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# From spectacle to disaster scenario: Reimaging fictional catastrophe in The Day After Tomorrow with the current physical, political and social science of Atlantic Ocean circulation collapse

**Alicia Alli**[1]*, **Olaf Corry**[2], **Ruza F. Ivanovic**[1]

**1** School of Earth and Environment, University of Leeds, Leeds, United Kingdom, **2** School of Politics and International Studies, University of Leeds, Leeds, United Kingdom

* alicia.alli15@gmail.com

## Abstract

Two decades after it was first released, the Hollywood blockbuster movie The Day After Tomorrow remains an iconic and genre-defining 'climate disaster' film that - apart from entertaining audiences - still functions as an illustrative anchor or prompt for imaging the catastrophic consequences for people and planet of Atlantic Ocean circulation collapse. Despite scientific inaccuracies, climate scientists still use the film informally and formally (at topical conferences, policy-engagement workshops and in higher education) to bring to life or teach the very real physical and security impacts of crossing this climate tipping point. However, advances in understanding of near-future tipping of Atlantic Ocean circulation and two further decades of social science work on climate emergencies and the political dynamics of social and world order have rendered it increasingly dated and further unmoored from reality. So, what would a more up-to-date and useful representation of the science, politics and governance of such an event look like? This essay explores plot changes that could be considered by a docudrama screenwriter, that are equally dramatic but that better consider current climate science and analysis of world politics. The suggested changes place particular focus on how security framings of climate change manifest within the film. As momentum has grown behind the idea of a link between non-linear climate change and security dynamics or 'climate security', The Day After Tomorrow reduces climate to an isolated cataclysmic event that is dealt with through securitisation and exceptional measures, rather than as an interlinked and chronic process of physical and societal breakdown that will permanently change the way environments and societies behave and are governed.



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## Introduction

Twenty years on from its release, Roland Emmerich's 2004 film, *The Day After Tomorrow,* is still featured as one of TIME's top disaster movies 'of all time' [1]. The film captured

moviegoers and climate experts alike by centring anthropogenic emissions-induced climate change [2] as a threat to the Northern Hemisphere, but particularly to the US, where the film's protagonists are based. The plot follows Palaeoclimatologist Jack Hall from his presence at the 2002 collapse of the Larsen B ice shelf [3] through to his advocacy for climate action to prevent the collapse of the 'North Atlantic Current'. The North Atlantic Current is part of the Atlantic Meridional Overturning Circulation (AMOC), a collection of ocean currents that spans the Earth's longitude, acting as a global heat distributor. Although Jack Hall initially predicts an AMOC collapse in ~100-1000 years' time, in the film it collapses very suddenly with only days of warning, causing an Arctic hurricane storm that plunges the Northern Hemisphere into a snap ice age [4].

Studies of the film's audiences highlighted that *The Day After Tomorrow* significantly increased viewers' concerns and anxieties about the lack of progress on climate action [5,6] although the apocalyptic portrayal of extreme weather also reduced audiences' belief that climate change would cause extreme events [6]. Overall, *The Day After Tomorrow* is a dramatized, temporally and geographically inaccurate and socially de-contextualized representation – a 'spectaclized' depiction [7] – of the transgression of the AMOC tipping point. The inaccuracies, such as golf-ball sized hail stones and storm surges the size of tsunamis made the film a box office success [8], and accuracy is just one determinant of a piece of fiction's 'usefulness' and ability to deliver 'teachable moments' [9]. However, gross inaccuracies may also obscure the complex and uncertain physical climate and political impacts of a real AMOC collapse; which might not be as far off as assumed when the film first screened twenty years ago [10,11]. Unsurprisingly, a real AMOC collapse would not be neatly wrapped up after a seven to ten day long Arctic hurricane storm and the evacuation of half of the US' population to Mexico [4]. Moreover, the science of tipping points has progressed since 2004 [12–17], and the social and political renditions of a catastrophic climate event in films like *The Day After Tomorrow* should also be critically considered in terms of their contemporary 'educative, truthful and trustworthy' credentials [9].

This essay offers an answer to what parts of *The Day After Tomorrow's (TDAT)* plot would need to be changed first if it were to be remade to be more disaster scenario and less a spectacle – if not wholly accurate, then more up to date, educative and trustworthy in relation to climate change science as well as understandings of the politics of danger and security. Rather than re-treading climate experts' well trailed discussions on the geographical, temporal and weather-based inaccuracies of the film, we focus on two plotline changes that centre discussions on climate security in order to tackle the reductionist portrayal of both the AMOC collapse and the simplified pathways to securitising nation-states and international order that the original version purveyed. We do this because the framing of climate change as a matter of security or a threat multiplier [18] increasingly shapes future imaginaries often with the aim of enabling more transformative or equitable responses, but also potentially reinforcing existing power structures.

