Part III:
The Integration of Science into Law

On the Science-Coloured Glasses of the ICJ: Harmfulness, Wrongfulness, and Climate Accountability

Katalin Sulyok[*]

I. Introduction

In its July 2025 Advisory Opinion on Climate Change,[1] the International Court of Justice (ICJ) gave a thoroughly science-based reading of State obligations with respect to climate change. This, in and of itself, is not very surprising considering the standard practice of domestic and human rights courts to cite scientific findings in climate change. Indeed, references to the findings of the International Panel on Climate Change (IPCC) appears to be an essential ingredient in climate litigation judgments.[2] The Advisory Opinion, nevertheless, stands out, first, as compared to the ICJ's own previous environmental case-law, and second, for the way in which the Court interpreted the scope of state obligations with respect to the climate crisis, and how it paved the way towards establishing state responsibility for climate harm with climate science evidence.

The Advisory Opinion sends a strong message that scientific evidence is no longer a nuisance that should be avoided by the reasoning of the ICJ as much as possible,[3] or an extra-legal knowledge that is irrelevant

* Associate Professor in International Law and Sustainability at Durham University.

1 ICJ, *Obligations of States in respect of Climate Change*, Advisory Opinion of 23 July 2025.

2 Cf. for instance Dutch Supreme Court, *Urgenda Foundation* v. *The State of the Netherlands,* 20 December 2019, no.19/00135; The Hague District Court, *Vereniging Milieudefensie v. Royal Dutch Shell Plc,* judgment of 26 May 2021, C/09/571932 / HA ZA 19–379, para. 2.3.5.; German Constitutional Court*, Neubauer et al. v. Germany*, decision of 24 March 2021, 1 BvR 2656/18; ECtHR (Grand Chamber), *Verein KlimaSeniorinnen Schweiz and Others v Switzerland,*. judgment of 9 April 2024, No. 53600/20.

3 See *Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, Judgment of 20 April 2010, para. 167.

for deciding the legal controversy. Long gone the days when members of the bench argued that adjudging science-heavy legal questions (in the material case, whether Japan's whaling program can be deemed scientific in nature) is 'more suited to scientists rather than lawyers'.[4] Nor did the Court deem sufficient to make only symbolic gestures towards scientific authority. Instead, it engaged with climate science meaningfully, assigning a central role to scientific knowledge in how the Court defined the content of state obligations.

The Court spared no efforts in weaving together legal and scientific knowledge in translating the 'more than legal problem'[5] of climate change to the language of international obligations and state responsibility. This short contribution will comment on how the Court was balancing factual and legal aspects in operationalizing the duty to prevent harm to the climate system and will discuss the ways in which climate science informs the content of legal concepts, with a special focus on how scientific evidence now may pave the way to a new legal paradigm of climate accountability.

II. Science as the Backbone of State Obligations with Respect to Climate Change

References to climate science run through the Opinion as a consistent thread. With the 76 appearances of the term 'science' or 'scientific' across the 133 pages, the Opinion reads like the Court is using climate science knowledge as the main compass for navigating the uncharted waters of state responsibility for climate harm.

This was made possible likely due to a pre-hearing meeting the Court held with scientists of the IPCC. The goal of the day-long exchange was 'to enhance the Court's understanding of the key scientific findings'[6] which the IPCC has delivered through its periodic assessment reports. Even though the exact questions and answers were not revealed to the public, it seems quite likely that but for this substantive engagement with leading scientists, climate science could hardly fly so high in Court. After all, the scientific fact-finding powers used by a judicial body fundamentally

4 Separate Opinion of Judge Sebutinde, *Whaling in the Antarctic (Australia v. Japan: New Zealand intervening)*, judgment of 31 March 2014, para. 9.
5 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 456.
6 See the IPCC anouncement: https://www.ipcc.ch/2024/11/25/ipcc-icj/.

shape the extent to which the judgment will rely on scientific knowledge meaningfully.[7]

Having declared that IPCC reports 'constitute the best available science on the causes, nature and consequences of climate change'[8], the Court went on reiterating the main findings of these reports,[9] which is a standard practice of domestic courts in climate cases. What is perhaps more surprising is that the ICJ also used IPCC science as the starting point for basic legal definitions, such as 'the climate system' or 'mitigation', even though these very terms are also defined in climate treaties.[10]

The science-coloured glasses of the ICJ also enabled giving a holistic solution to the problem before it. Given the scientific fact that the climate crisis is inextricably linked to other human-enhanced planetary challenges, such as the ecological crisis or desertification, the Court included the Convention on Biological Diversity and the Convention to Combat Desertification among 'the most directly relevant applicable laws', and it did so again on the basis of primarily scientific justifications.[11]

Furthermore, just like climate science, which is not confined to inquires studying the impacts of rising emissions only, but also includes research into the various other anthropogenic drivers behind the climate crisis (e.g. land use change, ozone destruction, pollution, etc.), the ICJ also defined the 'material scope of its inquiry' very broadly, encompassing 'the full range of human activities that contribute to climate change as a result of emissions of GHGs, including both consumption and production'.[12] This science-based narrative paints a very broad picture of the various human (and state) conduct, which is now placed within the scope of international law obligations.

