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Four scenarios for an IPCC navigating Artificial Intelligence

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Abstract

During the first six assessment cycles of the Intergovernmental Panel on Climate Change (IPCC), generative artificial intelligence (AI) tools were not widely available. This is rapidly changing. The IPCC will need to make choices about how to use artificial intelligence-powered applications in three areas: literature identification, literature assessment, and communicating the contents of the report. These are not merely technical decisions, but socio-political challenges, as the IPCC is not just about synthesizing literature or report-writing but has a social function of creating a shared basis of reality for addressing climate change. To explore these challenges, this paper describes four scenarios of potential AI development — futures that see the rapid adoption of AI agents, societal perception of AI as more reliable than humans, a precautionary approach to AI from scientific communities, and public backlash to AI in general. Each of these futures present particular challenges and opportunities for the IPCC as an institution, authors of the report, and science and society. However, if the IPCC can navigate social challenges such as the intersection of AI and inclusivity and societal polarization around AI, there is an opportunity for the institution to serve as a model and learning opportunity for other institutions grappling with how to do scientific assessment in a world with generative AI.

Contents

Introduction

An Intergovernmental Panel on Climate Change (IPCC) assessment report takes hundreds of people and several years of work. The sixth assessment report (AR6), in a cycle from 2015-2023, involved more than 700 selected authors, many more contributing authors, and thousands of expert reviewers producing three Working Group reports and a final Synthesis Report, in addition to the initial Special Reports. This collective labor, to be repeated in the seventh assessment cycle (AR7) ending in 2029/30, synthesizes tens of thousands of scientific articles to describe the state of knowledge about climate change, its impacts, and how to address it.

In many ways, this kind of synthesis work seemingly looks like a perfect candidate for employing artificial intelligence (AI), with generative AI (GenAI) tools able to synthesize text — and increasingly, able to search the literature as well. While there is a summary of the Synthesis Report that is just thirty-four pages, the full report is also around 8,000 pages long, meaning that users will need to extract information from it for details beyond the summary: another use for AI.

There are three basic areas that the IPCC will need to make decisions about when it comes to employing AI. The first is about the use of machine learning (ML) algorithms in *literature identification*, in terms of finding relevant literature and narrowing it down to the most relevant publications. The second concerns actually using GenAI in the *assessment* — using AI not just to collect those papers, but read and draft synthesis of the literature. The third is about using GenAI to *communicate* what is written in the reports, operating as a smart search function that could help in answering questions or even interpreting what the findings mean for people's particular concerns.

The potential benefits seem obvious — but their implementation will be contentious. How to incorporate AI into scientific research and assessment is already widely debated and studied, including work focusing specifically on climate change assessments.[1,2,3]

The academic discourse surrounding GenAI reflects a spectrum of engagement ranging from enthusiastic adoption to cautious evaluation and skepticism,[4] with early explorations raising questions about changing definitions and practices of authorship[5,6,7] and the issue of how AI will disrupt the traditional role of knowledge brokers in translating knowledge.[8] In the past few years, a body of literature has emerged on how AI is used in scientific information retrieval[9,10] and how AI portrays scientific controversies and scientific misbehaviors.[11] Research also examines how to use AI to improve climate literacy, assesses the reliability of AI products to offer climate-related information, and explores potential geographic biases from training datasets.[12] Scholars have also examined the environmental footprint of AI, and are studying the greenhouse gas emissions[13] and impacts on the energy transition as well as the ethical dimensions of sustainability in AI systems.[14]

If we take comprehensively assessing the ever-growing scientific literature on climate change[15] as the focus activity of the IPCC, AI seems to have incredible utility. But AI adoption within the IPCC has a particular socio-political challenge. Importantly, the IPCC is not a purely scientific organization but an intergovernmental United Nations (UN) body under the auspices of the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). The IPCC does not exist to simply produce a synthetic assessment of the latest scientific literature. A core function of the IPCC is to create a scientifically authoritative but politically legitimized consensus about the state of climate knowledge.[16,17] AI might excel at the former task whilst fundamentally undermining the latter. Social scientists have described how the IPCC's practices can function as "de facto governance," or an unacknowledged steering that shapes the field of scientific inquiry and the context for formal national and global governance.[18,19] The IPCC is policy neutral in principle, yet also has symbolic power in helping to legitimize courses of action, from

informing mitigation planning to shaping adaptation policies.[20,21] Hence, the value of such a process is not just in the output but also in the discussions through which hundreds of scientists develop a shared understanding across academic disciplines in the full assessment reports and the approval of *Summaries for Policymakers* (SPM) through which a subset of authors and IPCC member governments agree on the official, consensus-based view of climate change — a view that is usually not called into question in similarly consensus-based settings under the UN Framework Convention on Climate Change (UNFCCC).[22,23,24]