The first change suggested is the replacement of the 'new ice age'. This is presented by the movie as a planetary re-freeze, triggered by the AMOC collapse, that causes a temporary reversal of warming trends in regions proximal to the North Atlantic [19].

While *TDAT's* new ice age brings with it a form of immediate stability and physically erases the power imbalance between the Global North and Global South, a real AMOC collapse would not be decoupled from other earth systems and tipping points, and though it may cause a temporary, regional pause in mean surface temperature warming, it would not reverse the rising greenhouse effect of current emissions trends and is in fact likely to trigger European storminess and heat extremes, hot and cold [16]. Therefore, any global security crises would be catalysed through interconnected tipping points [20], while AMOC collapse would also have other impacts, on the efficiency of ocean carbon storage, for example [21].

The second change suggested is to shift the perspective of the film away from a US-centric nation-state securitisation narrative of emergency and exceptionality, to instead depict a longer-term and more routinised international risk-management perspective. *TDAT* imagines a chain of events dominated by 'securitisation' where normal rules and norms are upended or suspended [22]. The existential threat of AMOC collapsing and ice age emergence is felt, and only then a hard-won securitisation is established when the US administration finally take Jack Hall's advice, putting in place extraordinary measures like evacuating the southern half of the country to Mexico [4]. This works for the film's truncated time-scale of events that span a mere two weeks. However, AMOC collapse and other resulting tipping points in the cryosphere (ice sheets, glaciers and sea-ice) and oceans take place over decades to millennia [20], within which nation-state securitisation and emergency measures may not be triggered in this way. Instead, an international riskification lens [23] could provide a more accurate view of governmental responses, pre and post a climate tipping point being surpassed. This changes the role of audiences in accepting climate change risks and threats and has implications for the measures implemented to manage shifting climate. The paper is structured to succinctly deal with the temporal and geographical inaccuracies in *TDAT,* before addressing the two suggested plot changes.

### Temporal and geographic inaccuracies

There are temporal and geographical inaccuracies in *TDAT* which are useful to address as background for the arguments established later. Firstly, the events in the film show the Northern Hemisphere moving from its relatively stable, recognisable Holocene/Anthropocene climate to a new ice age within weeks. When Jack Hall says to Professor Rapson that the change in circulation is 'happening too fast' [4], he is correct. Change in deep ocean circulations, like AMOC, takes place over a multi-decadal to multi-centennial timespan [20]. For example, The Younger Dryas event, which the film is based on, was a ~1,300-year event [24]. The period saw abrupt cooling, thought to have been caused by changes in the delivery of freshwater from the Laurentide Ice Sheet to the ocean, which weakened the AMOC 12 thousand years ago [25–27]. Additionally, Jack Hall's initial estimate that AMOC tipping/collapse could happen in ~100–1,000 years fits better with current debates that demonstrate that the AMOC will weaken over the 21st Century [11,13,15,17], but large uncertainties over whether it could collapse in any period from mid-century to 2300, if at all, still exist [10,28].

The film is also geographically inaccurate; its focus on the US is a political (and dramatological) choice. The abandoned oil tanker and galleria appear as spectres of overconsumption; consequences of climate change are felt fully and quite selectively by the largest historic greenhouse gas emitter [29]. This is out of step with previous AMOC shutdowns. For example, the need to evacuate all of the US apart from Texas and parts of Florida is unrealistic. During the Younger Dryas, the Laurentide Ice Sheet extended over most of Canada, but only over a few of the northern US states. At its maximum extent, it reached some parts of New York [30]. While the collapse of AMOC is likely to cause cooling in the Northern Hemisphere, this will impact North and Western Europe more than other places [14,16], although the tropical monsoons will also be affected [13]. Thus, the plot changes suggested acknowledge the expanded timespan an AMOC collapse would occur over, and de-centres the US and its security.

