Supplementary Materials

Strengthening the role and exploring the effectiveness of new climate finance target

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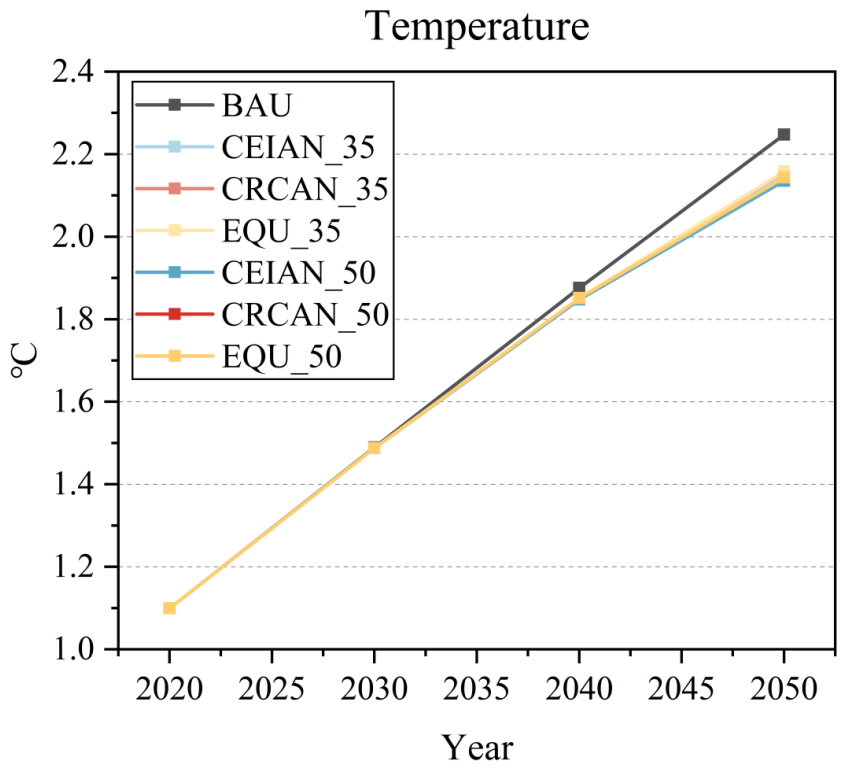
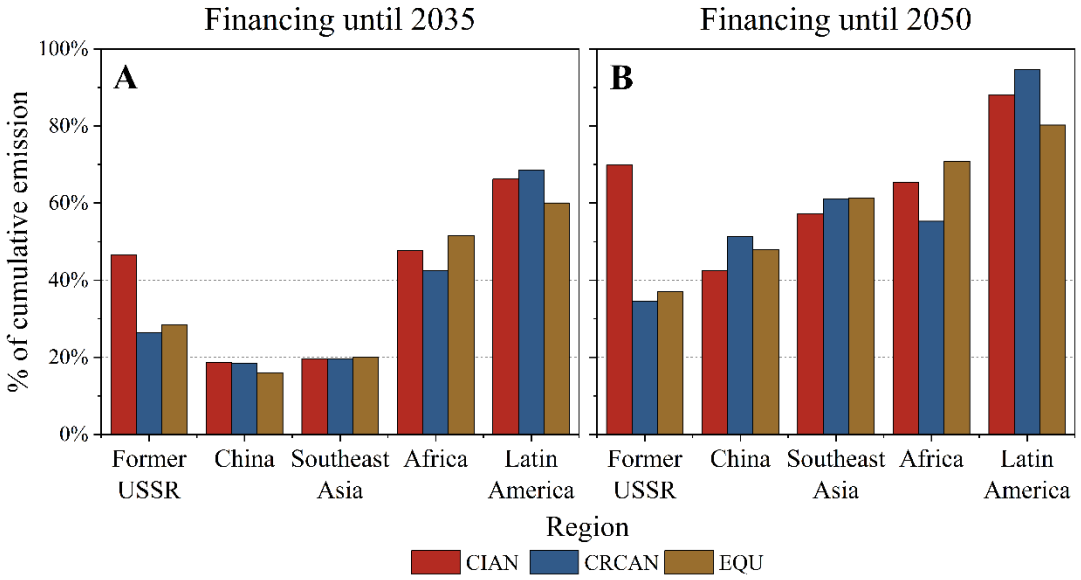
Supplementary Figures

