

EXECUTIVE SUMMARY

Getting started on Physical climate risk analysis in finance - Available approaches and the way forward

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RESEARCH CONTEXT

This Executive Summary synthesizes key conclusions from the report “**Getting started on physical climate risk analysis in finance - Available approaches and the way forward**” published within the framework of the **ClimINVEST research project**.

Launched in September 2017, ClimINVEST aims at designing tailored information on physical climate risks to financial institutions, through a co-design process involving financial sector stakeholders themselves. All results will be publicly available between now and the end of the project in late 2020. The consortium gathers CICERO, I4CE, Wageningen Environmental Research, Météo-France and Carbone 4.

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What are physical climate risks to a financial institution?

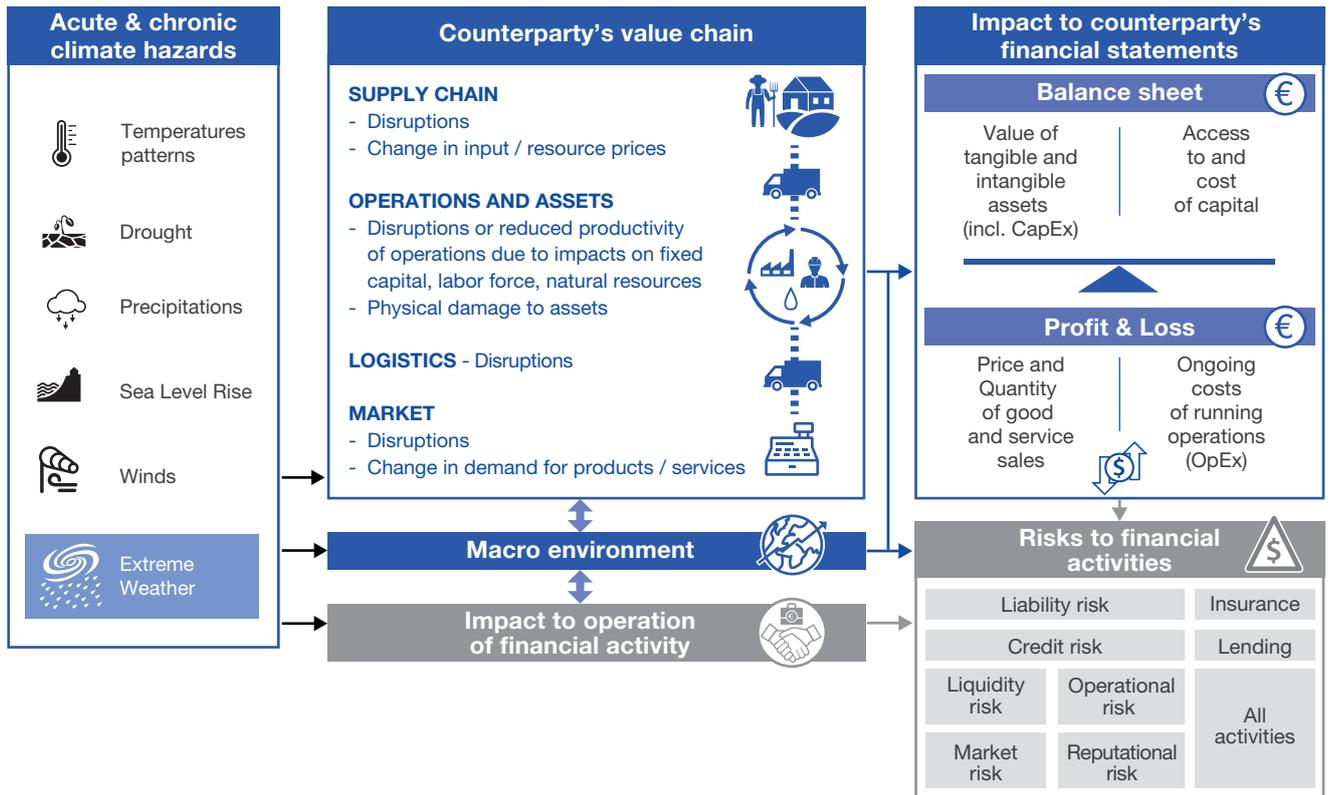
Climate change causes both acute hazards (*i.e.* event-driven hazards, including more frequent and intense extreme events such as cyclones or heatwaves), and chronic hazards (*i.e.* long-term change in the mean and variability of climate patterns such as mean temperatures). As shown on **Figure 1**, these hazards can affect financial institutions mainly through impacts on their counterparties in the real economy. These impacts can affect not only physical facilities that are directly exposed, but also the counterparty’s results and value chain and the macro conditions¹. Depending on the sensitivity and adaptive capacity of the counterparty to each specific impact, this affects its financial performance. In turn, it exposes the financial institution to financial risks that we call physical climate risks.