Thus, developing a comprehensive policy on AI for the IPCC in particular is going to be more complicated than just negotiating its roles in scientific knowledge production or climate communication, given the unique function the IPCC fulfils at the climate science-policy interface. In fact, any comprehensive AI policy for the IPCC must be approved in a plenary session of member governments by consensus, and this alone could be a difficult task, like any change of the ground rules in a contested field of interactions.[25] The IPCC operates within a complex sociopolitical landscape where perceptions of legitimacy matter as much as fidelity to the literature. All of this means that developing a policy on AI for the IPCC is not simply a matter of understanding the technical potential (speed, efficiency, most useful AI tools), all of which affect the practicalities of scientific consensus building processes.[26] It is also about how such a policy affects the *societal* consensus building process. AI will disrupt not just the process of writing a report and communicating its findings, but also the deep purpose of the IPCC in building a shared version of reality to work from.

Fundamentally, AI adoption in the IPCC will depend on broader contextual changes in society due to AI. We cannot discuss the merits of the IPCC's choices without considering the wider societal AI adoption that will shape both the landscape of options and how the IPCC's choices are interpreted. To understand how the IPCC might navigate this new terrain, we explore four scenarios about how social understanding and adoption of AI might evolve over the next assessment cycle, AR7 (2023-2029/30). These are informed by two axes of assumptions about the future development of AI before 2030. The first is the spectrum of societal and scientific acceptance, ranging from a future where AI is broadly trusted and adopted to one where it is met with widespread resistance and viewed as taboo. The second axis is the degree of automation AI introduces into in knowledge processing, which could vary from tasks remaining entirely human-driven to becoming fully AI-driven (Figure 1, p. 6). Importantly, these scenarios are not predictions about what the IPCC will or could do, but as-if thought experiments about the futures in which it might be embedded.[27] Each presents distinct challenges for maintaining both scientific rigor and wider social consensus, which includes political legitimacy.

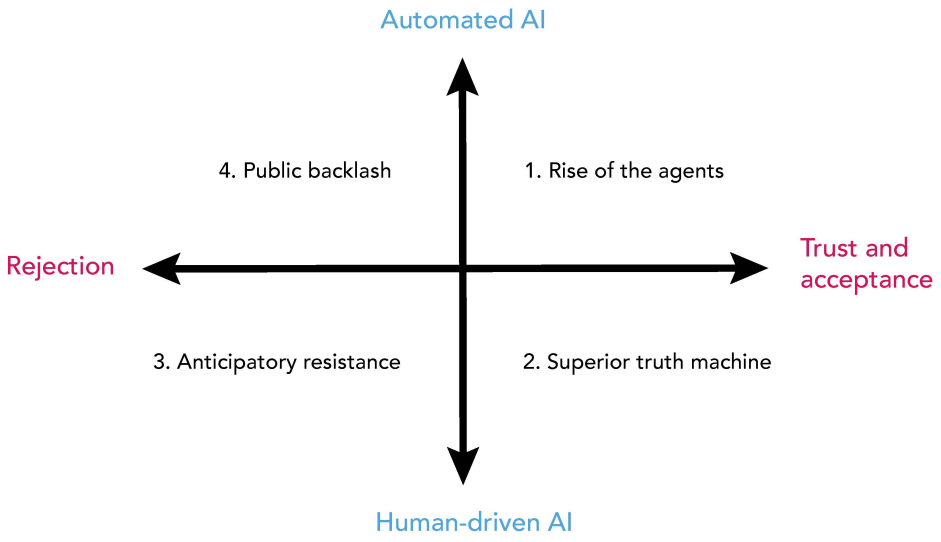

Figure 1. Four scenarios for AI development

Scenarios

1. Rise of the agents

In this scenario, agentic AI becomes widespread within the next few years, fundamentally changing how professionals work. Agentic AI is where artificial agents use natural language interfaces to execute sequences of actions on users' behalf.[28]

