Government Participation in Virtual Negotiations: Evidence from IPCC Approval Sessions*

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Abstract

The Covid-19 pandemic challenged global governance in unprecedented ways by requiring intergovernmental meetings to be held online. For the Intergovernmental Panel on Climate Change (IPCC), this meant that the intergovernmental approval of the key findings of the Sixth Assessment Report (AR6) had to be conducted virtually. In this paper, we assess how the move away from face-to-face meetings affected country participation in IPCC approval sessions. Our findings demonstrate that virtual meetings increased the size of member governments' delegations, but this did not necessarily translate into a greater number of interventions during the approval of the Summary for Policymakers (SPM) as time zone differences reduced engagement levels significantly—particularly for countries from the Pacific, East Asian, and Latin American regions whose delegations often found themselves in IPCC meetings late at night and early in the morning. These results offer initial, empirically robust evidence about what online meetings can and cannot achieve for promoting more inclusive global governance at a time when the IPCC and other organizations reflect on the future use of virtual and hybrid meeting formats.

Keywords: virtual meetings; hybrid meetings; IPCC approval sessions; Sixth Assessment Report (AR6); Summary for Policymakers (SPM); delegation size; time zones; Covid-19.

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Statements and declarations

Ethics approval and consent to participate

Not applicable as study does not involve any human subjects.

Consent for publication

Not applicable as study does not involve any human subjects.

Competing interests

The authors have no relevant financial or non-financial interests to disclose.

Author contribution

This paper is the result of a larger collaborative research project and as such Patrick Bayer, Lorenzo Crippa, Hannah Hughes, and Erlend Hermansen all contributed to the conceptualization of the study. Patrick Bayer devised the methodology together with Lorenzo Crippa, wrote the first draft of the paper, oversaw the study, and led the acquisition of research funding. Lorenzo Crippa curated and analyzed the data, created all visualizations, and holds primary responsibility for the results section. Hannah Hughes wrote the literature review section. All authors commented on previous versions of the manuscript. All authors read, edited and approved the final manuscript.

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Availability of data and materials

All data and replication code will be made available on Harvard Dataverse upon publication.

Introduction

Almost all social interactions in private and professional life were moved online during the Covid-19 pandemic. In the case of global governance, this meant that intergovernmental negotiations between country delegations—the core of high-level diplomatic exchange and collective action—could no longer take place face-to-face and had to be conducted virtually. Digital diplomacy is not new as such (Seib, 2012; Adesina, 2017; Adler-Nissen and Drieschova, 2019; Bach and Martin, 2023), yet the speed and comprehensiveness with which the pandemic forced organizations to adapt was unprecedented, fueling debates about challenges and opportunities of virtual multilateral negotiations (Chasek, 2021; Vadrot, Langlet, and Tessnow-von Wysocki, 2021; Hughes et al., 2021; Vadrot and Ruiz Rodriguez, 2022). At the time, the Intergovernmental Panel on Climate Change (IPCC) was halfway through its Sixth Assessment Report (AR6) cycle, which meant the final lead author meetings and the intergovernmental approval of the Summary for the Policymakers (SPM) for the three Working Groups (WGs) were moved online.

Face-to-face meetings are credited with creating trust between negotiators through "precedence, predictability, (and the) ability to build relationships" (Chasek, 2021, 61). On a personal, delegation-to-delegation level, trustful relations are essential for successful multilateral cooperation (Touval, 1989; Coleman, 2011; Chasek and Wagner, 2016). Aside from venues of information exchange, in-person meetings allow negotiators to empathize with each other, which helps reduce uncertainty and increases understanding each others' bargaining positions and "red lines" (Holmes, 2013; Kamau, Chasek, and O'Connor, 2018; Shukla et al., 2020). The multiple sites of physical meetings also facilitate informal discussions and proposals in huddles, corridors, and over coffee (Bansard, 2023). This offers more direct and immediate ways to resolve outstanding issues and clear up misunderstandings that might otherwise get protracted in plenary sessions (Chasek, 2021; Vadrot and Ruiz Rodriguez, 2022).

Despite these advantages, face-to-face meetings are costly in terms of time, money, and their

carbon footprint. According to a recent report by the International Institute for Sustainable Development (IISD) the largest benefits from virtual negotiations are lower costs and greater participation (Williams and St John, 2021). Among some, moving multilateral negotiations online, hence, comes with hopes for more transparency, better access, and greater inclusion in international negotiations for and participation from the Global South. The extent to which this optimism is justified, however, depends on how organizations design virtual negotiation spaces because digital diplomacy can intensify existing inequalities and, indeed, create new ones (Vadrot and Ruiz Rodriguez, 2022; Wagner and Allen, 2020).

Our paper contributes to the growing literature of scholarly assessments of the impact of virtual meetings on negotiations, and in particular, on country delegations' attendance in meetings and their capacity to actively engage and shape a negotiated document (Wagner and Allen, 2020; Chasek, 2021; Vadrot and Ruiz Rodriguez, 2022; Williams and St John, 2021). It does so through a study of the IPCC's virtual approval of the key findings of AR6 as presented in the Working Group SPM documents. As was the case for many other intergovernmental processes, the timeline for finalizing the AR6 was delayed by the pandemic. However, the assessments were ultimately completed by moving to virtual author meetings to finalize the drafting of the reports and by conducting the line-by-line approval of the SPMs online.

Complementing the IPCC's own analysis of virtual lead author meetings (Shukla et al., 2020), this study focuses on the virtually conducted, intergovernmental approval sessions. We conceptualize participation as the combination of countries' *attendance* at and *engagement* during these meetings. Without attendance, there is no participation; yet, attendance can be on paper only, so distinguishing between attendance and engagement is important. Our research design uses a two-pronged strategy to assess the impacts of virtual meetings on countries' attendance and engagement levels. First, we compare the size of member governments' delegations in the approval of the AR5 and the AR6 to identify how the virtual meeting format impacted participation. Second, we map attendance onto countries' engagement levels during AR6, while scrutinizing the role of time zone

differences, as these have repeatedly been brought up as a downside of virtual negotiations (Shukla et al., 2020; Chasek, 2021). This allows us to evaluate the impacts of this distinctive feature of digital diplomacy on delegations' engagement levels in multilateral negotiations of SPM text. While our analysis is primarily descriptive, the mostly exogenous variation in meeting formats and time zones helps increase the credibility of our research design.

Our results indicate that although there was only a modest increase in the total number of member governments participating across WG and Synthesis Report approval sessions in AR6 (147 countries) compared to AR5 (134 countries), the composition of which countries attended changed: 18 governments with a presence at an approval sessions in AR5 did not send a delegation to any of the approval sessions at AR6, while 31 countries attended at least one of the approval sessions at AR6 without having attended any of these meetings in AR5—many of which are from highly climate vulnerable nations, such as small island states.[1] Aside from total counts, we additionally show that most countries increased the size of their delegations during the virtual approval of the AR6 Working Group reports over AR5, and this effect is particularly pronounced in WGII and WGIII. Our analysis suggests that the online setting has increased delegation sizes, on average, by two additional delegates compared to in-person meetings. From this point of view, conducting IPCC approval sessions virtually seems to have enhanced countries' delegation sizes among attending governments. However, we also find that larger delegations do not necessarily result in a greater number of interventions in IPCC discussions of the SPM text. Although delegation size and engagement levels are positively correlated, time zone differences dampen this relationship significantly. In particular, the statistical association between attendance and engagement levels disappears for countries that were hit the hardest by being located in time zones furthest away from Europe, such as those in the Pacific, East Asian, and Latin American regions.

