



Supplement of

The Indonesian Throughflow circulation under solar geoengineering

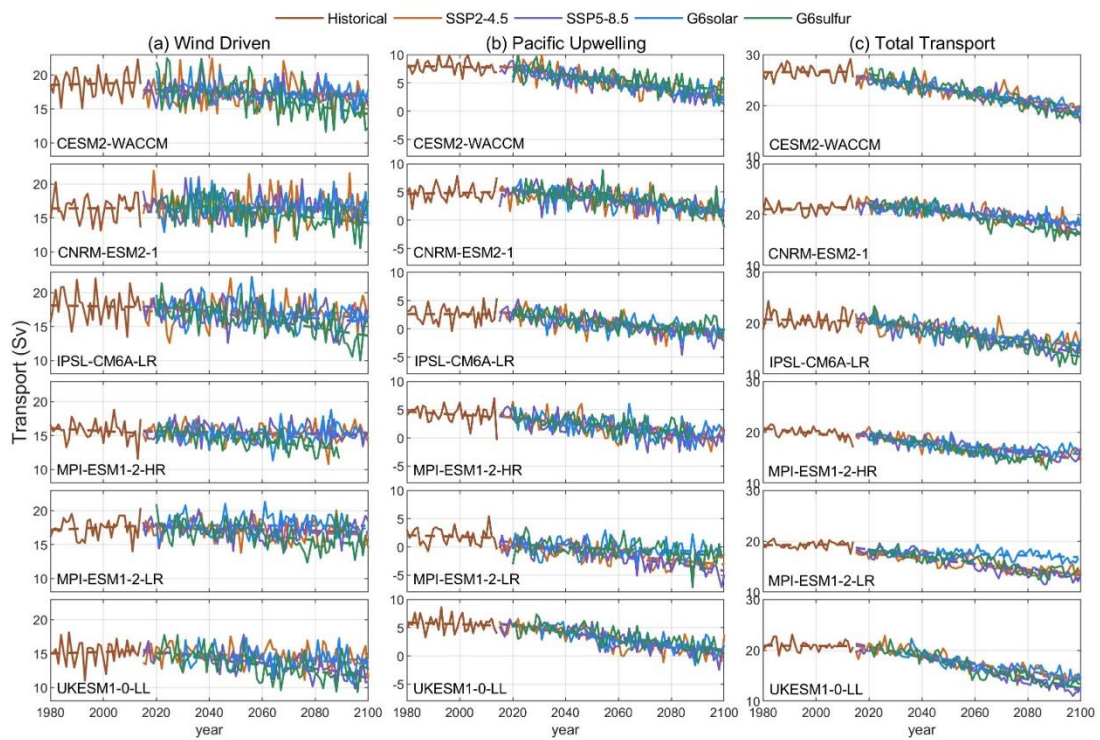
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1 **Supplementary Information**

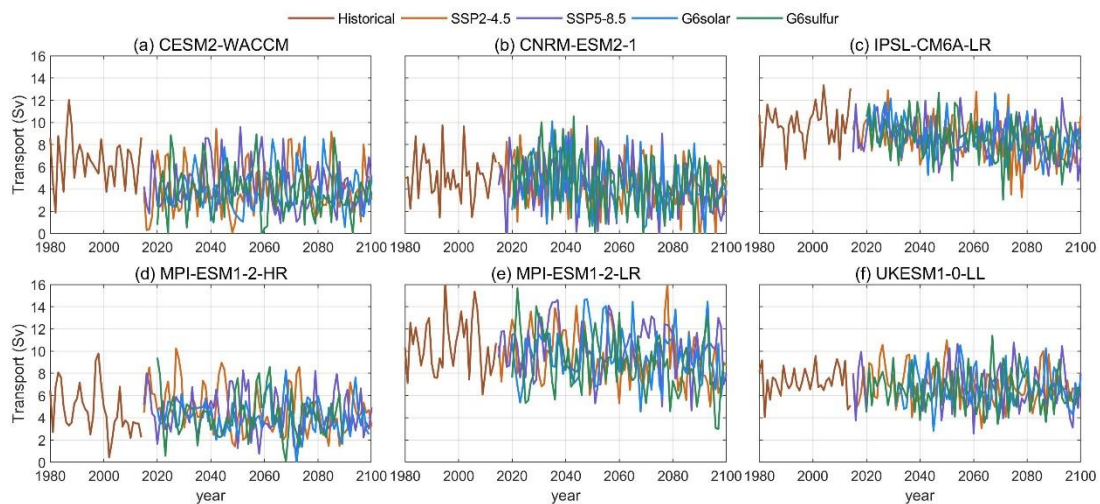
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4 **Figure S1.** (a) the time series of ITF transport in the six ESMs for wind driven component under
5 different scenarios. (b) as Figure S1a for Pacific upwelling contribution. (c) as Figure S1a for total ITF
6 transport under Amended Island Rule.