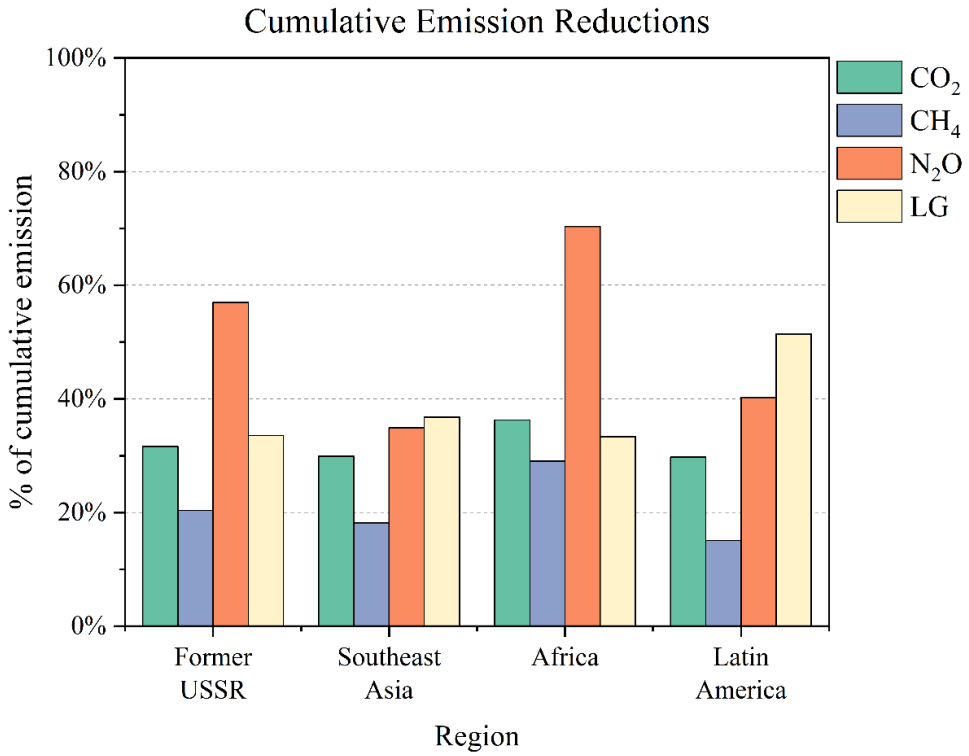


Supplementary Figure 1. Global temperature rise from 2020 to 2050 under different scenarios considering only CO_2 emission reductions

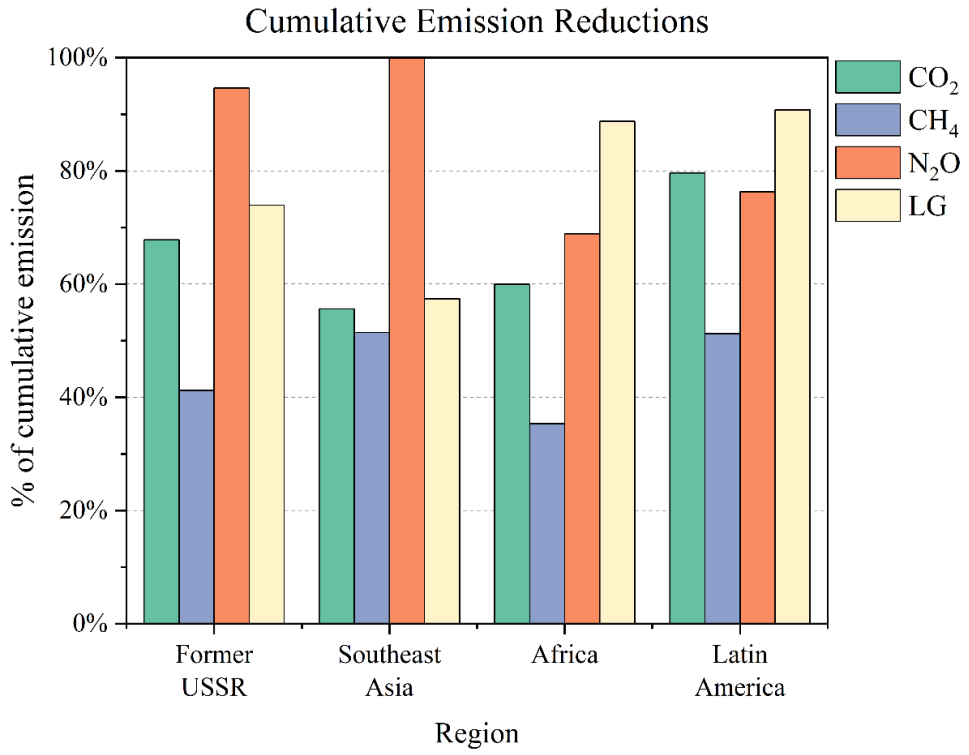
Note: the result of temperature rise is affected by parameter uncertainties. For clarity of representation, only the mean results for each scenario are shown in this figure. The results for the 95% confidence intervals are presented in Supplementary Table 7.



