Inside and outside the climate negotiations: Contrasting networks of conference diplomacy reporting and media perception

Paula Castro (castro@pw.uzh.ch)

Department for Political Science and
Center for Comparative and International Studies,
University of Zurich

Marlene Kammerer (marlene.kammerer@ipw.unibe.ch)

Oeschger Centre of Climate Change Research, Institute of Political Science,
University of Bern

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Abstract. Given the global nature of climate change, prevalent free-riding incentives, and ongoing contestations between the Global South and North, understanding the factors that foster international cooperation in this field is crucial. The negotiations around the United Nations Framework Convention on Climate Change (UNFCCC) are the main forum in which global agreements to fight climate change are debated. However, partly due to the inability of this multilateral process to reach solutions, and to growing recognition of the complexity of the challenge, climate change has begun to be addressed across multiple channels outside the official negotiations. In addition, the press plays a key role in reporting on climate-related political events and thus portraying them to the broader public, possibly also influencing the political process itself. So far, there is scant research into the potential similarities, differences and interrelationships between the UNFCCC negotiations and how climate diplomacy is portrayed by the media. This study takes a first systematical step in this direction.

We expect reporting by the press is biased by a focus on key large global players, while the negotiations also encompass small and vulnerable countries. In addition, we expect that interactions inside the negotiation rooms are driven by coalitions of like-minded countries, while such groups are less important in diplomatic interactions as reported by the press. Furthermore, outside cooperation may help to pave the way for more cooperative negotiations. Therefore, we should see that more cooperative UNFCCC meetings tend to follow a period of increased cooperation in the real world, or that groups of countries that cooperate in the real world also increase their cooperation within the negotiations.

To explore these patterns, we rely on two novel datasets. The first one records agreements and disagreements between country dyads at the UNFCCC negotiations, hand-coded from summaries of the negotiations published between 1995 and 2013 in the Earth Negotiations

Bulletin. The second one is based on automated text coding of press releases, and contains information on cooperative and conflictive climate-related diplomatic interactions between country dyads between 1995 and 2015. We use a combination of descriptive statistics and dynamic social network analysis to investigate the data.

Keywords. Climate change, Cooperation, International Relations, Negotiation, Press reporting, Political Networks

1 Introduction

Traditionally, the United Nations Framework Convention on Climate Change (UNFCCC) has been the main forum to debate global agreements on climate change, with the negotiation delegations of countries as its most visible actors. However, due to recurring setbacks and stalemate the multilateral process has been slow in achieving meaningful action to stop climate change.

In recent years, partly due to the inability of the multilateral process to reach solutions and due to the growing recognition of the complexity of the challenge, climate change has begun to be addressed across multiple channels outside the official negotiations. It has for example become a recurring topic in the G8 and G20 meetings and declarations (Kim and Chung 2012; Kirton 2016; Meyer-Ohlendorf and Peichert 2007). Bilateral agreements, such as the Joint Statement on Climate Change between the US President Obama and the Chinese President Xi in September 2015, are known to have been crucial to move forward the multilateral process. The literature thus increasingly refers to a "regime complex" for climate change (Keohane and Victor 2011) or to the "polycentricity" of climate change governance (Bulkeley et al. 2014; Jordan et al. 2018; Ostrom 2010).[1]

However, while it is clear that the multilateral process is slow and so far insufficient to stop dangerous climate change, there are also doubts about what the other, external processes can actually achieve (e.g. Chan et al. 2015; Michaelowa and Michaelowa 2017). At the conceptual level, the initial reaction to the proliferation of initiatives to address global environmental issues was partly negative – one argument was that the "fragmentation" of the governance system into smaller club-type initiatives could generate disincentives for third parties to engage in larger international efforts, thus leading to lower participation and higher overall costs (Biermann et al. 2009). Yet, other scholars regarded these initiatives as potential alternatives to the stagnated UN regime (Hoffmann 2011; Ostrom 2012). From an empirical point of view, however, the available information has so far not been sufficient to assess the effectiveness of most individual climate governance initiatives in achieving their own goals (Hsu et al. 2016), let alone to assess the overall performance of this whole polycentric system.

Beyond these conceptual debates and the underlying empirical uncertainty, nonetheless, it is hoped that the multilateral ("inside") process and the ("outside") bilateral, international

[1] While there is also an increasing number of sub-state, non-state and transnational cooperative initiatives on climate change (see, e.g. Widerberg and Stripple (2016); Bulkeley et al. (2014) the analysis in this paper so far focuses on state-level interactions.

initiatives complement each other in moving efforts to address climate change forward (e.g. Ostrom 2010, 552). But so far, there is scant empirical research into the potential interrelationships between both spheres of governance (Jordan et al. 2015).

This study aims to take a first step in systematically analyzing the interrelationships between countries' interactions inside the UNFCCC negotiations and outside through other diplomatic channels. Inside the negotiations, county delegates multilaterally meet and debate about specific aspects of the international climate regime under the umbrella of the UNFCCC, for example about mitigation, adaptation, or the provision of finance. This internal negotiation process happens usually more or less unnoticed by the wider public. Outside the negotiations, country interactions related to climate change are manifold. State representatives might meet to discuss important aspects regarding the UNFCCC. For example, in preparation for the important climate summit in Paris in 2015, France met with both high-level country representatives in China and the US to make sure that there would be enough agreement between the two adversaries to make the Paris Agreement happen. More generally, country representatives might agree on a bilateral agreement, might exchange resources or openly praise or criticize each other's climate policy. This outside process is far less structured and far more complicated to grasp. Nevertheless, this political process occurring outside the ivory tower of the negotiations is of key importance, as it is what permeates to the wider public through the press.

While we still cannot make empirical claims about the implications of this polycentric governance system for the overall effectiveness in addressing climate change, we can nonetheless explore how the *political processes* inside and outside the negotiations interact. We do this by observing and comparing instances of conflict and cooperation between country pairs (or dyads) inside and outside the negotiations, on the basis of two novel datasets. The first one records agreements and disagreements between country dyads at the negotiations, hand-coded from summaries of the negotiations published between 1995 and 2013 in the Earth Negotiations Bulletin. The second one is based on automated text coding of press releases, and contains information on how the international public observes cooperative and conflictive interactions on climate-related topics between country dyads outside the negotiations between 1995 and 2015.

For this study, we understand cooperative dyadic interactions as dyads of countries joining forces with the aim of reaching their own common goals with respect to climate change, either inside or outside the negotiation process. Such definition is agnostic of the question whether such cooperation might be pursuant of more ambitious climate policy. In theory, two countries

could cooperate with each other to block efforts to promote more ambitious policy. Nonetheless, assuming that most countries have a sincere concern about climate change and its impacts, we expect that on average more cooperation will lead to better efforts to address climate change.

The paper continues as follows. We start by outlining some first theoretical expectations about cooperation in polycentric governance systems, i.e. how the political processes inside and outside the UNFCCC negotiations link to each other. Next, we describe the two novel data sets and how they were collected. Methodologically, we draw on descriptive statistics, network centrality and centralization statistics, and multilevel stochastic actor-oriented models to compare and investigate potential interdependencies between both political processes.

2 Inside and outside the climate negotiations: Contrasting conference diplomacy and media perception

Climate change governance has increasingly evolved from a monocentric system centered on the UNFCCC and its top-down Kyoto Protocol, to a polycentric system. In this polycentric system other intergovernmental fora, state- and sub-state-level governments, non-state actors, and transnational initiatives bring together different actors to engage in governance activities. At the same time, state-level actors themselves engage in bilateral and "minilateral" coordination and exchanges to try to circumvent or alleviate the gridlock in the multilateral process (Falkner 2016). This decision-making arena "outside" the negotiations is closely followed by the international press. Although media attention is usually high before, during, and after the negotiations, press reporting delivers a biased picture of the negotiations to the international public. This is because of a strong focus on key actors, like the EU, the USA, China, and other emerging economies. Outside diplomacy and media awareness are also not seldom a tool for conference preparation. For example, in preparation to 2015 climate conference in Paris the French presidency engaged key players in diplomatic meetings to facilitate a possible agreement between key opponents like the US and China, which enabled the actual negotiations to succeed (Brun 2016).

In contrast, in the negotiations, i.e. the inside decision-making arena, small and highly vulnerable countries play a much more important role (Betzold 2010), than the outside perspective would imply. In addition, while the EU usually speaks with one voice inside the negotiations, its member states are often perceived and also act as independent actors in the outside decision-making process. Hence, it can be assumed that the factors driving these complementary decision-making arenas, i.e. inside negotiations and outside diplomacy, are different. This leads us to a first hypothesis.