Physical climate risks have three main characteristics. First, they are linked to specific hazards – or a combination of different hazards² – that can lead to different impacts on the counterparty. Second, potential physical impacts depend on the specific situation of each counterparty and on its broader environment. Third, many physical impacts that scientists had originally anticipated over a much longer time horizon are being observed today across the globe, and will continue to increase in the next 10-20 years regardless of the greenhouse gas (GHG) emission trajectory. Such a trajectory will however influence physical impacts in the longer term (CICERO (2017)). This justifies the need for forward-looking analysis on short to longer time horizons.

¹ ‘Macro’ conditions define the broader business environment of the counterparty. They comprise socio-economic aspects including for instance macroeconomic, political, financial, sociological or technical conditions. These conditions may affect the resilience of the broader business environment to climate change impacts, with potential consequences on the counterparty.

² For instance, hurricanes in combination with sea level rise result in exacerbate flooding in coastal regions.

FIGURE 1. PROPAGATION CHANNELS OF CLIMATE RISKS TO THE REAL ECONOMY AND THE FINANCIAL SECTOR



Source: Authors, adapted from CICERO (2017) "Shades of Climate Risk"

Financial institutions are beginning to explore physical climate risks with service providers

Financial institutions are gaining awareness on physical climate risks, but they are not yet necessarily taking action

I4CE carried out a review of information made public by a sample of 80 financial institutions on physical climate risks in 2017. This review indicates that financial institutions are gaining awareness on physical climate risks, with 51% of institutions mentioning this issue in their public documents. However, only less than a quarter of sampled financial institutions reported conducting a physical climate risk analysis. Moreover, among these the exercise was mostly qualitative, with a fragmentary scope, and built on available approaches from external sources for a majority of analyses.

A limited number of service providers have developed approaches on physical climate risk analysis for financial institutions

As part of ClimINVEST, I4CE carried out a review of existing approaches to analyze physical climate risk dedicated to financial institutions. The pool of operational available approaches tailored for financial institutions is limited in number. Specialized service providers have developed

most of the approaches that were included in this report, as shown on Table 1.^{3 4} Half of these approaches are available for payment, while WRI's Water Risk Atlas and Trucost's Water Risk Monetizer are available for free.

Existing approaches address potential impacts of climate change on the counterparties of financial institutions

Service providers target different end-uses and end-users relevant for financial institutions. Nevertheless, they all try to answer the same type of question: how climate change can potentially affect counterparties such as projects, companies or governments. Not all of the selected approaches cover every type of counterparties and every aspect of potential impacts. In terms of counterparties, projects are in the scope of Acclimatise, Carbone 4 and Mercer's approaches; sovereigns are in the scope of Moody's Investors Service, 427, Carbone 4 and Mercer's approaches; companies are in the scope of 427, Carbone 4, Carbon Delta, Mercer and Trucost approaches. In terms of analysis of potential impacts, the WRI focuses on a sub-category of climate hazards, while the other approaches seek to incorporate the different aspects.

3 This report has reviewed the approaches that were available when starting this review in late 2017. The report has selected approaches in order to establish an overview of methodologies.

4 For brevity, this report provides examples on the selected approaches by mentioning the name of the service provider. When the Water Risk Monetizer is concerned, "Ecolab, Trucost and Microsoft" are mentioned shortly as "Trucost".