Our findings make two main contributions. First, they speak to existing research that identifies

[1] Appendix A reports a full list of countries that attended at least one approval session only in AR5, only in AR6, or in both.

asymmetries in participation in the assessment of global climate knowledge in the IPCC (Agrawala, 1998; Corbera et al., 2016; Blicharska et al., 2017; Schipper et al., 2021; Hughes, 2024). As the IPCC currently finds itself at an important constituting moment for the new assessment cycle, our evidence suggests that virtual negotiations can increase attendance at (yet not necessarily engagement during) IPCC meetings from country delegations that are otherwise often limited to a single delegate during in-person meetings. Acknowledging that resolving conflicts can take longer in online than in-person environments, greater use of virtual preparatory sessions and hybrid formal meeting formats may chart a way forward for the least resourced developing countries to have well-informed, larger delegations with a broader range of expertise in attendance during relevant IPCC meetings. Second, our findings add to a growing literature that assesses the opportunities and challenges of digital diplomacy more broadly (Williams and St John, 2021; Chasek, 2021; Vadrot, Langlet, and Tessnow-von Wysocki, 2021). Here, we add nuance to the role of delegation sizes and the relationship to engagement levels during meeting discussions, which helps inform debates about more inclusive forms of global governance through technological advances.

Government participation in the IPCC

The IPCC is understood as a site for producing authoritative scientific assessments of climate change and response options to inform negotiated actions within the United Nations Framework Convention on Climate Change (UNFCCC). To achieve this mandated task, the IPCC produces assessment reports of the latest knowledge of the scientific basis of climate change (Working Group I); impacts, vulnerability and adaptation to climate change (Working Group II); and mitigation (Working Group III). To date, the IPCC has completed six assessment cycles and is in the process of undertaking its seventh one. The reports are produced by authors who are nominated by governments or observer organizations and selected by each Working Group Bureau to ensure the relevant scientific expertise to assess the latest knowledge on climate change alongside orga-

nization criteria for a range of views and geographical and gender balance within author teams. Authors produce reports guided by the government approved outlines. Each WG produces both a comprehensive assessment report and a summary of key findings in the Summary for Policymakers (SPM). Member governments play a central role in the production of this assessment, through approving the report outline, reviewing the draft report, and approving the final SPM document (Hughes, 2022). It is this line-by-line approval process that is the focus of this article (De Pryck, 2021, 2022).

While the SPM is distinct from most intergovernmentally negotiated documents because it is drafted by scientific authors and the key messages it contains are drawn from and supported by the underlying assessment report (Hughes, 2024), the wording and figures describing and depicting the key messages to inform collective action are negotiated (Kouw and Petersen, 2018). As such, new research conceptualizes this intergovernmental component of global environmental assessment processes like the IPCC and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) as central sites of negotiation in the making of collective action on the environment (Hughes and Vadrot, 2019; Hughes et al., 2021; Hughes and Vadrot, 2023). Given our substantive interest in how digital meetings affect countries' participation in multilateral negotiations, this makes the IPCC an important case for studying how the virtual setting shapes a country's capacity to participate and actively engage in the negotiating process.

Participation has been a central issue to the IPCC since its formation in 1988 (Bolin, 2007). Those leading the establishment of the organization and tasked with producing an international assessment of climate change realized the critical importance of the participation of *all* countries in intergovernmental decision-making in the IPCC and the authorship of its reports, which turned barriers to meaningful engagement for developing countries into a core organizational concern (Agrawala, 1998). Despite quickly establishing funding to support developing country travel and attendance at IPCC panel, bureau and author meetings, developing country participation has remained a significant issue on the IPCC agenda shaping the organization, its assessment practice

and the reports produced (Hughes, 2015).

Research on developing country participation in the IPCC has largely been focused on the involvement of experts in the assessment (Bhandari, 2020; Ho-Lem, Zerriffi, and Kandlikar, 2011; Hulme and Mahony, 2010; Standring and Lidskog, 2021; Standring, 2022). This literature has illuminated significant asymmetries in the number of developing country authors across assessment cycles and explored the national political and research contexts that contribute to this (Biermann, 2002; Borland, Morrell, and Watson, 2018; Ibarra et al., 2022; Kandlikar and Sagar, 1999; Lahsen, 2004; Mahony, 2014). This research indicates that even when appointed as authors, scientists and other expertise from the Global South face significant barriers in their capacity to meaningfully contribute to and impact the assessments' content.

These barriers operate both at the material and social level. Materially, countries' economic wealth and national investment in research are critical factors (Blicharska et al., 2017; Ho-Lem, Zerriffi, and Kandlikar, 2011) and translate into less national and institutional support in the authorship role compared to authors from the Global North. Internet quality and access to the international journals required to review and assess the state of climate knowledge have also been identified as significant issues (Schipper et al., 2021). These material effects combine with social scientific dynamics within the chapter teams, where contribution to knowledge is measured through institutional affiliation and publication record (Hughes and Paterson, 2017). As a result, authors from the Global South, particularly those who are less confident English speakers, are often perceived as less accomplished and authoritative in the assessment of knowledge, shaping the social space for participation (Hughes, 2024). While the AR6 boasted greater diversity over previous assessments, the shift to a virtual process augmented the material asymmetries identified above, which made it hard for some authors to contribute at all (Chasek, 2021; Ketcham, 2022; Shukla et al., 2020; Vadrot and Ruiz Rodriguez, 2022).

One of the core conclusions of this literature is that ultimately global knowledge and assessments on climate change are dominated by authors and institutions from the Global North (Corbera

et al., 2016). As a consequence, the knowledge in IPCC reports is predominantly produced and assessed by authors from the Global North about these regions of the world (Blicharska et al., 2017; Karlsson, Srebotnjak, and Gonzales, 2007). Authors have suggested that this dominance may contribute to controversy in the approval of a report's key findings and the collective response (Corbera et al., 2016; Blicharska et al., 2017), although there is no evidence that more diverse voices will necessarily lessen this. While the literature on author participation clearly demonstrates how participation is shaped by material and social factors (Bolin, 2007; Ho-Lem, Zerriffi, and Kandlikar, 2011; Corbera et al., 2016; Hughes and Paterson, 2017; Vardy et al., 2017; De Pryck and Hulme, 2022; Hughes, 2024), much less is known about how these factors shape member government capacity to participate in organizational decision-making in the IPCC and the approval of the report's key findings. If we know that institutional setting and internet access shape the participation of authors, to what extent does this impact on member government participation? To what extent did the shift to the virtual approval of the AR6 content shape and impact governments' capacity to actively participate in proceedings?

Research design

We take a first step towards answering these questions with original data that allow us to examine empirical patterns in country participation, delegation size, and engagement levels during IPCC approval sessions. Conceptually, we distinguish participation into a minimalist notion which comes in the form of a country's mere presence at multilateral negotiations, or what we call *attendance*, and a country's efforts to actively participate in negotiated outcomes, which we refer to as *engagement*. Attendance and engagement levels are our key outcome variables of interest.

Attendance: Measurement and empirical strategy

We measure attendance—as the most minimal form of participation—through country delegations' presence at IPCC approval sessions. For this, we rely on participant lists as documented in the official IPCC reports that are published after each session and are available from the IPCC website.[2] This data provides us with information about: (i) which countries attended IPCC meetings and (ii) the size of delegations. Since we are interested in the impacts of virtual meeting formats on country participation, we compare attendance rates and delegation size across AR5 (negotiated in-person in 2013/14) and AR6 (negotiated virtually in 2021/22, except for the Synthesis Report). At least descriptively, over-time changes between AR5 and AR6 in country attendance and delegation size can be indicative of potential effects from moving negotiations online.

