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A new approach for crisis management analysis: Considering the anticipation/decision making pair as a continuum

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Abstract

The polysemy of crisis anticipation and decision-making in crisis situations, and the difficulties regularly encountered during these processes, have been highlighted in the literature. This paper illustrates the obstacles to accurately predicting crisis situations by demonstrating the fragmentation of the pair anticipation/decision-making. It does so through two studies involving the Caribbean Irma–Jose–Maria hurricane sequence (2017), through the respective lenses of the French National Crisis Coordination Centre at the Interministerial level and of a government operator, the French Geological Survey, at the territorial level. Absence of shared vision within and between crisis management rooms regarding the nature, time horizon, and methodological framework of the anticipation function all hampered its effective implementation during the hurricane sequences. This was mainly due to the coexistence of different ministerial cultures regarding crisis anticipation and the siloed structure of the French Crisis Management System. Findings suggest that time is a critical structuring element for adaptive and shared anticipatory approaches. Therefore, the anticipation/decision-making pair can be seen as a continuum integrating all temporalities from prevention to crisis management and reconstruction. This new paradigm should be applied through the plurality of administrative cultures, which are in great tension with each other in preventing and managing crisis situations.

KEYWORDS
anticipation, crisis management, hurricane, temporality

1 | INTRODUCTION

Preparation for and anticipation of climate-related events have become unavoidable in a world of 'natural' disasters (Revet, 2020) requiring an 'all hazard' approach (Lakoff, 2007). This approach lies at the root of the construction of many socio-technical systems, plans, and devices (e.g., warning networks, prevention plans and critical infrastructure) and demands responsiveness at both the technical and political levels (Anderson, 2016). The two pillars of responsiveness are anticipation and decision-making (Farazmand, 2009), but limited attention has been given to how these two notions are articulated in relation to one another. We

propose, therefore, to analyse anticipation and decision-making together.

This paper is based on two studies conducted during the Irma–Jose–Maria hurricane sequence (September 2017) on the geographical extremes of anticipation/decision-making. The first is a description of the anticipation/decision-making pair at the Interministerial level during the activation of the French government's national crisis management room (CIC),[1] observed through the lens of research conducted on behalf of France's General Secretariat of Defence and National Security about government organisation to address major crises (November & Azémar, 2018). The second is based on the experience of a government operator (BRGM, the French Geological Survey) that specializes in coastal risks and marine flooding (Le Roy et al., 2015; Lecacheux et al., 2018), complemented by interviews conducted within the APRIL project.[2] One of the missions of the BRGM during these events was to anticipate which areas would be flooded, based on marine weather forecasts, to facilitate decision-making in each territory.

Bringing together these two studies is the first novel aspect of this article. Doing so helps us reframe the anticipation/decision-making pair pragmatically by questioning the fragmentation of the pair as currently used by actors in practice, be it in Interministerial crisis management rooms or the experiences of government operators relative to local territories. The second novelty of this study is that it proposes a paradigm shift by integrating the time of anticipation into decision-making and considering the pair as a continuum.

To achieve the goals of this study, after a presentation of the case study (Section 2), we highlight the polysemic nature of anticipation and decision-making with a review of international studies (Section 3). We then analyse the limitations of the anticipation/decision-making pair using the findings of two studies conducted during Hurricane Irma (Section 4). Based on our findings, we propose and argue for a new paradigm of the anticipation/decision-making continuum (Section 5). Finally, we explore the relevance of this new paradigm beyond the French context.

2 | CASE STUDY

In September 2017, Hurricane Irma was the first category-5 hurricane of the year to hit the West Indies, causing some marine flooding on the exposed northeastern coast of Guadeloupe (Cangialosi et al., 2018). The eye of the storm crossed Saint Martin and Saint-Barthélemy on September 6, and these regions suffered major consequences (Météo-France, 2017a). The damage took many forms. Gale-force winds with gusts of up to 244 km/h tore the roofs off buildings (including that of the Prefecture of Saint Martin, the administrative authority of the island), uprooted vegetation, tore down walls, and knocked out the electrical network (Gargani, 2022), among other damages. The swell of over 12 m and the storm surge above 3 m also significantly eroded the lower coastal areas and caused substantial flooding. Roads, water networks, and buildings along the shoreline were severely damaged, some to the point of total ruin (Azémard et al., 2017; De la Torre, 2017; Rey et al., 2019). In Saint Martin, 11 people lost their lives, and 95% of the buildings were damaged (Gustin, 2017).

Hurricane Jose hit a few days later. Although it did not cause any additional damage owing to its small size and trajectory (farther to the north), Hurricane Jose's passage was not without consequence. Strong swells and weather conditions blocked sea and air transport for several hours, hampering the delivery of relief supplies following Hurricane Irma. In addition, there were persistent doubts about its trajectory for several days, heightening the confusion among the population and further weakening the response of the civil security forces.