Literature search: As these agents become ubiquitous across sectors, there will be implications for literature search — agents may collaborate to scout the literature. Agents could be embedded within the IPCC process, continuously screening the literature. Strict bounds for automated inclusion, such as confining agents to known databases for peer-reviewed literature, could make it challenging to include "gray" (i.e. not peer-reviewed) literature or Indigenous Knowledge.

Synthesis: Another set of agents could synthesize the literature and update draft chapters, including generating data visualizations, whilst maintaining a detailed log for authors' verifications against established benchmarks, and for expert reviewers and the public for transparency.

Communicating: IPCC reports must be written with content optimized not just for human readers, but for AI consumption and processing. Consequently, much of science synthesis and communication — including IPCC outputs — transforms into agent-to-agent information exchange, where content is accessed, interpreted, and transmitted through AI intermediaries (i.e. LLMs), in addition to humans. This requires the IPCC to consider how its assessments can be structured for optimal LLMs and human parsing and synthesis.

A critical concern emerges under such a scenario: what happens when users extract IPCC text and process it through chatbots for interpretation? Such practices are already occurring.[29,30] Should the IPCC pre-empt potentially problematic third-party interpretations by providing "official" chatbot access? On the other hand, having a record of agentic decisions could provide a "traceability" in the IPCC's reasoning that might enhance its credibility for some. Still, there will continue to be inherent limitations in LLMs used for communicating scientific reports.[31]

Implications for IPCC as an institution: this raises fundamental questions about workflows, audience and format. First, should the IPCC develop its own agentic capabilities for IPCC authors? Second, how much should the IPCC optimize its outputs to be read and processed by AI agents, and what changes to the preparation and presentation of the report should be undertaken with agentic readers in mind? Third, should the IPCC actively house a LLM to help readers navigate the report and its data? The IPCC already produces multiple formats (PDFs, printed copies, webpages, infographics). Creating an official LLM that reproduces paragraphs verbatim would be technically straightforward and it could essentially operate as an enhanced search functionality that could prove beneficial for accessibility, albeit this comes at risk of hallucinations, among other limitations that are inherent to the LLM architecture. In such a highly automated environment, the traditional human-led approval process for SPMs may suddenly appear to be "outdated." But any attempt at automating the generation of SPMs creates tensions with the still human-led and consensus-based negotiation mode in the UNFCCC.

Implications for IPCC authors: Adoption of agentic AI would fundamentally transform the author's role from a writer to an expert verifier and agent manager.

Wider social implications: Whilst AI intermediaries could enhance access to text, they risk diluting the IPCC's carefully chosen language around uncertainty and confidence. The very authority of the IPCC, built on human expertise and deliberation, could be undermined by the perception that machines are the primary constructors, readers and interpreters of its work.

2. Superior truth machine

In this scenario, there is a low degree of automation in knowledge processing — humans guide the process and make the final judgements — and there is high trust in AI-generated output. AI-generated output becomes viewed as superior to human equivalents, and is often turned to as an arbiter of truth or in social and political disputes about knowledge. LLMs gain trust in terms of being perceived as more comprehensive and balanced, and free from human political biases. Users become accustomed to AI summaries that are accurate and readable, leading to higher perceptions of credibility and trustworthiness of the authors.[32] Private platforms for scientific summaries present themselves as tools for human creators to undertake scientific synthesis and consensus building (such as those developed by Elsevier — ScopusAI — and other publishers) and emerge as competitors to traditional assessments, potentially offering more rapid summaries or even providing functions of assessment and knowledge synthesis.

Literature search: Humans are directing the literature search, but their expert choices are open to greater scrutiny, as anyone could use a trusted AI tool to check the same body of literature for omissions. There are opportunities to increase the amount of literature in multiple languages, and possibilities for AI augmentation to make both more and less use of Indigenous Knowledge and works beyond the academic literature, depending on human direction.