Moreover, climate science evidence served as the main epistemic justification for reaching almost every novel conclusion as to the content of legal obligations. More specifically, climate science laid the foundations for several key legal findings, including:

---

7 Katalin Sulyok, 'Science, Epistemology and Legitimacy in Environmental Disputes - The Epistemically Legitimate Judicial Argumentative Space', LJIL 37 (2024), 139 (163).

8 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 74.

9 ICJ, *Obligations of States in respect of Climate Change* (n. 1), paras. 72-87.

10 But the respective legal definitions come only second in the Opinion after the scientific definitions, see ICJ, *Obligations of States in respect of Climate Change* (n. 1), paras. 75, 85.

11 ICJ, *Obligations of States in respect of Climate Change* (n. 1), paras. 325, 331.

12 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 94.

- that the harm prevention principle is applicable in the context of climate change and poses corresponding obligations for all States,[13]
- that the standard of due diligence must be stringent, as every fraction of the degree matters, and 'may also become more demanding in the light of new scientific or technological knowledge',[14]
- that the determination of 'significant harm to the climate system and other parts of the environment' must take into account the IPCC reports, which identify 'harms associated with climate change as including sea level rise, extreme weather events and severe consequences for ecosystems and biodiversity',[15]
- that risks caused by GHG emissions should be assessed as part of States' EIA obligations, including 'their possible downstream effects',[16]
- that the 'primary' temperature goal of the Paris Agreement is 1.5°C, and notes that this interpretation is the one that is consistent with best available science,[17]
- that State efforts to 'enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change' must also conform to best available science,[18]
- that scientific evidence informs what measures are deemed necessary within the meaning of Article 194 (1),[19] and
- that sea-level rise is 'not without consequences for' the right to self-determination.[20]

Additionally, the Court also showed how scientific data will inform the legal analysis around causal questions in the context of state responsibility. This merits further discussion given the complexity of the issue, to which I will return later in Section IV.

Finally, despite unanimous acceptance of climate science at large, judges of the Court had slightly different takes on climate science evidence, as transpires from several individual opinions. The main point of contention among members of the bench lies in whether the Court went *far enough*

13 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 137.
14 ICJ, *Obligations of States in respect of Climate Change* (n. 1), paras. 245, 284.
15 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 278.
16 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 298.
17 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 224.
18 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 258.
19 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 334.
20 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 357.

in relying on climate science. Judge Yusuf deemed the Court's reasoning as 'scientifically ill-grounded'[21] for stopping short of legally recognizing what scientific evidence, in his view, suggested for States' responsibility for climate harm. Judge Nolte defended the Opinion's approach to conceptualizing wrongful acts,[22] whereas Judge Xue would have preferred more extensive reliance on per capita emission data provided by the IPCC.[23]

III. Harmfulness vs Wrongfulness of Emissions

A particularly consequential finding of the Advisory Opinion pertains to operationalizing the duty of prevention in the climate context. In this respect I will focus only on the Court's firm distinction between *harmful* emissions (in the ordinary, and scientific, sense) and *wrongful* emissions (in the legal sense). This element in the reasoning reveals how the 'scientific' and 'legal' narrative on climate change may conflict with each other, even though they relate to the same element of the factual reality, namely, the effects of anthropogenic emissions.

Scientifically speaking, every tonne of GHG emissions contributes to global emissions, which mix up in the atmosphere, and collectively, cause harmful climate impacts well beyond the territory of the State of origin. However, the Court points out that 'the internationally wrongful act in question is not the emission of GHGs per se'[24] only those that contravene international law obligations. As a result, with the words of Judge Nolte, 'only a limited amount of all anthropogenic GHG emissions since industrialization has been caused by *wrongful* acts.'[25]

This conceptualization of the unlawful State conduct is in line with the approach that the European Court of Human Rights took towards assessing climate obligations in the *Verein KlimaSeniorinnen Schweiz and Others v Switzerland* case, which also assessed domestic climate policies, and resulting GHG emissions, as part of States' positive obligations under