H1: Press reporting on the outside climate change diplomacy is driven by a strong focus on key actors, whereas inside the negotiations smaller and more vulnerable countries are highly active.

Moreover, inside the negotiations diplomatic interactions are driven by a group logic. In order to reach common goals, countries tend to join forces with similarly-minded peers and form coalitions and alliances. This allows them to pool bargaining resources and bargain more effectively. Countries – particularly small ones - thus tend not to negotiate individually, but as part of these coalitions (Klöck and Castro 2018). In the outside process, in contrast, we expect the coalitions to play a less decisive role, as in this case diplomacy takes place through bilateral or minilateral channels or in small specific fora such as the G8 or the G20.

H2: While inside the climate negotiations diplomatic interactions are driven by coalitions of like-minded countries, such groups are less important for the diplomatic interactions reported by the media outside the negotiations.

Another central proposition of polycentric governance is that the different elements of the system adjust to each other, developing collaborations that lead to more trusting (and hopefully effective) interrelationships (Jordan et al. 2018). However, research has not yet caught up with the challenge of working out how the different elements of the climate governance landscape interact and how they adjust to each other (Betsill et al. 2015; Jordan et al. 2018). Do different decision-making arenas learn from each other, or is there rather competition? Are external governance initiatives complements or supplements to the UN process (Michaelowa and Michaelowa 2017; e.g. Moncel and van Asselt 2012)

So far, there is some evidence that public awareness on cooperative diplomatic interactions has had some positive spillovers for cooperation in the negotiations. For example, attention to non-state and sub-state initiatives for climate action has enriched negotiations on the level of ambition of climate action in the pre-2020 period (Jordan et al. 2015). Similarly, both the bilateral agreement between the US and China described above, and diplomatic efforts by the French negotiations chair in the run-up to the Paris meeting, are considered to have been instrumental for the success of the Paris Agreement (Falkner 2016). Accordingly, our third expectation is as follows:

H3: Outside cooperation may help to pave the way for more cooperative negotiations under the UNFCCC.

3 Measuring cooperation and conflict in- and outside the climate negotiations

In this section, we describe the two datasets. Both datasets are so-called event datasets. In the event data literature, there is a wide discussion about the nature of a political event (e.g. Schrodt 1994). We define a political event as an incident that can be located at a single time, for example a day, and a set of actors, usually a dyad. Here, the dyads are pairs of political actors/ countries that interact in cooperative or conflictive manner. Usually, the interaction is initiated by one actor/ country and directed to one or more alters. Each interaction has a certain quality, i.e. it can be more or less cooperative or more or less conflictive. In more formal terms, each event is defined as a tuple $e = (a_e, b_e, w_e, t_e)$ where a_e is the initiating political actor (the *source*), b_e is the addressed actor (the *target*), w_e is the quality of an event (the *event type*), and t_e the *time* when e happens (Lerner et al. 2013; Schrodt 2012b).

3.1 Relational data between parties to the UNFCCC (ENB dataset)

This dataset identifies cooperative and conflictive oral interactions between parties at the UNFCCC negotiations (see Castro 2017). The data was coded from summaries of UNFCCC negotiation meetings reported by the International Institute for Sustainable Development in its Earth Negotiations Bulletins (IISD, International Institute for Sustainable Development 1995 - 2013). It covers all meetings of the UNFCCC Conference of the Parties, subsidiary bodies and ad-hoc bodies in the period 1995-2013, and comprises 51625 negotiation interactions, between 188 countries and the EU, throughout a total of 427 negotiation days.[2]

The Earth Negotiations Bulletins (ENBs) provide daily reports of the negotiations, which are highly standardized in their language and style, and contain summaries of statements made by the different delegations on behalf of their countries and the respective reactions by others. The dataset relies on these summaries to identify how countries interact with each other orally in the negotiations, distinguishing between cooperative and conflictive behavior. In addition, the dataset includes information on the topics or issue areas that each of these negotiation interactions is about, and the date in which they took place.

Table 1 presents the general coding scheme used to identify cooperative and conflictive negotiations in the ENBs. As an example, we have the following section of the ENB published on 15 December 2009: “BRAZIL preferred no change in greenhouse gases […] that are

[2] While the original dataset also includes coalitions such as the Group of 77 and China, the Least Developed Countries, or the Alliance of Small Island States, for this version of the paper we have decided to exclude them, so that we have a comparable set of actors for the interactions outside and inside the negotiations. The only exception is the case of the EU, which is kept in the dataset because it mostly speaks with one voice at the negotiations.

reported but not accounted for […]. AUSTRALIA, the FEDERATED STATES OF MICRONESIA and SWITZERLAND supported estimating and reporting new greenhouse gases." In this example, we would code an undirected cooperative interaction (agreement) between Australia and Micronesia, Australia and Switzerland, and Micronesia and Switzerland, while we code a directed conflictive interaction (opposition) between Australia and Brazil, Micronesia and Brazil and Switzerland and Brazil. The resulting unit of analysis is a *negotiation interaction*, characterized by a pair or dyad of interacting countries, the type of interaction (cooperative or conflictive), its topic (for the above example it would be "reporting of emissions"), and the date in which it took place.

The coding was carried out by hand. This allowed us to also code agreements or disagreements that were not easily identifiable through sentence construction (e.g. by the use of verbs such a support or oppose), but whose identification needed an understanding of the substantive topics under discussion. Four coders contributed to the data collection process. To ensure consistency, they all started by coding the same sample of text, comparing results, and discussing the coding rules to reach a common understanding. Later, random portions of text were double coded in order to test for intercoder reliability. Cohen's kappa ranged from 0.90 to 0.98 for the coding of the type of interactions.

Table 1: Types of dyadic interactions in the UNFCCC negotiations

Strongly cooperative negotiation interactions	***On behalf of***: when one country speaks for a group of countries that is not an established coalition. Presupposes active coordination of common positions. Mutual (undirected) tie. ***Support***: when the text explicitly indicates that one country supports another one. Indicates active and outspoken support. Directed tie.
Mildly cooperative negotiation interactions	***Agreement***: when several countries hold the same position on an issue. Mutual (undirected) tie.
Mildly conflictive negotiation interactions	***Delaying proposal***: when a country asks that someone else's proposal be discussed at a later time. Directed tie. ***Opposition***: when two countries have opposing positions, or when one is reported to oppose the other one. Directed or undirected tie.
Strongly conflictive negotiation interactions	***Criticism***: when one country explicitly criticizes another country's position or statement. Directed tie.

The ENBs are the most complete and regular reports of the climate change negotiations available. The consistent manner in which they are written over the years make them an

excellent data source for text coding. However, they have limitations. They present just a summarized version of the discussions, and it is very difficult to ascertain what is not reported. They only attribute statements to specific parties when they report on meetings that are open to observers. Despite these shortcomings, the ENBs are still the best data source available for the type of analysis we intend to carry out.

Another potential limitation of the dataset is that it is based on agreements and disagreements during the oral discussions. For this reason, each interaction by itself is likely just "talk": positions and statements are strategic, they may change and be adjusted over time. But, at the same time, these agreements and disagreements are important, given that the UNFCCC takes decisions by consensus so that the support of each party is required to reach an agreement (Bagchi, Castro, and Michaelowa 2017). In addition, each statement provides a signal to all other parties about a country's position in the negotiation, and can thus be used to ascertain positional closeness between parties. Another important aspect of the data is that, as explained in the introduction, cooperation does not necessarily mean cooperation to achieve the goals of the UNFCCC regime. It just means that two parties share a similar position, or are supportive of each other in the negotiations, or coordinate positions.

3.2 The POLCLIMATE event dataset

The POLCLIMATE (Politics on Climate Change) event dataset (cp. Hirschi 2008; Kammerer 2018) identifies political events between pairs of actors outside the climate negotiations. The original data set is a sequence of daily, dyadic, political events related to climate change mitigation that occurred between 1995 and 2015 and that are captured by international press releases. The raw dataset includes 3919 both conflictive and cooperative political events between 215 countries and international organizations. It includes a wide range of actors, such as national governments, sub-national governments, international governmental organizations (IGO), non-governmental organizations (NGO), media actors, science actors, business actors, civil society actors, etc. It also covers cooperative or conflictive events of different type and quality.

