Supplement of

Revealing the significant acceleration of Hydrofluorocarbon (HFCs) emissions in East Asia through long-term atmospheric observations

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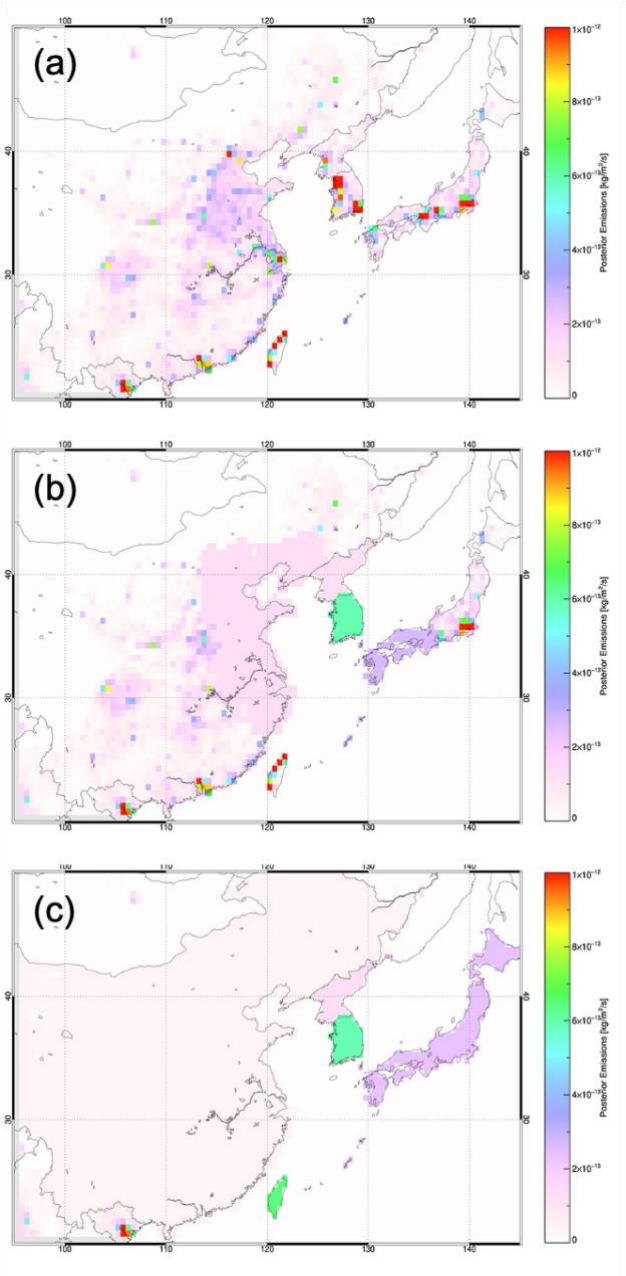

Figure S1: Types for the prior emission distribution used in FLEXPART-FLEXINVERT+, (a) population distribution, (b) eastern Asia flatten, and (c) Asia flatten, respectively. For each HFC substance, the prior spatial distribution of each type is the same, the only difference is magnitude of each pixel.

Table S1: The prior emissions for each HFC per country.

Species	Prior Emissions (Gg/yr)				
	Eastern China	Japan	South Korea	North Korea	Taiwan Region
HFC-134a	4.80	3.10	1.90	0.46	0.80
HFC-32	1.49	0.40	0.21	0.03	0.05
HFC-125	1.15	0.70	0.27	0.07	0.07
HFC-143a	0.22	0.40	0.08	0.05	0.04
HFC-152a	2.01	1.20	0.11	0.15	0.08