21 Separate Opinion of Judge Yusuf, *Obligations of States in respect of Climate Change*, Advisory Opinion of of 23 July 2025, para. 16.
22 Declaration of Judge Nolte, *Obligations of States in respect of Climate Change*, Advisory Opinion of of 23 July 2025, paras. 24–27.
23 Separate Opinion of Judge Xue, *Obligations of States in respect of Climate Change*, Advisory Opinion of 23 July 2025, paras. 9–10.
24 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 427.
25 Declaration of Judge Nolte (n. 22), para. 27.

human rights law.[26] The alternative view would have appraised domestic climate laws, and the resulting emissions, as part of the negative obligations of States, under which States have an obligation to refrain from infringing on the protected sphere of private and family life. Under this approach, greenhouse gas emissions *per se* would have been deemed unlawful, for being the cause of the human rights violation. Notably, the European Court of Human Rights instead found that it was the lack of 'effective protection by the State authorities from serious adverse effects of climate change on' the individuals' life and wellbeing that constituted the breach of positive obligations under the right to private life,[27] and not the emissions themselves, which were coming mainly from corporate sources.

Nevertheless, the view taken by the ICJ on the breach of international obligations is not fully backed by all members of the bench despite the Opinion being adopted unanimously. Judge Yusuf finds this reconstruction of the relevant processes problematic, calling it 'completely detached from empirical realities and the scientific findings relating to the causes and consequences of climate change'.[28] He concludes that the Opinion's finding that 'climate change is inherently a consequence of activities … *of all States* (emphasis added) is scientifically ill-grounded'.[29]

It is argued here, however, that rejecting the harmfulness of the emissions of all States disregards the scientific fact that every tonne of emissions (regardless of its source) has equal warming potential (and hence, *harmful* in the scientific sense). This is not to say, of course, that all States' emissions are equally *blameful* or *wrongful,* in a moral and legal sense. Only, that the difference between the different portions of emissions lies in the normative part of the wrongfulness calculus and not in the scientific dimension of harmfulness.

Moreover, Judge Yusuf focuses his legal inquiry on IPCC data confirming a disparately bigger portion of emissions of the Global North compared to developing States as far as historical emissions are concerned.[30] In his reading, these data would justify a system of State responsibility for climate harm that is proportionate to the respective State's cumulative emissions,

26 ECtHR (Grand Chamber), *Verein KlimaSeniorinnen Schweiz and Others v Switzerland* (n. 2), para. 292.
27 ECtHR (Grand Chamber), *Verein KlimaSeniorinnen* (n. 26), para. 519.
28 Separate Opinion of Judge Yusuf (n. 21), paras. 8.
29 Separate Opinion of Judge Yusuf (n. 21), para. 16.
30 Separate Opinion of Judge Yusuf (n. 21), para. 15.

including historical emissions dating back to 1850. In contrast, Judge Nolte invokes IPCC data showing a growing share of emissions post 1990 in all anthropogenic emissions, which by now has reached the same order of magnitude than emissions prior 1990 (42 %-58 %, respectively).[31] This is possible given that *current* levels of emissions are dominated by emerging economies, and not by historically high emitting States from the Global North.

These competing judicial narratives building on different sets of equally robust scientific data highlights the importance of the broader question of the appropriate role of scientific knowledge in adjudication. As I argued elsewhere, even though scientific evidence is crucially relevant and can (and should) *inform* the judicial decision on legal responsibility for climate harm, climate science alone cannot answer the legal question directly, nor such answer is *dictated* by climate science.[32] Evidence needs to be legally contextualized and interpreted for purposes of answering the legal question put before a court. The hard limit, in this respect, lies in that the judicial narrative on factual processes should not contradict robust climate science knowledge. Doing so would undermine the epistemic legitimacy of the reasoning.[33] Nevertheless, the presence of scientific evidence cannot exempt judges from their task of undertaking normative considerations in deciding (science-heavy) legal dilemmas. The climate crisis throws into the limelight the inevitable role and importance of making (scientifically informed) value judgments. These new legal standards can be best spelt out in legislation, or in the persistent lack thereof, in judicial decisions.

After all, the Court seems to strike a careful balance between scientific and normative components in reconstructing the legally relevant process leading from anthropogenic GHG emissions to harmful climate impacts. The Opinion remains within the bounds of epistemically legitimate reasoning when distinguishes the harmfulness of emissions from their wrongfulness. It is argued here that equating the two would have 'scientized' the issue of state responsibility to an excessive extent by eliminating the normative aspects of the (essentially legal) calculus, which would have undermined the epistemic legitimacy of the reasoning.

31 Declaration of Judge Nolte (n. 22), para. 25.

32 Katalin Sulyok, 'Speaking in the Language of Law or Science? Epistemic Hard Cases and Reasoning Dilemmas for Courts in Adjudicating Climate Change', NZJEL 28 (2024) 21–27.