The current version of the POLCLIMATE data set was coded automatically using the software TABARI (Text Analysis by Augmented Replacement Instructions, Schrodt 2011) based on news reports from Agence France Press (AFP). AFP provides a rich data source for monitoring and analyzing the international politics of climate change (Hirschi 2008), as it rather frequently reports on international political events on the climate change issue throughout the last decades. We use lead sentences of a news story as text source for event data. Lead sentences summarize the whole story and usually include already the main elements of the reported

event. The remainder of the text usually captures more details and background information. Therefore, full-text coding risks to pick up older events that are not of particular interest and thus provides false positives. Moreover, the syntax of lead sentences is usually simpler and therefore easier to capture by an automated coding system. On the downside, rare events or events that are assessed as less important are more likely to be reported on in the body text and are therefore neglected in lead sentence coding. This holds true for the POLCLIMATE data set. An investigation of an earlier version of the data set has shown that the "POLCLIMATE data set includes more than five times more events when the whole text source is coded" (Hirschi 2008, 17). One explanation for this is that climate change politics-related "news stories often only provide brief topical summaries of current developments in the lead sentence, whereas more detailed account of involved actors and their interaction is provided in the main body of the story" (ibid.). However, further investigation of the event type patterns across the full-text and lead sentence data set have shown that they show very similar behavioral patterns. For later analysis, the lead sentence data set is smaller and thus computationally easier to handle. Therefore, we prefer the lead sentence data set.

The TABARI software is able to automatically identify the date, the involved actors, and the nature of an international event. To make sure that the coding software recognizes important actors, we hand-coded the lead sentences of the press releases for each year in the months October and November. We selected these two months per year, as these are usually characterized by a high level of attention to the climate change topic, due to the international climate summits taking place in November or December. Using the TABARI interface, we went through all lead sentences and checked whether the software correctly identified actors and events. If not, we added an actor or a verb construction. For example, with the inauguration of a new state official, it has to be added to the actor dictionary. So, "president Barak Obama" received the new code "USAGOV" in 2009. This has to be done for a variety of possible formulations, e.g. "US president Obama", "Obama", "Barak Obama", and so on. For a detailed overview on the actor coding system, refer to the actor codebook of the "Conflict and Mediation Event Observations (CAMEO)" coding scheme (Schrodt 2012a).

To determine the quality of cooperation or conflict, i.e. the event type, the data set relies on the verb codebook of the "Conflict and Mediation Event Observations (CAMEO)" (Schrodt 2012a) scheme as a coding framework. The original CAMEO coding scheme is a codebook for verbs and verb constructions and actors to analyze violent international conflict. The main idea is to assign nominal event codes to verbs and verb constructions and actors codes to actors. In the original version of the codebook, the nominal event codes reflect 10 different categories (with many subcategories) of cooperation ranging from simple positive verbal

comments to an exchange of material resources and 10 different categories of conflict ranging from verbal comments to different kinds of military violence. As the original codebook was created to analyze conflict, we had to adjust the coding framework for international climate policy by adding the relevant political actors and by fine-tuning of verbs and verb constructions.

Coding the POLCLIMATE event data set based on the original CAMEO coding scheme led to some problematic misclassifications. Expressions such as “combat climate change”, for example, resulted in events that were classified as military conflict. We inspected the data set for these kinds of problems and adjusted the verb dictionary accordingly. We continued this process until no such misclassifications occurred anymore. We also adjusted and aggregated the CAMEO sub-categories into twelve main event categories, ranging from positive statements to substantial cooperation on the cooperative side, and ranging from negative statements to substantial conflict on the conflict side (compare Appendix A for the adjusted and aggregated event types). This reduced the number of distinct event type categories to a manageable number. In addition, the effect of coding errors is reduced by avoiding misclassification within ambiguous categories (Schrodt and Gerner 2004). Now each event code can be clearly assigned to one of the CAMEO event categories.

But, how exactly are cooperation and conflict defined in the POLCLIMATE dataset? Cooperation (or conflict) often starts in a declarative way, for example, by praising or criticizing the behavior of countries, like the release of a new policy, a political reform, or the general climate performance. Moreover, cooperation comes about when two countries meet to discuss each other’s plans on national climate policy, but it also deals with appealing for, offering, or providing material cooperation, such as economic and judicial support, exchanging information, involving in diplomatic interactions, providing financial or human resources, and sharing knowledge. Finally, cooperation involves easing sanctions, solving disputes, mediating, and apologizing. In contrast, conflictive interactions involve critical comments related to other countries’ climate policy, denying responsibility, rejecting cooperation or negotiations, threatening with or getting involved in substantial conflict.

For the most part of this analysis, we draw on cooperative events only; and we focus on countries. That is, we exclude all non-state, non-governmental, and sub-national actors. We do so to ensure comparability with the ENB dataset, which does not contain non-state actors. This leaves us with 1844 cooperative political events between 1995 and 2015 and 186 countries in the dataset.

Strengths and weaknesses of this kind of event data for empirical analysis have been comprehensively discussed in the literature (Gerner, Schrodt, and Yilmaz 2002; Hirschi 2009;

Huxtable and Pevehouse 1986; King and Lowe 2003; Schrodt 1994). The most common threats to validity in event data coding are biases introduced by the media sources that provide the raw material and biases due to the coding scheme or coding process. Media releases are selective towards specific events that receive high attention, e.g. around the yearly climate summits. In consequence, some events are overreported in comparison to other events that happen at less crucial points in time. It remains, however, unclear if these unreported events are also less important in the policy process. In this regard, event data based on media reports is always also a reflection of the public and political attention to a topic. The use of an automated coding software solution ensures higher time efficiency in the coding process and assures inter- and intra-coder reliability. Once the coding rules are established, the coding software always produces the same dataset, given the sample of text sources. However, if coding rules are ill defined the software might produce false codings. A thorough validity check of the POLCLIMATE dataset has been conducted on an earlier version of the dataset (Hirschi 2008).

Table 2: Coding examples for the POLCLIMATE data set

Example sentence	Actor (Source)	Actor (Target)	Coding	Event type
A **senior US official** blamed **divisions within the European Union** for blocking a deal at the UN climate talks here Saturday and held out the hope of reviving the negotiations.	USA	EU	USA ***accuse*** EU Original CAMEO code for accuse = 112 (“Accuse, not specified”) Assigned to aggregated CAMEO code “criticize, accuse, disapprove"	Conflict level -3 “criticize, accuse, disapprove"
China has assured the European Union of its commitment to the Kyoto agreement on global warming after the United States refused to support the pact, the EU said Monday.	CHN	EU	CHN ***assures*** EU Original CAMEO code for assure = 030 (“Express intent to cooperate, not specified”) Assigned to aggregated CAMEO code “intend positive action”	Cooperation level 4 “intend positive action”

3.3 Data aggregation

In this paper, we are interested in finding out about the difference and interdependency of two complementary decision-making arenas, i.e. between diplomatic cooperative interactions outside and inside the climate negotiations. As mentioned above, the diplomatic interactions

outside the negotiations are based on media data. Hence, they reflect diplomatic interactions and how the media perceives them. We thus expect the two datasets to be fairly different, as described in Section 2. We are in particular interested in disentangling these differences between inside and outside conference diplomacy, on the one hand, and the official reporting about conference diplomacy, on the other. At the same time, we are also interested in how far these two decision-making arenas influence or complement each other. Hence, does increased or decreased media reporting on cooperative interactions affect the likelihood for cooperative interactions in the negotiations?

As we are not interested in analyzing the detailed evolution of cooperation at the event level described in sections 2.1 and 2.2, we aggregate both event datasets into observations of the existence of cooperation between each pair of actors within a year. For the ENB (inside) dataset, we code a tie, reflecting cooperative diplomatic interactions inside the negotiations, between countries *i* and *j* in year *t* if there was at least one strongly cooperative negotiation interaction (i.e. "on behalf of" or "support", see Table 1) between those two countries during that year's negotiation sessions. For the POLCLIMATE (outside) dataset, we code a tie, reflecting cooperative interactions outside as perceived by the media, between the countries *i* and *j* in year *t* if there was at least one cooperative tie (all cooperation levels, see Appendix A). There is one important distinction between the two aggregated versions of the network datasets. Due to the high level of reciprocity in the POLCLIMATE dataset, we treat the dataset as de facto undirected. In contrast, the ENB dataset has a lower level of reciprocity, which is why we treat it as directed. In addition, both datasets are dichotomized.

For our descriptive analysis, we use the completely available period, i.e. from 1995 to 2013 to assess main similarities and differences between the two datasets, based on simple (network) statistics. Specifically, we compare the number of actors involved in each decision-making arena for each year, as well as the evolution in the number of cooperative events over time. Both helps us to justify the focus on cooperative events. Moreover, we graph the evolution of network density, average degree and degree centralization, in order to compare the evolution of actor level involvement in the two decision-making arenas. Finally, we also compare the most active actors at a critical point in time. This analysis is one way of testing Hypothesis 1 on the types of actors involved in each network.