Finally, on September 19, the eye of Hurricane Maria passed a few kilometres south of the Guadeloupe archipelago, surprising inhabitants by its explosive intensification, with the wind intensity doubling to gusts of more than 215 km/h over a 24-h period (Météo-France, 2017b). The damage to the developed shoreline areas due to the direct impact of waves and soil erosion was considerable (Popescu et al., 2020). On many sites, coastal installations such as *carbets* (open-sided community meeting shelters), benches, and roads (including the RD6 departmental road) were battered and in some cases overturned (Legendre & Guillen, 2017). A few years later, the recovery process was still ongoing on the French (Jouannic et al., 2020) and Dutch sides of the island (Collodi et al., 2021; Medina et al., 2019).

The Irma–Jose–Maria hurricane sequence shows that, despite significant progress in recent years, hurricane forecasting is still fraught with uncertainty, especially in terms of estimations of intensity, which involve very small-scale processes (DeMaria et al., 2014). The trajectories of Hurricanes Irma, Jose, and Maria were predicted correctly, enabling the determination of areas that would be hardest hit by intense conditions several days in advance. However, beyond marine weather forecasts and warning levels, the shortcomings of the September 2017 hurricane crisis management reveal the need to anticipate hurricane impacts onshore, especially marine floods and their aftermath, for the sake of both the environment and human lives. With the information provided by Météo-France regarding the progress of Hurricane Irma, the French government's national crisis management room (ICC) was activated, as were crisis management rooms at the zonal and prefectural levels in Martinique, Guadeloupe and Saint Martin, in anticipation of an unprecedented scale of events (see Figure 1). Hence, at the governmental level, the focus was on preparing the most appropriate response based on uncertain information not only for marine weather forecasts but also considering the socioeconomic dimensions of the territories that would potentially be impacted and the resulting cascading effects (insularity, impacted networks, vulnerability of the population, insurance contexts, etc.).

3 | ANTICIPATION: A COMPLEX PROCESS

It is simple enough to define 'anticipation' generically: getting ahead of a future situation or simply forecasting or preempting a situation or event. It is more difficult to agree on how to build strategies ahead of