These changes over time are not solely the result of the shift in meeting format as climate politics also shifted. During the eight years between the approval of AR5 and AR6, the Paris Agreement was negotiated and ratified, renewing political interest in climate change and in the IPCC assessment process; climate impacts around the world intensified; and countries struggled to recover from the Covid-19 pandemic. While these broader developments matter for the interpretation of our results, the credibility of our empirical analysis is strengthened by the fact that both AR5 and AR6 Synthesis Reports were negotiated in-person. Any changes in outcome measures for the two Synthesis Reports between assessment rounds might result, for instance, from the increased salience of climate change over time, yet, by design, they *cannot* be the result of variation in meeting formats as both meetings were conducted face-to-face. This allows us to use differences in outcome measures from the Synthesis Report negotiations in 2014 and 2022 to "net" out the effect of all other variables that shape country participation in IPCC plenaries that are *unrelated* to differences in meeting format.

To illustrate, assume the fictitious country ABC-LAND had sent 3 delegates to the in-person

[2] Appendix B reports links to this data source.

WGI plenary in 2014 and 6 delegates to WGI plenary in 2022, which was held virtually. A naïve estimate of the effect of virtual meetings in this case is an increase of $+3$ delegates. However, we cannot be sure whether this increase in delegation size is due to the meeting format or for any other reason, such as greater issue salience of climate change or increased climate impacts. Knowing that ABC-LAND delegations for Synthesis Report meetings, all held in-person, increased from 1 delegate to 3 delegates allows us to calculate an adjusted effect of virtual meeting formats of $+1$ delegate (i.e., $(6-3)-(3-1)=1$). This empirical strategy is akin to a difference-in-differences estimator which cancels out over-time changes in outcome measures that are not driven by differences in meeting formats (Angrist and Pischke, 2008; Card and Krueger, 1994). Since we cannot assess the extent to which identifying assumptions hold, our results remain correlational, but they offer a more credible estimate of the "true" effect of meeting formats on country participation.

Engagement levels: Measurement and empirical strategy

Country delegations can attend negotiations, but that does not mean they will actively engage in discussions during meetings. Observational research on the IPCC has highlighted that not all governments appear to participate in IPCC plenary meetings and has identified a small group of highly active member governments (Hughes, 2022, 2023, 2024). However, to date there is no quantitative data on this relationship in the approval of a report's key findings. In order to explore this, we operationalize government delegations' engagement levels in IPCC discussions by whether they make interventions during IPCC sessions. We measure levels of engagement as the total number of country mentions in Earth Negotiation Bulletin (ENB) reporting of the IPCC meetings.[3] ENB summary reports are built from systematic observation of meetings by ENB writers that provide an account of the event, including which member governments intervened on what issue. In the absence of verbatim transcripts of IPCC approval sessions, ENB records—which are systematic, coordinated across ENB writers, provide granular information, and undergo quality control before

[3] We exclude mentions of the European Union when referred to as an actor of its own, but, of course, include mentions of individual EU member states.

publication—allow us to construct a replicable and fine-grained measure of countries' engagement levels. That said, ENB reports are not word-by-word minutes of meetings, so they naturally focus on *notable* interventions by country delegations and there is a risk that not every country's intervention is recorded.

We use this measure of countries' engagement levels to assess how it varies with delegation size and time zone differences. Larger delegations and delegations from countries located in time zones that are geographically closer to Europe, where the Working Group Technical Support Units (TSUs) were based and whose office hours dictated the majority of the overall negotiating schedule, are likely to find it easier to actively engage in negotiations. Relationships between delegation sizes and engagement levels are descriptively important, while time zone differences offer us greater analytical leverage. Unlike decisions about delegation sizes, resourcing, and meeting schedules, the time zone of any given country is beyond the control of country governments, which helps us to isolate the effects of time zones on engagement levels more cleanly. Although a country's research capacity, its vulnerability to climate change, and its domestic climate politics are likely to shape engagement levels to a greater extent, variation in time zones might have an important conditional effect. This expectation is consistent with qualitative evidence that time zone differences were perceived as a major downside of virtual meetings by negotiators across the board (Chasek, 2021; Vadrot and Ruiz Rodriguez, 2022).

Results

We present three sets of empirical results: First, we show that delegation sizes in IPCC meetings increased between AR5 and AR6, on average. Second, by focusing on online negotiations in AR6, we assess the extent to which delegation size matters for countries' engagement levels during approval sessions, where we find mixed results. Third, we provide evidence that differences in time zones did mute the positive effect of larger delegations on engagement levels in WGII and

WGIII.

Changes in delegation sizes from AR5 to AR6

We begin by demonstrating that country delegations increased in size across all three Working Groups for virtual meetings. Figure 1 shows average increases when we pool our data across all three WGs (left panel) and for each WG separately (other three panels). The solid line documents that, across the board, delegations were, on average, larger by about two delegates in virtual approval sessions in AR6 compared to in-person approvals in AR5. This increase is most pronounced in WGs II and III and consistent with evidence that WGII in AR6 "had the highest number of delegates ever registered for an approval session" (ENB, 2022, 22).

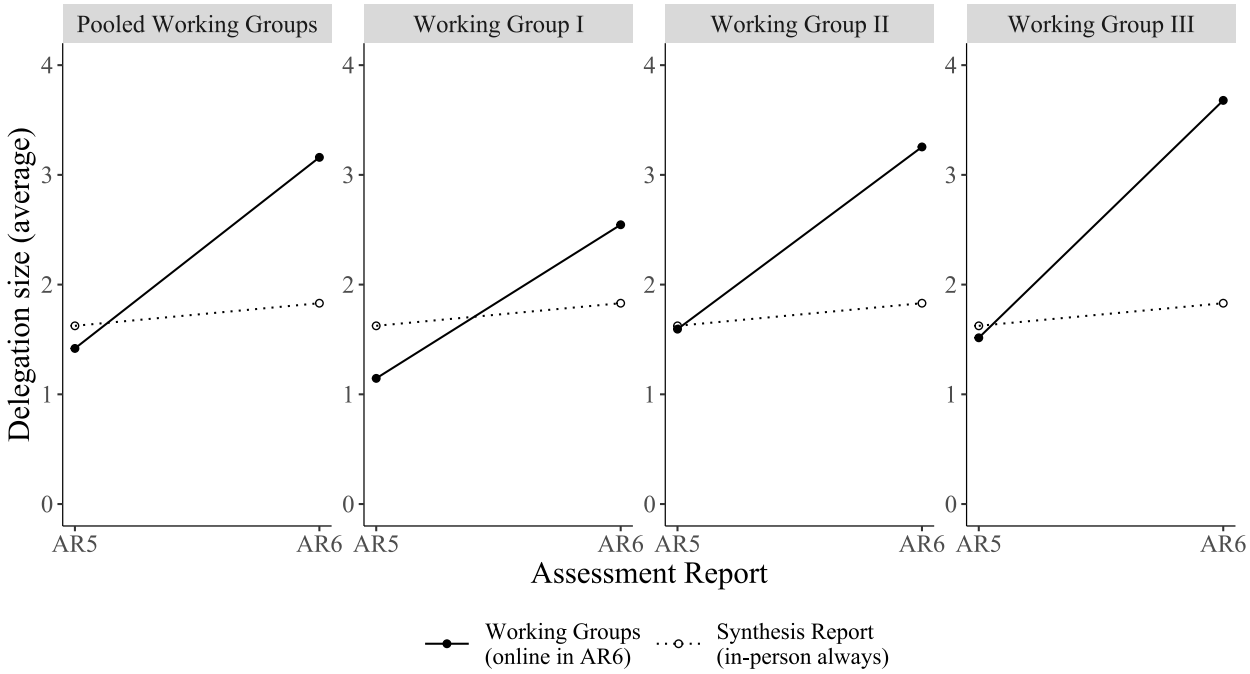

FIGURE 1: Average delegation size in AR5 and AR6. Solid lines show changes in average delegation size from in-person IPCC approval sessions in AR5 to virtual IPCC approval sessions in AR6. Dotted lines show changes in delegation size for Synthesis Report approval sessions in AR5 and AR6, both of which were conducted face-to-face. The left panel shows results for pooled data across all three Working Groups; the other three panels show results separately for each Working Group.