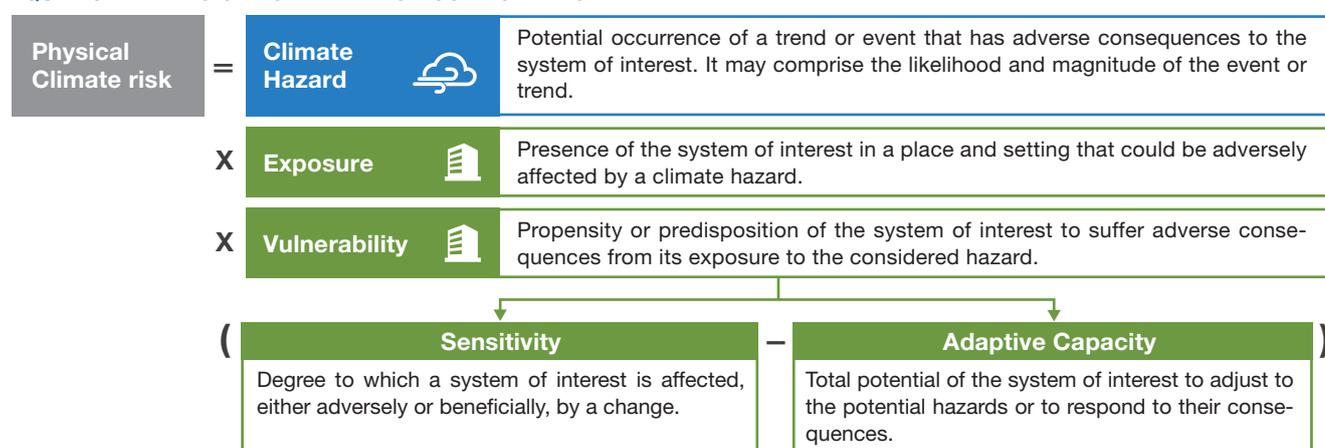
TABLE 1. SELECTED SERVICE PROVIDERS AND APPROACHES TARGETING DIFFERENT NEEDS

Target use	Target user	Service provider (Approach)
Pre-screening before financing	Project officers and risk managers – More suitable for development banks	Acclimatise (<i>Aware for Projects</i>)
Exploratory approach*	Risk managers – All financial institutions	Moody's Investors Service (<i>Physical Effects of Climate Change on Sovereign Issuers</i>)
Analysis of a portfolio exposure to climate hazards	Not defined – All financial institutions	WRI (<i>Aqueduct Water Risk Atlas</i>)
Analysis of physical climate risk	Not defined – All financial institutions	Carbon Delta (<i>Climate VaR</i>) Carbone 4 (<i>CRIS</i>) Ecolab, Trucost and Microsoft (<i>Water Risk Monetizer</i>) Four Twenty Seven (<i>427 Climate Risk Scores</i>) Mercer (<i>TRIP framework</i>)

* Moody's approach is exploratory in the sense that it does not constitute a new product to investors and it is based on illustrative data.

Source: Authors

EQUATION 1. PHYSICAL CLIMATE RISK COMPONENTS



Source: Authors

To investigate potential impacts, the approaches can combine information on the four broad categories explained in Equation 1 below: on climate hazards; on the counterparty's exposure to these hazards; on the sensitivity of the counterparty to this exposure; and on its capacity to address these potential impacts.

The approaches reviewed build on public data sources for climate hazards, with further steps of post-processing internally. The lists of climate databases used are easily accessible from service providers. The situation differs regarding the sources of information on counterparties (i.e. exposure, sensitivity and adaptive capacity data). The exposure can be provided by the end-user of the approach (in the case of Acclimatise, Trucost and Mercer's approaches), or combinations of counterparty's publicly reported information, commercial and proprietary databases (in the case of the other selected approaches). Sensitivity data can also be provided by the end user (in the case of Acclimatise and Trucost's approaches), or arise from combinations of public and commercial databases, public or proprietary cost functions, and expert judgment (in the case of the other selected approaches). The adaptive capacity is addressed for sovereigns with publicly available databases, while it is less covered for

corporate counterparties. The tools and data sources on counterparties are less transparent than on climate hazards.

Service providers' approaches use diverse information formats and methodologies

While service providers address the same type of question, they generate information with little cross-comparability. They make different methodological choices that can translate into different information formats.

Existing approaches provide scores or quantitative estimates with different types of details

Five service providers choose to provide scores on the level of physical climate risk of the counterparty (see Figure 2 below). Four other approaches produce quantitative information such as estimates of potential costs or asset value impact resulting from climate risks to a single counterparty. Furthermore, this information is produced using a range of normalization methodologies and uses different scales and units.

The information provided to end users also differs regarding the type of detail (e.g. per: type of hazard; climate scenario; time horizon; category of impact; counterparty) and the level of detail (e.g. counterparty or sectorial level analysis) they provide as illustrated in Figure 2.

Tradeoffs on specificity, exhaustiveness and detail result in different scopes of analysis

Service providers encounter difficulties in providing information that is exhaustive, detailed per type of impact and specific to the counterparty at the same time. They, in turn, tend to concentrate their efforts on specific aspects of physical climate risks that are more currently manageable.