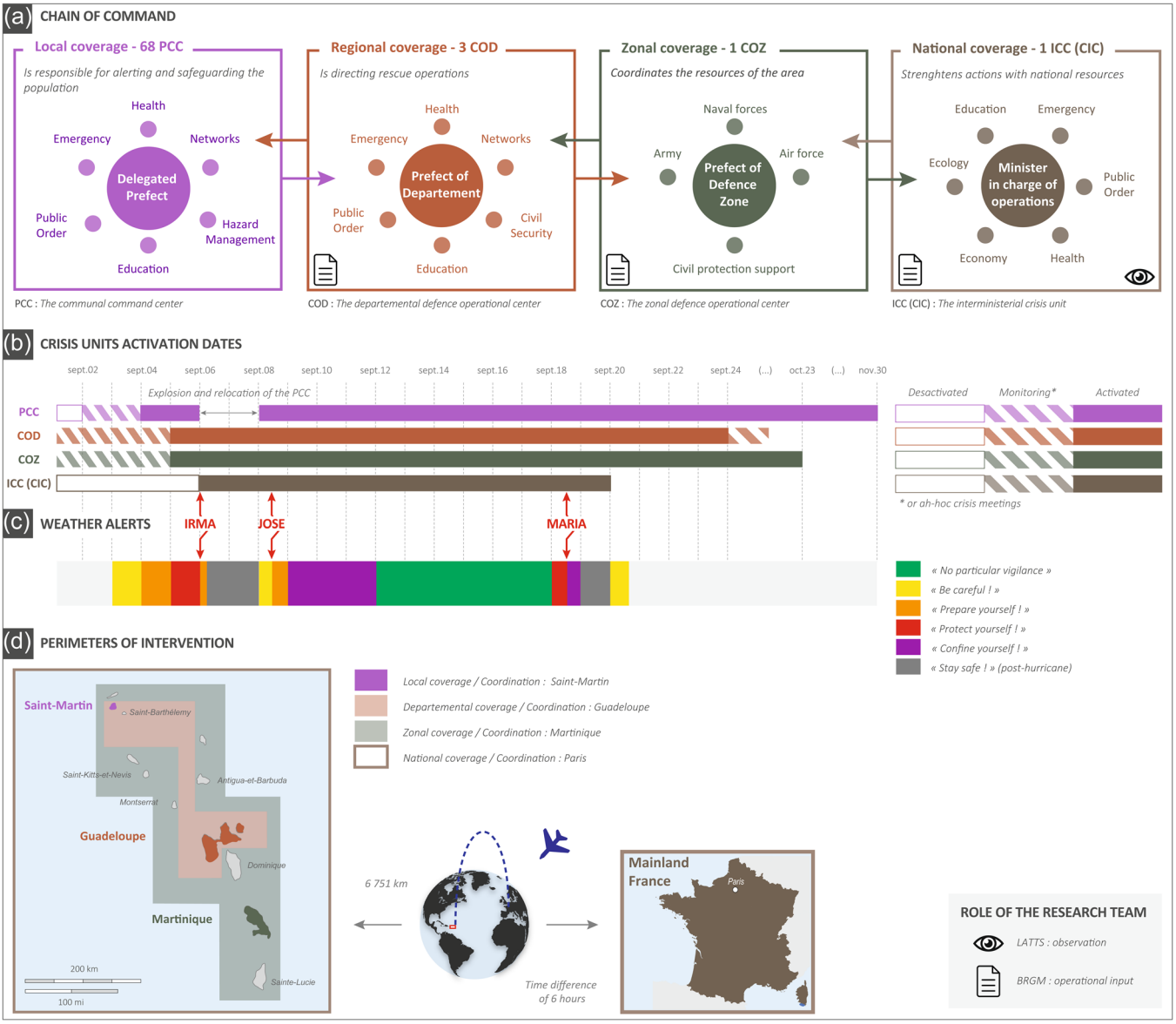

FIGURE 1 Spatio-temporality of the 2017 Hurricane sequence. This figure shows the timeline of the event and the activation of the corresponding crisis rooms. It illustrates the French crisis management organisation within the chain of command, as enacted during the 2017 hurricane sequence.

time. How can we be certain of their effectiveness? Under what conditions could anticipation lead to relevant, ethical decision-making with positive practical impacts? The response to these queries lies in understanding the various obstacles that can limit the creation or development of anticipation strategies. Below, we present these obstacles.

First, during major crises, anticipation and decision-making in uncertain (e.g., weather-related) conditions are conducted based only on partial perceptions of the situation at hand (Reghezza-Zitt, 2019). These perceptions are often based on heterogeneous, incomplete information in a shifting temporal and spatial context and are highly dependent on the way information is understood, interpreted, and projected within a timeframe (Endsley, 1995). Although prevention research can target the most vulnerable areas, its utility in terms of crisis management is limited, as even small variations in the forecast characteristics of an approaching hurricane (trajectory, intensity, or size) can result in very different consequences onshore (Rohmer et al., 2016). Interpretation and intuition, therefore, play important roles in the anticipation process. However, decision-making uses complex, dynamic methods that are often amplified by a multilevel chain of command (Dionne et al., 2018). This twofold 'perception–decision' relationship structures the 'Common Operational Picture' (COP), which describes a situation at a given moment *t*. Wybo and Latiers (2006) observe that a COP is difficult to construct, even within a single crisis management room. Whereas each actor's subjective experience determines their own perception, the COP should offer a shared vision of the 'here and now' of the situation at hand (Danielsson et al., 2014; p. 29), which promotes collective sensemaking (Wolbers & Boersma, 2013).

Thus, seemingly differing decisions and actions can be implemented partly because of the variability of experiences and interpretations of the objectives of the operational response and of unshared information from the field. There is minimal investigation of the interplay among 'perception–COP–decision processes' during actual low probability, low-intensity events (Donahue & Tuohy, 2006) beyond generic or theoretical approaches (Heikkilä et al., 2015; Rosqvist et al., 2017). Yang et al. (2019) distinguishes three planning approaches—robust, adaptive, and repeated planning—for evacuation decisions during hurricanes based on how they account for uncertainty. 'Robust' planning must explicitly address this uncertainty and aim to design plans that are advisable for multiple, if not all, scenarios. Given the need to monitor conditions and provide different measures according to a hurricane's evolution, 'adaptive' planning consists of developing multiple contingency plans and defining the circumstances in which they must be enacted. Finally, 'repeated' planning generates new plans as new information becomes available, whereas initial plans are made regardless of how conditions and information evolve.

Second, in the field of risks and crises, flow of and access to relevant quality information are the most crucial elements to effectively anticipate. Both aspects are well-documented and easy to observe (Coombs & Holladay, 2010; Lindell, 2018). However, some aspects remain unclear; notably: (i) information being available does not guarantee that those to whom it is addressed receive it, and (ii) information that circulates is not necessarily understood. In other words, it takes substantial reformulating for information to become usable (Paton, 2008). To cope with risk and crisis situations, it must be feasible for a wide range of actors to capture and translate information (Baker & Ward, 2002; November & Leanza, 2015). Practice reveals that information flows in complex, heterogeneous, and nonlinear ways (Treurniet & Wolbers, 2021). There are examples of cases in which information, even of ample quantity, does not reach the addressee, and other cases in which information is found, used, and helps reduce risk situations (Rizza et al., 2017). Often during crises, governments face multi-layer challenges and are required to address the transboundary nature of the crisis in which multiple administrative levels and several geographical areas are involved simultaneously (Ansell et al., 2010; Boin, 2019; Boin & Lodge, 2016).

Third, disaster management is part of a 'preparation–planning–emergency management–end crisis' continuum (Lakoff, 2007). Each step in this chain requires anticipation to establish strategies for action and resource allocation (i.e., Xiang & Zhuang, 2014) in a way that does not jeopardize the future or the impacted territories' ability to recover (Neisser & Runkel, 2017). These strategies have both technical and profound political consequences: anticipating (and thus, problematizing) the future means asking ethical questions about which actions to prioritize, which populations to prioritize, and which infrastructure to secure (Anderson, 2010). In crisis situations, this could mean leaving some needs on hold, staggering relief efforts, and favoring certain territories over others (Bolin & Kurtz, 2018; Metzger et al., 2014). Accusations are also often made about responses being delayed (Anderson, 2016).