Average changes in delegation sizes do, however, mask important variation at the country level. Out of a total of 156 countries which sent delegates to either the AR5 or AR6 Working Group approval sessions, roughly 6 out of 10 increased their average delegation size (93 countries), while one third, or 52 countries, reduced it; 7% held delegation sizes constant (11 countries). The increase in countries' delegation sizes—averaged across WGs for each of the ARs—were much larger (+3.6 delegates on average) than reductions in those countries that sent fewer delegates (−0.8 delegates on average). Aside from Japan, whose delegation size decreased substantially from an artificially high baseline of 53 delegates in WGII in AR5, which was hosted in Yokohama, most countries that reduced their delegation sizes did so by less than one delegate on average.

Compared to attendance in AR5, 31 countries no longer had a presence in Working Group sessions of AR6, whereas 25 countries attended AR6 Working Group sessions but were absent in the approval of AR5, including many small island states like Antigua and Barbuda (1.33 delegates), Samoa (2.33 delegates), St. Kitts and Nevis (5.33 delegates), and Vanuatu (8 delegates). The three largest delegations came from the United States (25.3 delegates, +19.3 from AR5), Canada (23 delegates, +19.7 from AR5), and South Korea (21.3 delegates, +10.3 from AR5). Some countries, such as Turkey (10.7 delegates, up from 0.3 delegates in AR5), Malaysia (15 delegates, up from 1 delegate in AR5), and Argentina (13.7 delegates, up from 1 delegate in AR5) increased their delegations more than ten-fold for the approval of the AR6. Figure SI1 in Appendix C visualizes these changes for all countries and all approval sessions.

As discussed in the Research Design section above, the increases in delegation sizes may not relate to the virtual format of the approval sessions, but may instead reflect the greater salience of climate change in domestic politics (Colgan, Green, and Hale, 2021; Bayer and Genovese, 2020). To caution against concerns that the identified empirical patterns are purely a result of broader societal and political trends, Figure 1 also plots, as dotted lines, average sizes of negotiating delegations in Synthesis Report approval sessions in AR5 and AR6. Relying on the fact that Synthesis Reports were negotiated face-to-face in both assessment rounds, we find that delegation

size has grown only minimally between the two ARs' Synthesis Report approvals, which suggests a modest increase in delegation size for reasons that are plausibly unrelated to the virtual format. We also note that the average delegation size remains remarkably similar across all four AR5 approval sessions, which minimizes concerns that the approval of the Synthesis Report draws systematically larger or smaller delegations than the WG approvals. We are, hence, confident that the increase in member governments' delegation sizes results largely from changes in meeting formats rather than the increased salience of climate politics. If the latter was indeed the case, we would expect much larger average delegations in the approval of the Synthesis Report of AR6.

We quantify the effect of virtual negotiations on countries' average delegation size in a linear regression model using the difference-in-differences estimator. Table 1 summarizes the results when we pool data across Working Groups (Model 1) and when estimating the models separately for each Working Group (Models 2−4). The four models correspond to the four panels in Figure 1 above. The coefficient estimate in the top row (AR×virtual) shows the effect of virtual negotiations on delegation size as an increase of between 1.2−2.0 delegates on average. This effect is strongest for WGII (Model 3) and WGIII (Model 4), and all estimates are statistically distinguishable from zero at conventional levels of significance.

Lending further credibility to our empirical strategy, we find that delegation sizes for Synthesis Report approval sessions in AR5 and AR6 were not statistically significantly different (as indicated by the AR6 estimates). Similarly, delegations in Working Group and Synthesis Report approval sessions in AR5 were roughly of the same size (as indicated by the WG estimate). This strengthens claims that the observed increase in delegation size indeed stems from virtual session formats because changes in delegation size between AR5 and AR6 *only* occurred for exactly those approval sessions that happened online (i.e., WGI−III approvals), but not for the ones that were conducted face-to-face (i.e., Synthesis Report approvals).

TABLE 1: Effect of virtual negotiations on average delegation size (DID estimator)

	Model 1	Model 2	Model 3	Model 4
	Pooled	WGI	WGII	WGIII
AR6 × virtual	1.535**	1.194*	1.455*	1.958**
	(0.512)	(0.479)	(0.635)	(0.606)
AR6	0.206	0.206	0.206	0.206
	(0.443)	(0.339)	(0.449)	(0.429)
virtual	-0.206	-0.479	-0.030	-0.109
	(0.362)	(0.339)	(0.449)	(0.429)
(Intercept)	1.624***	1.624***	1.624***	1.624***
	(0.313)	(0.240)	(0.317)	(0.303)
Num.Obs.	1320	660	660	660
R2	0.038	0.026	0.028	0.049
R2 Adj.	0.035	0.022	0.023	0.045

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes:
Outcome: Delegation size. Standard errors in parentheses. Model 1 pools data across WGs; models 2−4 show estimates for WGs separately.

Delegation sizes and engagement levels in AR6

Building on the above finding that delegation sizes increased in AR6, we now examine whether larger delegations translate into greater engagement levels in IPCC negotiations. We provide a first answer to this question by describing the relationship between countries' delegation sizes and delegations' engagement levels, as approximated by country mentions in ENB reports. Figure 2 plots the distributions for both variables for the 30 largest countries by delegation size. For each of the three Working Groups in AR6, the bar plots to the right show a country's delegation size; the "×" marks delegation sizes in AR5 for comparison. Colors denote gender breakdowns, where female and male delegates are shown in red and blue, while gray indicates delegates whose gender we could not assign based on information about their first names. Bar plots to the left show countries' engagement levels.

Confirming what we described in the previous section, delegations in AR6 were substantially larger compared to AR5 for almost all countries in the figure. With the exception of Japan (53 del-

egates in AR5, 17 delegates in AR6) and Saudi Arabia (9 delegates in AR5, 7 delegates in AR6) in WGII and Germany (22 delegates in AR5, 17 delegates in AR6) and China (16 delegates in AR5, 15 delegates in AR6) in WGIII, AR6 delegations became larger for all these top-30 countries.[4] Among our 30 largest countries, delegations in WGI had an average size of 9.6 delegates, which was significantly smaller than delegations in WGII (12.8 delegates, $p < 0.025$) and WGIII (13.8 delegates, $p < 0.006$). Many countries therefore seem to have used the online setting as a way to increase their presence at IPCC negotiations.

[4] Countries that host IPCC approval sessions will have larger delegations in that Working Group and year. This accounts for the large delegations of Japan, which hosted WGII approval sessions in Yokohama in AR5, and Germany, which hosted WGIII approval sessions in Bonn in AR5.