For our stochastic network model, we selected three consecutive years that have been highly important in the climate negotiations i.e. the period between 2007 and 2009. During this period, the most important issues were to implement the Kyoto Protocol and to negotiate its successor. With respect to the institutional framework conditions, two important milestones must be

mentioned: (1) the adoption of the *Bali Road Map* in 2007, which paved the way for a post-2012 agreement, and (2) the release of the IPCC's Fourth Assessment Report in 2007, which brought the climate change issue on top of the international agenda. It instilled great enthusiasm among the parties ahead of COP 15 in Copenhagen with respect to agreeing on a new international legally binding agreement and a second commitment period of the Kyoto Protocol. This period is also significant due to the stronger involvement of developing countries in climate change mitigation through the Kyoto Protocol's Clean Development Mechanism, and an increasing focus on adaptation-related issues (Gupta 2010). The high expectations in the run-up to the Copenhagen (COP 15) summit are an important characteristic of year 2009. However, they remained unfulfilled due to the parties failing to agree on a legally binding follow-up agreement to the Kyoto Protocol. With the Copenhagen Accord, the parties only submitted non-binding emission reductions to be implemented at a later point in time. In general, this phase started with high political and public attention towards the climate change issue because of the release of the fourth IPCC report and former US Vice-President and environmentalist Al Gore winning the Nobel Peace Prize in 2007. It, unfortunately, ended with disappointment over the 'Copenhagen disaster' (Blühdorn 2012). The static North-South divide between countries' positions remained, with developing countries and emerging economies seeing themselves as having little (or no) responsibility nor capability to combat climate change.

4 Model and model specification

The following section describes our model for network coevolution and the model specification.

4.1 Stochastic actor-oriented model for network co-evolution

Stochastic actor-oriented models (SAOM) are designed to assess tie formation dynamics in panel network data (Snijders, van de Bunt, and Steglich 2010). This means that each network is measured at discrete time points. In our case for the year 2007 (t_0), 2008 (t_1), and 2009 (t_2). SAOMs assume that unobserved changes in the network (at the tie level) arise between the measurement points. These changes in the ties occur due to the actors in a network striving to optimize their social environment (therefore actor-based). To model network evolution, SAOMs estimate an evolution function (also objective function):

$$f_i\,(\beta, x) = \sum_k \beta_k s_{ki}(x)$$

The objective function models the probability of tie change in the network, given that an actor is able to make a change. Put differently, it reflects the "rules for network behavior" (Snijders, van de Bunt, and Steglich 2010, 47). These rules of behavior are determined by the state of

the network, i.e. the ties and nodes present at a specific point in time, but also by covariates, i.e. actor characteristics. The function $f_i(\beta, x)$ reflects the value of the objective function for actor *i* depending on the state of the network *x*. The right-hand side of the equation comprises, like in generalized linear regression models, a linear combination of a set of effects, i.e. statistical parameters that reflect network (sub)-structures like the tendency to reciprocate ties, to triangulate, or to form ties with similar alters. For example, if an actor prefers to form ties with "the friends of friends" there will be a positive and significant transitivity parameter in the objective function. The parameter estimates are gathered by simulation. Specifically, using a current estimate the model simulates a chain of tie changes resulting in a new graph per simulation round. The new graphs are then compared to the observed network data. Next, the parameter estimate is tuned based on any discrepancy until all parameter estimates converge. Note that SAOMs condition the estimation on the first observation point, hence they model the process of change, and not the structure of the network at a particular point in time.

For this analysis, we use a variation of SAOMs to model the co-evolution of our two one-mode network observations, i.e. to model multiplex dynamics (Snijders, Lomi, and Torlo 2013), based on the state of each network, the respective actor attributes, and multilevel effects. The main goal of our model is to see how the diplomatic interactions in the two decision-making arenas (inside and outside the negotiations) depend on different drivers (within network effects) and how they also interact (between network effects). Hence, the only difference to a basic network evolution model is that a network co-evolution model also contains network interdependencies, i.e. effects that represent the tendency that a change in the network configuration in network W also affects a change in network Y.

4.2 Uni- and multiplex network specification

In this section, we present the specification of the model. We start by introducing dyadic and nodal within network effects, i.e. uniplex network specification, and end by describing the multilevel effect we included, i.e. multiplex network specification. We estimate our models using the Rsiena package available for the programming language R (Ripley et al. 2018; Snijders 2017).

4.2.1 Network dependencies

All our models contain several basic network dependency terms. The most basic is the outdegree (*density*) of an actor *i*. This term has to be included into all models. It reflects the tendency for an actor to have ties at all. As most network are sparse (i.e. they have density below 0.5), most network models generate a negative parameter estimate for the degree effect

(Snijders 2010). For directed networks, a further basic network effect is the tendency to reciprocate ties (*reciprocity*). As only one of our networks is directed (inside), we include the reciprocity parameter only once in our model. As reciprocity is a common feature in a social network, and given that one of the strongly cooperative interaction types in the inside dataset is undirected (see Table 1), we expect the parameter estimate to be rather high and positive. A further common feature of most social network is transitivity or network closure, i.e. the tendency of "friends of friends become friends" (Snijders, van de Bunt, and Steglich 2010, 47). Put differently, the tendency of countries to interact with the cooperation partners of the own cooperation partners. As transitivity or network closure is rather common for social networks, we expect large, positive parameter estimates for both networks. For convergence reasons, we included a geometrically weighted edge-wise shared partners (*gwesp*) effect in both models (directed version for the inside network and an undirected version for the outside network). These terms also include transitivity / network closure of higher order by counting configurations in the local neighborhood of a given actor. For a more detailed description of the network dependency term, please consult the SIENA Manual (Ripley et al. 2018).

4.2.2 Nodal and dyadic covariates

In addition to the network dependencies, our dynamic network analysis incorporates several node-level and dyad-level covariates that are of substantive relevance for the analysis of climate change diplomacy. Power is a crucial resource in diplomatic and negotiation situations (Keohane and Nye 1977). Larger economies tend to have higher absolute levels of emissions, and are thus perceived to be especially relevant to address climate change meaningfully – this is the case for example of China and the US, the two largest world economies and the two largest CO_2 emitters. Powerful countries also usually want to portrait themselves as global leaders, and therefore tend to assign themselves special responsibilities, rights and duties towards global problems such as climate change (Bukovansky 2012). Finally, larger countries are better able to put together a larger and more skilled negotiating team. They are generally expected to bargain in a harder way to try to obtain their desired outcomes. We use a logged version of total GDP (obtained from the World Development Indicators[3]) as our measure of economic power. Debates about who should contribute how much to mitigating climate change are driven by the idea that different states have different levels of responsibility towards this problem. We use a country's level of CO_2 emissions per capita (also obtained from the World

[3] https://datacatalog.worldbank.org/dataset/world-development-indicators

Development Indicators) as our measure of responsibility for climate change, as has been done in previous work (e.g. Castro and Kammerer 2018). In all SAOMs, we use a homophily variable, which measures how similar two countries are with respect to their GDP and per capita CO_2 emissions. In both cases, a positive and significant parameter estimate indicates that two countries cooperate more if they are similar concerning their GDP or their level of CO_2 emissions. The underlying assumption is that more similar countries also share the same interests and are therefore more likely to cooperate. We expect GDP and CO_2 emissions to be important drivers of cooperative diplomatic interactions in both networks.

Vulnerability towards the effects of climate change is another important driver of countries' positions on climate change. We use the ND-Gain Index developed by the Notre Dame Global Adaptation Initiative[4] to reflect countries' level of climate vulnerability and resilience. To test our Hypothesis 1, we are specifically interested in whether vulnerable actors are more active inside the negotiations, or vice versa less often portrayed in the media outside the negotiations. For this purpose, we integrate an interaction between the level of vulnerability and the outdegree of an actor (vulnerability*outdegree) for both networks. If vulnerable actors are more active inside the negotiations, our model should show a positive a positive parameter estimate related to the interaction term in the inside model. In contrast, if the international media less often portray vulnerable actors, we should see a negative parameter estimate related to the interaction term in the outside model.

Two further covariates are used to reflect some of the key features of the UNFCCC negotiation process. In order to reach common goals, countries tend to join forces and form coalitions and alliances. This allows them to pool bargaining resources and discuss more effectively. Countries – particularly small ones - thus tend not to negotiate individually, but as part of these coalitions (Klöck and Castro 2018). To account for this structure, we add a dyad-level covariate – common coalitions – that counts the number of common coalition memberships that each dyad has. The data was obtained from (Castro 2017). Following Hypothesis 2, we expect that coalition membership is more likely to drive cooperative interactions inside the negotiations, while it should not be so relevant for the interactions reported by the media outside the negotiations, since the media is more focused on key actors. We therefore expect the parameter estimate related to the coalitions parameter to be positive and significant only in the inside dataset.