The scope of hazards covered by each approach is variable. Most of the current approaches address acute climate-related phenomena (e.g. hurricanes; heat waves; drought and floods) while coverage of chronic phenomena is emerging (e.g. some approaches focus specifically on water availability; no approach addresses wind patterns). There are potential further differences in the indicators that describe a given hazard (e.g. water stress can be studied through mean yearly water supply or intra-year variability of water supply) but in several approaches there is limited transparency about the chosen indicators.

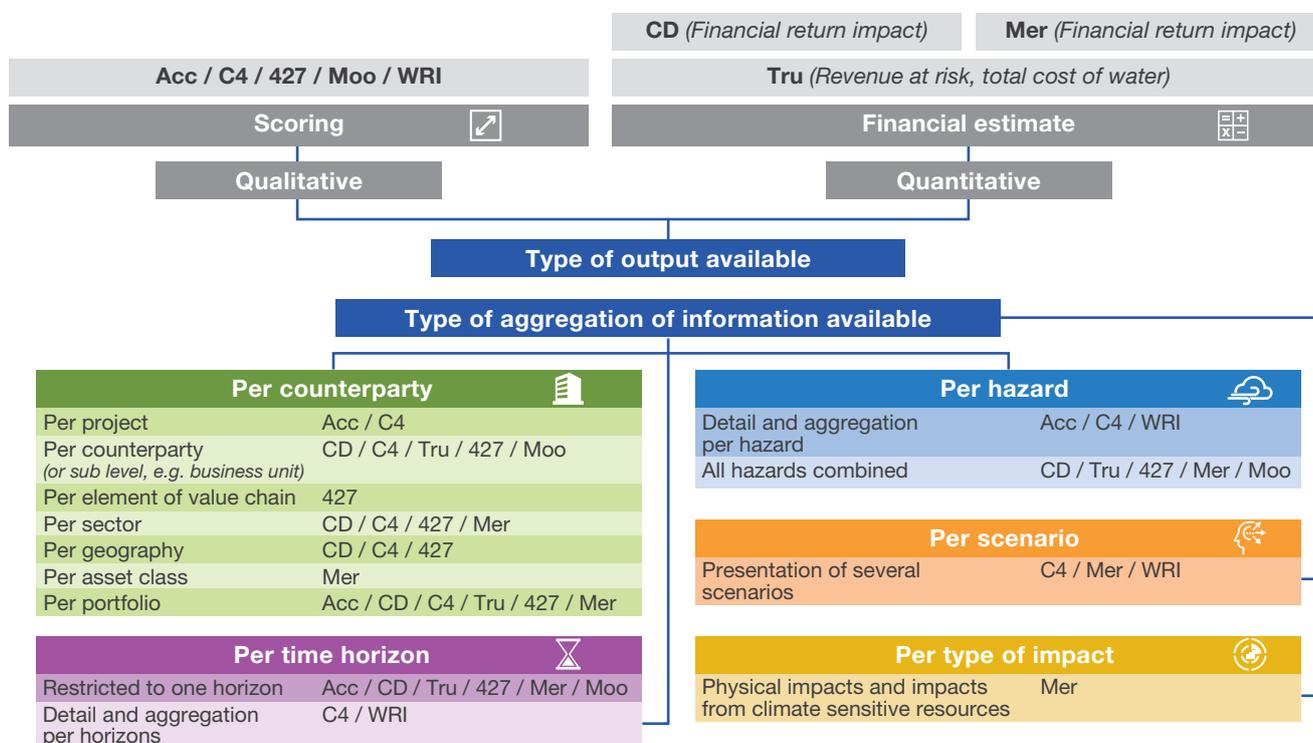
In addition, the existing methodologies covered by this study address different climate-related impacts on

corporate counterparties. They focus on different scopes of the counterparty's exposure; for instance, some methodologies cover the upstream and downstream value chain and the logistics whereas some others cover only operations. In the same vein, only a few cover capital, labor, natural resources and the macro context.

The limited availability of counterparty-specific data is a major challenge

One major reason for the difficulty to provide exhaustive and specific information is the limited availability of counterparty-specific data, especially for companies. First, while exposure of operations and downstream value chain is always detailed at a counterparty-specific level (with data on fixed capital and sales, at latitude/longitude scale or country scale), supply chain exposure is always assessed using sectoral data - and the macro context is seldom explicitly addressed. Second, sensitivity is always assessed at a sectoral level; it could benefit from micro information specific to each counterparty, as well as macro information on the business environment. Third, adaptive capacity is not addressed in the methodologies studied in this report due to the lack of available information. Finally, in front of limited availability of counterparty-specific data, the service providers have chosen between providing quantified financial estimates of impacts and providing qualitative analysis presented through scoring.