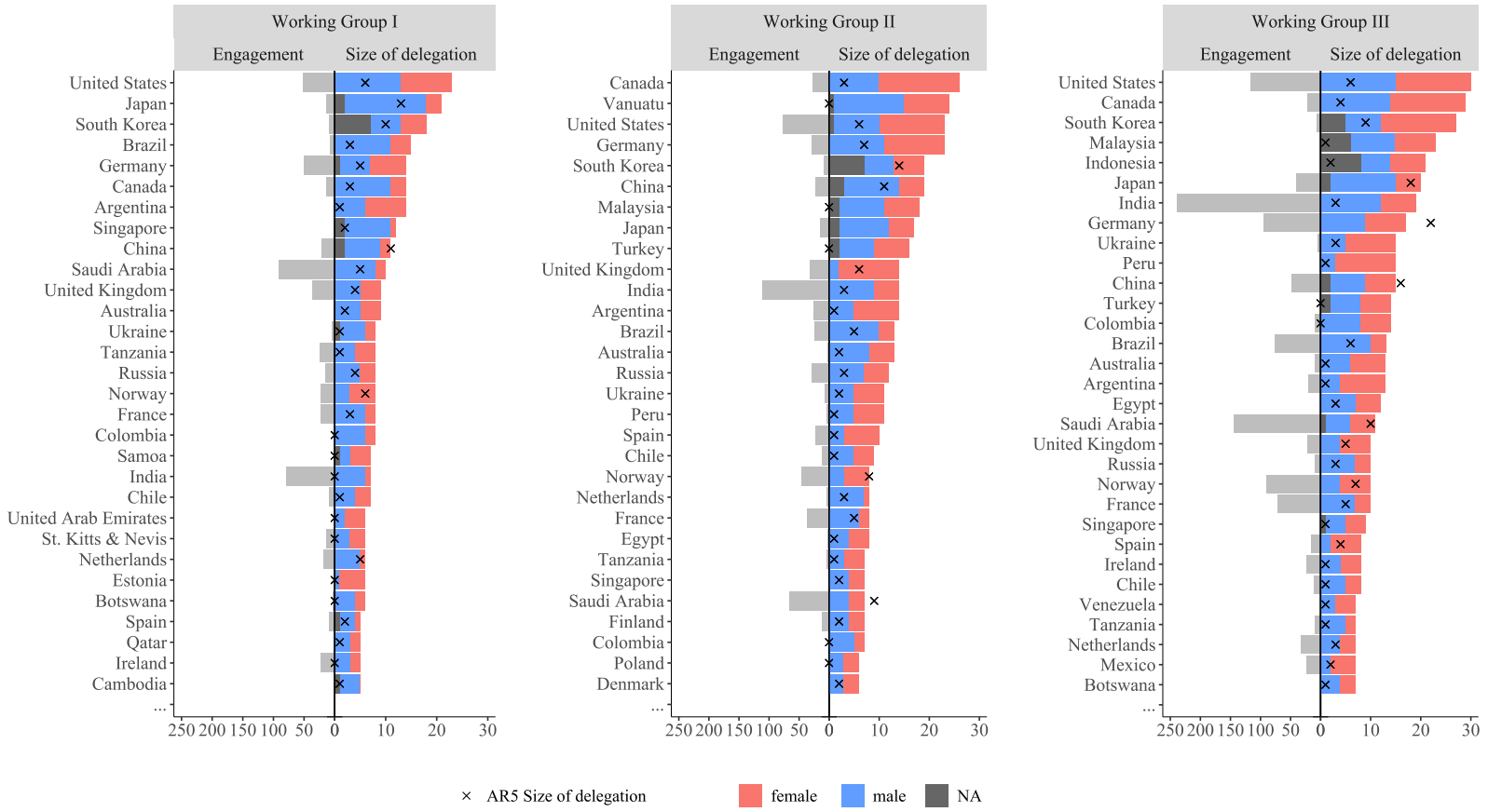

FIGURE 2: Delegation sizes and engagement levels for 30 largest countries (by delegation size) in AR6 for WGI–III. Colors indicate gender breakdowns for each of the delegations, where we distinguish between female delegates (red), male delegates (blue), and those for whom we could not assign gender based on first name information (gray); "×" marks delegation size in AR5 for comparison.

Note: Japan nominated 53 delegates for WGII in AR5 (as it hosted the approval session in Yokohama). We omit this count in the plot for purposes of visualization.

However, delegation size does not directly translate into engagement levels as measured by country mentions in the ENB reports. While the 30 largest countries account for 77% (537 of 695 mentions in WGI), 74% (616 of 831 mentions in WGII), and 80% (1,145 of 1,424 mentions in WGIII) of mentions compared to all other countries, and hence account for a vast majority of total interventions, considerable variation exists within this diverse set of states. Countries at the top of the list in Figure 2 do not necessarily engage more in the approval sessions. This pattern is robust across Working Groups.

India, Saudi Arabia, and the United States are consistently the countries with the largest number of interventions, accounting for about one third of total mentions in each of the Working Groups (32%, 221 total mentions in WGI; 31%, 254 mentions in WGII; 35%, 500 mentions in WGIII). While mentions do not tell us anything about the direction or success of the interventions, these data indicate that these countries are actively involved in shaping SPM text. Other countries that engaged heavily were Germany (50 mentions) and the UK (36 mentions) in WGI, Norway (46 mentions) and France (36 mentions) in WGII, and Germany (95 mentions) and Norway (91 mentions) in WGIII. At the same time, this also means that several countries with sizable delegations remained largely silent, such as, for instance, Argentina, Indonesia, Malaysia, Turkey, and Vanuatu. Similar to a conclusion reached for IPCC plenary sessions (Hughes, 2022, 2023) and authorship contributions (Hughes and Paterson, 2017), these results identify a core group of IPCC member countries actively involved in approving the key findings of the AR6 Working Group reports. We also notice that the number of interventions in Working Group III on mitigation options was about twice the number of interventions in the other two Working Groups on the physical science basis and climate impacts and adaptation.

Engagement levels and time zone differences

So far, we have shown that large delegations are not synonymous with high engagement levels as captured by country mentions in ENB reporting; and, in fact, in some instances smaller delegations were more actively involved in the approval than larger delegations. This may not come as a surprise, as other factors, like a country's research capacity, its domestic economic and political constraints and priorities, or its vulnerability to climate impacts may be more important drivers of engagement levels in IPCC approval sessions. Nevertheless, our results document stark differences in levels of country engagement. Clearly, the "grueling" schedule of the meeting (ENB, 2022, 23), with longer days as the approval sessions progressed, did not have the same impact on all delegations.

In order to better understand country-level variation, we turn to the role of time zone differences. Despite the IPCC's efforts to recognize time zone differences in scheduling meeting sessions (IPCC, 2022, 2), negotiators and observers alike complained heavily about this particular feature of the online negotiation sessions in AR6. As delegations attended virtual negotiations from their own respective time zones, they often experienced negotiations that stretched far beyond standard work hours late into the night and early mornings, disrupting delegates' personal life and resulting in fatigue and exhaustion (Chasek, 2021; Vadrot and Ruiz Rodriguez, 2022). Notwithstanding that in-person meetings also run long hours, this problem was especially acute for delegations in time zones that were the most distant from Europe.

To analyze the effect of time zone differences on country participation during the approval, we first convert the day-by-day negotiation schedules for WGII (14−26 February 2022) and WGIII (24 March−4 April 2022) approval sessions from Coordinated Universal Time (UTC) into each delegation's *home* time zone.[5] We then compute, on an hour-by-hour basis, whether negotiations

[5] We focus our analysis on WGII and WGIII (for which we have detailed, hourly schedule information) and on those countries that nominated at least one delegate to any of these two WGs. For countries with multiple time zones, we use the time zone which a country's capital is located in.

took place during or after standard 9am-5pm office hours *in a delegation's home time zone*. Aggregating these data up to the country level provides us with a measure that captures the share of negotiation hours that fall outside of each delegation's normal office hours.