Synthesis: The primary challenge comes not from automation within the IPCC, but from externally produced "shadow versions" of the reports. These AI-generated alternative assessments produced by groups with specific agendas — could emerge to contest the IPCC's findings using the same corpus of literature. These could also emerge during the review process, followed by claims that the IPCC ignored superior AI-assisted input. This creates an arms race dynamic. Government delegations, invested in maintaining influence over the "official" climate narrative, will reinforce the IPCC version, particularly for the SPM approval.

Communications: Users will increasingly question whether they should trust human-crafted text over AI alternatives, particularly when AI versions seemingly appear to be

more up to the task by updating more frequently or being more comprehensive in scope. The wide availability of competing AI-generated versions of reality allows users to "shop for" interpretations that align with their preferences.

Implications for IPCC as an institution: If different chapters or even whole Working Groups adopt varying approaches to AI integration, these differences will become publicly visible, exposing weaknesses in human-only synthesis. The institution may also face pressure from "gotcha" papers that highlight discrepancies or show use preferences for AI-generated summaries, hence potentially undermining the IPCC's credibility.

If shadow assessments are inevitable, it becomes untenable for the IPCC to take a restrictive stance towards AI. It will be under pressure to develop its strategy to incorporate and respond to AI alternatives proactively. The question becomes how to maintain legitimate authority when AI output is perceived to be superior. Embedding AI with clear benchmarking criteria may be necessary for the IPCC to defend the legitimacy of its main products, not only the full assessment but also the carefully crafted SPMs.

When it comes to the SPMs, how much they deviate from the underlying assessment will become an object of AI-supported re-analysis — and governments will deliberate them in approval plenaries with the help of the various AI agents that they can build or access. At the same time, this doesn't affect the way the negotiated SPM can be used in the human-led and consensus-based UNFCCC negotiations.

Implications for authors: AI's legitimacy and perceived superiority brings challenges for authors. Should each chapter develop an official AI-generated shadow version, against which they justify their differing judgement? On the one hand, this could elucidate the value of their expertise, but equally could prove cognitively demanding and demoralizing. This would shift the authors' role from primary synthesizers to expert adjudicators, who must develop clear technical and scientific benchmarks to justify why their conclusions should be preferred to a trusted AI output. At the same time, some authors may embrace AI models as scientific collaborators in their own research,[33] which would spill over into their IPCC work.

Wider social implications: This widespread trust in AI as an arbiter of truth in science has profound social consequences. First, there is the risk that diverse forms of knowledge, including Indigenous Knowledge, will be disregarded. Second, as social science literature points out that the struggle about policy alternatives and the meaning of climate change itself is the basis of legitimacy in democratic decision-making. If AI is used in climate governance in ways that shortcut this debate by presenting a single "correct" synthesis, there is a risk of closing down policy options in ways that limit robust decision-making.[34] In a study of the challenges of AI in climate governance, Ruth Machen and Warren Pearce caution about "not just the importing of particular methods but also of particular logics, aesthetics, and values into processes of environmental governance."[35]

3. Anticipatory resistance

In this scenario, AI augments humans, but people are also wary of it, leading to pressure to take precautionary or restrictive approaches that may underutilize AI's potential. At the same time, its augmentation capabilities are not equally accessible — leading some to bring up the equity dimensions of restrictive approaches.

Literature search: Some people reframe restrictive policies on AI use as gatekeeping mechanisms through which developed countries maintain epistemic control. However, the central challenge is the escalating pressure of managing the ever-growing body of scientific literature manually. Human-synthesis is viewed as a premium product; at the same time, authors face a deluge of literature to synthesize and the underlying literature's quality is under constant critique, making synthesis more difficult.

Synthesis: There remains some pressure to make use of AI tools in synthesis, to save time and make participation easier, but critics are concerned about examples of bias in AI leading to biased syntheses even when humans are in the driver's seat and AI is merely augmenting their work. The credibility of any AI-generated content is increasingly questioned. Climate advocacy groups mobilize against AI over-use in the IPCC, criticizing alignment with the same techno-optimist paradigm driving ecological crisis. This creates an internal crisis: authors know that highly automated tools could process the deluge of literature more efficiently, but using them would compromise the report's credibility. Policymakers face pressure from constituents suspicious of AI involvement.