Fourth, anticipation (and relief efforts) must be understood in terms of predicting and preventing hazards before they occur (Kruke & Olsen, 2005). During particularly complex, dynamic crises, planning has often proven inflexible, making improvisation or adaptation random (Adrot & Moriceau, 2013; Lagadec, 2009). Some studies have stressed the need to anticipate uncertainty and the unexpected (i.e., Arnoldi, 2009; Aven & Renn, 2009; Reghezza-Zitt, 2019). Therefore, preparation must not be limited to the ability to respond to an event but must also anticipate different possibilities for managing this event from the perspective of resilience (Hémond & Robert, 2012; Medd & Marvin, 2005), particularly in postcrisis phases.

Although this literature review shows the complexity of the anticipation and decision-making process, it insufficiently explains how to characterize the anticipation/decision-making pair. To further understand the characteristics of this pair, we analyse the findings of two studies, one at the national level and the other at the territorial level.[3]

4 | ANTICIPATION PUT TO THE TEST BY CRISIS MANAGEMENT

4.1 | Anticipation and decision-making at the Interministerial level

As part of our research on the organisation of the French government's disaster management plan (November & Azémar, 2018), we observed the ICC during three drills and the September 2017 Hurricane Irma crisis. These in situ observations (40 h of drills or real crisis observations) were enriched with more than 30 interviews with actors who regularly chaired the ICC (e.g., staff of the Prime Minister's office, Ministry of the Interior staff, Senior Defence and Security Officers of all Ministries involved, etc.).[4]

The role of anticipation in the ICC was described in a January 2, 2012, circular about the government's disaster management plan as follows:[5] 'As the situation evolves, attention focuses on increasingly distant time horizons, a few hours initially, then telescoping to days or even weeks. The cascade effects of the crisis on sectors of activity other than those originally affected are analysed' (French Prime Minister's Office, 2012, 2019; p. 9). From a practical and organisational standpoint, anticipation is a 'subset' of the situation function that oversees data collection to inform the evolving situation. Through drills and disaster situation experience (notably, the 2015 terrorist attacks in France[6]), anticipation has become a function in its own right, with situation, communication, and decision functions (see Figure 2).

Our study confirms the usefulness and importance of the anticipation function in governmental crisis management plans, although participants often complained about errors in its use and/or lack of relevance regarding its production during the study period. There were different opinions about the causes of the failures, from inappropriate work methodology to underutilisation at the political level and coordination difficulty at different geographical scales.