In Figure 3 we plot this measure for the 30 delegations that were the most exposed to time zone differences. The bar plots show the share of negotiation hours outside of normal work hours. To illustrate, for the delegation of Vanuatu only eight out of a total of 106 negotiation hours in WGII approval sessions took place during normal 9am-5pm work hours. Over the duration of two weeks of virtual negotiations, Vanuatu delegates worked outside of normal hours more than 92% of the time. This is but one example since other countries in the Pacific region, including Australia, South Korea, Japan, the Cook Islands, Samoa, New Zealand, and Kiribati experienced similarly high shares outside core working hours. The same, albeit to a slightly smaller degree, is true for countries in East and Central Asia as well as in Latin America, whose delegations participated in the approval at least half of the time outside of their 9am-5pm work hours.

While larger country delegations are undeniably more likely to engage more actively in negotiations, purely as a result of greater numbers, we also expect that this effect might dissipate when delegations are located in geographies with unfavorable time zones. Indeed, countries furthest away from Europe, which expected negotiations to take place out of core 9am-5pm work hours for most of the time, may purposefully have nominated larger delegations to mitigate these negative effects on engagement levels.

We model this conditional effect with an interaction regression model and show the estimated relationships in Figure 4 for pool data (left panel) and separately for WGII (middle panel) and WGIII (right panel).[6] Black lines report the effect of an additional delegate on countries' engagement levels (with associated 95% confidence intervals shown in gray) for different levels of our measure of time zone exposure from linear regression models. Dots and vertical whiskers produce

[6] We regress the logged number of ENB mentions +1 (to reduce skewness in the outcome measure) on delegation size, the share of negotiation hours outside of office hours, and their interaction.

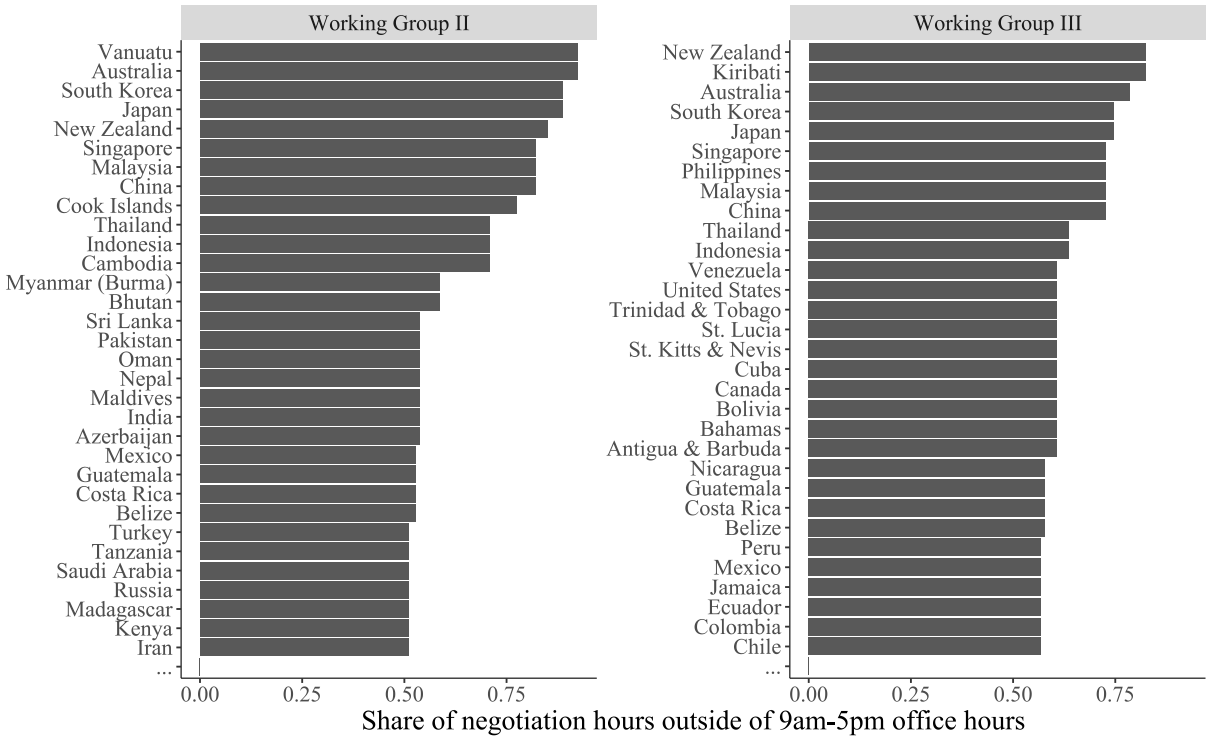

FIGURE 3: Share of negotiation hours outside of 9am-5pm office hours in AR6 by country.

the same effects of interest from a non-linear binning estimator (Hainmueller, Mummolo, and Xu, 2019).

Across the board, we observe that larger delegations are associated with greater engagement levels, so the "strength in numbers" logic finds support in our data in general and for both Working Groups individually. However, this positive relationship attenuates as time zone differences become pronounced. This becomes clear when comparing estimates along the horizontal axis of each of the panels in Figure 4. Estimates are positive when the shares of the session hours outside of core work hours are small (left end of x-axis), such as for European delegations. However, these effects are statistically no longer different from zero for delegations in time zones with very large shares of hours outside of 9am-5pm work hours (right end of x-axis) as in the case of delegations from the Pacific and Latin American regions. In other words, while increasing delegation size tends to increase delegations' engagement levels, this is much less the case for delegations that