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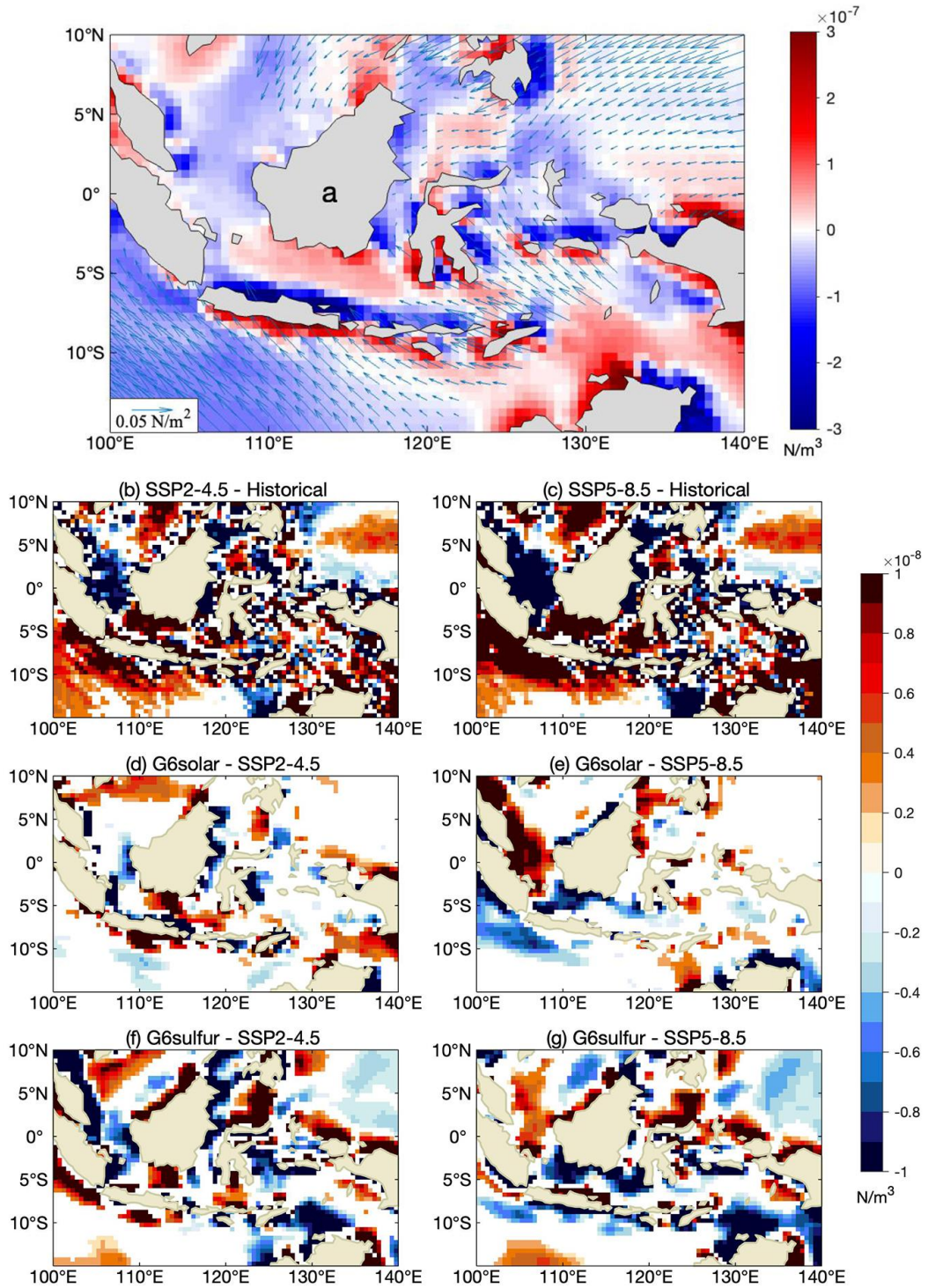