Supplementary Figure 2. Cumulative CO_2 emission reduction rate by region under different scenarios considering only CO_2 emission reductions.



Supplementary Figure 3. Cumulative emission reduction rate for each GHG considering governance capacity.



Supplementary Figure 4. Cumulative emission reduction rate for each GHG considering the change of donors and recipients.

Supplementary Tables

Supplementary Table 1. The proportion of climate finance for mitigation and adaptation actions in each recipient country[1]

	Former USSR	China	Southeast Asia	Africa	Latin America
Mitigation	0.53	0.87	0.84	0.67	0.85
Adaptation	0.47	0.13	0.16	0.33	0.15

Note: the proportion is derived from the bottom-up regional NDC climate finance needs during 2021–2030, and are averaged after being aggregated according to the regional classifications used in PAGE-ICE.

Supplementary Table 2. The proportion of climate finance for mitigation actions to different GHGs in each recipient country[2]

	EU	US	Other OECD	Former USSR	China	Southeast Asia	Africa	Latin America
CO_2	0.79	0.79	0.79	0.74	0.84	0.70	0.63	0.64
CH_4	0.11	0.13	0.12	0.17	0.09	0.21	0.24	0.26
N_2O	0.07	0.05	0.05	0.06	0.04	0.08	0.09	0.09
LG	0.02	0.03	0.03	0.02	0.02	0.01	0.03	0.02

Note: the ratios are based on the average of greenhouse gas emission shares over the past five years.

Supplementary Table 3. The mean value of global temperature rise and 95% confidence interval for each scenario in 2050

	Mean	95% confidence interval
CIAN_35	2.1031	2.0939~2.1124
CRCAN_35	2.1113	2.1021~2.1205
EQU_35	2.1128	2.1028~2.1229
CIAN_50	2.0822	2.0730~2.0914
CRCAN_50	2.0914	2.0809~2.1018
EQU_50	2.0921	2.0829~2.1013
CIAN_50_cpi	2.1411	2.1306~2.1516
CIAN_50_ci	2.1057	2.0955~2.1159

Supplementary Table 4. The Corruption Perceptions Index (CPI) for each region[3]

	EU	US	Other OECD	Former USSR	China	Southeast Asia	Africa	Latin America
CPI	63.97	70.92	66.80	37.31	60.18	38.03	35.10	38.04

Note: CPI, compiled by Transparency International, is used to measure the perceived level of corruption across countries and regions, with lower scores indicating higher levels of perceived corruption. In this study, we use the average CPI scores for each country or region over the period 2012–2024, and align them with the regional classifications used in PAGE-ICE.

Supplementary Table 5. Impact of a parameter increase by one standard deviation on the 2050 SCC

Parameter	Explanation	Impact of a+1 St.Dev increase on the 2050 $SCCO_2$
a1_percentco2oceanlong	Percentage of Ocean CO_2 Uptake	516.2121
tcr_transientresponse	Transient Climate Response	125.9062
frt_warminghalflife	Feedback Response Time	42.69645
w_NonImpactsatCalibrationTemp	Non-Market Damages at Calibration Temperature	25.87603
pow_NonMarketExponent	Non-Market Damages Exponent	25.70875
ampf_amplification_Africa	Temperature Amplification for Africa	18.14654
iben_NonMarketInitialBenefit	Initial Benefit of Non-Market Impacts	10.83534
stay_fractionCO2emissionsinatm	Long-Term Atmospheric Retention Fraction of CO_2	10.66423
ipow_NonMarketIncomeFxnExponent	Non-Market Damage Income Function Exponent	10.53095
ipow_MarketIncomeFxnExponent	Market Damage Income Function Exponent	9.194554
ampf_amplification_SEAsia	Southeast Asia Amplification Factor	7.259572
sltemp_SLtemprise	Sea Level Temperature Rise with Temperature	6.915305
rtl_abs_0_realizedabstemperature_Africa	Realized Absolute Temperature Rise for Africa	5.159511
pow_SLRImpactFxnExponent	Sea Level Rise Impact Function Exponent	4.743876
W_SatCalibrationSLR	Saturation Value for Sea Level Rise Impacts	3.880073
t2_timeco2oceanshort	Timescale of CO_2 Short-term Ocean Uptake	3.539485
ind_slopeSEforcing_indirect	Slope of Indirect Forcing (e.g., Aerosol Effects)	2.952025
a2_percentco2oceanshort	Percentage of CO_2 short-term ocean uptake	2.473586
sltau_SLresponsetime	Sea Level Response Time	2.467561
rtl_abs_0_realizedabstemperature_SEAsia	Realized Absolute Temperature Rise for Southeast Asia	2.346004
a3_percentco2land	Percentage of CO_2 land uptake	2.190023
AbatementCostParametersCO2_emit_UncertaintyinBAUEmissFactorinFocusRegioninFinalYear	Abatement Cost Parameter: Uncertainty in BAU Emissions Factor in Focus Region at Final Year	-2.0118
impf_coeff_quadr	Market Damage Function Quadratic Coefficient	-2.56425

tcal_CalibrationTemp	Calibration Temperature for Non-Market Damages	-14.3983
impf_coeff_lin	Market Damage Function Linear Coefficient	-37.2361
emuc_utilityconvexity	Elasticity of Marginal Utility of Consumption	-59.173
ptp_timepreference	Pure Time Preference	-73.4007