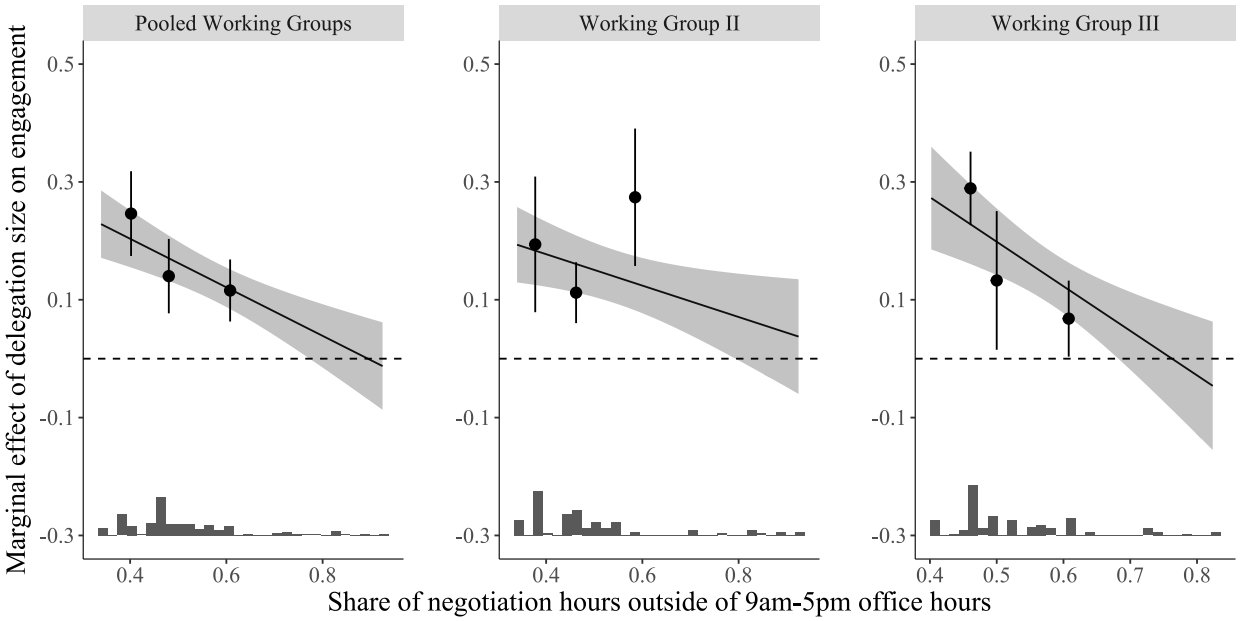

FIGURE 4: Marginal effect plots of delegation size on engagement levels as a function of the share of negotiation hours that fall outside 9am-5pm office hours. Black lines indicate estimates from a linear regression model with 95% confidence bounds shown in gray for pooled data (left panel), WGII (middle panel) and WGIII (right panel). Dots and vertical whiskers are point estimates and confidence intervals from a non-linear binning estimator (Hainmueller, Mummolo, and Xu, 2019). The histogram along the x-axis shows the distribution of the data.

are located in time zones that are greatly different from the time zone that IPCC meetings take place in. These results are correlational because delegations in remote time zones will clearly have expected this effect, but they nonetheless shed important light on the conditional impacts of time zones on countries' abilities to substantially and meaningfully engage in the virtual approval of the key findings of the AR6.

Concluding discussion

Effective global governance rests on countries' meaningful participation in multilateral negotiations. Much of this intergovernmental exchange has traditionally been conducted in face-to-face meetings, which was thrown into disarray with the outbreak of the Covid-19 pandemic, fast-tracking discussions about the opportunities and challenges of digital diplomacy. With good argu-

ments on both sides, ranging from travel costs, carbon footprints, time zone differences, internet access to power asymmetries (Williams and St John, 2021; Vadrot and Ruiz Rodriguez, 2022; Sanderson, 2023), this paper provides empirically robust, descriptive evidence about how the virtual approval of the AR6 impacted member governments' attendance, the size of their delegations, and their delegations' engagement levels in the line-by-line negotiation of the Working Group SPMs. In doing so, we complement existing studies on various aspects of virtual negotiations (Williams and St John, 2021; Chasek, 2021; Vadrot, Langlet, and Tessnow-von Wysocki, 2021).

Our main theoretical and methodological contribution is to separate government participation into attendance, i.e., the presence at intergovernmental meetings, and engagement, i.e., the effort to actively shape outcomes of discussions and their reflection in approved text. Building on original data from official IPCC delegation lists, hourly schedule information of IPCC approval sessions, and ENB reports, we find three main results. First, while the total number of attending countries increased modestly across all approval sessions from AR5 (134 delegations) to AR6 (147 delegations), delegation size increased on average by two delegates in virtual meetings. Second, delegation size does not directly translate into greater engagement levels in the form of government interventions during IPCC discussions of SPM text. Third, time zone differences attenuate the otherwise positive relationship of larger delegations on engagement levels—which was particularly marked for delegations located in the Pacific, East Asian, and Latin American regions. Practically, this means that delegations from some of the most climate vulnerable countries provided less input into the discussions over the SPM text than one would expect given how these countries are impacted by the issue and their large delegation sizes. Some of this effect, we show, results from differences in time zones, even though other, and possibly much stronger drivers may include countries' research capabilities, their economic, political, social, and cultural constraints, and their general long-term engagement levels with IPCC and UNFCCC processes (Hughes, 2024). Our analysis of time zone differences is nonetheless important and carries even more weight given that the IPCC, conscientious of the challenge and as one of the only organizations (Chasek, 2021), de-

liberately scheduled sessions in ways to minimize disadvantaging delegations based on time zone differences (IPCC, 2022).

These findings has important implications for the IPCC at the start of the seventh assessment cycle, as its leadership reflects on the role of virtual and hybrid meeting formats in this next cycle (IPCC, 2024). Existing research has emphasized unequal access and asymmetric participation in the IPCC for some time (Agrawala, 1998; Corbera et al., 2016; Blicharska et al., 2017; Schipper et al., 2021; Hughes, 2023). Conducting IPCC meetings virtually can, as we show, increase countries' delegation sizes. These effects appear to be strongest among delegations from developing countries, where only one delegate is funded by the IPCC Trust Fund to attend in-person meetings. We caution that delegation size is not an immediate fix to ensure greater engagement by member governments, but having a larger number of delegates is an important enabling factor to increase country engagement, as measured by interventions, especially for contentious issues that are often discussed in parallel sessions.

Supplementing first-hand evidence from negotiators who attended virtual approval sessions and highlighted important constraints around reliable internet connections, availability of IT infrastructure, and time zone differences (Chasek, 2021; Williams and St John, 2021), our results provide systematic empirical support that attending meetings during hours outside of core work hours stymies delegations' interventions significantly. In order for virtual meetings to enable more effective participation by all member governments in the future, meeting schedules will need to be carefully crafted around time zones and ideally, would provide a detailed breakdown of the meeting schedule by SPM section or agenda item to enable countries to distribute and organize their expertise and participation effectively within and across parallel sessions. In this respect, hybrid meetings may be particularly useful for ensuring that small delegations can be supported virtually from expertise within their expert communities and government at home. The practicalities around achieving this and creating organizational policy to support its realization in the next assessment will require further research and data collection to better understand the barriers and

enablers within and across different national contexts.

Beyond the IPCC, this paper contributes to a growing literature that assesses strengths and weaknesses of digital diplomacy (Williams and St John, 2021; Chasek, 2021; Vadrot, Langlet, and Tessnow-von Wysocki, 2021). Our findings indicate that the extent to which virtual and/or hybrid intergovernmental meetings can improve inclusiveness in global governance depends on how international organizations design and apply them. Virtual formats in themselves are neither good nor bad. They can increase participation in multilateral negotiations—for instance, for governments that do not have the resources to send large delegations for long overseas travels to in-person meetings—, but equally, if organized around European time zones and dependent on national internet infrastructure, they can equally reinforce power asymmetries in the existing international order (Vadrot and Ruiz Rodriguez, 2022). Especially in view of the accelerating climate crisis (Sanderson, 2023), international organizations have an important obligation to promote greater research into the conditions under which virtual meeting formats may be used for preparatory sessions, alongside or appropriately substituted for in-person meetings, and when they may not.

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Government Participation in Virtual Negotiations: Evidence from IPCC Approval Sessions

—SUPPLEMENTARY MATERIALS—

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July 2, 2024

Contents

A Country participation in AR5 and AR6 approval sessions

The following countries participated with at least a single delegate in any of the WGI-III or Synthesis Report approval sessions in both AR5 *and* AR6:

Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bangladesh, Belarus, Belgium, Belize, Bolivia, Bosnia & Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Chad, Chile, China, Congo - Brazzaville, Cook Islands, Costa Rica, Croatia, Cuba, Czechia, Côte d'Ivoire, Denmark, Djibouti, Ecuador, Egypt, El Salvador, Ethiopia, Finland, France, Gambia, Georgia, Germany, Ghana, Guinea, Guinea-Bissau, Hungary, India, Indonesia, Ireland, Italy, Jamaica, Japan, Kenya, Latvia, Liberia, Luxembourg, Madagascar, Malaysia, Maldives, Mali, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Myanmar (Burma), Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, North Macedonia, Norway, Oman, Pakistan, Panama, Peru, Philippines, Qatar, Russia, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovenia, South Africa, South Korea, Spain, Sri Lanka, St. Lucia, Sudan, Sweden, Switzerland, Syria, São Tomé & Príncipe, Tajikistan, Tanzania, Thailand, Togo, Trinidad & Tobago, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe

Table SI1 below shows countries with at least one delegate in any of either the AR5 *or* AR6 approval sessions, but not both. While the total number of attending delegations increased by 13 countries, the composition of countries also changed: 18 countries that attended at least one of the AR5 meetings did no longer participate in AR6, while 31 countries attended in at least one of the AR6 approval sessions, but did not attend any of the AR5 approval sessions.

