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After the storm: climate change, disaster, and the experience of historical time

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Abstract
This paper argues that climate change constitutes not only an environmental or political crisis, but a transformation of historical temporality itself. Contemporary climate instability challenges the temporal categories that have structured modern historiography since the 19th century, particularly the separation between past, present, and future. In response, it proposes the concept of climate historical time: a temporal regime marked by stratified durations, conditioned contingencies, irreversible processes, prolonged presents, and contested futures. Using environmental history, Anthropocene studies, contemporary history, and environmental humanities, the paper examines how climate change destabilizes the modern regime of historicity, reshapes historical explanation under conditions of planetary crisis, and introduces ethical and political tensions associated with irreversibility and predictability. The paper analyzes narratives following the 2025 tornado in Rio Bonito do Iguaçu (Parana, Brazil) to discuss how climate historical time emerges through disaster and can reveal the compression of lived time, the unequal distribution of vulnerability, and the transformation of the present into a prolonged condition of risk.

Keywords: disaster; temporality; climate historical time; environmental history of the present.

Depois da tempestade: mudança climática, desastre e a experiência do tempo histórico

Resumo
Este artigo argumenta que a mudança climática constitui não apenas uma crise ambiental ou política, mas uma transformação da própria temporalidade histórica. A instabilidade climática contemporânea desafia as categorias temporais que estruturaram a historiografia moderna desde o século XIX, particularmente a separação entre passado, presente e futuro. Em resposta, propõe o conceito de tempo histórico climático: um regime temporal marcado por durações estratificadas, contingências condicionadas, processos irreversíveis, presentes prolongados e futuros contestados. Recorrendo à história ambiental, aos estudos do Antropoceno, à história do tempo presente e às humanidades ambientais, o artigo examina como a mudança climática desestabiliza o regime moderno de historicidade, remodela a explicação histórica sob condições de crise planetária e introduz tensões éticas e políticas associadas à irreversibilidade e à previsibilidade. O artigo analisa narrativas posteriores ao tornado de 2025 em Rio Bonito do Iguaçu (Paraná, Brasil) para demonstrar como o tempo histórico climático se torna visível por meio do desastre e pode revelar a compressão do tempo vivido, a distribuição desigual da vulnerabilidade e a transformação do presente em uma condição prolongada de risco.

Palavras-chave: desastre; temporalidade; tempo histórico climático; história ambiental do tempo presente.

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Introduction: from climate crisis to temporal crisis

Climate change is most often framed as an environmental emergency of the present, a scientific warning, or a political and educational challenge (Siperstein; Hall; LeMenager, 2017). Beneath these presentist dimension lies a deeper challenge for historical thinking: the destabilization of historical time itself. The persistence of long-term environmental damages, rising global temperatures, or extreme events have rendered inadequate the temporal categories through which historiography has traditionally operated, especially since the 19th century. When confronted with climate change, the separation between past, present, and future – foundational to that historical consciousness – no longer provides an adequate framework for understanding planetary change.

In this paper I argue that climate change constitutes a transformation of historical temporalities. The idea is discussing how climate change (as a historical process) can reshape the conditions under which history can be written. Climate change produces what I call *climate historical time*: a temporal regime marked by layered durations, irreversible processes, extended presents, ethical implication, and contested futures.

To conceptualize this transformation in historical temporality, this paper brings together contributions from environmental history, Anthropocene studies, the history of the present, and environmental humanities. It pays attention to the work of historians like Dagomar DeGroot (2021), Dipesh Chakrabarty (2021), Carolyn Merchant (2020), and María Inés Mudrovcic (2023), in dialogues with other authors as Bruno Latour (1994; 2020) and Joanna Zylinska (2014). It suggests a plural theory of historical time capable of addressing planetary instability without collapsing into determinism or abstraction.

To achieve this point, the paper examines how climate change disrupts modern historicity, and explores how environmental history refines explanation under conditions of climatic constraint. It also analyzes the ethical and political implications of irreversible time. Finally, it suggests that climate historical time can be situated within both pasts and lived presents, emphasizing the importance of a recent extreme event in Southern Brazil (2025) in making this temporality visible.

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The limits of modern historicity

Modern historical thought emerged within a specific temporal configuration and the awareness of temporal change that took shape between the late 18th and 19th centuries among European educated classes (Aurell; Burke, 2013). This configuration, often described as modern historicity (Hartog, 2013; Klausen, 2020), was grounded in a linear and progressive understanding of time, within which the past appeared as completed, the present as transitional, and the future as open to human design. Such temporal ordering provided the epistemological foundation for history as a discipline and for modern political imagination more broadly.

Within this framework, history unfolded as a human-centered process. Social conflict, institutional change, technological innovation, and political emancipation were intelligible precisely because time itself was conceived as open, cumulative, and oriented toward the human future. Nature, while never entirely absent, remained largely external to historical temporality. Environmental conditions could influence societies, but they did not fundamentally shape the structure of historical time. Natural time and historical time were analytically distinct.

Climate change exposes the fragility of this separation. The accumulation of greenhouse gases, the persistence of ecological damage, and the long temporal reach of contemporary decisions undermine the assumption that historical processes unfold independently of Earth systems (Simon; Thomas, 2022; Horn; Bergthaller, 2020). Past actions do not remain confined to the past; they remain culturally and materially active in the present. In this sense, future consequences are no longer speculative but anticipated. As a result, the temporal boundaries that sustained modern historicity begin to dissolve when climate change is considered in the historical analysis.

This transformation does not merely expand historical scale. It alters the ontology of time itself precisely because historical temporality can no longer be understood as autonomous from planetary processes.

