricultural drought, etc.)

⇨ No constrained reference variables (except for non-cyclonic storms).
⇨ Consideration of their impact on non-life results evolution encouraged if these perils are 1/ material for the insurer, 2/ liable to be exacerbated by climate change, and 3/ consistent with RCP 4.5 trajectories (divergences to be explained, where applicable).
⇨ The methodological note should include information on how these perils are taken into account.

2. Open source resources

This section presents a sample of open source data that can be used for peril modelling. It is not intended to be exhaustive, and does not constitute an opinion on the appropriateness of using these models compared with private alternatives.

The availability of open source tools and data seems to vary according to the perils considered:

- River flooding offers a directly usable open source solution, with CLIMADA and its simplified interface developed by EIOPA;
- CLIMADA (but not the EIOPA interface) can be used to model cyclonic storms, and other phenomena such as agricultural drought;
- For marine submersions and subsidence, public resources seem limited.

Other open source initiatives were presented at the EIOPA event *Opening the world of catastrophe models.* Presentation material is available here: Opening the world of catastrophe models (europa.eu).

2.1. Simplified CLIMADA user interface developed by EIOPA

EIOPA is making available a simplified user interface for the CLIMADA open source NatCat model, in the form of a downloadable Python application. The tool presentation and related documentation are available here: Open-source tools for the modelling and management of climate change risks (europa.eu).

The application allows users to upload exposures at a selected granularity level (geographic coordinates or NUTS2), then select a given hazard/scenario and exposure assumptions. Damages can be displayed directly on the app or exported on an Excel format.

For the time being, the hazards available data in Europe concern river flooding and (non-cyclonic) storms, where only river flooding is provided with a prospective vision. It also allows users to upload their own hazard files.

For the purposes of the climate exercise, damage projections for river flooding can be carried out according to an RCP 6.0 scenario (RCP 4.5 is not available in the tool).

The financial stability report published by EIOPA in June 2023 offers a case study using the river flooding module. In particular, it provides information on the advantages and limitations of this tool.

Graph 1 - Illustration of the application interface developed by EIOPA

2.2. CLIMADA

In addition to the hazard files and damage functions included in the EIOPA user interface, the CLIMADA infrastructure itself can be used to model other perils. It is however both more flexible and less straightforward to access than the simplified interface.

CLIMADA thus makes it possible to analyse the impact of cyclonic storms, which at this stage are not included in the simplified EIOPA interface. A tutorial explaining how to analyse cyclonic storms in CLIMADA is available here: Hazard: Tropical cyclones — CLIMADA 3.3.2 documentation (climada-python.readthedocs.io)

It can also be used to model the impact of agricultural droughts and -more experimentally- forest fires.

Useful links:

- Tool presentation slides: Opening the world of catastrophe models (europa.eu).
- Comprehensive documentation for version 3.3.2: CLIMADA overview — CLIMADA 3.3.2 documentation (climada-python.readthedocs.io).

2.3. Other data sources

2.3.1. ISIMIP

ISIMIP is a protocol for pooling climate model projections within a shared methodological framework.
- It is presented on the following page: ISIMIP - The Inter-Sectoral Impact Model Intercomparison Project.
- The associated data directory can be accessed here: ISIMIP Repository - Search.

The ISIMIP directory offers:
- Climate variables from General Circulation Models (GCM);
- Variables derived from impact model, for the various sectors covered by ISIMIP.

As ISIMIP is the main data source for Climate Impact Explorer and CLIMADA, many of the variables presented cannot be directly applied to a natural disaster-related analysis. There are, however, hazard maps that can be used directly. For example, for river flooding, the hazard maps used in CLIMADA's

basic function and presented in Climate Impact Explorer are available here: [ISIMIP Spatially-explicit flood depth and flooded areas | Zenodo](#) .

Climate Impact Explorer presents, in a harmonised format:
- Climate variables from ISIMIP, adjusted and harmonised (see above);
- Primary and secondary impact variables derived from ISIMIP (e.g. sectoral impact models, such as agriculture) and CLIMADA (e.g., damage estimates from the model's basic functions, with estimated exposures based on LitPop).

Useful links:
- Climate Impact Explorer main page: [Climate Analytics — Climate impact explorer](#)
- The methodology page, with a list of available variables - [Climate Analytics — Climate impact explorer](#)
- Presentation of the Climate Impact Explorer during the *Opening the world of catastrophe models* event organised by EIOPA - [Presentation](#)

Public climate data catalogues provide resources that usually require adjustments before they can be used in a NatCat-type analysis. They also provide an aggregated view of risk for certain perils, which can help assess their materiality in relation to climate change. Below are a few examples of public data catalogues for Europe:
- [Data catalog of the European Commission's Joint Research Center](#)
- [Disaster Risk Management Knowledge Center Risk Data Hub](#) (European Commission)
- [Copernicus Project](#)

3. Assumptions for inflation and increase in exposure

Inflation - the inflation assumptions provided for the various scenarios of the FR/RoEU/US/RoW areas are to be used as a proxy for changes in the construction cost index.

Exposure in terms of risks insured - the assumptions used to take into account changes in exposure can be:

- In France, INSEE department-level demographic projections: *[Résultats détaillés des projections de population 2021-2070 pour la France – Scénario central – Projections de population 2021-2070 | Insee](#)*
- At international level, projections by country included in the middle variant scenario of the United Nations' World Population Prospects for 2022; i.e. the "Total population, as of 1 January" variable in the "Compact (most used: estimates and medium projections)" file, available here: [World Population Prospects - Population Division - United Nations](#). This variable is estimated historically up to 2022, then projected in a middle variant scenario up to 2100.

Any alternative assumption used to model the increase in exposure at international level must be fully documented in the methodological note.