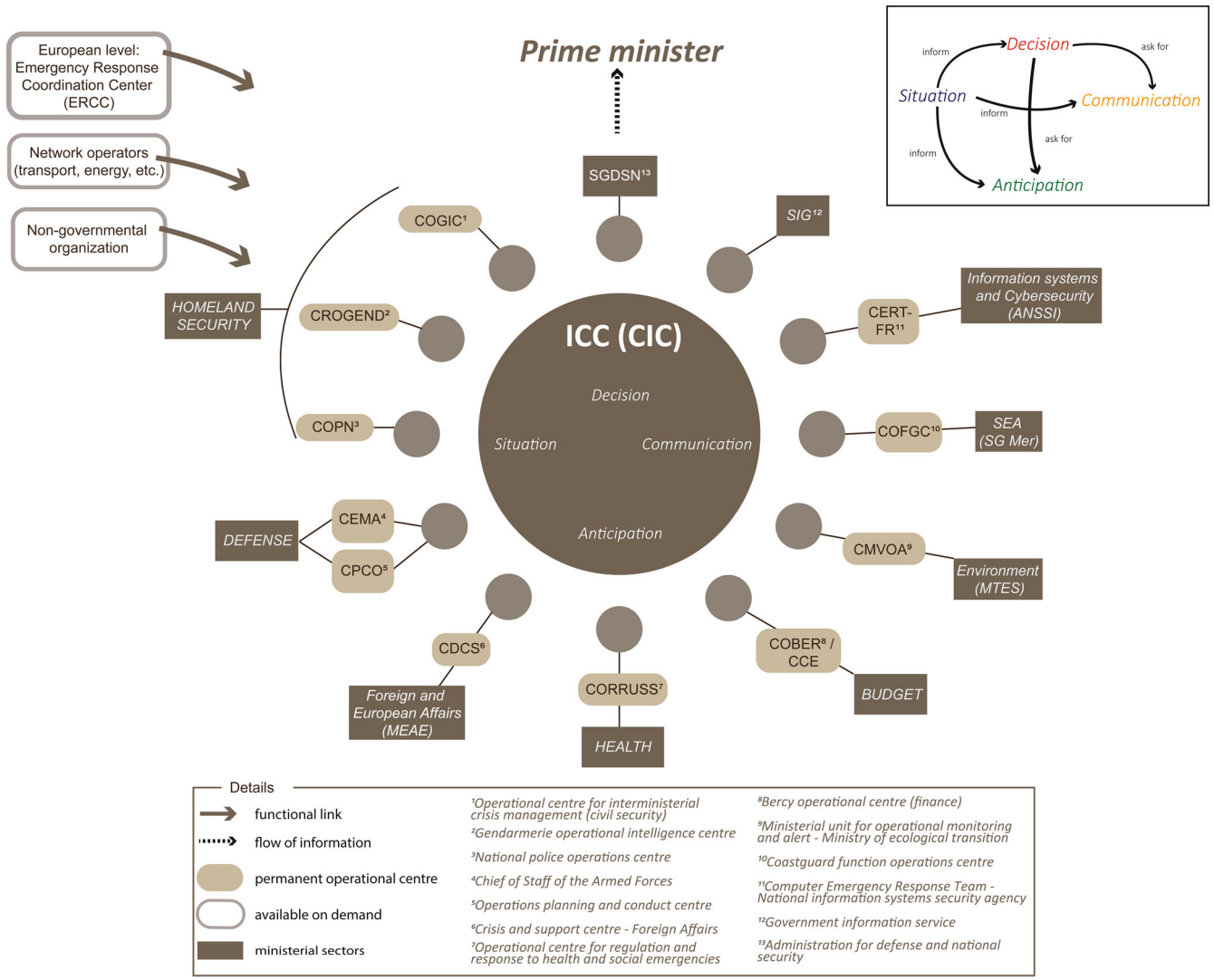

FIGURE 2 Focus on the French National Interministerial Crisis Centre (ICC/CIC) and involved actors around the table. The figure shows the relationships with each ministry and their dedicated crisis units that are activated in crisis situations.

For some interviewees, the lack of a clear working methodology was largely due to a clash of departmental cultures: For example, the Ministry of Ecology and the Ministry of Health were more oriented toward planning while the Ministry of the Interior and the Ministry of the Armed Forces were more focused on managing operational responses. Still, the latter two ministries have different conceptions of the notion of anticipation, particularly regarding the temporal dimension. For the Ministry of the Interior, anticipation means imagining what would happen in the short and/or medium term (a few hours to a few days) in a given crisis situation. As such, their goal is to design a response or means to avoid a chain reaction. Meanwhile, the Ministry of the Armed Forces adopts a long-term approach to thinking about the immediate effects of a crisis. The timeframe can extend from a few weeks to a few months in terms of both spatial consequences and economic effects on a territory. This type of anticipation implies a necessary distancing from the crisis at hand, and this is not always understood or applied in crisis management rooms. However, the conceptions of these ministries, while seemingly at opposite ends of a spectrum, are not contradictory or incompatible: The idea is to anticipate *both* the medium and long terms in the ICC. This would require implementing a new way of anticipation decoupled from classic ministerial cultures while still drawing largely on their ideas. As summarized by one of the actors interviewed: 'Anticipation requires a method, a good brain, and knowing the job, but not being too specialized so as to be able to think broadly and position oneself timewise'.

Nevertheless, the government's crisis management archives attest to the added value of the anticipation function in instances in which it has been activated, particularly during the Charlie Hebdo attacks (January 6, 2015) and those of November 13, 2015, both in Paris. However, for the first time since the publication of the January 2, 2012, circular, the anticipation function was not activated for this hurricane sequence. Instead, a new function called a 'logistic anticipation function' was implemented at the instigation of the

Ministry of the Interior, which was responsible for crisis management at the time. Indeed, it anticipated logistical needs: a request was made to the Ministry of Ecology (and to Météo-France in particular) concerning the vigilance needed to observe the evolution of Hurricane Jose and to the Ministry of Foreign Affairs for the relief that France could ask for from the neighbouring countries in the event of a crisis over crisis (mainly the Netherlands, with whom they 'share' the island of Saint Martin and the proximity of American territories). However, an ICC participant pointed out that 'the two functions are incompatible by definition. Logistics are always late, whereas anticipation must only consider the future by no longer dealing with logistical issues'. Questions relating to anticipation arose in ICC decision meetings (dedicated to the decision function) but were systematically deferred owing to a lack of understanding and projection (e.g., regarding reconstruction, the restoration of public buildings, habitat maintenance and urban planning rules). However, anticipation functions contribute to decision-making functions by avoiding compound disasters or holding too narrow a view of the crisis. In the case of Hurricane Irma, the idea of decision function 'control' over the anticipation function was not always clear. However, the anticipation function can work only on the orders of the decision-making function, which defines its mission. Interviewees complained that the Deputy Crisis Manager in charge of this specific crisis had no consideration of or interest in the anticipation function.

The lack of anticipation function was certainly due to a distance effect from the overseas territories and the immense challenge that logistics presented from the onset of the crisis, in particular, difficulty linking geographical scales. ICC crisis managers had no means of establishing communications via traditional networks (telephone, Internet, etc.) with the territorial echelons in the first hours following Hurricane Irma's passage. The only information from the ground was transmitted via a satellite phone from the sub-prefecture, which itself was hit hard. The fact that the affected territories were islands, the unexpected arrivals of Hurricanes Jose and Maria, and the risk of compound disasters they brought created a 'tunnel effect' regarding logistics to the detriment of anticipation. The lack of communication in the early aftermath of the crisis reinforced a crisis management 'vacuum effect' at the national level to the detriment of the local level, which had difficulty making itself heard or understood. However, a week before, in a parallel process, national and local authorities (departments of the Ministry of the Interior and Prefectures) requested the expertize of the BRGM and the Environment, Planning and Housing Department of Guadeloupe (DEAL) on the expected effects of Hurricane Irma[7] on the territories at risk of being impacted.