In this sense, Isabelle Stengers (2015) pointed out that climate change marks an irreversible rupture in modern historicity revealing that the political,

economic, and epistemological frameworks of modernity – mainly capitalism, progress, and governance – are incapable of responding to the planetary situation. According to Stengers (2015, p. 36), the danger is not only ecological collapse, but the emergence of a new barbarism where societies accept devastation and violence against natural world as inevitable, normalize sacrifice and are dominated by the idea of "there is no alternative".

The contribution of Dipesh Chakrabarty (2021) is central to diagnosing this rupture. His argument that climate change forces historians to think simultaneously in terms of political difference and species existence reveals a tension at the center of historical consciousness of the 21th century. On the one hand, climate change is produced through historically specific systems (e.g. capitalism, colonialism, industrialization) whose consequences are unevenly distributed. On the other hand, its effects are at the level of the species, implicating humanity as a collective geological force.

Modern historicity cannot accommodate both perspectives simultaneously, especially if we consider that environmental problems have cultural causes (Arponen, 2014). This kind of historical thinking was built to analyze freedom, conflict, and agency within societal time, not collective entanglement with now we call planetary limits. In this sense, Chakrabarty (2021) argues that when species time intrudes into historical time *without replacing* it, it produces a condition of conceptual dissonance rather than synthesis.

This dissonance marks one of the limits of modern historicity: its inability to hold together unequal responsibility and shared vulnerability within a single temporal frame. In this sense, environmental history as we write it in the present, emerges at this fault line. From its inception, the field sought to reintegrate nature into historical explanation without reverting to environmental determinism (Hersey; Steinberg, 2019). Donald Worster (1994, p. 30) pointed out that "there is little history in the study of nature, and there is little nature in the study of history", so environmental history emerged to tackle this gap.

Dagomar DeGroot *et al*. (2021) exemplify this methodological commitment. By demonstrating that climate variability reshapes historical possibilities rather

than dictating outcomes, the authors emphasize contingency as a foundational principle of historical thinking.

Climate, in this perspective, does not cause or drive history; it constrains it. It modifies probabilities, exposes vulnerabilities, and creates pressure that interact with institutions, governance structures, inequalities, and cultural responses, as we can observe in the historical analysis of disasters (Schenk, 2017; Mauch; Pfister, 2009; Nodari; Klanovicz; Santana, 2025). This approach is crucial for resisting narratives that portray climate change as destiny.

The work of DeGroot *et al*. (2021) also reveals a subtle transformation within history thinking itself. While contingency remains central, it no longer operates within an indefinitely open horizon. Climate change narrows the field of possibility, creating futures that remain open in theory but increasingly constrained in practice. Historical agency persists, but under conditions not of freedom alone, but of material limitation.

This shift from open contingency to constrained contingency represents a significant departure from modern historical imagination. The political implications of this transformation are articulated most clearly in Bruno Latour's critique of modernity (1994). Modern historical time presupposed a politically inert Earth/nature – a stable background upon which human affairs unfolded. Climate change dissolves this background. The Earth re-enters politics not as metaphor but as *actant*.

Latour's concept of 'the terrestrial' (2020) captures this reconfiguration. Political struggles are no longer oriented solely toward distribution within society, but toward the conditions of existence themselves. Land, atmosphere, water, and infrastructure become sites of political contestation. Political time stretches beyond electoral cycles and short-term planning, binding present decisions to long-term planetary consequences.

We can observe that modern historicity, structured around progress narratives and temporal acceleration, proves incapable of accommodating this expanded political (a new material) horizon. The future ceases to function as promise and increasingly appears as constraint.

This political transformation intersects directly with an ethical one. Modern historical consciousness was deeply invested in reversibility - the belief that social wrongs could be corrected and mistakes undone through reform or revolution. Climate change undermines this assumption by introducing irreversibility as a defining temporal condition.

In this sense, the notion of 'minimal ethics' by Joanna Zylinska, responds to this condition. In a world marked by irreversible damage, ethics can no longer be grounded in mastery or redemption, so the responsibility persists precisely because outcomes cannot be guaranteed. Ethical action in a world of climate change and multiple crises becomes situated, partial, and ongoing.

Carolyn Merchant (2020) complements this ethical position by insisting that irreversibility does not absolve societies of normative and historical obligation. While acknowledging limits, she maintains the necessity of orienting historical action toward sustainability and justice. The future, though constrained, remains ethically meaningful.

These perspectives reveal a further limit of modern historicity: its dependence on the idea that history could repair itself. Climate change introduces a temporal condition in which the past cannot be undone, yet action remains unavoidable, as a kind of 'ethical saturation of time'. The ethical saturation of time also destabilizes the modern separation between temporal domains in the following ways:

At the level of historical knowledge itself, climate change also transforms the status of the present. Modern historiography demanded temporal distance, treating the present as epistemologically unstable, and María Inés Mudrovcic's theory of the history of the present directly challenges this assumption.

By reconceptualizing the present as relational rather than chronological, Mudrovcic (2023) reveals how climate change produces an extended present in which past emissions, present experience, and future anticipation coexist. The present becomes thick rather than fleeting.

Under such conditions, the requirement of closure becomes untenable. Historical processes unfold in real time, yet their effects extend across

generations. Waiting for the past to end would mean waiting indefinitely. The history of the present thus emerges not as methodological anomaly but as an epistemological necessity. As a result, what emerges is not a new linear temporality, but a recognition of temporal plurality.

The secret, as historians, is to tackle the flat idea of climate change, arguing that it does not abolish history. It multiplies the times within which history must operate. The limits of modern historicity therefore do not signal its obsolescence, but its transformation. The task that follows is to articulate a theory of historical time capable of holding together constraint and contingency, deep pasts and unfinished presents, ethical responsibility and political struggle.