### Simplified portrayal of AMOC collapse

In *TDAT,* we are presented with a reductionist portrayal of AMOC collapse that works along a simplified cause and effect chain. Fresh water input from the Greenland Ice Sheet and sea ice melt causes a 'critical desalination point', which inhibits

convection at the North Atlantic Subpolar Gyre, plunging the Northern Hemisphere into extreme weather and a new ice age where a 'balance' or reset is reached. Astronauts at the International Space Station marvel at the clean air, with emissions trapped in newly formed ice. This depiction contrasts starkly with projections of AMOC collapse, which indicate a 40-50 year temporary, reversal of warming trends in the Northern Hemisphere, resulting in regional cooling of up to 10 °C [19,31] and an increase in temperature extremes across the region [16] in addition to amplified warming in the Southern Hemisphere and the shift of the Intertropical Convergence Zone (ITCZ) south [13]. The shift of the ITCZ weakens the West African Monsoon and disrupts the South American Monsoon, changing precipitation patterns. Monsoons provide 31% of global precipitation [20] and these systems are critical to sustaining regional food production and ecological and water security in both West Africa and South America. However, in the case of AMOC collapsing, models have shown precipitation to reduce from 5-50% in West Africa [13], while altered precipitation patterns in the Amazon, when paired with increased deforestation, could push the rainforest towards irreversible dieback, further increasing global emissions [20]. The transformation of regional climates in Northern Europe, South America and West Africa has the potential to catalyse food insecurity and resource scarcity that transcend individual nation states' capacity to manage climate change.

This could have implications for international security – something the film ignores entirely. The Global South, but particularly Africa and South America, have been the focus of climate conflict discourse, with imaginaries of desperate populations flooding into western nation-states, fundamentally threatening their stability [32]. However, historical climate conflict correlations are tenuous, though such climatic shifts may at the political level fuel the securitisation of the Global South as a threat [33]. Just the potential for resource scarcity and lack of access to African oil led the US to create a specific military command for Africa, AFRICOM [32], and hence the real manifestations of global food insecurity, resource scarcity, and increased displacement could increase the likelihood of militarisation and even interventions in vulnerable regions, driving interstate tensions. Accordingly, in a more trustworthy and educative depiction of AMOC collapse, its potential to trigger further tipping points would be seen as context or a catalyst for ongoing global security crises, not an equaliser and reset as depicted in *TDAT.*

The collapse of AMOC and the resulting temporary reversal of warming may also inflect global security crises as damage is wrought to the efficiency of ocean carbon storage. Unlike *TDAT's depiction,* AMOC collapse does not result in a rebalance of global emissions by trapping them in newly formed ice. If emissions continue at current rates, some models have predicted a return to a positive warming trend in the Northern Hemisphere within 100 years [19]. Critically, this return to warming could be accelerated, and exacerbate future planetary warming because AMOC collapse causes the ocean mixed layer, which interacts with the atmosphere, to become shallower at polar ocean convection sites, reducing deepwater mixing and thus oceanic carbon uptake. Inhibiting the vertical mixing of ocean water also reduces the amount of nutrients that reach the mixed layer from the deep ocean, limiting ocean productivity and reducing carbon storage in organisms living in the mixed layer [21]. The resulting drop in ocean carbon sequestration could exacerbate future global warming; the world's oceans store 38,000 billion tonnes of carbon, compared to the biosphere's 4,000 billion tonnes [34]. This should create more impetus to tackle rising emissions as reduced deep ocean carbon uptake is likely to lead to a more acidic mixed layer, with higher levels of sequestered carbon that threaten marine ecosystems [20], and the livelihoods that are dependent on them. The transboundary nature of this problem and a political securitisation of it might then be thought to lead to accelerated 'emergency' mitigation, or coercive measures from powerful states or security actors like NATO to secure emissions reduction, possibly mobilizing the main international institution charged with securing peace and security, the UN Security Council, even if this is currently thought to be unlikely [35]. Alternatively, however, it could drive the impetus for individual nations or international partnerships to push through (or invoke the potential to at some point in the future instead deploy) more extreme ways of increasing ocean carbon sequestration, such as using geoengineering methods like ocean fertilization [34]. If implemented these could in turn fuel contestation, and if land-based measures are used may even lead to conflict through green-grabbing, resulting in dispossession and/or resistance to these [7,36,37]. Therefore, AMOC's collapse and resulting temporary reversal of warming should not be depicted simply as a catalyst for solutions for emissions reduction or removals, but rather as an amplifier of global climate tensions.

### Governance in the face of global climate security crises

If AMOC collapse is a catalyst for global security crises, it is important to understand how these resulting crises and periods of significant climate change might be realistically governed. *TDAT* presents an illustration of the stages of securitisation as outlined by the Copenhagen School theorists with the construction of an existential threat that is (eventually) accepted by a relevant audience leading to exceptional measures [38]. However, these framing stages may not fit the more protracted timescale of AMOC collapse. Instead, an international riskification framing provides an alternative portrayal. Unlike securitisation, in which issues are moved outside of normal political and democratic domains and exceptional measures are implemented, to tackle an immediate external threat (real or imagined), riskification frames an issue in terms of conditions that allow for potential dangers or harm to occur. These conditions are usually governed not exceptionally, but over the long-term [23]. This framing better fits the temporality, urgency and global governance required for a real AMOC collapse and changes both the role of the state and military and the type of action justified in *TDAT's* plot.