FIGURE 2. EXISTING APPROACHES PROVIDE DIVERSE TYPES OF INFORMATION



Acc: Acclimatise – Aware for Projects
 CD: Carbon Delta – Climate VaR
 C4: Carbone 4 – CRIS
 Tru: Ecolab, Trucost and Microsoft – Water Risk Monetizer

427: Four Twenty Seven – 427 Climate Risk Scores
 Mer: Mercer – TRIP framework

Moo: Moody's Investors Service – Physical Effects of Climate Change on Sovereign Issuers
 WRI: WRI – Aqueduct Water Risk Atlas

Source: Authors

Forward-looking analysis is starting to be integrated in physical climate risk analysis

Assessing physical climate risks requires a forward-looking analysis on climate hazards and socio-economic aspects, in the short to long-term horizons. Many physical impacts of climate change are being observed today and will continue to increase in the next 10-20 years. In the longer-term, physical impacts will also depend on the greenhouse gas emission scenarios (CICERO (2017)). In any time horizon, climate change may generate unprecedented conditions with potential combinations of gradual change in current average climate patterns and more frequent and intense extreme events. The exposed counterparties and broader systems may also evolve and modify their capacity to adapt to these changes.

Service providers often include forward-looking scenario-based analysis for climate hazards with variable time horizons (from 15-years going along to 2100) and typically using a single scenario. These scenarios are either 'trend scenarios' in the sense that they extrapolate trends from the past, or 'exploratory scenarios' in the sense that they also consider a set of bio-physical and socio-economic hypotheses to extrapolate the future. In order to complement this forward-looking analysis, the exploration of unprecedented combinations of weather events could be useful, regardless of the time horizon of analysis. This would justify integrating the risk of occurrence and the impact of a combination of weather events in the analysis, including gradual change in average weather conditions.

However, few existing methodologies integrate socio-economic scenarios, e.g. evolution of the macro-economic context, evolution of sensitivity and adaptive capacity. Indeed, the uncertainty on socio-economic evolutions is more "usual" for financial institutions but it is also larger and less documented compared with climate uncertainties. Some methodologies nevertheless do integrate some socio-economic projections through user input or expert judgment.

The way forward on physical climate risk analysis in finance

Financial institutions need data and methodologies to develop their physical climate risk analysis

Physical climate impacts are occurring now and they will continue to grow in the near term even if significant GHG mitigation occurs. While financial institutions are increasingly aware of this topic, there is still little evidence of concrete integration of physical climate risk information into their decision-making processes.

Financial institutions have conducted a first round of physical risk assessments with the assistance of external service providers, without necessarily taking action based on this information. They need approaches on physical climate risk analysis that are tailored to their institutional needs.

Service providers face barriers to improving methodologies and further development

While service providers have demonstrated their abilities to provide information on diverse aspects of physical climate risks, several barriers may hamper their potential for further developments. First, data availability is a challenge to produce relevant information at the appropriate granularity. This concerns in particular access to counterparty specific data on exposure, sensitivity and adaptive capacity. Second, the commercial environment of most service providers may also limit their direct capacity to explore financial institutions' needs thoroughly and to implement solutions in gradual steps or that require long-term, resource-intensive development.

A public interest-minded 'co-design' approach could catalyze physical climate risk analysis in finance

The first challenge relates to data availability. The lack of public information in some domains (such as at the counterparty level) stresses the importance of improving public disclosure (e.g. through the implementation of the TCFD recommendations). This is clearly a necessary step toward a solution.

In addition, the other barriers could be lifted through a co-design approach between scientists and financial institutions in a public interest, non-profit approach. This could help scientists understand concrete decision-making processes within financial institutions to help overcome barriers to integrate information on physical climate risks. This could help raise the awareness of financial institutions that may currently consider climate risks not to be material for themselves. Reciprocally, financial institutions may benefit from climate scientists' exploration of available and reliable datasets on hazards, as well as relevant indicators and analytical techniques to overcome barriers. The co-design process in itself could yield relevant conclusions for further service providers' developments. Moreover, a public interest-minded approach to climate service development may be necessary to highlight the longer-term research avenues on physical climate risks.

In its next phase, the ClimINVEST project – which builds on a unique collaboration between academics, service providers, government data providers and financial institutions – will test a public interest co-design research approach to create actionable information on physical climate risk for financial institutions. The European team of climate and finance specialists will collaborate with financial institutions to co-design transparent and publicly available information and methodologies based on public data.