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9 **Figure S2.** The ITF transport in the six ESMs by buoyancy forcing during 1980-2100

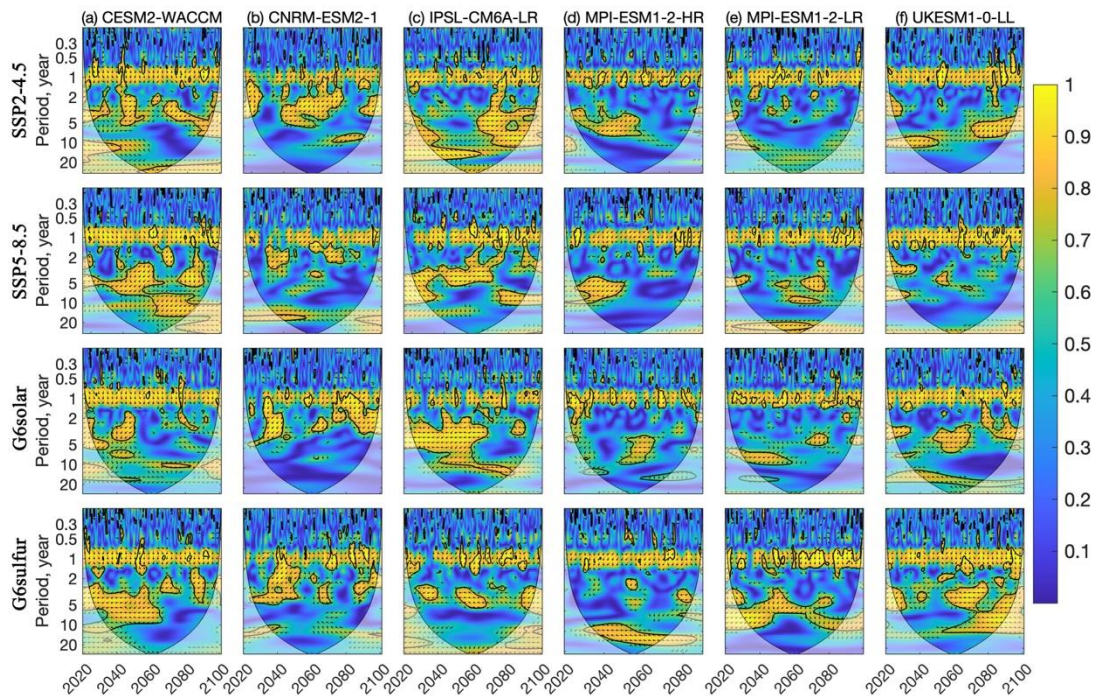
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 12 **Figure S3.** the ITF inlet region around the Indonesian archipelago in more detail than shown in Fig. 4.
 13 The multi-model mean differences in wind stress curl (a) the historical mean and the arrows show the
 14 wind stress, (b) SSP2-4.5 and historical, (c) SSP5-8.5 and historical, (d) G6solar and SSP2-4.5, (e)
 15 G6solar and SSP5-8.5, (f) G6sulfur and SSP2-4.5, (g) G6sulfur and SSP5-8.5. The historical period is
 16 1980-2014, and the future scenarios period is 2080-2100. Regions where differences are not significant
 17 at the 95% level by the Wilcoxon signed-rank test are masked in white.