The successful securitisation of the US nation-state is hard-won in *TDAT* when emergency measures and sovereign power is finally wielded to salvage what remains of the US after the climate cataclysm that befalls it. Jack Hall and Gomez, Director of NOAA are first repeatedly ignored when trying to warn the US Vice President of the impending threat that AMOC collapse poses to the US (in 2004). The centrality of acceptance of a successful securitisation required their audiences, the US Administration and public, to be persuaded of the existential danger that AMOC destabilisation posed. Only then did this legitimise the implementation of evacuations of southern US states and the relieving of Latin American debt to facilitate this [4]. This seems to be premised on the highly fictional immediacy of the onset of the crisis, which is far faster than even a rapid AMOC collapse would unfold [39] and on an environmental determinism through which physical changes transmute directly into political ones [40].

In contrast, through 'riskification' of AMOC collapse, state and public audiences' buy-in to the immediate need to tackle a climate threat or danger is of less importance than their perception that climate change or AMOC collapse could become a major condition of possibility for future harms of uncertain but potentially fundamental kinds [23]. A shift of focus like this from 'security' to 'risk' logics, and from immediate physical threats to hiked probabilities of changed patterns of weather, would pivot narrative focus from the traditional securitisers presented in the film (the state and military), toward a wider cast of policy makers, experts, regulators, enforcers and intergovernmental organisations as potential primary 'riskifying' actors [23]. Here, long-term risks are managed through expert assessments, models and other forms of prediction, that then build the impetus for regulation and planning for the extreme and uncertain conditions that AMOC collapse results in. Therefore, in a remade version of *TDAT,* core audiences of US administration and US public could be supplemented with a wider tapestry of risk-governance organisations like the International Panel on Climate Change (IPCC) in the case of long-term planning on climate action, coordination and governance. Routine security providers (border officials, policy, regulators, peace-keepers etc.) and institutions like the UN Security Council would monitor and manage global climate security risks and potential for conflict [35]. They would be expected to recognise climate change's potential to facilitate harms but not require it to be the direct or immediate harm itself. Where securitisation is temporary and 'normal' politics reemerges as the storm subsides, riskification implies a more chronic shift in societal governance and power based on probabilities of harm and attempts to deal with them.

While the slow grind of riskification thus may provide a more realistic framing for a *TDAT* remake, it also comes with limitations (beyond its less cinematic qualities) and dangers. Its reliance on preventive and precautionary logics governance [23] could cause it to fall victim to the consensus processes that impact the IPCC Assessment Reports and dilute more urgent narratives [41], preventing governance and regulation work being carried out for lower probability, but higher impact events such as AMOC collapse due to uncertainty. This could be offset by expanding 'climate endgame' research agendas that look at worst-case risks to earth systems [41]. On the other hand, risk-logics themselves can merge with security-logics and become both chronic *and* draconian and repressive, with pre-emption, surveillance and bureaucracies supporting violent interventions, bordering and carceral regimes, as happened in the 'War on Terror' [42].