[4] https://gain.nd.edu/our-work/country-index/

Finally, the UNFCCC and its Kyoto Protocol institutionalized two country groups in terms of the types of emission reduction obligations they had. Thus, Annex I of the Framework Convention lists all countries with emission reduction commitments, and comprises all OECD members and several transition economies. All other countries, without emission reduction commitments under the Convention or the Protocol, became known as non-Annex I countries. Membership to these annexes has shaped negotiations under the climate change regime throughout its history (Castro and Kammerer 2018). We therefore add a dyad-level control for common membership to Annex I or non-Annex I to take account of this phenomenon. Specifically, we include a homophily (same annex) variable in both models to test whether countries within the same annex tend to be more often involved in cooperative diplomatic interactions.

4.2.3 Multiplex specifications

Finally, in order to test Hypothesis 3 about outside cooperation leading to more cooperative negotiations inside the UNFCCC, we include one type of between-network interdependency in our model. We test on the network level whether cooperative outside diplomatic interactions as reported by the media influence inside cooperation as coded from the ENBs (*outside on inside*) or vice versa (*inside on outside*). If there is interdependency between the two decision-making processes, we should see one or both of the parameter estimates related to the two effects to be significant.

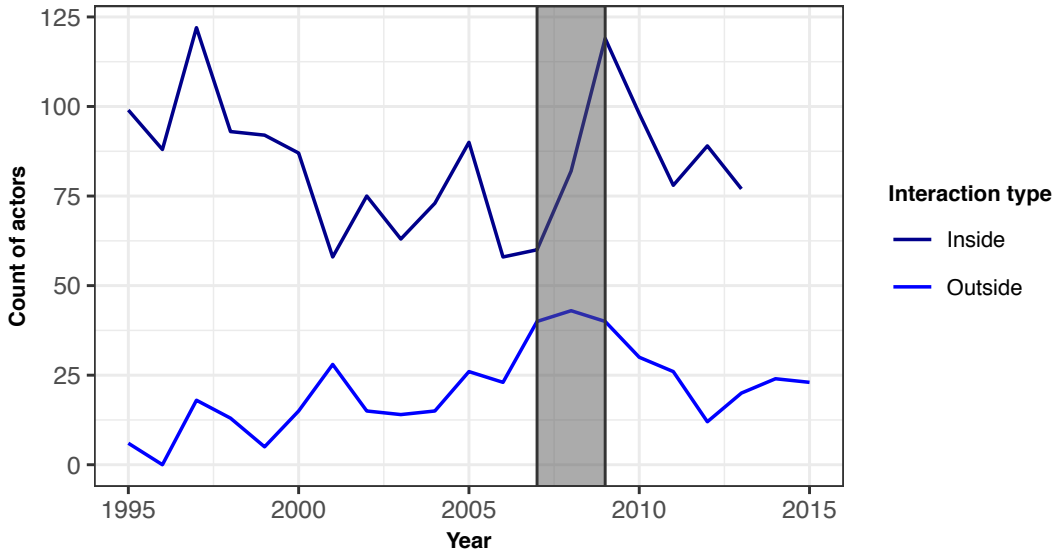
5 Results

5.1 Tracking cooperation inside and outside the negotiations over time

Figure 1 displays the number of countries identified by the outside media as interacting on climate-related issues over time. This is compared to how many countries have been involved in the UNFCCC negotiations. Clearly, the media reports about far fewer countries than actually have participated in the climate negotiations. Given that the outside dataset is based on international press releases, it is natural that the coverage of events taking place in smaller countries is comparatively limited, but the focus is mainly on key global players or on large events in which several countries participate. In addition, we observe only very few actors participating in the outside diplomatic process in 1995 and none in 1996. However, there is an increasing trend over time, as the climate topic gains in prominence for both the press and actual international cooperation. The number of actors decreases in the aftermath of the failure of the negotiations in Copenhagen in 2009, what is probably linked to declining media

attention. In contrast, the UNFCCC was from the beginning a universal forum meant to include all countries contributing to and affected by climate change – therefore the much larger number of countries involved.[5] In this case, we observe a drop in the number of actors between 2001 and 2007 with some minor peaks in between. During this period of time, discussions centered on very technical issues regarding the implementation of the Kyoto Protocol, a matter in which smaller parties may not have had sufficient expertise to participate actively.

Figure 1: Number of actors over time, inside and outside diplomatic interactions



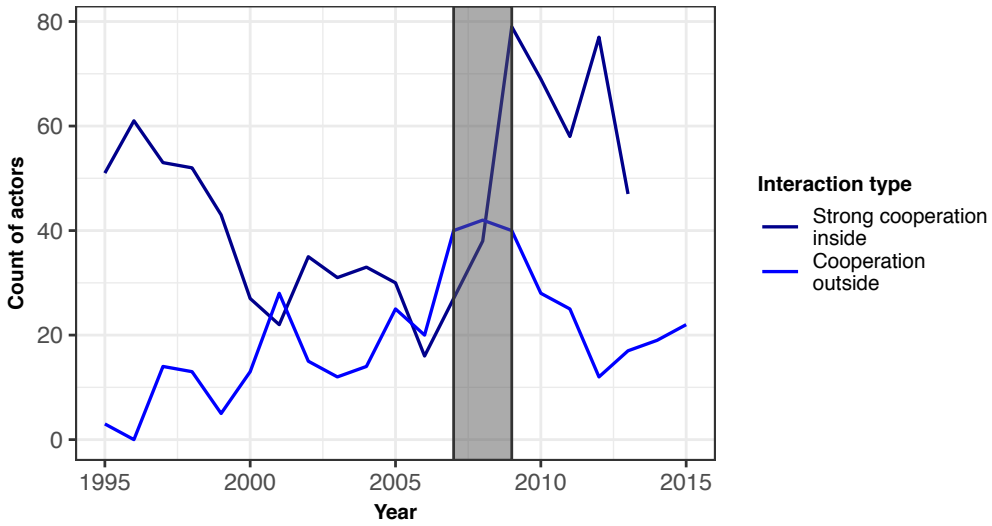
Note: The area in grey comprises the time period used for the dynamic network analysis in Section 5.2.

Some of the peaks in the number of actors in both graphs coincide with the years in which crucial negotiation rounds took place: the adoption of the Kyoto Protocol in 1997, the entry into force of the Kyoto Protocol in 2005, the Copenhagen negotiations in 2009.

Figure 2 displays again the number of active actors, but focusing only on the cooperative interactions for the outside dataset, and the strongly cooperative interactions for the inside dataset. Clearly, the number of actors involved in both diplomatic arenas is now more comparable. The dynamic network analysis in Section 4.2 focuses on this subset of diplomatic interactions.

[5] Still, even under the UNFCCC the participants that are active at any specific point in time are much fewer than the 197 parties to the Convention. The reason is that many small countries do not engage individually in the discussions, but only through the coalitions they are members of, which have been excluded from this analysis.

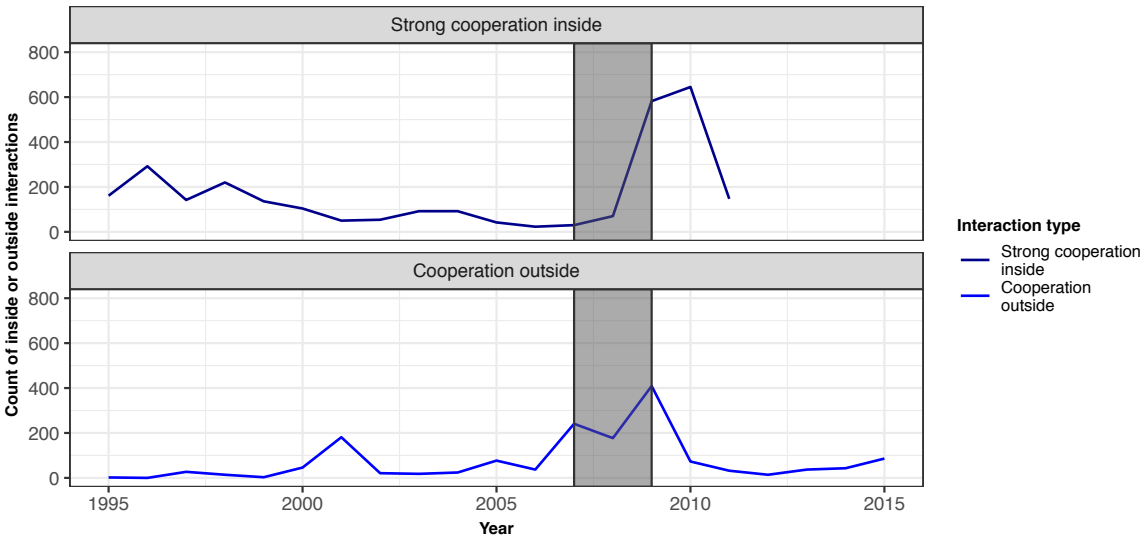
Figure 2: Number of actors over time, only cooperative diplomatic interactions



Note: The area in grey comprises the time period used for the dynamic network analysis in Section 5.2.