Environmental history and constrained contingency

If climate change exposes the limits of modern historicity, it simultaneously raises a fundamental methodological question: how can historians integrate environmental processes into historical explanation without collapsing agency into nature? The challenge is not new, but its urgency has intensified under planetary conditions and under 'anthropocenic' point of view. Environmental history has long operated at the unstable boundary between natural and social causation, seeking to account for ecological forces while preserving the openness that defines historical inquiry.

At the center of this tension between ecological forces and ecological ideas lies contingency. Modern historiography has understood contingency as the defining mark of historical time. As Franz Brüseke (2002, p. 283) pointed out, when we consider contingency, it remains the idea of "something is as it is, but it could also be different", so it is in historical perspective: History is as what it is, but it could also be different and events might have unfolded otherwise.

Climate change appears to threaten this principle by introducing long-term physical processes that operate historically and independently of human intention. The risk, therefore, is that history becomes once again subordinated to nature, resurrecting forms of environmental determinism that historians have spent decades dismantling.

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DeGroot's insistence that climate functions as a constraint rather than a cause provides a conceptual foundation for climate historiography in avoiding that risk. Climatic variability does not produce historical outcomes directly; instead, it reshapes fields of possibility within which social, political, and cultural forces operate. Climate alters probabilities, not destinies.

This distinction is crucial. It preserves historical explanation while acknowledging that environmental processes matter profoundly. Climate change influences the distribution of risk, the exposure of vulnerability, and the viability of institutions, but it does not eliminate mediation, while human societies respond to climatic pressures through governance structures, economic systems, knowledge regimes, and cultural practices. In this sense, climate historical time does not replace social causality; it re-frames it.

DeGroot *et al*. (2021) reveal a transformation in how contingency itself operates in historical thinking. In modern historicity, contingency was imagined within a broadly open horizon. Even under conditions of crisis, futures remained fundamentally indeterminate. Climate change seems to alter this configuration. While outcomes are not predetermined, the range of plausible futures becomes increasingly limited by physical thresholds, ecological feedbacks, and infrastructural reality, in a process that can be described as constrained contingency.

Constrained contingency does not imply inevitability. It recognizes that historical openness unfolds within material limits that cannot be negotiated politically alone. The atmosphere does not respond to a specific culture or political project, as well as oceans do not recognize governments. These constraints do not determine outcomes, but they shape the space within which outcomes can emerge. Historical agency survives, but no longer under the assumption of unlimited futurity.

Climate change does not flatten history; it amplifies its inequalities. In this respect, DeGroot *et al*. (2021) trace how institutions absorb, redirect, or exacerbate climatic pressures showing that vulnerability is not natural but historically produced.

Carolyn Merchant (2020) emphasizes the historical roots of environmental inequality and the ethical responsibility embedded in development trajectories, where sustainability cannot be reduced to technical adaptation. It is inseparable from historical choices concerning land use, energy regimes, and social organization.

Constrained contingency also introduces a temporal asymmetry absent from earlier environmental histories. Past decisions exert prolonged influence far beyond their original context. Infrastructures built decades ago continue to structure emissions trajectories; deforestation alters regional climates for generations, showing that the past is durational rather than episodic.

This durational quality of causation – that operates across distinct temporal scales - challenges event-centered historiography, and climate historical time unfolds not primarily through discrete moments, but through accumulations. Causality stretches, diffuses, and delays. Consequences appear long after decisions have been made, with inter-generational sharing of responsibility.

The history of the present introduced by María Mudrovcic (2023) becomes methodologically indispensable to read this reflection about casualties. If causation is extended across time, then historical processes cannot be fully reconstructed retrospectively. They must be analyzed as ongoing. Historians, in this sense, must confront processes that have begun but not ended.

Constrained contingency therefore implies a shift in historical practice: from explaining completed outcomes to interpreting unfolding trajectories. At the same time, irreversibility introduces a new ethical dimension to contingency. While futures remain open, certain losses cannot be recovered. Zylinska (2014) suggests a ‘minimal ethics’ directly to this condition: responsibility persists not because outcomes can be guaranteed, but because choices continue to matter even when damage cannot be undone.

This ethical framing prevents constrained contingency from sliding into fatalism (and into presentism). The presence of limits does not negate responsibility; it intensifies it, and decisions acquire weight because they occur under conditions of diminishing possibility.

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The present differs in scale and speed. The acceleration of anthropogenic change compresses climate history into historical time. This compression coexist with the consequences of contingency, rendering decisions irreversible within a single generation.

If time would absorb errors in the modern historicity rationale, climate historical time reveals that time can also magnify it, and these insights transform the methodological foundations of History when we focus on disasters.

The task is no longer to integrate nature into history as an external variable, but to understand how historical agency operates under planetary constraint as constrained contingency functions as a central analytical category of climate historical time. It names the condition in which history continues, but no longer under assumptions of unlimited openness. It describes a temporal regime in which choice persists, yet choices accumulate consequences that exceed their immediate context.

Political time in the terrestrial age and the ethics after irreversibility

The natural world functioned as background or a set rather than a political participant in modern historicity. This assumption enabled political institutions to operate (as well as to be interpreted and explained historically) within relatively short temporal horizons – electoral cycles, policy frameworks, and generational expectations – without confronting long-term geophysical consequences. Political time was short, segmented, and oriented toward progress. During the second half of the 20th century, this assumption was challenged in different ways, through other explanatory logics, before the emergence of environmental history.

Now, climate change collapses (once again, perhaps with more intensity) this arrangement and Latour's point of view is crucial for the reading of this collapse. His already consolidated critique of modernity demonstrates that the separation between nature and society organized how politics imagined its domain. Once climate change destabilizes Earth systems, the illusion of a politically neutral nature completely dissolves. The Earth returns – not as object of management, but as an actor.

Latour (2020) names this condition as 'the terrestrial'. The terrestrial is not a new idea, but a new mode of political existence. It designates a situation in which humans must negotiate their political futures within planetary limits that cannot be externalized. Politics becomes grounded, territorial, and materially constrained and this transformation fundamentally alters political time.