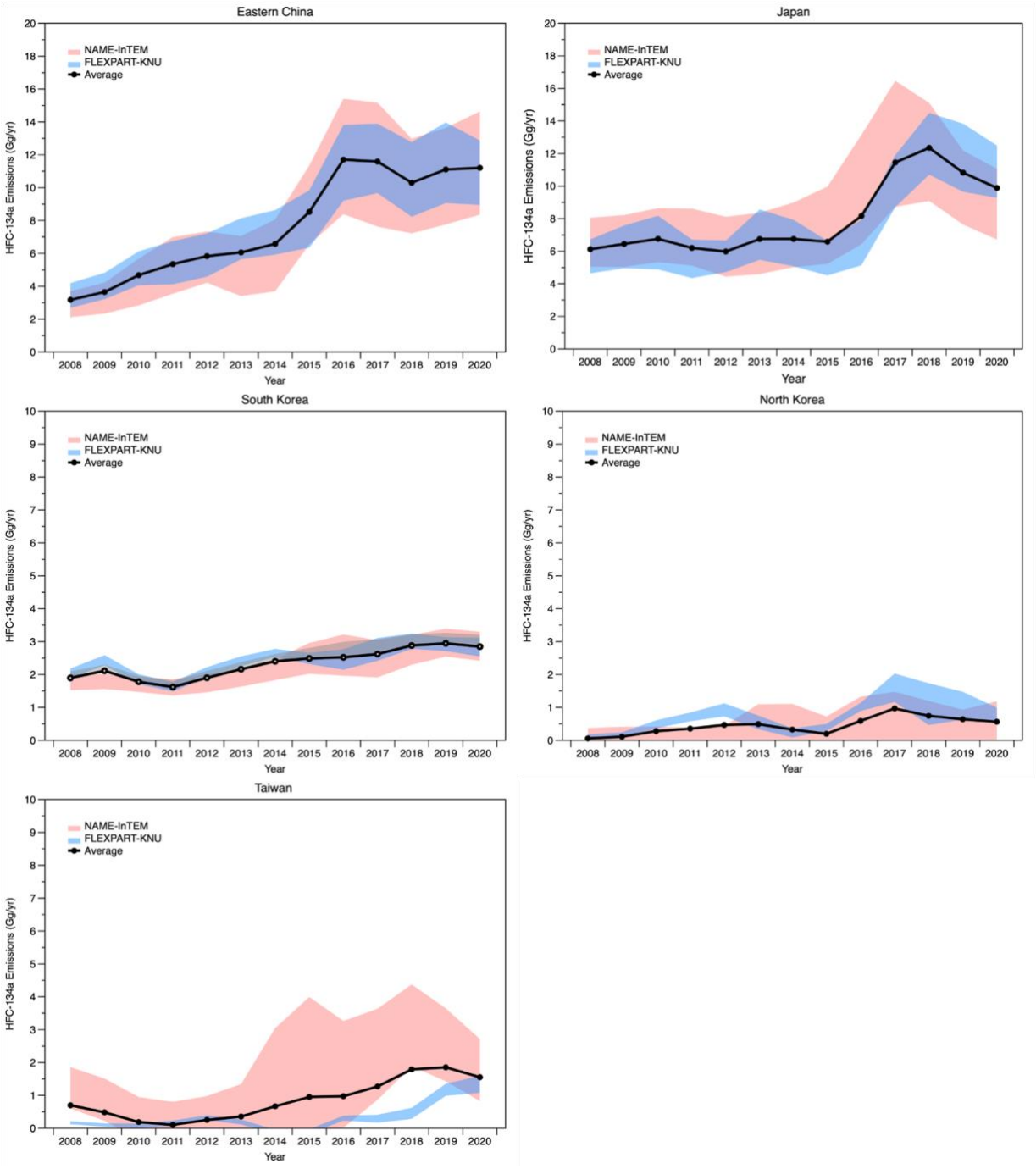

Figure S2: The annual HFC-134a emissions for each country derived from FLEXPART-FLEXINVERT+ (in blue shaded) and NAME-InTEM (in red shaded), and average values (black solid line), respectively.