4.2 | Anticipation and decision-making in operational management

As part of the operational crisis management of the Irma–Jose–Maria hurricane sequence, the input of the French public service and operators, including the BRGM, was in high demand by the different levels of the ORSEC system, the French generic emergency plan for disasters (prefectures; defence zone, or regional level authorities; COGIC, or Interdepartmental Operations Centre for Crisis Management; and ICC/CIC). There were two recurring questions throughout the hurricane sequence: (i) what was the risk of marine flooding? and (ii) which sectors should be evacuated? These questions were especially pressing at the local level, where the anticipation for hurricanes is generally understood in terms of implementing backup and evacuation measures before the event. The simultaneity of these questions, which occurred less than 48 h before Hurricane Irma hit the West Indies, and their repetition during Hurricanes Jose and Maria illustrate the many obstacles to anticipation.[8]

At the request of the prefecture, the BRGM and the DEAL provided lists of zoned areas that were likely to be flooded in Saint Martin based on information available from heterogeneous sources with different functions (e.g., Coastal Risk Prevention Plans, Atlas of Risk, local knowledge, scientific publications, etc.) in the 2 days preceding Hurricane Irma's landfall in the West Indies. Given the major intensity of the expected impacts, areas with high flooding hazard levels were expanded by expertize with topographic information. This initial mapping was based on neither the hurricane's characteristic or uncertainties nor the flood modelling but rather on prevention documents that had been turned into a crisis management tool. Moreover, modelling of the potential extent of marine flooding in the municipalities in northern Guadeloupe based on marine forecasts was performed on representative profiles (for computing time reasons). If the Saint Martin mapping served as a basic document for evacuation operations, the modelling results on profiles for Guadeloupe were rarely used owing to their limited visual and informative significance. Successive diagnostic updates performed over the entire hurricane sequence for the three territories (Guadeloupe, Martinique, and Saint Martin) were carried out in a 'macro' way by targeting the exposed communities and considering the scale of the expected impacts based on expertize regarding changes in marine weather forecasts (see Figure 3).

Although based on a 'degraded' diagnosis of the exposed areas, the prefectures' operational responses were resolute and effective (leading to minimal human loss). However, there is reason to question the underlying lack of anticipation before the disaster given the lack of crisis management mapping, which would have facilitated:

(i) the development and implementation of 'robust, adaptive' planning to identify exposed areas and the evacuation routes necessary based on the hurricane's expected trajectory and evolution according to the prediction networks; and
(ii) the construction of a COP shared by different levels of the ORSEC system.

A fundamental question that can be raised by this example is that of apprehending and managing uncertainty regarding the evolution of hurricanes' trajectories and characteristics, which must be anticipated within a reasonable timeframe before the impact (e.g., Hoss & Fischbeck, 2016). How do users of evolving risk mapping make decisions