In the terrestrial age, political decisions extend far beyond their immediate context. Infrastructure choices, energy regimes, land-use policies, and extractive practices produce consequences lasting centuries. The future becomes entangled with the present in unprecedented ways. Political action is no longer oriented toward indefinite progress, but toward the maintenance of habitable conditions.

The perspective of a climate historical time thus (re)introduces or reconnects long duration into political reasoning. The future is no longer a distant horizon but a pressing concern shaping present legitimacy.

This expansion of political time is not a peaceful process, especially because political institutions (democratic or not) were not designed to govern on planetary timescales. Electoral accountability, public or even legal responsibility operate within short temporal frameworks and climate change stretches these frameworks beyond their institutional capacity.

This temporal mismatch produces political instability where decisions are deferred, responsibility displaced, and accountability fragmented. Political systems struggle to act decisively when consequences unfold beyond the lifespan of governments and citizens alike.

The terrestrial condition intensifies existing asymmetries. Those least responsible for disasters experience the most immediate consequences. Vulnerability is spatially uneven and temporally accelerated. Political time thus becomes a site of injustice, where some futures are foreclosed while others remain buffered.

History that merges climate, deep time and present time, particularly in DeGroot's sense, is crucial for exposing these asymmetries. By tracing how institutions mediate climatic pressure, historians reveal that political vulnerability is historically produced. Climate change does not create inequality; it amplifies it.

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Inequality now unfolds across time. Present populations inherit decisions made decades earlier, while future generations bear the consequences of present inaction. In this sense, political responsibility becomes temporally distributed and this temporal redistribution challenges conventional models of accountability. Who governs a future not yet present? Who represents those who do not yet exist? Modern political theory offers limited answers to such questions.

The terrestrial politics idealized by Latour does not solve this dilemma, but reframes it. Politics is no longer about projecting universal futures; it becomes a struggle over attachments- over which worlds are defended, sustained, or sacrificed. Political time becomes plural, contested, and situated.

This pluralization of political time resonates with Merchant's argument that sustainability must be understood historically rather than technically. Sustainability is not a neutral goal but a political project grounded in past development trajectories and present power relations. Competing visions of the future reflect competing historical responsibilities.

Climate historical time therefore transforms the future from a promise into a battleground and ethics Ethics enters politics at this point. Zylinska's minimal ethics articulates the moral condition of acting without certainty. In a world where political decisions carry irreversible consequences, responsibility cannot depend on outcomes alone. Political action becomes ethically charged even when success is partial or uncertain.

This ethical saturation of political time complicates governance. Acting too slowly exacerbates harm; acting too quickly risks injustice. Political time becomes a space of moral tension rather than strategic calculation alone.

Mudrovcic's approach of the present further illuminates this condition. Political decisions increasingly occur within an extended present shaped by anticipation. Climate projections, risk assessments, and disaster preparedness policies bring the future into present deliberation in societies that are constructing themselves as 'predictive societies'. Politics, in this sense, becomes preemptive, while the present expands temporally as future scenarios colonize decision-

making. Emergency declarations, adaptation plans, and resilience strategies operate within imagined futures that shape present authority.

Political time thus becomes anticipatory rather than sequential. This anticipatory governance transforms democratic legitimacy, delivering decisions justified by future risk often bypass traditional deliberative processes. Climate emergency politics in predictive societies can simultaneously enable action and erode accountability when the temporal logic of urgency reshapes political norms.

In this scenario, climate historical time forces a redefinition of politics itself. It demands institutions capable of operating across multiple temporal scales – immediate needs, generational justice, and planetary stability and such institutions do not yet exist in stable form. What exists now is tension between urgency and deliberation, between democracy and emergency, between equality and survival and this tension is not accidental and can be seen as the political expression of climate historical time.

If climate historical time can change the conditions of politics, it does so even more profoundly at the level of ethics. Modern moral frameworks emerged within temporal assumptions that climate change now fundamentally disrupts. These frameworks presupposed reversibility: harm could be repaired, injustice corrected, and historical errors compensated through reform, progress, or revolution. Ethics was oriented toward restoration.

The uncertainty context of climate change undermines this orientation when we consider the ethical condition of the climate change as irreversibility (Zylinska, 2014; Gardiner; Hartzell-Nichols, 2012). Species extinctions, for instance, cannot be undone or atmospheric transformations persist for centuries. Ecosystems cross thresholds beyond recovery as the past remains active not only symbolically but materially. Under such conditions, ethical responsibility can no longer be grounded in the promise of repair.

This condition creates the possibility of thinking historically ethics in its confront with time itself. This temporal transformation marks one of the most decisive limits of modern moral imagination. Ethical theories rooted in intention, consequence, or redemption struggle to account for actions whose full effects

will unfold long after the actors are gone. Responsibility becomes temporally displaced, stretching across generations.

Zylinska's concept of minimal ethics provides an alternative response to this dilemma. In rejecting fantasies of mastery, she argues that ethical action persists even when control is impossible. According to her, ethics does not depend on certainty, success, or innocence. It emerges from implication – from being entangled in processes one did not fully choose yet continues to shape. Her argument is that the Anthropocene should not be understood as a problem to be solved through technological mastery or grand moral systems, but as an ethical condition that demands ongoing, modest, and situated responsibility. Zylinska (2014) argues for a "minimal ethics" grounded in human accountability within more-than-human entanglements, accepting damage, uncertainty, and limitation as the starting point for ethical action in planetary time. She treats images, narratives, and media as ethically active: how we visualize climate matters; how we narrate the Anthropocene shapes responsibility. Thus ethics is inseparable from representation. So, minimal ethics re-frames responsibility as situated rather than sovereign, and sees the ethical subject not as the autonomous modern individual but as being embedded within damaged worlds. Action becomes response rather than resolution.