Communication: There is increased demand for using AI to make the IPCC reports easier for speakers of varied languages to navigate and use in policy decisions. At the same time, interfaces for querying and having conversations about the reports face questions of bias as well.

Implications for IPCC as an institution: The institution must balance real concerns about AI quality and access with the potential reputational risk that AI restrictions perpetuate existing power imbalances in the assessment process and accessibility to its findings. For member governments, the degree of involvement of AI features in different parts of the underlying assessment becomes an additional layer of scrutiny during the SPM approval.

Implications for authors: Authors from different regions experience AI tools differently. Whilst developed country authors with limited technical skills struggle with advanced features, developing country authors may view even basic AI translation and writing assistance as transformative, creating new avenues for tension within author teams. Authors also feel overtaxed by the amount of literature to synthesize and assess, and knowing that there are tools that could help becomes a source of frustration.

Wider societal implications: The IPCC's legitimacy is derived from its traditional, human-deliberative process, which is framed as a core strength. At the same time, parts of the broader climate community begin to view the IPCC as dated, or even as holding back progress given its power to set norms.

4. Public backlash

Widespread backlash to generative AI in this highly automated scenario has a variety of drivers: concern within academia about using AI, perceived deskilling, AI-induced job loss, surveillance applications of AI, bad behavior on the part of AI companies, environmental and energy use impacts of AI, or experience with socially damaging or misaligned AI products. For the IPCC, a legitimacy crisis emerges from the use of AI, and the perceived "purity" of human-led scientific assessments becomes compromised. This scenario illustrates how social norms about technology can override technical merit. Media narratives about generative AI shape public reception negatively,[36] creating a context where any AI involvement taints perceived legitimacy.

Literature search: Despite the availability of automated tools capable of comprehensively scanning the literature, low trust in AI and social perceptions of AI lead to non-adoption by some authors or chapters, also reflecting disciplinary cultures. Concrete choices about workflows trigger broader cultural and ideological debates about the role of AI in society.

Synthesis: Documentation of automated workflows becomes a major challenge because report authors have become accustomed to opacity in automated workflows for scientific production.

Communication: AI detection tools may be used by critics to accuse the IPCC of using GenAI and discredit it. The IPCC may also invest time in developing communications interfaces only to have them not adopted, with the whole project being rejected.

Implications for IPCC as an institution: The IPCC faces attacks from multiple directions. Climate advocates hostile to AI due to its environmental impacts feel betrayed by an institution that sanctions its use, and use of AI tools becomes weaponized as evidence of corporate capture or techno-solutionism, drawing on research that suggests that AI biases perceptions of environmental challenges in terms of proposing incremental solutions rather than radical or transformative ones and avoid associating environmental challenges with social justice issues.[37] Meanwhile, AI enthusiasts criticize restrictions as evidence of the IPCC's capture by advocacy interests, and frame non-use as a Luddite stance. The institution might be forced to publicly adopt a restrictive stance on AI to maintain legitimacy with key stakeholders, even at the cost of internal efficiency and completeness. In this light, the human-led SPM approval process holds the potential to be more prominently presented as a core asset of the organization.

Implications for authors: Using AI in academic contexts becomes stigmatized, with researchers unwilling to face reputational damage from association with AI tools. Author teams fragment between those who view AI as necessary for comprehensive assessment and those who see it as fundamentally compromising scientific integrity. The collegial spirit needed for producing an assessment erodes under such conditions.

Implications for wider society: In the public eye, the perception of division within the climate research community over the methods of assessment spills over into perceptions of divisions about the findings of climate science itself, eroding trust.

Options for the IPCC

The future of AI is dynamic, and it is difficult to know how it will be viewed even five years from now. It is possible that AI companies will run out of money before figuring out how to monetize their products, leading to a spectacular bubble-burst with implications for the wider economy; it is also possible that by the end of this decade, it will look inevitable that scientific understanding is maintained in a collection of "living evidence databases,"[38] and the IPCC evolves to become one of them. The point of the thought exercise above is merely that the IPCC should develop a way of dealing with AI that is robust to a variety of outcomes.