Figure 3 compares the number of strongly cooperative inside interactions with the number of cooperative outside interactions over time. Again, we tend to have more diplomatic interactions at the negotiations than in the outside world as portrayed by the press, which is not surprising given the different nature of interactions coded in each of the datasets. In addition, we again see peaks of activity reflecting some of the busiest years of climate actions, including 1997 (adoption of Kyoto Protocol, more important in the negotiations than outside), 2001 (Marrakesh Accords, with technical details on implementation of the Kyoto Protocol), 2007 (Bali Action Plan, setting out a plan for new climate action after the Kyoto Protocol), 2009 (Copenhagen) and 2010 (Cancun Agreements).

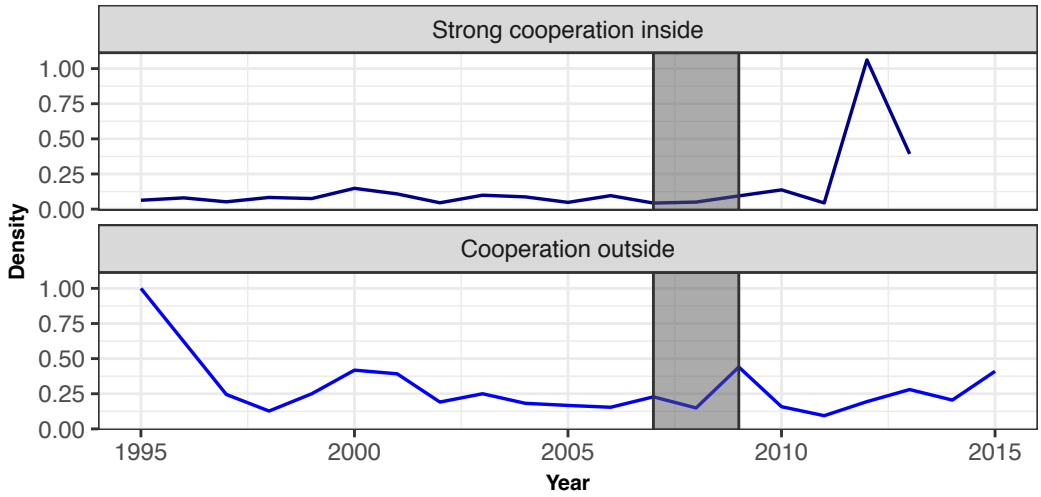
Figure 3: Cooperative diplomatic interactions over time, inside and outside



Note: The area in grey comprises the time period used for the dynamic network analysis in Section 5.2. Very high outliers in years 2012 and 2013 not shown for the inside interactions.

Figure 4 displays how the network density evolves over time for the (strongly) cooperative diplomatic interactions in the inside and outside datasets. For a given network, the density is defined as the quotient between the observed number of ties (i.e. dyadic interactions) and the number of all potential ties between the involved actors. It provides an indication of the intensity of interactions between the actors.

Figure 4: Density over time, networks of (strongly) cooperative interactions



Note: The area in grey comprises the time period used for the dynamic network analysis in Section 5.2.

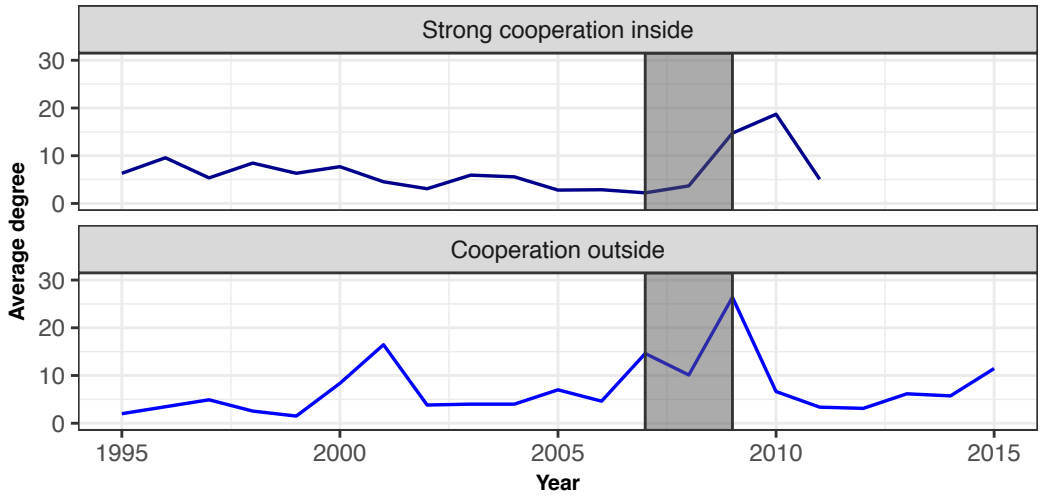
Within the negotiations, network density remains relatively stable throughout, before rising sharply in year 2012. Given that the number of active countries fluctuates a lot but does not change with a specific trend, this indicates that a relatively stable share of countries tends to cooperate in a strong manner with each other over time, which suddenly changed in 2012. In contrast, the rather decreasing trend in the outside interactions is due to the increasing number of actors involved: While at the beginning there were few countries involved in climate cooperation outside the UNFCCC, but with a comparatively high number of ties between them, over time more countries become involved, but initiating cooperation only with a few selected partners.Figure 5 displays the evolution of the networks' average degree over time, which provides a measure of how cohesive the networks are. The average degree is computed by calculating the degree for each node and then averaging these values by the number of actors (Borgatti, Everett, and Johnson 2013). A higher average degree reflects stronger network cohesion as more actors are tied to each other. This indicates a more fragmented power structure as more actors are active. On the contrary, a lower average degree reflects weaker network cohesion, because fewer actors are tied. This points to a more centralized power structure, with a small number of well-connected actors.

Within the negotiations, the average degree remains quite constant over time, adopting an increasing trend between 2007 and 2010. It seems that the network becomes more cohesive and less centralized when the negotiations cover politically important topics – average degree is higher in years in which important political decisions within the regime were taken, such as 2009 (Copenhagen), 2010 (Cancun) or 2012 (Doha Climate Conference, where it was decided to extend the Kyoto Protocol). In contrast, when the negotiations revolve around more technical and less political issues, it seems that fewer parties become involved and most negotiation interactions take place between the most powerful countries. Thus, while more actors become engaged when important political decisions need to be taken, power becomes more centralized when the discussions require more technical and specialized knowledge.

In the outside interactions, the average degree seems to increase over time – with some specific peaks – up until 2009, after which it suddenly falls again. This is in line with the previous observation that the number of actors increases over time but falls again after 2009. The network thus becomes larger and less centralized as more countries start to cooperate with respect to climate change. After the failure of the Copenhagen talks in 2009, press attention to climate change decreased substantially.

In Figure 6 we see how the degree centralization evolves over time for the networks of cooperative interactions inside and outside the negotiations. Centralization "refers to the extent a network is dominated by a single node" (Borgatti, Everett, and Johnson 2013, 159). A fully centralized network would have the shape of a star, in which one actor is connected to all others, but there are no other connections. The opposite extreme is a network in which all actors are connected to each other.