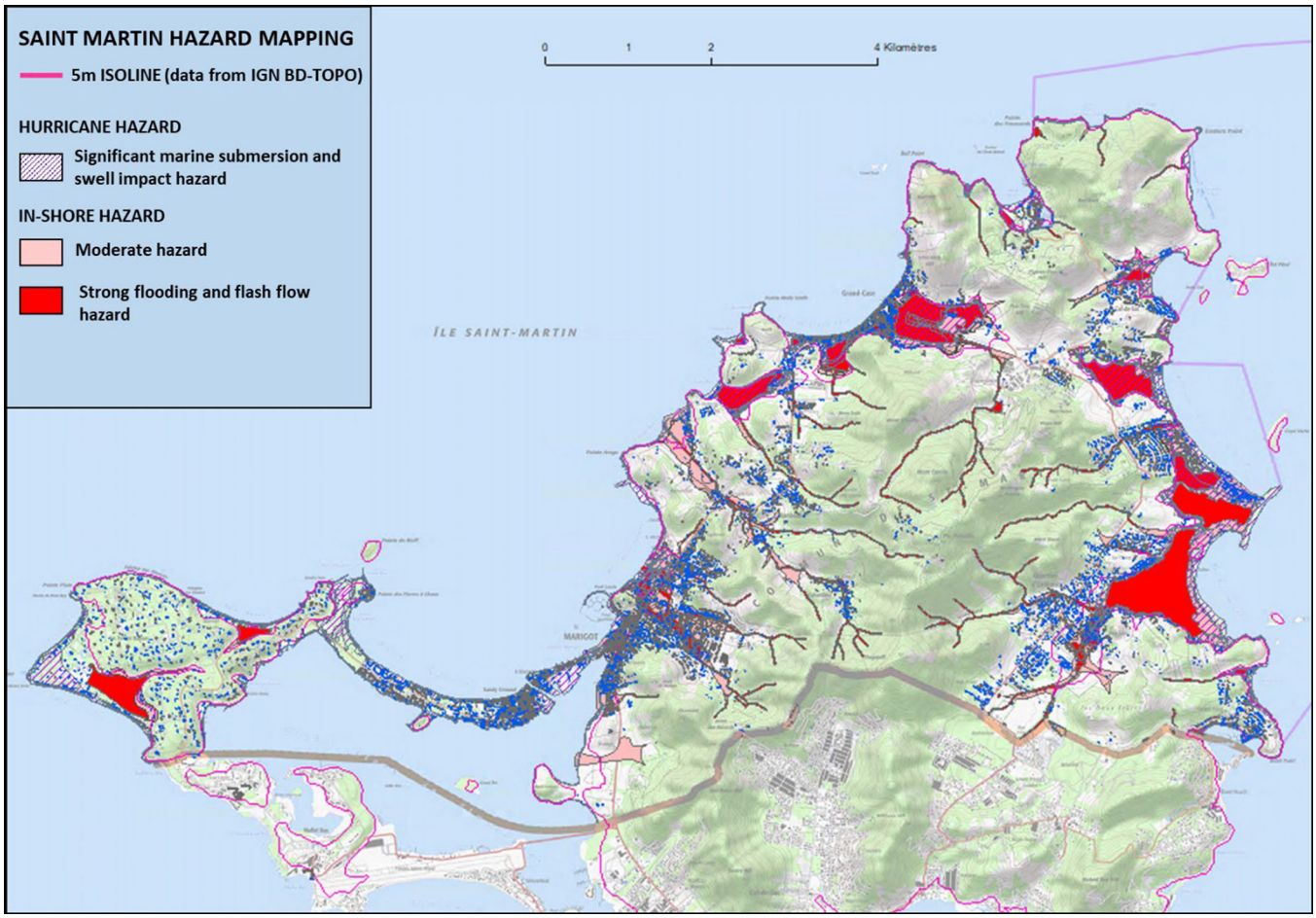

FIGURE 3 Submersion map created by the French Geological Survey (BRGM)

based on uncertain information? Theoretically, such decision-making involves weighing possible scenarios, their relative probability, and the advantages and benefits of specific actions. Decisions made early can often be jeopardized by changes in forecasts or an event's characteristics. There is contrasting experience feedback and experimental results between those who claim that more information enables better decisions (e.g., Joslyn et al., 2007; Mu et al., 2018) and those who believe that the complexity of information must be reduced to make quick decisions (e.g., Doksaeter Sivle & Kolstø, 2016). Thus, anticipation and the resulting decisions could be significantly affected by both the sheer quantity of the information provided and its format. In relation to evacuation management during the Irma–Jose–Maria sequence, the mappings of flood-exposed areas on Saint Martin—although devoid of quantitative information on related uncertainties—were considered both informative and efficient means of communication between the prefecture and municipalities. Whether the provision of additional information on probabilities and uncertainties would have significantly impacted decisions is not univocal, depending on the psychological profiles and experiences of the individuals involved (e.g., Dash & Gladwin, 2007; Sherman-Morris, 2013). However, we stress that, once information on a scientific diagnosis is enriched, there is a critical need for pedagogical support so that crisis managers can observe, measure, and anticipate the impact of these probabilities and uncertainties on future operational decisions.

These findings from the two studies, while not exhaustive, show the complexity in the production conditions of anticipation during crisis management. There is a need to reconsider the anticipation/decision-making pair, and we argue for a paradigm shift that considers this pair as a continuum.

5 | MOVING FROM THE ANTICIPATION/DECISION-MAKING PAIR TO AN ANTICIPATION/DECISION-MAKING CONTINUUM

There are three reasons why we should consider the anticipation/decision-making continuum, based on our findings developed in the previous section.

First, the multifaceted nature of the concept of anticipation is fully assimilated in actors' practices. Depending on the ministerial culture or temporality, crisis management actors might not be in agreement. The two studies showed that some interviewees speak about planning anticipation, while others refer to operational anticipation, and yet others

to strategic anticipation (November & Gueben-Veniere, 2019). These different temporalities make it particularly difficult to construct a COP and can exacerbate tensions in situations of uncertainty and/or extreme events when decisions are made. Moreover, situations of uncertainty are characterized by iterative decision-making, 'a series of appointments' rather than a single, once-and-for-all decision, as shown by Callon et al. (2009). This is the idea behind 'repeated' planning (Yang et al., 2019).

Second, time appears to be a critical structuring element of a dynamic and adaptive anticipatory approach. All information has a 'finite useful life' corresponding to the time during which it can be considered 'stable' (Wybo, 2013; p. 61). This 'useful life' must be measured against the ability to recognize and (re)qualify information received and then to quickly adapt to these exogenous temporalities for anticipating and decision-making. Ballard et al. (2008) demonstrate the existence of endogenous rhythms with group dynamics (epochal temporality) adapting to external stimuli, thereby creating a temporal sequencing that naturally governs collective work (Ballard et al., 2008). Thus, during the Irma–Jose–Maria hurricanes, the juxtaposition of all temporalities (exogenous, endogenous, and so-called 'planning') associated with the multiplicity of crisis management rooms (ORSEC and territorial grid levels) and the different meanings of 'anticipation' led to the fragmentation of the anticipation/decision-making pair, and thus, generated dissonance.

