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Commentary

A biased fairness assessment against developing countries

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Since the adoption of the Paris Agreement, almost all countries have submitted their nationally determined contributions (NDCs) to the United Nations Framework Convention on Climate Change (UNFCCC) secretariat. Those submissions form the basis for the implementation of Paris Agreement. However, recent research [1] has shown that existing NDCs will not bring the world to the goal of limiting global temperature increase to below 2 °C above pre-industrial levels, much less achieving the goal of limiting warming to 1.5 °C [2,3]. According to this research, if countries achieve their NDCs, the global temperature rise can only be limited to around 3 °C by the end of 21st century, while still having a 10% probability of exceeding 3.5 °C. To close the gap between current efforts and the 2 °C goal, the Paris Agreement established a global stocktake (GST) mechanism to periodically review the collective progress of long term goals set in the Paris Agreement. Information on the fairness of countries' NDCs will be one of the vital inputs to the GST, as well as the information required for the next-round submission of NDCs after 2025. Some studies have evaluated the fairness of current NDC targets submitted by major countries [4–8], but a series of articles by Robiou Du Pont et al. [5,7,8] is undoubtedly the most controversial [9].

Recent articles by Robiou du Pont et al. [3,4] suggest that the emissions reduction targets of developed countries are more ambitious than those of developing countries, and developed countries have made a more "equitable" contribution than developing countries. In a recent study in *Nature Communications* [8], Robiou du Pont et al. argued China's NDC would lead to over 5.1 °C of global warming, thus not meeting the well-below 2 °C goal of the Paris Agreement. Those results contradict a recent study that shows that China's carbon intensity is declining at about 4.5% per year, much more than the global average of 2% and the rate of carbon intensity decline in most developed countries [6]. Those results are also counter to the fact that developed countries have contributed about 60%–80% to global temperature rise, upper ocean warming, and sea-ice reduction, while their mitigation efforts only amount to a one-third reduction in global temperature rise relative to business as usual, which is less contribution compared with developing countries [10]. The underestimation of mitigation efforts for developing countries by Robiou Du Pont et al. is mainly due to their methodology, which selected favorable approaches for developed countries in three ways.

First, their approach adopts the "grandfathering principle" as an equity principle and a central part of their assessment. Grandfathering principle use prior emissions to justify future emission entitlements, thus assign more emission entitlements to high emitting developed countries than low emitting developing countries. Prior research has proposed many allocation schemes to divide emission reduction responsibility among countries, but not all of them can be justified as "fair" based on ethical considerations. Climate change has been widely acknowledged as a moral minefield due to the complexity of ethical issues integrated into its fundamental nature [11]. However, a relatively small number of proposed allocation schemes have emerged as centrally important. These proposals include the following: causal responsibility (the proportion of obligation to solve the climate problem is determined by the proportion of responsibility for causing climate change), equal burden-sharing (all involved actors should share an equal burden to address climate change), ability to pay (the proportion of contribution to addressing climate change should be in proportion to the capabilities to do so), equal rights (all people have equal claims to global collective goods), and beneficiary pays (those who benefit from mitigation must pay). This is not an exhaustive list, but it covers the majority of current debate on climate equity. Grandfathering is not one of these well-recognized equity principles, and has been criticized by political theorists and applied philosophers as evidently unjust because it maintains the current shares of high-emitting countries in future emissions allocations. Grandfathering will give preference to developed countries by allowing them per capita emissions that are 3–4 times higher than developing countries, despite the fact that many developing countries still struggle with poverty, hunger, lack of education, and many other social development challenges.

Second, Robiou du Pont and colleagues also fuse the grandfathering principle with two other approaches they adopted ("equal rights" and "ability to pay") by designing a slow transition period from pure grandfathering to other principles by 2040. With this transition period, a large portion of future emissions will be grandfathered, diluting the principles of "equal rights" and "ability to pay" and letting "grandfathering" become the dominant approach in their analysis.

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Third, their approach selected a very weak version of the "historical responsibility principle". The key parameter of the historical responsibility principle is the starting year of the cumulative emissions calculation, which has a significant impact on the results of the allocation. China and most developing countries have emphasized the need for a comprehensive accounting of historical emissions, that is, the calculation of historical emissions starting from the beginning of the Industrial Revolution in 1850. The results of the IPCC Fifth Assessment Report [12] also show that global average surface temperature rise is largely determined by cumulative emissions. In Robiou Du Pont's article, the starting year of historical responsibility was selected as 1990, and the historical responsibility was also discounted by a yearly discount factor of 1.5%. This setting drastically underestimates the historical responsibility of developed countries. Our previous research [10] shows that the historical emissions of developed countries contribute about two-thirds of the current temperature rise, and if historical emissions are only calculated from 1990, the "historical responsibility" of developed countries will be significantly underestimated.