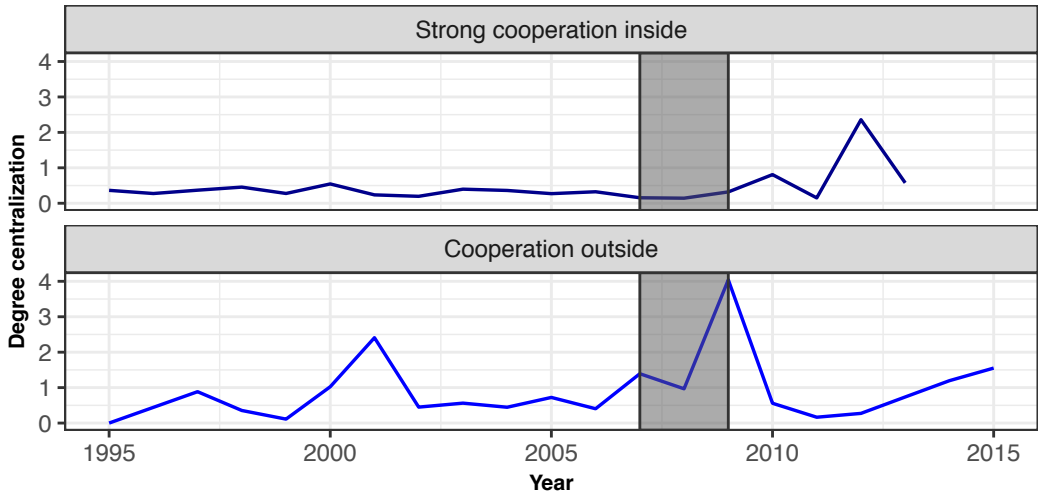
Figure 5: Average degree over time, networks of (strongly) cooperative interactions



Note: The area in grey comprises the time period used for the dynamic network analysis in Section 5.2. High outliers in years 2012 and 2013 not shown for the inside interactions.

It is difficult to identify a specific pattern for the level of degree centralization of the networks. For the inside interactions, while some politically relevant years seem to be more strongly centralized (e.g. 2010 with the Cancun meeting and 2012 with the Doha meeting), other similarly important years (1997 with the adoption of the Kyoto Protocol, 2001 with the Marrakesh Accords, 2007 with the Bali Action Plan) seem to be among those with the lowest centralization. In the outside world, again the years 2001 and 2009 seem to have been highly centralized in terms of the cooperative interactions.

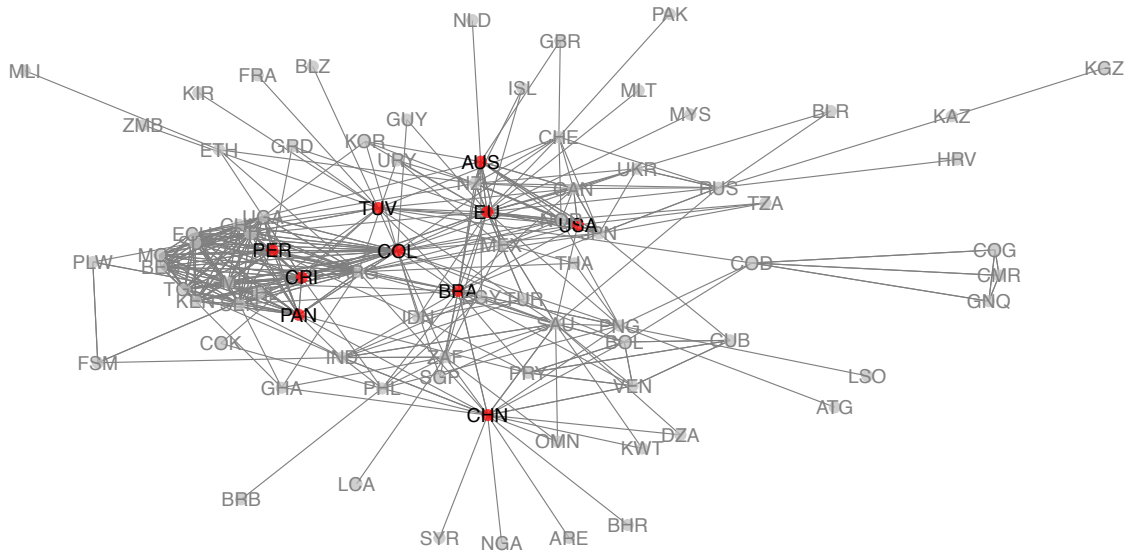
Figure 6: Degree centralization over time, networks of (strongly) cooperative interactions



Note: The area in grey comprises the time period used for the dynamic network analysis in Section 5.2.

Figures 7 and 8 focus on the period that will be analyzed in the dynamic network models in Section 5.2: the years 2007 to 2009. Figure 7 shows the network of strongly cooperative interactions inside the negotiations over this time period, highlighting the ten most central actors with respect to indegree (activity). Interestingly, while large and powerful actors such as the US, EU and China are among the most central actors, also small developing countries including Tuvalu (a vulnerable small island state), Costa Rica, Colombia or Panama seem to be very active. Figure 8 shows the corresponding network for the cooperative diplomatic interactions as portrayed by the press, again highlighting the ten most active actors. In this case, almost all central actors can be considered great powers: besides the US, EU and China, also Japan, India, Germany, Great Britain and France are among the ten most active actors. The prominent role displayed by Denmark – a comparatively small country – is explained by it having been the host of the Copenhagen climate conference. It is to be expected that the media has frequently reported about Denmark's diplomatic role in the run-up to and during the conference.

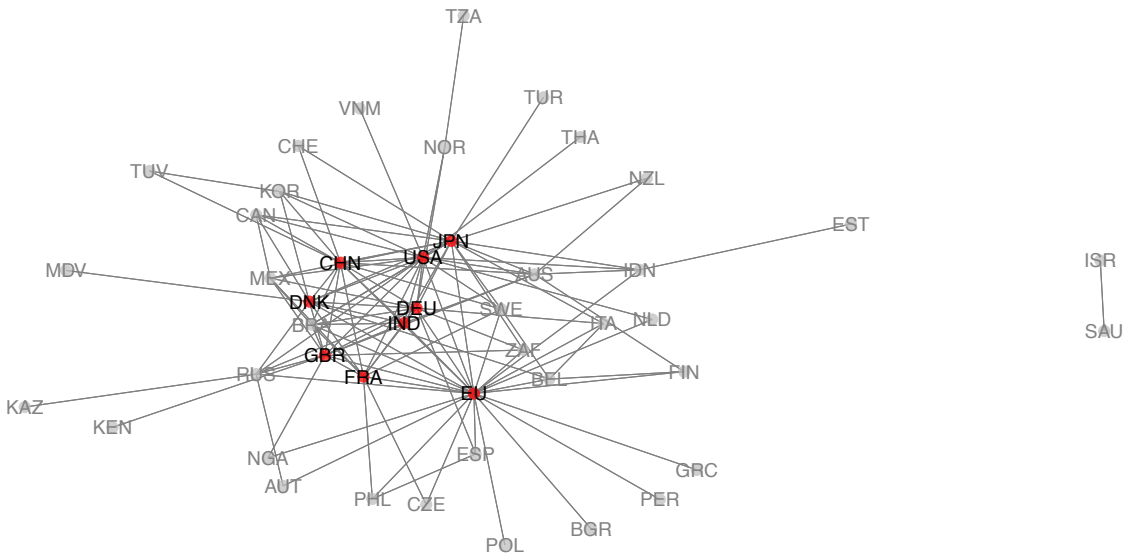
Figure 7: Network of strongly cooperative interactions, inside dataset, 2007-2009



Note: The nodes highlighted in red are the ten most active actors.

These descriptive results already support our Hypothesis 1, which states that the outside press reporting on climate change diplomacy is driven by a strong focus on key, powerful actors, while in the inside negotiations also smaller and more vulnerable countries are very active. Appendix B shows a more complete list of highly active actors in both and in each one of the networks.

Figure 8: Network of strongly cooperative interactions, outside dataset, 2007-2009



Note: The nodes highlighted in red are the ten most active actors.

5.2 Network co-evolution model

Table 3 presents the results of the multilevel stochastic actor-oriented models. Models 1 to 3 include basic within-network effects and covariates that allow us to test Hypotheses 1 and 2, and models 4 and 5 add the multilevel between-network effects necessary to test Hypothesis 3. For all models, we have achieved very good convergence, with an overall convergence ratio below the threshold of 0.25 recommended by the RSiena manuel (Ripley et al. 2018). In addition, all significant effects are robust across the five different specifications, which increases our confidence in the results.[6]

All network dependencies behave in the expected way. Across all models, the degree parameters – reflecting the level of activity of actors – are highly significant and have the negative sign we expect for this type of sparse networks. The reciprocity parameter included in the inside network is highly significant and has a large positive coefficient, which supports the idea that countries tend to reciprocate cooperative behavior by their peers in the negotiations. In both networks, the transitivity parameter is positive and significant across all models, reflecting, as expected, the tendency of actors to cooperate with the friends of their friends.

According to our Hypothesis 1, we expect that outside reporting on climate change diplomacy focuses on large key actors, whereas inside the negotiations smaller and more vulnerable countries are more active. We test this hypothesis by including an interaction between vulnerability and outdegree. This effect is negative and significant across all models for the outside network, but never significant for the inside network. Thus, while we do not find support for the idea that vulnerable countries tend to be particularly active in the inside network, we find support for the idea that they tend to be less active in the outside network. Together with the findings of the descriptive analysis above, this result lends some support to Hypothesis 1.