This formulation is profoundly temporal. Ethics unfolds in a present haunted by irreversible pasts and constrained futures. Moral action does not restore balance; it navigates imbalance. Zylinska challenges modern historicity's faith in moral progress. In the climate age, history cannot guarantee ethical improvement while responsibility persists without narrative closure.

Carolyn Merchant (2020) approaches this ethical condition from a complementary direction. Rooted in environmental history and feminist ecological thought, Merchant (2020, p. 107) insists that irreversibility must not collapse into resignation. While acknowledging limits, she maintains the necessity of normative orientation toward sustainability, justice, and care. For Merchant (2020), ethics cannot be reduced to individual response. It is historically structured. Industrialization, extractivism, and colonial expansion have produced uneven

ecological burdens. Ethical responsibility therefore demands historical accountability.

Merchant anchors ethics within political economy and historical development trajectories. She argues that sustainability is not a technical fix but a moral response to past choices as the future remains ethically meaningful because harm is unevenly produced.

Both Zylinska (2014) and Merchant (2020) articulate an ethical tension within climate historical time. On one side lies the recognition of irreversible damage; on the other, the insistence that responsibility does not disappear. Ethics persists, but under historical and transformed conditions.

This tension reshapes the temporal orientation of moral reasoning. Ethics no longer looks backward toward restoration nor forward toward redemption alone. It operates within an extended present marked by loss. The ethical subject of climate historical time is therefore neither heroic nor innocent. It is compromised, implicated, and yet responsible.

This ethical reconfiguration intersects directly with the temporal rupture identified by Chakrabarty (2021). Species-level agency intensifies moral implication while diluting individual causality. No single actor caused climate change; yet responsibility cannot be dissolved into abstraction.

Modern moral philosophy was not designed for such scale-crossing responsibility and environmental history contributes critically at this juncture by revealing how ethical implication is historically produced. As DeGroot *et al*. (2021, p. 540) demonstrate, vulnerability and resilience emerge through institutional mediation, and ethical responsibility cannot be universalized without attending to historical difference.

Climate historical time therefore demands a historically differentiated ethics - one attentive to who caused damage, who benefits from delay, and who bears disproportionate risk.

Irreversibility intensifies this differentiation. Those least responsible often face the most immediate consequences, while those most responsible retain greater temporal buffers. Ethics becomes inseparable from temporal inequality.

In this sense, Latour's terrestrial perspective reenters the discussion. Ethical responsibility is no longer abstractly universal; it is grounded in attachments to particular places, infrastructures, and modes of life. Ethics becomes territorial.

The question shifts from "what is right in general?" to "what worlds can be sustained, and at whose expense?" Moral reasoning becomes entangled with geography and duration, and Mudrovcic's re-conceptualization of the present further clarifies this ethical condition. In an extended present, ethical decisions are made under urgency without resolution. The future weighs upon the present through anticipation, while the past persists through material consequence.

Writing history in an unfinished present

The climate crisis unfolds in real time, but its consequences extend far beyond the present generation. The historian confronts processes that have begun but not ended, whose full significance cannot yet be known, and this condition exposes a decisive limit of modern historicity: its dependence on completed time.

Mudrovcic's theory of the history of the present offers a crucial conceptual reorientation. Rather than defining the present as a chronological point, she conceives it relationally, as the condition of sharing time. The present is not what happens now, but what binds actors within a common temporal horizon.

In terms of the historicity of climate change, this shared time includes past emissions, present experience, and future anticipation. The present becomes temporally saturated. It thickens as a thick time refers to a temporal condition in which multiple durations coexist within lived experience. Past actions remain materially active, and future consequences are anticipated through scientific modeling, political discourse, and everyday anxiety.

This expansion destabilizes the classical temporal sequence. Past, present, and future no longer succeed one another; they overlap and climate crisis therefore produces a historical experience unlike that assumed by modern historiography, because it is not transitional but durational, and persistent.

Environmental history makes this thickening visible. Long-term ecological transformations unfold slowly and continuously, resisting event-centered

narration, as causes accumulate rather than occur. Effects are delayed, uneven, and nonlinear.

DeGroot *et al*. (2021) suggest that historical thinking can make this thickening visible and their emphasis on probabilistic causation reinforces this insight. Climate does not generate discrete historical moments; it reshapes conditions across time. Historical explanation thus becomes longitudinal rather than episodic.

This transformation demands new historiographical sensibilities. Explanation must attend to trajectories rather than turning points, to accumulations rather than ruptures alone. Thick time is not merely an analytical construct; it is lived socially, and climate change reorganizes everyday temporal perception. Seasonal rhythms become unreliable; disasters recur with increasing frequency; recovery becomes provisional. Societies experience time as unstable, and the present feels heavier, burdened by both responsibility and anticipation. Historical agency persists, yet it unfolds within an atmosphere of constraint.

Authority operates through projections and the future colonizes the present, and such temporal colonization carries profound epistemological consequences. Historical knowledge becomes entangled with prediction and the boundaries between explanation and anticipation blur.

This does not render historical inquiry obsolete; it transforms its object. Historians must now interpret how futures are imagined, mobilized, and contested within present politics and Mudrovcic's framework legitimizes this endeavor. The history of the present is not a deviation from historical method but a response to altered temporal conditions. Climate historical time produces presents that cannot be postponed.

Lived climate time

Climate historical time is not experienced or narrated uniformly and its effects can be discussed or become visible, e.g., through recurrent disasters rather than abstract models. It is important to say that some disasters can be linked

directly with climate change but not all of them. In the U.S., experts in tornadoes, for instance, point out that:

> It's not yet fully understood how climate change will affect tornadoes, due to modeling challenges, high variability and limited data collection. As the most recent National Climate Assessment noted, while the link between climate change and some extreme weather is apparent, 'changes in smaller-scale, short-lived severe weather such as tornadoes and thunderstorms are more difficult to assess, and direct observations of those events and the conditions associated with them are incomplete.