Is China's NDC consistent with the global goal to limit global temperature rise to below 2 °C. The answer depends on which "equity principle" will be used to assess the fairness of China's NDC target. We used 23 different allocation schemes and different parameters settings to analyze the fairness of China's NDC [4]. The results indicate that the "fair share" of China's cumulative CO_2 emissions from 2011 to 2050 is in the range of 168–420 $GtCO_2$ (quartiles 252–315 $GtCO_2$, median 238 $GtCO_2$). The allocation schemes based on historical responsibility principles give China a higher emissions entitlement, about 300–420 $GtCO_2$. Under the NDC scenario, China's CO_2 emissions will peak around 2030 at a level of 11–12 $GtCO_2$, with cumulative CO_2 emissions of 187–203 $GtCO_2$ during 2011–2030 (the lower and higher ends refer to 60%–65% reduction of carbon intensity by the year 2030, respectively). If China can successfully peak its emissions by 2030 and reduce its emissions to 2010 levels by 2050, then China's NDC will be within the range of its fair share and consistent with the historical responsibility principle (Fig. 1). However, the United States, the EU, and Japan will almost exhaust their 2050 emissions allowance by 2030 (represented by dots in Fig. 1), even in the most favorable allocation schemes for them.

We also argue that it is unreasonable to use the annual emissions of the target year (such as 2030) as an indicator for assessing the fairness of China's NDC. This is because the 2 °C path requires global emissions to decline rapidly after 2020, and China is still on the path of peaking its emissions between 2020 and 2030. Therefore, the use of 2030 as a milestone year will inevitably underestimate the ambition and fairness of China's NDC targets. We recommend using "cumulative emissions" as an indicator to assess the fairness of NDCs of each country, rather than just using annual target emissions.

Under the principle of "historical responsibility" for per capita cumulative emissions equivalent, China's NDC target is consistent with a global temperature rise of 2 °C. Therefore, the conclusion that China's NDC target will cause the global temperature to rise by 5.1 °C is unreasonable. Such a conclusion is based on the assumption that the "grandfathering principle" is fair, and historical responsibility begins only in 1990. Such assumptions are not in line with the scientific findings from ethics studies and climate science.

Research on NDC fairness assessment bridges the study of ethics and climate science. The choice of equity principles, emission entitlement allocation schemes, and the setting of parameters have significant ethical implications. The researcher's role should be to clarify the moral justification behind different emissions entitlement allocation schemes, set quantitative solutions through careful parameterization, and analyze the technical, economic and social impact of different ethical choices. Researchers should not pre-establish ethical positions and use this position as a basis for moral judgment. The research by Robiou Du Pont et al. [5,7,8] builds its evidence for a more favorable position for developed countries through biased scheme selection and parameter setting, leading to an unfair assessment for the emissions reduction efforts by developing countries including China.

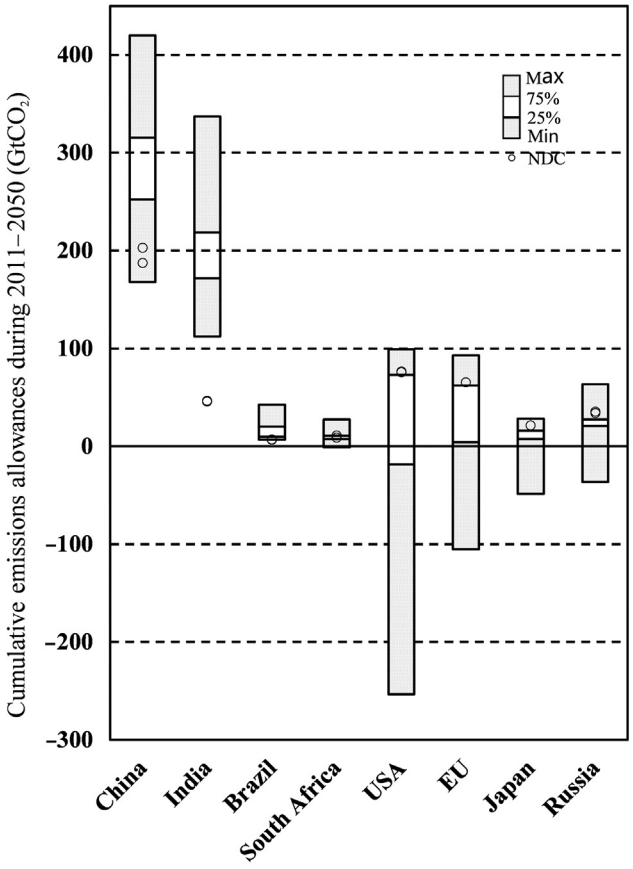

Fig. 1. Fairness assessment of countries' NDCs compared with their emissions fair share. Bars indicate the full range for the fair share of countries' cumulative emissions allowances (2011–2050) under 2 °C pathways. The higher end represents the most preferable allocation schemes and the lower end represents the least preferable allocation scheme. Dots indicate the cumulative emissions from 2011 to 2030 under different countries' NDCs (2025 for the U.S.). For China, the higher dot represents a 60% reduction of carbon intensity by 2030 compared with 2005 levels, while the lower dot represents a 65% carbon intensity reduction by 2030.

Conflict of interest

The authors declare that they have no conflict of interest.

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