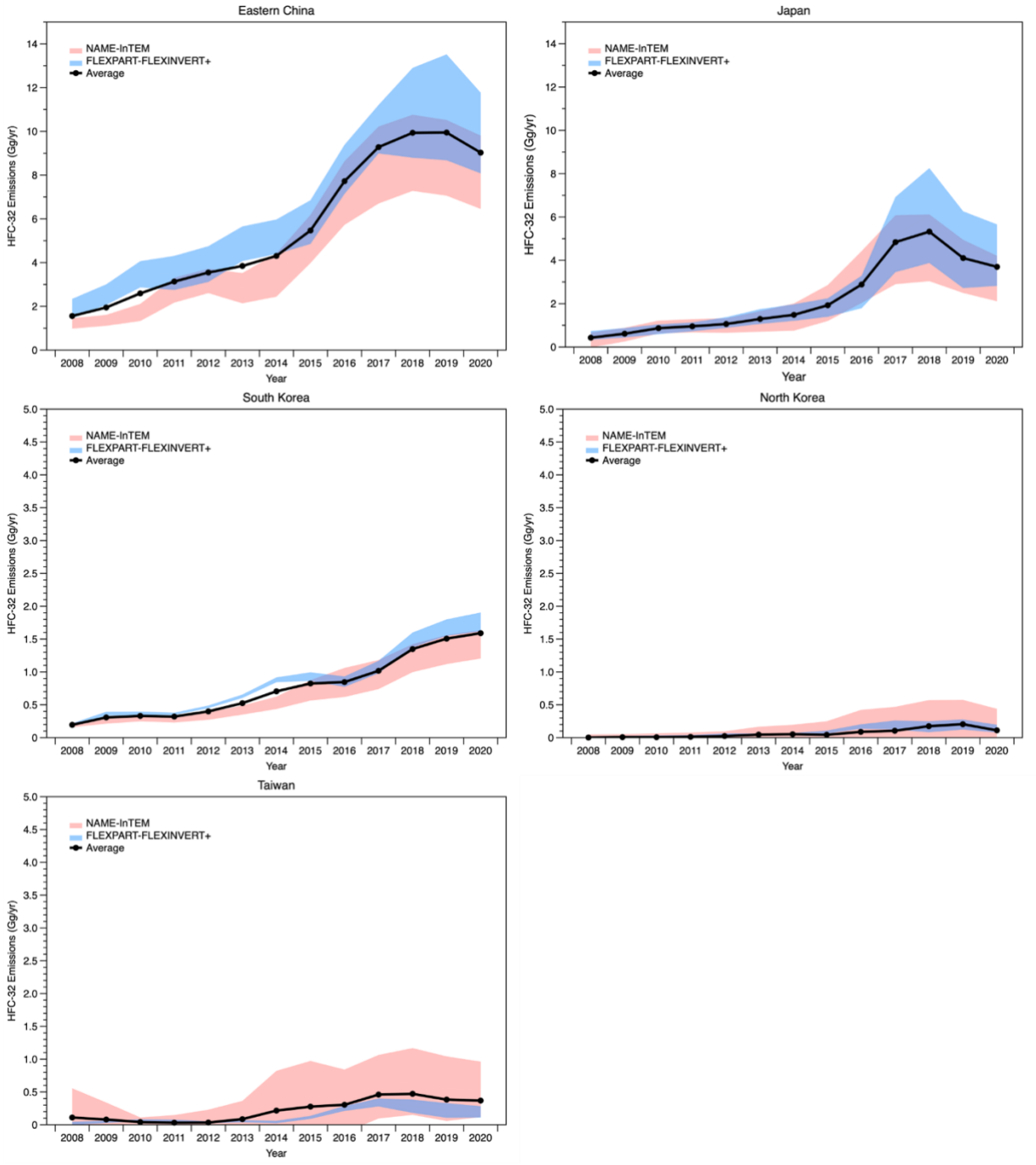

Figure S3: Same as Fig. S2, but for HFC-32.