Note: the impact on SCC is determined by first calculating the SCC at the mean value of the parameter's Monte Carlo distribution. Then, SCC is recalculated after increasing the parameter's mean value by one standard deviation, while keeping all other parameters at their default values. The SCC impact is defined as the difference between these two results. Only parameters with an absolute SCC impact of at least $11 are displayed here.

Supplementary Table 6. Impact of a parameter increase by one standard deviation on the 2050 $SCCO_2$

Parameter	Explanation	Impact of a-1 St.Dev increase on the 2050 $SCCO_2$
ptp_timepreference	Pure Time Preference	116.88
emuc_utilityconvexity	Elasticity of Marginal Utility of Consumption	92.52173
impf_coeff_lin	Market Damage Function Linear Coefficient	37.37319
tcal_CalibrationTemp	Calibration Temperature for Non-Market Damages	17.76073
impf_coeff_quadr	Market Damage Function Quadratic Coefficient	2.57003
a3_percentco2land	Percentage of CO_2 land uptake	-2.19035
rtl_abs_0_realizedabstemperature_SEAsia	Realized Absolute Temperature Rise for Southeast Asia	-2.34397
sltau_SLresponsetime	Sea Level Response Time	6.805171
a2_percentco2oceanshort	Percentage of CO_2 short-term ocean uptake	-2.47394
ind_slopeSEforcing_indirect	Slope of Indirect Forcing (e.g., Aerosol Effects)	-2.94538
t2_timeco2oceanshort	Timescale of CO_2 Short-term Ocean Uptake	-3.7824
W_SatCalibrationSLR	Saturation Value for Sea Level Rise Impacts	-3.8512
pow_SLRImpactFxnExponent	Sea Level Rise Impact Function Exponent	-3.98308
rtl_abs_0_realizedabstemperature_Africa	Realized Absolute Temperature Rise for Africa	-5.15391

sltemp_SLtemprise	Sea Level Temperature Rise with Temperature	-4.05009
ampf_amplification_SEAsia	Southeast Asia Amplification Factor	-6.89295
ipow_MarketIncomeFxnExponent	Market Damage Income Function Exponent	-8.31548
ipow_NonMarketIncomeFxnExponent	Non-Market Damage Income Function Exponent	-9.24559
stay_fractionCO2emissionsinatm	Long-Term Atmospheric Retention Fraction of CO_2	-10.7661
iben_NonMarketInitialBenefit	Initial Benefit of Non-Market Impacts	-10.813
ampf_amplification_Africa	Temperature Amplification for Africa	-16.9312
pow_NonMarketExponent	Non-Market Damages Exponent	-22.8595
w_NonImpactsatCalibrationTemp	Non-Market Damages at Calibration Temperature	-25.6369
frt_warminghalflife	Feedback Response Time	-38.634
tcr_transientresponse	Transient Climate Response	-97.9478
a1_percentco2oceanlong	Percentage of Ocean CO_2 Uptake	-33.9811

Note: the impact on SCC is determined by first calculating the $SCCO_2$ at the mean value of the parameter's Monte Carlo distribution. Then, SCC is recalculated after decreasing the parameter's mean value by one standard deviation, while keeping all other parameters at their default values. The SCC impact is defined as the difference between these two results. Only parameters with an absolute SCC impact of at least $2 are displayed here.

Supplementary References

[1] Strinati C, Alberti C, Parenti C, Baudry C, Patience L, Sharma A, et al. Bottom-up climate finance needs. Climate Policy Initiative. 2024 Oct 30 [cited 2024 Jul 10]. Available from: https://www.climatepolicyinitiative.org/publication/bottom-up-climate-finance-needs/.

[2] Climate Watch. Greenhouse gas (GHG) emissions [Internet]. [cited 2024 Jul 10]. Available from: https://www.climatewatchdata.org/ghg-emissions?breakBy=gas&end_year=2021&regions=IND%2CWORLD&sectors=total-including-lucf&start_year=1990.

[3] Transparency International. The ABCs of the CPI: how the Corruption Perceptions Index is calculated [Internet]. [cited 2024 Jul 10]. Available from: https://www.transparency.org/en/news/how-cpi-scores-are-calculated.