33 Katalin Sulyok (n. 7), 163.

Nevertheless, the Advisory Opinion did avoid answering the hard question of which portions of emissions (i.e. whose emissions?) are *harmful*. This is primarily a normative assessment, which will have to be done in future cases, should those reach the Court. Any such assessment will revolve around the application of the various standards[34] that the Court specified under the obligation of due diligence.

IV. Attribution, Causation: Climate Science in Establishing the International Responsibility of Individual States

The Court, as shown above, preserves room for normative appraisals in the assessment of the wrongfulness of emissions. The Opinion, in fact, swings the door wide open to finding the responsibility of individual States (or group of States) established for climate harm in future contentious proceedings, and, importantly for present purposes, the chances of success of any such claims will, for a large part, hinge on climate science. Relevant scientific questions include causal determinations and assessing whether the respective State took measures that are reasonable, appropriate and necessary to prevent harm to the climate system.

The Court finds that 'the rules on State responsibility admit the possibility of determining the responsibility of States in the climate change context',[35] and the extent of liability must be established 'in concreto',[36] that is, in individual contentious proceedings.

The success of climate damage claims hinges on whether the respective court is willing to accept climate attribution science, a field of climate research that studies whether individual climate impacts, such as extreme weather impacts, can be attributed to anthropogenic climate change (impact attribution), or even further back to individual emitters, based on their share from the global emissions (source attribution).[37] The Advisory Opinion openly welcomes the insights deriving from attribution science. It finds, first, that source attribution studies can have bearing on a state

34 ICJ, *Obligations of States in respect of Climate Change* (n. 1), paras. 280–300.
35 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 431.
36 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 437.
37 Carly A. Phillips, Delta Merner and Friederike Otto, 'Attribution Science', in: Margaretha Wewerinke-Singh and Sarah Mead (eds), *The Cambridge Handbook on Climate Litigation* (Cambridge University Press 2025), 79–102.

responsibility, by emphasizing that 'it is scientifically possible to determine each State's total contribution to global emissions, taking into account both historical and current emissions'.[38] Moreover, it also acknowledges impact attribution findings by citing IPCC data 'clearly linking the human contribution to climate change to observed increases in heatwaves, flooding and drought'.[39]

While attribution science causally links a portion of emissions to certain harmful impacts and the sources of emissions, respectively, legal causation must still be established separately in the context of state responsibility. This requires the demonstration of a causal link between a wrongful act and a specific climate harm. This is sometimes called as attribution in the climate law sense, which is used for purposes of assigning a given climate impact to a certain emitter.[40] Importantly, this type of attribution must be distinguished from the notion of attribution used in the law of state responsibility,[41] used most notably under the Articles on Responsibility of States for Internationally Wrongful Acts,[42] and equally also from the scientific notion of attribution as used by scientists in climate attribution studies.[43]

Importantly, the Court stresses that finding a causal nexus 'is not impossible' and will have to be done in each case 'through an *in concreto* assessment'.[44] The difficulties presented by scientific uncertainty burdening causal evidence 'must be addressed as and when they arise in light of … the evidence presented to the Court'.[45] This wording of the Court suggests that the certain factual scenarios may be sufficient for the Court to find causali-

38 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 429.
39 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 437.
40 For a more detailed discussion, see Petra Minnerop, 'Climate Causality – From Causation to Attribution', in: Margaretha Wewerinke-Singh and Sarah Mead (eds), *The Cambridge Handbook on Climate Litigation* (Cambridge University Press 2025), 421–427.
41 Gábor Kajtar, 'The fragmentation of attribution in international law', in: Gábor Kajtár, Basak Çaliand Marko Milanovic (eds), *Secondary Rules of Primary Importance in International Law – Attribution, Causality, Evidence, and Standards of Review in the Practice of International Courts and Tribunals* (Oxford University Press 2022).
42 ILC, Articles on Responsibility of States for Internationally Wrongful Acts, 2001, General Assembly Resolution 56/83 of 12 December 2001, and corrected by document. A/56/49(Vol. I)/Corr.4.
43 Sulyok (n. 32).
44 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 438.
45 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 437.

ty established despite the Court's insistence on its causal standard requiring 'a sufficiently direct and certain causal nexus between the wrongful act... and the injury suffered'.[46]

The ICJ's findings on the possibility of establishing (individual) state responsibility for (individual) climate harm may seem progressive, surprising or even radical to some. Yet, there exists robust scientific evidence that is capable of establishing causality, not only in the scientific sense, but also in legally appreciable terms. Any friction is, therefore, not between the logic of (climate) science and the logic of (international) law, but rather between two legal worldviews: the old paradigm of climate impunity and the new paradigm of climate accountability.

46 ICJ, *Obligations of States in respect of Climate Change* (n. 1), para. 436.