Under Hypothesis 2 we expect that coalitions or groups of like-minded countries drive cooperation in the inside negotiations but not necessarily in the outside diplomacy. We use the covariates *common coalitions* and *same annex* to test this hypothesis. The positive and strongly significant effect of common coalitions in the inside network in Model 5, as well as the positive and significant effect of same annex in the inside network in Models 2 and 4 support the first part of this hypothesis. Interestingly, dyads that are more similar in terms of the size of their economies or of their CO_2 emissions per capita do not tend to cooperate more inside the negotiations. In the outside dataset, we find that neither common coalition membership nor

[6] Further goodness-of-fit statistics will be added to a further version of the paper.

being in the same annex lead to increased cooperation, which is in line with the second part of Hypothesis 2. However, we have some (not very robust) evidence that countries that are similar in terms of the size of their economies (GDP) tend to cooperate more in the outside negotiations.

The idea that outside diplomacy might be interrelated with the inside negotiations was codified under Hypothesis 3. We particularly expected that more outside cooperation may lead to more cooperative inside negotiations. The multilevel dependencies that we used to test for such between-network effects in models 4 and 5 were never significant. It thus seems that the networks do not interact with each other, at least within the time period we chose for this detailed analysis (2007-2009).

6 Conclusions

In this paper, we compared and looked for interdependencies between two networks that present different perspectives of the international political process around climate change: the detailed (inside) negotiations under the UNFCCC, as reported in the Earth Negotiations Bulletins, and the outside view, by the international press, of the diplomatic exchanges on climate change in and around the UNFCCC meetings.

We used ideas drawn from polycentric governance theory and from our knowledge of climate change multilateralism to derive three hypotheses, which we tested first through a descriptive analysis of the network characteristics and then through a dynamic model of network co-evolution.

Generally, we find that these two networks present two quite different pictures of climate change diplomacy. While the inside negotiations do offer small players a voice, as seen in the descriptive analysis, vulnerable countries tend to be less active in the diplomatic interactions reported by the press. Rather, the outside press focuses on large and strong actors in its reporting. Secondly, inside cooperation seems to be driven by coalitions of like-minded countries and/or by the North-South divide enshrined in the categorization into Annex I / non-Annex I. Such groups do not seem to play any role in the outside diplomacy. Rather, similarity in terms of economic strength seems to be more important here.

Finally, our findings do not support the idea that the inside negotiations and the outside reporting by the press are interrelated, at least not for the period 2007-2009 in which we carry out the network co-evolution analysis.

Table 3: Results of the multilevel stochastic actor-oriented models

Effect	**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Inside negotiations: within-network effects										
Rate constant (period 1)	2.120	(0.816) **	1.724	(0.600) **	1.596	(0.546) **	1.585	(0.467) ***	1.505	(0.483) **
Rate constant (period 2)	15.931	(8.963) ·	21.690	(8.550) *	25.302	(30.769)	29.179	(6.659) ***	28.369	(6.861) ***
Outdegree	-5.753	(0.867) ***	-6.079	(0.594) ***	-5.761	(1.203) ***	-5.756	(0.432) ***	-5.389	(0.404) ***
Reciprocity	5.609	(1.650) ***	4.547	(0.675) ***	4.134	(1.240) ***	4.061	(0.576) ***	3.740	(0.812) ***
Transitivity	5.470	(0.945) ***	4.670	(0.909) ***	4.506	(1.588) **	4.189	(0.574) ***	4.185	(0.563) ***
Log GDP similarity					1.991	(2.567)	1.809	(1.517)	1.441	(1.017)
CO_2/capita similarity					1.886	(1.409)	1.862	(1.596)	2.353	(1.796)
Common coalitions (H2, test 1)									0.387	(0.086) ***
Same annex (H2, test 2)			1.094	(0.448) *	0.782	(0.488)	0.838	(0.465) ·		
Vulnerability * Outdegree (H1)	2.667	(1.652)	1.136	(0.716)	0.466	(0.679)	0.511	(0.584)	-0.346	(0.832)
Outside diplomacy: within-network effects										
Rate constant (period 1)	1.608	(0.978)	2.016	(0.569) ***	3.229	(1.776) ·	3.192	(1.250) *	3.166	(1.898) ·
Rate constant (period 2)	5.128	(3.308)	5.128	(NA)	3.454	(2.716)	3.324	(1.071) **	3.387	(1.613) *
Degree	-8.204	(1.822) ***	-7.790	(0.883) ***	-7.395	(1.126) ***	-7.632	(0.696) ***	-7.480	(0.711) ***
Transitivity	3.429	(0.523) ***	3.307	(0.370) ***	2.738	(0.440) ***	2.781	(0.446) ***	2.747	(0.649) ***
Log GDP similarity					6.510	(4.827)	7.134	(3.012) *	6.724	(4.903)
CO_2/capita similarity					1.013	(1.851)	0.808	(1.918)	1.149	(1.871)
Common coalitions (H2, test 1)									-0.162	(0.239)
Same annex (H2, test 2)			0.278	(0.355)	-0.182	(0.440)	-0.055	(0.369)		
Vulnerability * Outdegree (H1)	-2.856	(1.311) *	-2.431	(0.530) ***	-2.421	(0.491) ***	-2.552	(0.429) ***	-2.525	(0.593) ***
Between-network effects: overall network level										
Outside cooperation on inside cooperation (H3)							0.616	(0.946)	0.612	(1.068)
Inside cooperation on outside cooperation (H3)							-2.790	(2.077)	-2.811	(1.998)
Overall maximum convergence ratio	*0.114*		*0.098*		*0.198*		*0.225*		*0.193*	

Note: Standard errors in parentheses. Significance levels: ***: p>0.001, **: p>0.01, *: p>0.05, ·: p>0.10

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Appendix A: Coding of event types, POLCLIMATE dataset

Event types nominal	Event types	Description	Event dummy
Positive statement	1	Optimistic or emphatic comments, symbolic acts, express accord, consider policy option, acknowledge responsibility	Cooperation
Concrete action	2	Consult, make or host a visit, meet, mediate, negotiate, discuss	Cooperation
Appeal positive action	3	Appeal for material cooperation (economic, judicial, information), diplomatic cooperation, aid, political reform, to yield (e.g. easing sanctions, dissent), to negotiate, to settle dispute, to mediate	Cooperation
Intend positive action	4	Express intends to engage in material cooperation (economic, judicial, information), diplomatic cooperation, aid, political reform, to yield (e.g. easing sanctions, dissent), to negotiate, to settle dispute, to mediate	Cooperation
Yield cooperation	5	Ease sanctions, political dissent, agree on political reform	Cooperation
Substantive cooperation	6	Provide aid or engage in material cooperation (economic, judicial, information, intelligence), engage in diplomatic cooperation (praise or endorse, rally support on behalf of, grant diplomatic recognition, apologise, forgive, sing agreement)	Cooperation
Negative statement	-1	Decline or make pessimistic comment, deny responsibility	Conflict
Demand cooperation	-2	Demand for material cooperation (economic, judicial, information), diplomatic cooperation, aid, political reform, to yield (e.g. easing sanctions, dissent), to negotiate, to settle dispute, to mediate	Conflict
Criticize, accuse, disapprove	-3	Disapprove, criticise, accuse, rally opposition against, complain officially, lawsuit, find guilty or liable	Conflict
Reject cooperation, veto	-4	Reject material cooperation (economic, judicial, information), diplomatic cooperation, aid, political reform, plant, proposal, to yield (e.g. easing sanctions, dissent), to negotiate, to settle a dispute, to mediate. Defy norms, laws, and to veto.	Conflict
Threaten	-5	Threaten to reduce or stop aid, with sanctions, boycott, embargo, with political dissent or repression, to halt negotiations or mediation. Give ultimatum.	Conflict
Substantial conflict	-6	Protest, strike, or boycott, engage in political dissent. Reduce relations, stop material aid, halt negotiations or mediations, impose an embargo, boycott, or strike, coerce, and assault.	Conflict

Appendix B: Top active actors in inside and outside networks compared

Countries among the 20 top active actors in both networks	Australia, Brazil, China, EU, Japan, USA
Countries among the 20 top active actors in inside network only	Argentina, Benin, Chile, Colombia, Costa Rica, Ecuador, Gambia, Guatemala, Kenya, Mozambique, Panama, Peru, Senegal, El Salvador, Togo, Tuvalu, Uganda
Countries among the 20 top active actors in outside network only	Belgium, Canada, Denmark, France, Germany, India, Indonesia, Mexico, Philippines, Russia, South Korea, Sweden, United Kingdom