International Council on Monuments and Sites (ICOMOS) points out that

> Climate change may be responsible for the shifting of tornado regions, and the changing seasonality and severity of thunderstorms that may produce tornadoes. Specifically, the number of days favorable for tornadoes is expected to increase, and tornado season may start earlier. As tornado season and tornado alley are changing, the most important thing is to be educated and prepared (ICOMOS, 2026).

Southern Brazil integrates the South America Tornadoes Alley (Candido, 2012) – the second region worldwide in numbers of tornadoes. In this region, not only tornadoes but also severe storms, and flooding constitute historical and lived experiences that offer an entrance to think everyday temporal perception of climate change.

The Prevots iniciative is a group of meteorologists dedicated "to improve the documentation, research and forecasting of severe storms in Brazil," and it is the result of a partnership between the Universidade Federal de Santa Maria (UFSM), the Instituto Nacional de Pesquisas Espaciais (INPE), the South America Meteorological Hazards Database (SAMHI), the Instituto Mineiro de Gestão das Águas (IGAM), and the University of Oklahoma.

Prevots is one of the most important sites that documented the devastation of November 7th, 2025 in southern Brazil, from a point of view of Meteorology. The iniciative issued a forecast of severe storms for the Western and Southwestern regions of Paraná and Western Santa Catarina for November 7th, 2025, carefully describing the tornadoes sequence that happened in this region.

Recently, there is a consensus about the number of tornadoes registered in Southern Brazil and the cities affected. In Santa Catarina, from 1940 to 1990: 16 cities were affected; from 1991 to 2000: 13; from 2001 to 2010: 39; from 2011 to

november 7th, 2025: 91 cities affected. In Paraná: from 1940 to 1990: 22; from 1991 to 2000: 13; from 2001 to 2010: 21; from 2011 to November 7th, 2025: 49 cities affected. In Rio Grande do Sul: from 1940 to 1990: 13; from 1991 to 2000: 7; from 2001 to 2010: 56; from 2011 to November 7th, 2025: 102 cities affected. This compilation demonstrates that the visibility of the phenomenon is linked to an environmental history to be written in productive dialogue with Climatology, Geography, and in a context of discussion about societies of predictability.

In November 7th 2025, multiple tornadoes were registered in Parana and Santa Catarina. At least four tornadoes were classified as F2 - Fujita scale. The most expressive of those events, a F4 tornado, destroyed almost the entire town of Rio Bonito do Iguaçu, with winds from 331 to 419km/h (image 1) in Western Parana.

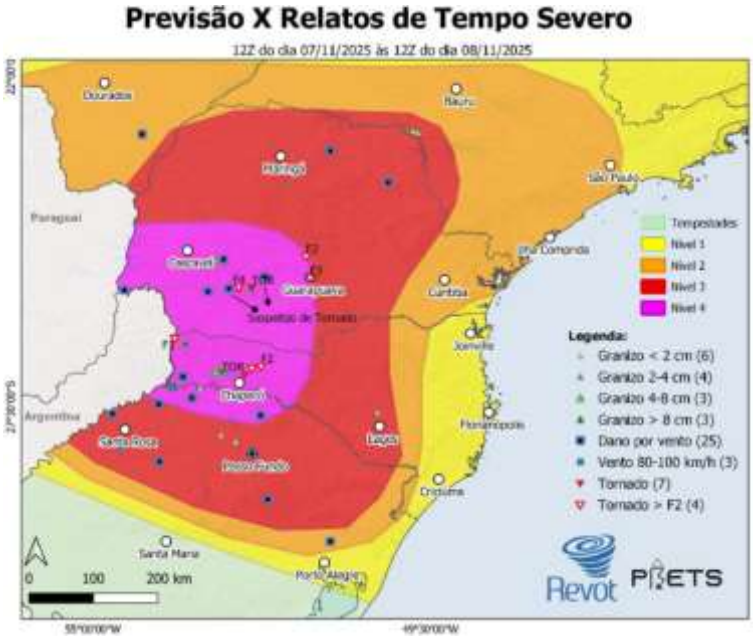
Image 1 – The town of Rio Bonito do Iguaçu after the tornado of November 7th 2025.

Source: prevots (2026).

The tornado appears as an atmospheric event, but its destructiveness is mediated by anthropogenic transformations – deforestation, agricultural expansion, and settlement patterns. The climatologist Francisco Mendonça links vulnerability to the near-elimination of Paraná's original forest cover ("less than *5% of the original forest*") and argues that without this "natural barrier," winds "form faster" and "reach cities stronger." He further characterizes the regional landscape as "Increasingly unprotected, with 'agriculture spanning hundreds of kilometers, without the protection of forests or mountains.'"