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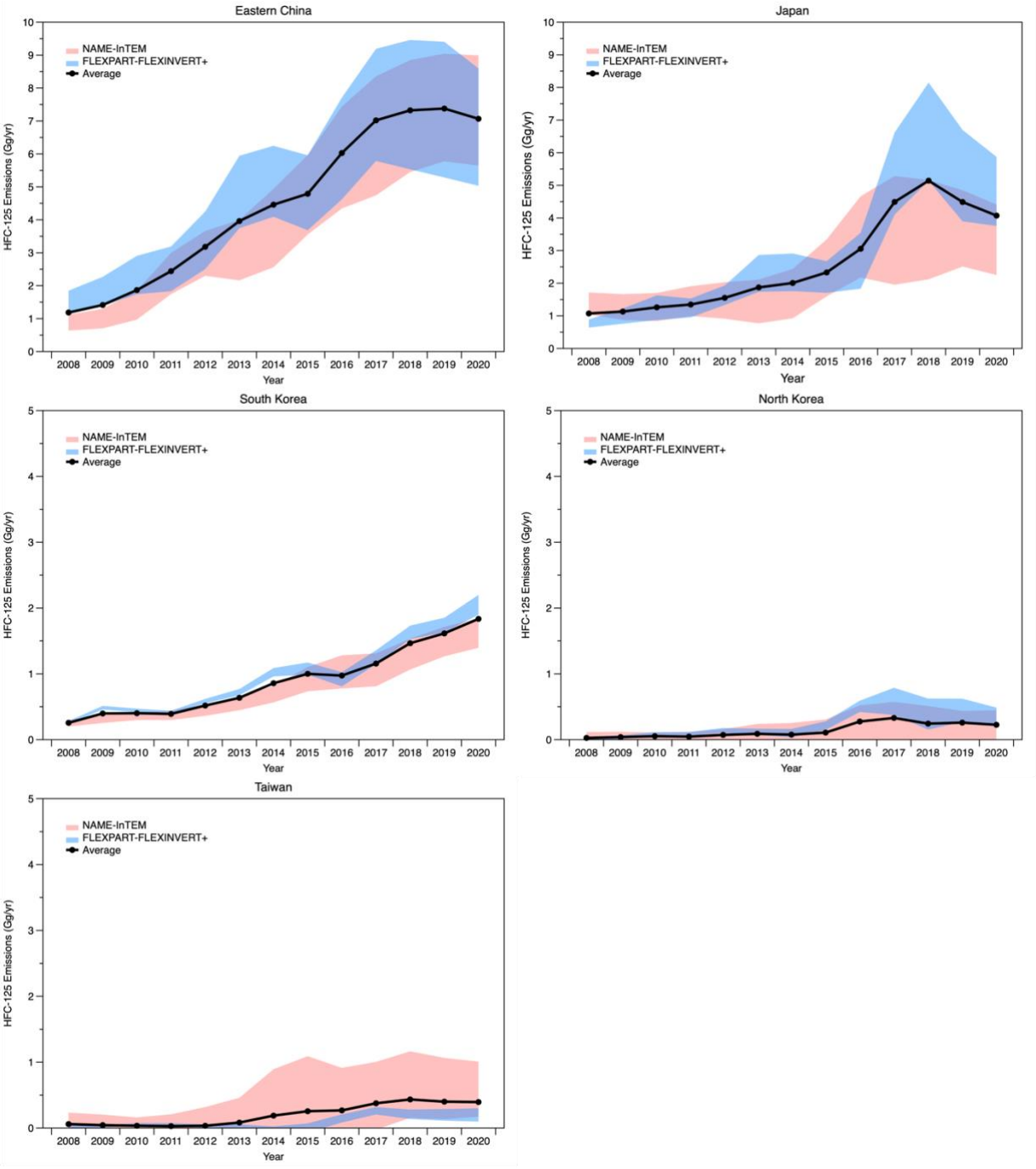

Figure S4: Same as Fig. S2, but for HFC-125.