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21 **Figure S4.** The squared wavelet coherence between the Nino3.4 (representing ENSO) and the wind-
 22 driven ITF transport monthly anomalies under the two SSPs (2015-2100) and two G6 (2020-2100)
 23 scenarios in six models. The 95% significance level above the background of 1000 Monte-Carlo
 24 ensemble of series of identical mean and standard deviation with identical power spectra but phase-
 25 randomized Fourier noise (chosen instead of the usual first order autoregressive null hypothesis here
 26 because of the strong annual signal; Xia et al. (2023)), is represented by a thick contour line. The
 27 arrows indicate the relative phase relationship, that is, in-phase points to the right, anti-phase points to
 28 the left, the arrow up indicates that the ITF anomaly leads ENSO by 90°, and a down arrow indicates
 29 that the ITF anomaly lags ENSO by 90°.

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32 **Table S1**

33 The differences in monthly ITF Transport (2020-2100)^a and its components for six models; wind is the
 34 ITF transport derived from Island Rule; Upwelling is the area integral of Pacific upwelling rate at
 35 1500m; Total is the ITF transport calculating by Amended Island Rule; Buoyancy is the ITF transport
 36 by buoyancy forcing. Unit: Sv (1Sv = 10⁶ m³/s)

Differences		CESM2- WACCM	CNRM- ESM2-1	IPSL- CM6A-LR	MPI- ESM1-2- HR	MPI- ESM1-2- LR	UKESM1- 0-LL
G6solar – SSP2-4.5	Wind	0.01	-0.11	-0.07	-0.16	0.76	-0.33
	Upwelling	-0.04	0.23	0.03	0.25	1.17	0.32
	Total	-0.03	0.12	-0.04	0.09	1.93	-0.02
	Buoyancy	-0.27	0.08	0.35	-0.6	0.18	-0.14
G6sulfur – SSP2-4.5	Wind	-0.8	-0.92	-1.05	-0.95	-0.65	-1.34
	Upwelling	0.5	0.36	0.29	0.34	0.99	0.58
	Total	-0.31	-0.56	-0.76	-0.61	0.34	-0.76
	Buoyancy	-0.49	0.25	0.15	-0.41	-0.55	-0.4
G6solar – SSP5-8.5	Wind	0.11	0.02	0.25	-0.21	0.63	0.64
	Upwelling	0.15	-0.01	0.22	0.44	1.29	0.25
	Total	0.26	0.01	0.46	0.22	1.92	0.89
	Buoyancy	-0.17	0.08	0.05	-0.23	-0.6	-0.06
G6sulfur – SSP5-8.5	Wind	-0.7	-0.79	-0.74	-1.11	-0.78	-0.37
	Upwelling	0.68	0.12	0.48	0.55	1.12	0.51
	Total	-0.02	-0.67	-0.27	-0.57	0.33	0.14
	Buoyancy	-0.39	0.25	-0.15	-0.07	-1.34	-0.33
G6sulfur – G6solar	Wind	-0.81	-0.81	-0.99	-0.82	-1.41	-1.01
	Upwelling	0.53	0.13	0.26	0.23	-0.18	0.26
	Total	-0.28	-0.68	-0.72	-0.59	-1.59	-0.75
	Buoyancy	0.22	0.17	-0.21	0.20	-0.74	-0.27

37 ^aThe end dates of the G6solar and G6sulfur of MPI-ESM1-2-HR are 2099 and 2089, respectively, and
 38 those of MPI-ESM1-2-LR are both in 2099. Values in bold are significant at the 95% level according
 39 to the Wilcoxon signed-rank test.

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