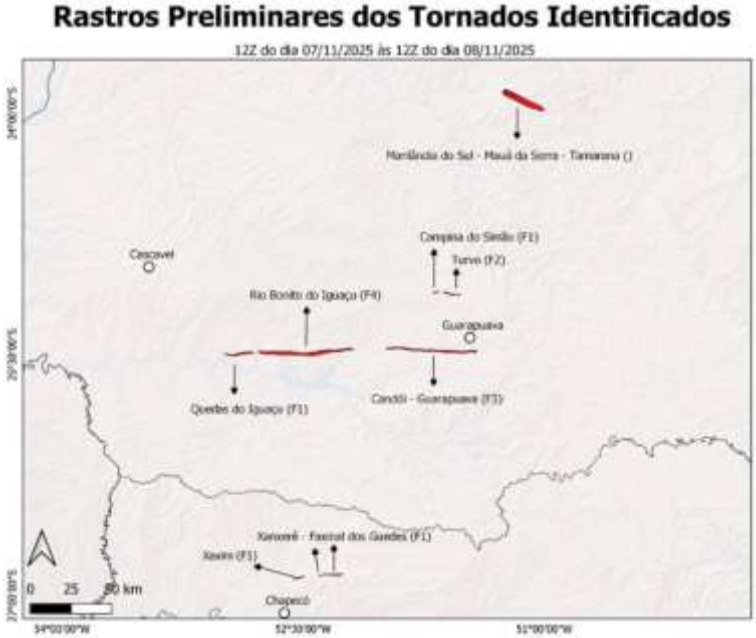
The following day, Prevots released some maps of the tornadoes and other storms (image 2, image 3), comparing the forecast with witness accounts. The tornado that struck the municipality of Rio Bonito do Iguaçu at 6pm, proved to be an extreme event of destructive power. Images of the destruction caused by the tornado showed it would take several more days to assess its impact.

Image 2 – Map by Prevots comparing pre-disaster and post-disaster – November 8th 2025.



Source: prevots (2026).

Image 3 – Map by Prevots with main tornadoes traces – November 8th 2025.



Source: prevots (2026).

Testimonies gathered after the Rio Bonito do Iguaçu tornado are not only "accounts of damage"; they are narratives that reveal how extreme events rupture ordinary time, reorder priorities, and expose structural vulnerabilities. In them, we can see what Reinhart Koselleck (2014) would call a sudden compression of the "space of experience" into an acute present, alongside a forced re calibration of the "horizon of expectation." The son who arrives fearing to "find [his] parents alive" narrates a passage from anticipatory dread to the moral relief of survival: "Thank God it was only material loss" – and, immediately after, the recognition that the disaster exceeds household preparedness: "Nobody has money saved up for this kind of situation." This is experience turning into diagnosis: the event is not framed as mere misfortune, but as an encounter with a limit – economic, emotional, and infrastructural.

The same temporal collapse is expressed through memory and gestures of survival: the unnamed pregnant woman, alone at home, hears "a bang," crouches "under the table," while "pieces of the roof were falling." These details matter analytically because they show how tornado suffering is lived as a physics of fear: sound, glass, fragments, and improvised shelter. Anatália Lunardi emphasizes the "noise" then the collective vision of generalized ruin: "the neighborhood... everything destroyed."

In Koselleckian terms, the event becomes a "threshold experience" – a sudden crossing where the familiar world is rendered unstable, and where future planning is re-written under the sign of risk.

The accounts repeatedly stage a presentist horizon: the disaster's meaning is anchored in immediate survival, not in long historical continuities. José Godoy (Agência Estadual de Notícias do Paraná, 2025) turns this into an explicit hierarchy: "Not the life. Life is irretrievable."

The present becomes ethically saturated: life is the non-negotiable value, while property is mourned but theoretically repairable. Yet the same presentism also carries a political demand: rebuilding is narrated as dependent on assistance, because the household lacks the reserves to "restart." Carla Kerkhoff's statement: "Without assistance, we are not in a position to start over... this help is essential... it's what will save our lives now" – reveals how the "present" is structured by

institutional capacity and social inequality. The present is not simply “now”; it is a distribution of protection, credit, housing security, and access to recovery.

From the standpoint of Chakrabarty (2021), these testimonies also demonstrate how climate-related extremes destabilize the neat separation between “human history” and “natural history.” Read through Chakrabarty (2021), the tornado is not merely a meteorological episode; it is a socially amplified event, where suffering cannot evenly distributed across “nature”: it follows the contours of different phenomena such as deforestation, infrastructural fragility, and rural marginality.

The testimonies of improvised shelter after the event can be read as the embodied consequence of informational scarcity. Here, vulnerability is not only exposure to wind; it is exposure to *surprise*. And surprise is politically produced: it emerges where radar coverage, last-mile communication, housing standards, and emergency planning fail or never existed.

A further historical comparison clarifies what is new and what is recurrent in these narratives. Daniel Henrique Candido’s doctoral dissertation (2012) shows that in Brazil, tornadoes were long misrecognized: the scientific community only accepted tornado formation as a Brazilian reality after the 1991 Itu event, and earlier episodes - including in Santa Catarina and Parana - were “subestimated and classified simply as ‘fortes vendavais’.” Candido (2012) also warns that fewer older records do not necessarily mean fewer events; rather, technological change (especially ubiquitous cameras) has increased the ability to register atypical phenomena. In historical terms, the storm that heppened in Itu, in 1991, and the tornado of Xanxere, in 1989, established a milestone in terms of visibility, driven by the widespread circulation of images and a shift in the media and social recognition landscape, altering the grammar of risk, and promoting a semantic and epistemic shift from ‘vendaval’ (windstorm) to ‘tornado’. Prior to recent phenomena, many events of extreme destruction were underestimated or classified generically, which obscured the need for specific warning and reconstruction protocols.

This change in nomenclature reveals the depth of the historical vulnerabilities produced in the region. While the term “vendaval” suggests a

common seasonal occurrence, the category “tornado” highlights the impact of long-term socio-environmental changes, such as the replacement of native forests with corn and soybean monocultures. Without the natural barrier provided by the forests of Parana and Santa Catarina, winds find a clear path to reach densely populated urban and rural areas, making the disaster a social construct amplified by land use and the lack of protective infrastructure. Therefore, the shift to the term “tornado” serves as evidence of differential exposure, where human suffering is no longer viewed merely as a momentary “physics of fear” but is interpreted as the result of an environmental history of forest devastation and infrastructural marginalization.