TABLE SI1: List of countries that sent at least one delegate to any IPCC negotiation only in AR5 or only in AR6

N	Countries participating only to AR5	Countries participating only to AR6
1	Afghanistan	Albania
2	Central African Republic	Algeria
3	Comoros	Antigua & Barbuda
4	Dominica	Barbados
5	Dominican Republic	Benin
6	Eswatini	Bhutan
7	Fiji	Colombia
8	Iraq	Equatorial Guinea
9	Jordan	Estonia
10	Kyrgyzstan	Grenada
11	Laos	Guatemala
12	Lesotho	Iceland
13	Malawi	Iran
14	Monaco	Israel
15	South Sudan	Kazakhstan
16	Turkmenistan	Kiribati
17	Tuvalu	Morocco
18	Uzbekistan	Mozambique
19		Namibia
20		Paraguay
21		Poland
22		Portugal
23		Romania
24		Samoa
25		Slovakia
26		Solomon Islands
27		St. Kitts & Nevis
28		Suriname
29		Timor-Leste
30		United Arab Emirates
31		Vanuatu

B Country delegation lists: Sources

TABLE SI2: Details on IPCC Working Group (WG) and Synthesis Report Approval (SYN) sessions used in the study. The table reports the Assessment Report (AR), type of session (WG/SYN), session number, location, dates, and a link to the IPCC report that includes delegation lists as an Annex.

AR	WG/SYN	Session	Location	Dates	Link to PDF
5	WGI	IPCC-36	Stockholm, Sweden	2013/09/23 – 2013/09/26	PDF here, Annex 4, pp. 7−21
5	WGII	IPCC-38	Yokohama, Japan	2014/03/25 – 2014/03/29	PDF here, Annex 6, pp. 10−29
5	WGIII	IPCC-39	Berlin, Germany	2014/04/07 – 2014/04/12	PDF here, Annex 14, pp. 33−49
5	SYN	IPCC-40	Copenhagen, Denmark	2014/10/27 – 2014/11/01	PDF here, Annex 3, pp.18−35
6	WGI	IPCC-54	Online	2021/07/26 – 2021/08/06	PDF here, Annex 3, pp. 9−67
6	WGII	IPCC-55	Online	2022/02/14 – 2022/02/27	PDF here, Annex 3, pp. 8−43
6	WGIII	IPCC-56	Online	2022/03/21 – 2022/04/04	PDF here, Annex 2, pp. 7−46
6	SYN	IPCC-58	Interlaken, Switzerland	2023/03/13 – 2023/03/19	PDF here, Annex 3, pp. 8−36

C Change in delegation sizes between AR5 and AR6

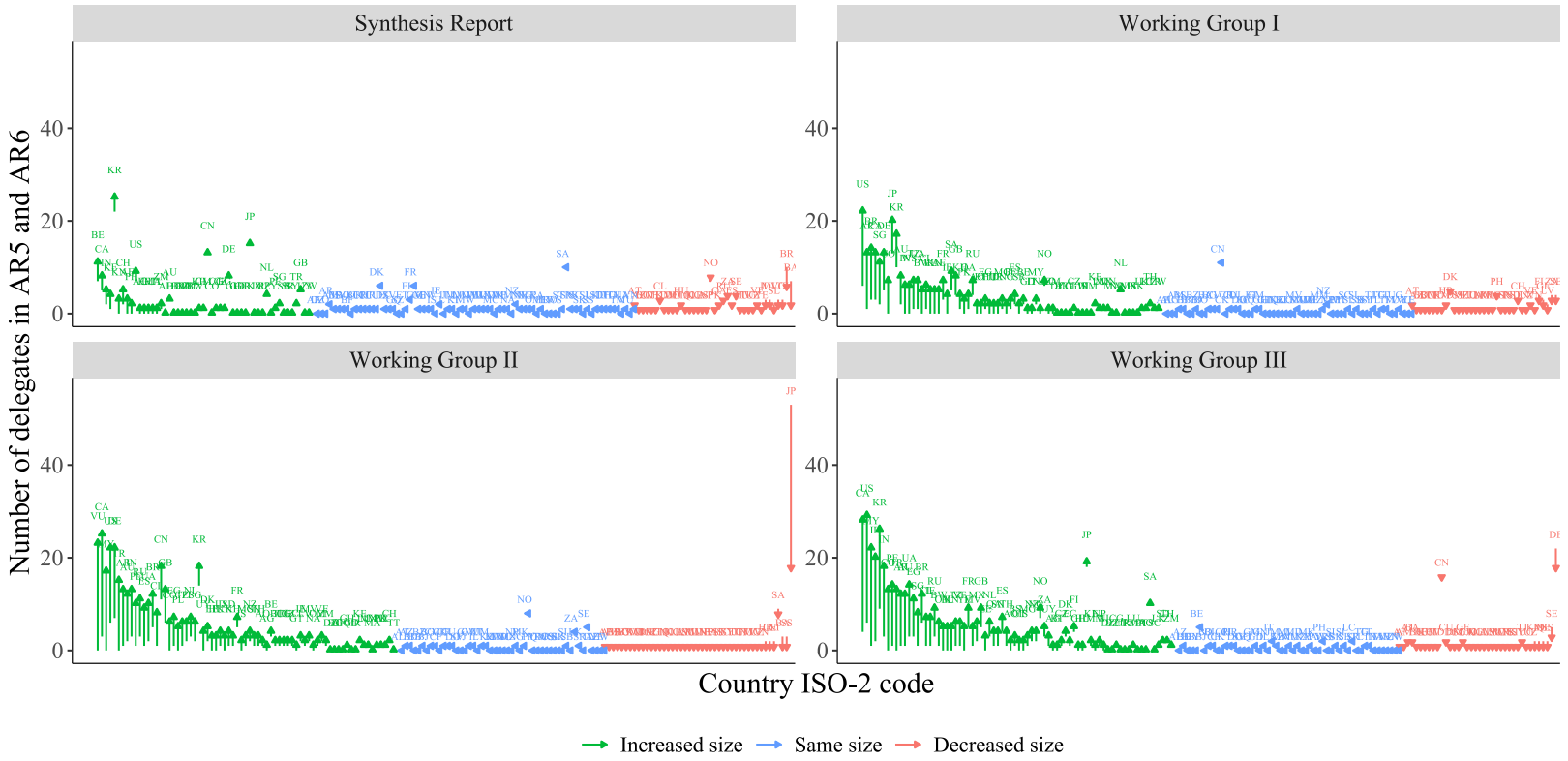

FIGURE SI1: Change in delegation size. Panels show the changes in delegation sizes between AR5 and AR6 for the Synthesis Report (top left panel) and Working Groups I–III approval sessions (other panels). Countries that increased, held constant, or decreased their delegation sizes are marked by green, blue, or red arrows, respectively.
Note: Country names are shown as ISO-2 country codes.