If there is a spectrum of choices, where one end is a ban and the other is mandating widespread adoption by author teams and for communicating reports, it is likely that in the coming years the IPCC will stay somewhere in the middle, with a common set of rules (guidelines and practices) which may be more or less enabling of AI applications use in various domains. Still, within this middle ground, there are key choices.

First, the IPCC can choose to incorporate AI in ways that could level the playing field for developing country researchers. Whilst internet access and advanced AI features remain expensive in developing countries and economies in transition, with latest capabilities often unavailable there, AI tools could potentially address systemic barriers and inequities in science. For example, right now, language barriers systematically disadvantage the majority of the world's population. One survey indicated non-native English speakers require 91% more time to read papers and 51% more time to write them;[39] AI could help with translation.[40] Studies also demonstrate greater interest and optimistic attitudes about AI in some Global South countries, highlighting cultural or demographic differences in AI adoption,[41] with middle income countries having a disproportionately high adoption of generative artificial intelligence relative to their economic scale.[42] Adopting a restrictive approach to AI use might thus be seen as another systemic barrier to epistemic equity in the IPCC, eroding its perceived legitimacy.

When it comes to communication, the IPCC faces another difficult choice: should it create its own official chatbot that gives stable, predictable answers, or should it allow its findings to be interpreted by a wide range of external AI tools? The risk of not creating an official tool is that the IPCC's carefully built consensus could be fractured into countless different interpretations by third-party chatbots. This challenge stems from the unpredictable nature of today's AI language models. Because these systems are designed to generate responses by making a series of creative guesses, asking the same question twice can lead to two different answers.[43] This would be true even for an IPCC official chatbot, should it be created. For example, two policymakers or public officials asking for a summary of permafrost melt projections could receive subtly different responses. This variability goes against a core principle of science, where the same query should always produce the same result. This creates a paradox: while AI promises to make climate science more accessible to everyone, it could also destroy the shared, stable foundation of facts needed for countries to work together. The IPCC's main role, providing a single, authoritative account of climate change for international negotiations, is weakened if every question can generate a slightly different answer. This randomness isn't a simple bug to be fixed; it is a fundamental part of how these AI systems currently work.

The IPCC faces an array of potential avenues for action. It could prepare curated datasets of key IPCC statements, figures, and confidence language for AI training. It could establish partnership agreements with one of the major AI providers (OpenAI, Google, etc.) to integrate authoritative IPCC content. It could develop a licensing process for IPCC-derived AI tools, distinguishing official from unofficial applications. In parallel with any of these, the IPCC could also work on developing concrete criteria for evaluating AI-augmented assessment against traditional assessment quality. However, in deliberating about whether to take any of these steps, the scientists that make up the IPCC assessments must be wary of several pitfalls.

The first pitfall is polarization, given how divisive the topic of AI is already. One study of AI narratives found that positive and negative narratives of AI were unhelpfully polarized, with stories that were more responsible and nuanced being overlooked.[44] The second is the trap of letting projections around public or stakeholder perception drive decision-making; ungrounded ideas about how publics or politicians might react to different implementations of AI are not a sound basis for choices that are both technical and social. Research could help navigate this last challenge, such as empirical studies of how authors feel about AI and use it in their primary research activities and studies of how different audiences respond to AI usage in science. However, academic research production takes time and decisions will need to be made soon. A third pitfall is the reasonable tendency to feel bewildered by the capacities of AI and the pressure to respond quickly. AI is advancing rapidly, but will be with us for a long time. There is time to take a thoughtful approach, but it will require resources and attention.

AI has the potential to fundamentally transform the nature of IPCC assessment, including its scientific authority and political legitimacy — and the IPCC must recognize both the risks and benefits of AI and act proactively to navigate this contested terrain. Rather than view this simply as a challenge, we can view it as an opportunity to shape what it means to build a global consensus in the age of AI. Nearly forty years ago, the IPCC was breaking new ground in how to practically do internationally collaborative assessment of the available scientific knowledge, and its success has spurred other fields have examined whether the IPCC might be a model for assessing risk, evidence synthesis, and translation in other areas, such as pandemics or chemicals.[45,46] As a model institution, what the IPCC decides in this arena could shape more than just climate science and communication.

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