Stengers (2015) helps us interpret why these narratives resist closure. The testimonies do not simply “explain” the tornado; they convey an encounter with what Stengers (2015) would describe as an intrusion – an event that forces attention, disrupts routines, and demands new collective compositions (between science, institutions, and residents). In Rio Bonito do Iguaçu, the repeated emphasis on mutual aid (“people uniting,” neighbors helping) and on the indispensability of public support marks a move from isolated loss toward a politics of recovery grounded in lived experience. In this sense, testimony is not merely retrospective; it is prospective: it articulates what a community must become in order to live with an increasingly volatile atmosphere.

Taken together, these accounts allow us to propose a historically grounded interpretation: tornado suffering in Southern Brazil is simultaneously a rupture of lived time, a product of long land-use histories, and a symptom of uneven protective infrastructures. The event’s violence is meteorological, but the disaster is social. The testimonies show how the present becomes a site where past environmental transformations (deforestation and agro-expansion), historical regimes of recognition (“vendaval” vs. “tornado”), and future-oriented claims (alerts, adaptation, rebuilding capacity) collide – making visible, in a few lines of speech, the layered historicity of climate vulnerability.

These experiences reveal climate historical time as lived reality. They demonstrate how global planetary processes become localized temporal conditions, reshaping historical consciousness from below.

Communities increasingly inhabit a condition of anticipation. Reconstruction follows destruction without respite and the future appears less as hope than as threat. Past disasters persist as memory and warning.

Toward a plural theory of climate historical time

Climate historical time does not unfold uniformly across the planet. While its planetary dimensions are global, its lived experience is deeply lococentric. The temporal transformations generated by climate change become perceptible not primarily through abstract scientific models, but through everyday encounters with instability, loss, and repetition. Nowhere is this more evident than in regions where environmental vulnerability intersects with historical inequality.

In those contexts, climate historical time emerges less as an intellectual concept than as a condition of life and the landscape or “disasterscape” of Rio Bonito do Iguaçu provides a revealing vantage point. In recent years, the intensification of extreme events – tornadoes, severe storms, floods, and prolonged droughts – is transforming local temporal experience right now, especially when the city has turned into a political place for the state governance of Parana. These events are not perceived as isolated anomalies. They recur with increasing frequency, disrupting seasonal expectations and destabilizing everyday rhythms.

Communities begin to live within anticipation, especially after the Parana’s government has made continuous investments in climate advertising. Secretary for Sustainable Development, Rafael Greca, recently declared, in January 2026, that the state of Parana will become the most climate-protected state in Brazil: “You have probably heard of Israel’s iron dome. Paraná will also have its dome, a dome of peace, a climate dome capable of intercepting storms and protecting lives” (Greca, 2026). What Greca expresses is the instrumental perspective of Parana’s government regarding a culture of anticipation, of weather prediction, but this must be interpreted inside a culture of anticipation.

This anticipatory condition exemplifies the thick present described by Mudrovcic (2023). The present ceases to function as a moment of transition and

becomes a prolonged temporal state shaped by memory of past disasters and expectation of future ones. Reconstruction does not restore normality; it establishes provisional stability. The condition of recurring instability gives rise to what might be described as 'environmental anxieties', a psychological and social dimension inherent to the historical climate. In the context of a prolonged present saturated by the memory of past disasters, the anticipation of new extreme events becomes an emotional constant that governs daily life. Environmental anxiety manifests itself when normality dissolves into a state of permanent alert, where each new storm system reactivates the trauma of the previous disaster. Thus, lived time is marked not only by material reconstruction but also by a collective anguish that recognizes the inadequacy of current infrastructure in the face of an atmosphere that has become intrusive and unpredictable.

Time becomes provisional. In such settings, climate historical time materializes as repetition without resolution. Events recur without closure. Damage accumulates faster than memory can fade. The future appears not as possibility but as risk. This experience directly challenges modern historicity's assumption that crises are temporary disruptions within a stable temporal order. Climate disasters instead reveal instability as the order itself.

Environmental history helps illuminate how this vulnerability is historically produced. As DeGroot *et al*. (2021) emphasize, climate does not generate disaster independently. Institutional fragility or straight, infrastructural inequality, land-use decisions, and development trajectories mediate environmental stress.

Final remarks

In Southern Brazil, patterns of urban expansion, deforestation, agribusiness intensification, and uneven public investment can be seen as amplifiers of exposure to extreme events. Vulnerability is not natural; it is historical and climate historical time thus intersects with political economy. Disasters accelerate historical inequalities rather than suspending them.

Emergency declarations of climate domes compress decision-making. Governance operates through urgency rather than deliberation. Exceptional

measures become routine. The present expands through continual crisis management.

This emergency temporality illustrates the transformation of political time under climate conditions. Decisions justified as temporary increasingly define long-term trajectories.

Ethical experience follows a similar pattern. Zylinska's minimal ethics finds concrete expression in disaster contexts. Individuals and communities act not because outcomes can be guaranteed, but because response is unavoidable. Care, solidarity, and improvisation replace long-term planning. In that view, ethics becomes immediate.

The present becomes a web of relations rather than a point on a line. Historical consciousness adapts accordingly. People no longer expect return to normal. Normality itself dissolves. Temporal orientation shifts from progress to endurance and survival replaces development as a horizon.

This shift marks a transformation in historical imagination. Modern historicity promised improvement through time, so climate historical time emphasizes persistence within instability. Climate change or some opportunities to think about climate like extreme events more recurrent in the scenario of climate change confront historians with a fundamental challenge: how to think time when the Earth enters history and history reshapes the Earth. It is possible that climate change produces a new temporal condition requiring conceptual innovation rather than disciplinary retreat.

By integrating environmental history, Anthropocene theory, the history of the present, and environmental humanities, it has proposed a framework capable of sustaining historical inquiry under conditions of planetary instability, focusing on significant authors and their contribution to historiography. Climate historical time, in this sense, marks a transformation in historical thinking – and the renewed necessity of historical thinking in an age when time itself has become fragile.

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