Third, one of the difficulties in effectively implementing the anticipation function during the Irma–Jose–Maria sequence stemmed from the coexistence of different reference frameworks of various ministries: crisis management versus risk management. Risk management, based on the objectification of risks, is a set of structural and nonstructural measures designed to prevent disasters and mitigate their impacts before, during, and after their occurrence (Jong & Brink, 2017; Khan et al., 2008; March, 2016). This universal conception, included in the United Nations Sendai Framework for Disaster Risk Reduction (United Nations Office of Disaster Risk Reduction, 2015), aims to increase overall resilience. This proactive approach contrasts with crisis management, which is reactive (Boin & Lagadec, 2000; Finnessey et al., 2016; Rosenthal & Kouzmin, 1997). It is based on contingency planning implemented by seasoned crisis professionals (Fu et al., 2013; Nourani et al., 2011).

In summary, our study shows that temporalities vary considerably and can lead to decisions that are at odds with each other. For example, anticipating water shortages by sending bottled water may seem like a good idea in the short term. However, a longer-term anticipation would probably have considered the problem of dealing with plastic waste in an island context—a problem that is far from being solved. Decisions must take into account the long-term effects on the territory to increase their resilience. The anticipation/decision-making pair struggles in temporalities, making it necessary to understand this pair as a continuum.

6 | CONCLUSION

The continuum concept is consistent with the paradigm shift in the late 20th century from crisis management to risk management, accelerated by numerous global large-scale disasters. Catastrophic events (the 'focusing events' of Birkland, 1998), such as Hurricane Katrina in the US in 2005, have promoted a more global vision of risks. In France in 2010, storm Xynthia showed how the two paradigms were not integrated in terms of French institutional regulations and services, which led to less leeway, stricter regulations, and more supervision for stakeholders (Chadenas et al., 2014). However, similar to other disasters (e.g., Penning-Rowsell et al., 2006; for the UK flooding), the 2017 hurricane sequence shows that this shift is incomplete. In France, the ORSEC emergency management plan is implemented when preventive measures are overwhelmed by the impact of the event. Hence, we are concerned that the shift toward nonintegrated paradigms could lead to difficulties in anticipating a way out of crises. Therefore, it seems legitimate to question the extent to which such difficulties, and those within crisis management, are linked to the constrained procedures of the ORSEC plan, which is designed by the Ministry of the Interior. These procedures amount to resistance in the deployment of 'planning' anticipation beyond the event. However, in transboundary crises, a multi-temporal and multifunctional line of reasoning (Moorkamp et al., 2020) is needed to build a shared culture of anticipation that goes beyond the fragmentation of the anticipation/decision-making pair. Thus, it is of practical use to consider the anticipation/decision-making pair as a continuum by integrating 'planning' temporality as an inherent element. These findings should lead to further research into other types of events. Finally, these two studies also underline the interdisciplinary dimension of crisis management. On the BRGM side, different engineering sciences were mobilized to establish the most accurate scenarios possible (in terms of weather, hydrology, etc.). On the ICC side and that of Interministerial coordination work, it appears that each ministry has its own professional culture that is strongly linked to the background and training of its agents. This points to the need for an interdisciplinary approach, at least at the professional level, to address the difficulties of anticipating crisis (cyclonic, in this case) situations and making the most appropriate decisions.

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DATA AVAILABILITY STATEMENT

Data from the GC-Gouv project is confidential due to the inclusion of sensitive information. A report has been written but is for restricted use only. However, data from the APRIL project are available on request.

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ENDNOTES

[1] CIC refers to *Centre Interministériel de Crise*. In the text, we use the translated term Interministerial Crisis Centre (ICC).

[2] The APRIL project (Optimize Anticipation and Decision Making in Extreme Crises to Sustain the Resilience of Society) is financed by the French Research Agency (ANR-18-OURA-0001).

[3] It should be noted that we provide in this paper a general vision of the anticipation/decision-making pair, exemplified with the case of the 2017 hurricane sequence in the Lesser Antilles. A more detailed account of how the crisis unfolded can be found in French in the papers of Canovas and Chevillot-Miot (2021), Canovas et al. (2019), and Chevillot–Miot et al. (2020). The final results of the APRIL project and postcrisis analysis will be the focus of another paper.

[4] The interviewees' list and report have dissemination restrictions but can be sent on request.

[5] A new circular was adopted on July 1, 2019, replacing the January 2, 2012, circular on government organisation for major crisis management, which provided the bulk of the crisis response architecture. The main updated aspects relate to better consideration of cyber threats and victim assistance (French Prime Minister's Office, 2012, 2019).

[6] Two terrorist attacks took place in Paris in 2015 and were a turning point in government crisis management: the first on January 6 in the premises of the weekly newspaper Charlie Hebdo and the second on November 13 in several places simultaneously (the Bataclan theatre, restaurant terraces, and near the Stade de France where a soccer match was being played).

[7] Information was solicited from the BRGM's local office in Guadeloupe by the prefecture 5 days before the hurricane's arrival. The Ministry of the Interior solicited information from the scientific and technical centre located in Orleans 2 days before the hurricane's passage on Saint Martin.

[8] The data of this sub-section come from the APRIL project where 50 interviews were conducted, completed by the experience of the BRGM operators themselves who were involved in the crisis.

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