Securitisation and riskification would thus have distinct implications for the measures which are used to tackle either a security threat or conditions where risks can emerge. In *TDAT,* extraordinary measures of evacuation are justified because of the existential threat that the Arctic hurricane storm poses to US national and human security. This also legitimises abandoning half of the US population as Jack Hall advises "it's too late for them" after his initial calls for evacuation have been rejected [4]. Here, the temporal and geographical inaccuracies of the film necessitate that we update the lens of nation-state security to include international riskification because the time scales and uncertainty around a real AMOC collapse would not entail short-term survival focused actions alone. Instead they would require precautionary planning, long-term regulation and legislation to deal with climate change and its impacts. In the case of the mass evacuations that see North American refugees forced to migrate to the Southern Hemisphere, a more realistic portrayal would likely see mass migration portrayed as a long-term threat to national security of developed nations, and international order that benefits them. In *TDAT,* Sam Hall and the small group that remain in New York's Public Library play out narratives that demonstrate that in the face of scarcity, developed nations innovate, and against all expectations the group find the resources they need to survive. This is at odds with discourses that focus on the Global South, that scarcity breeds conflict, helplessness and desperation [32], and therefore while Latin America accepts US refugees after removal of their debt and the Vice President turned President praises them for their hospitality, the reality of long-term, mass migration in the face of shifting climate would be riddled with far more complex adaptation and conflict. An international riskification lens would emphasise how long-term planning for migration could be mired in conflict but also exploited as justification for precautionary governance as the conditions for *potential* harm are centred, rather than the presence of an imminent threat to escape. Best case, riskification programmes may take a positive approach and build an internationally recognised status for climate refugees, with provision for their movement, which currently has no basis in international law [32]. Alternatively it may focus on suppressing climate induced migration through border controls to keep refugees and migrants out [43] and seek to maintain existing national and international orders that exclude and marginalise target populations. The core difference is that with a riskification of climate change, the referent object (that which has to be secured) becomes the focus of policy and governance actions (in this case, the climate itself or societies trying to cope), while under securitisation, an external threat (in this case the migrant) is the object of special measures. While the securitisation of climate is often cautioned against because of its placement of climate in an exceptional state [44], riskification has the potential drawback of being unable to manage the exceptional – or that it makes the exceptional permanent and precautionary. Riskification involves governance that seeks to control the conditions that lead to harm, with an emphasis on prediction and models to mobilize anxiety and control risk; rapid changes or abrupt, unexpected system collapses, as in *TDAT,* undermine governance and policies [45] causing potential security conflicts in both national and international order when events are destabilising and unanticipated.

Notable examples of risk framing executed well are encouraging for how mass moviegoers might interact with depictions of disaster scenarios instead of spectacles. Films like *Don't Look Up* [46] that satirise the failure of policymakers to act on credible, calculable risks due to political denial suggests that film makers can present longer-term, precautionary narratives without compromising on entertainment value and audience engagement. The dangers of riskification have also been successfully communicated to mass audiences, for example by the *Minority Report* [47], which explores the concept of "PreCrime" and frames future violence as a preventable risk, managed through predictive technology and surveillance. The film demonstrates how precautionary governance and risk management have limits with significant ethical implications. And, as in the case of *Dante's Peak* [48], where a mostly accurate representation of volcanic hazards and scientific monitoring bridges the gap between expert knowledge and understanding by making complex risks emotionally accessible to mass audiences [49], the balance of credible science with emotional engagement could lead to less distortion of climate disasters and politics [6].

## Conclusion

Overall, this essay has argued that in order to make Roland Emmerich's *The Day After Tomorrow* more accurate, useful and trustworthy in relation to climate change and climate politics, two main plot changes must be made. The first, is the

reframing of AMOC collapse and its fictional aftermath to acknowledge that this tipping point is not a physical climate reset, but part of network of interconnected tipping points with the Amazon and West African Monsoon, creating the potential conditions for global conflict and scarcity. This new framing better represents AMOC collapse as a longer-term stimulus of global security and risk implications, as opposed to the film's portrayal of an isolated – and passing – national security crisis. It also highlights the material impact AMOC collapse has on ocean carbon uptake, contributing to increasing emissions globally and opening doors for potential coercion or geoengineering. The second change proposed is the replacement of the nation-state security framing that characterises *The Day After Tomorrow's* reductionist temporally and geographically inaccurate portrayal of AMOC tipping, suggesting instead an international riskification framing that more realistically fits the decadal –to multi-centennial timescale of changes in major ocean circulations. A risk scenario would shift focus from spectacles of elite emergency management of immediate climate threats, to one of how state and world administrative power would adjust to persistent and interlinked environmental and societal stressors, better reflecting protracted global climate and security crisis governance.

Ultimately, the plot changes support AMOC collapse as a conceptual lens through which to explore the nonlinear, uncertain, and abrupt shifts in climate, the societal implications of a permanently destabilised Earth system and the challenge of taking on the task of governing or managing it. Whether it is used for mass entertainment, or as an educative tool for the real consequences of crossing tipping points in the Earth system, more accurate portrayals of the physical and social impacts of climate change allows storytellers to enhance public interest in extreme events and strengthen engagement in dilemmas involved in reacting to permanently altered levels of risk and danger. In turn this has implications for how collective understandings of climate change are conceived and responded to in navigating climate futures.

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## Author contributions

**Conceptualization:** Alicia Alli.

**Formal analysis:** Alicia Alli, Olaf Corry, Ruza F. Ivanovic.

**Supervision:** Olaf Corry, Ruza F. Ivanovic.

**Writing – original draft:** Alicia Alli.

**Writing – review & editing:** Olaf Corry, Ruza F. Ivanovic.

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