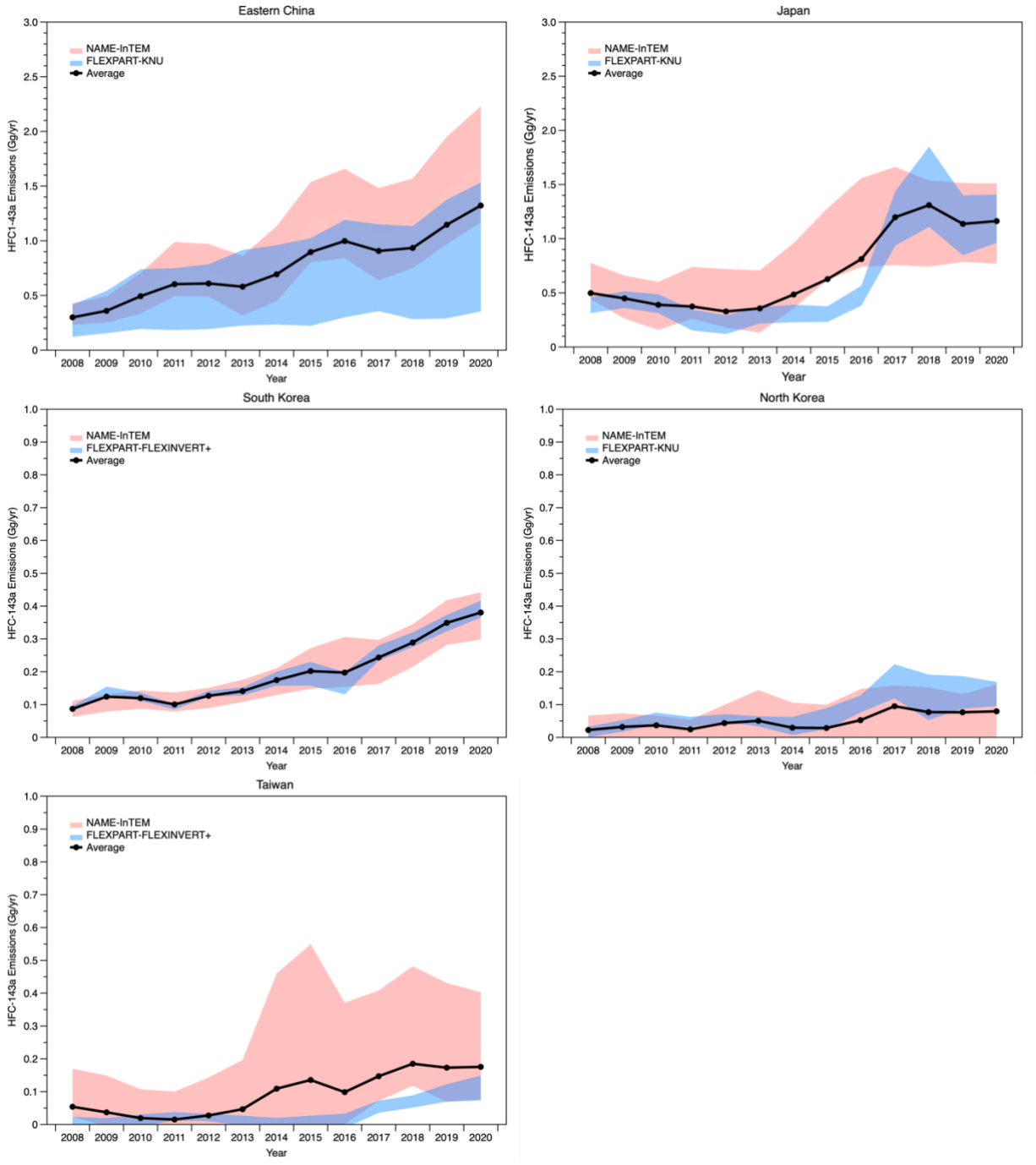

Figure S5: Same as Fig. S2, but for HFC-143a.

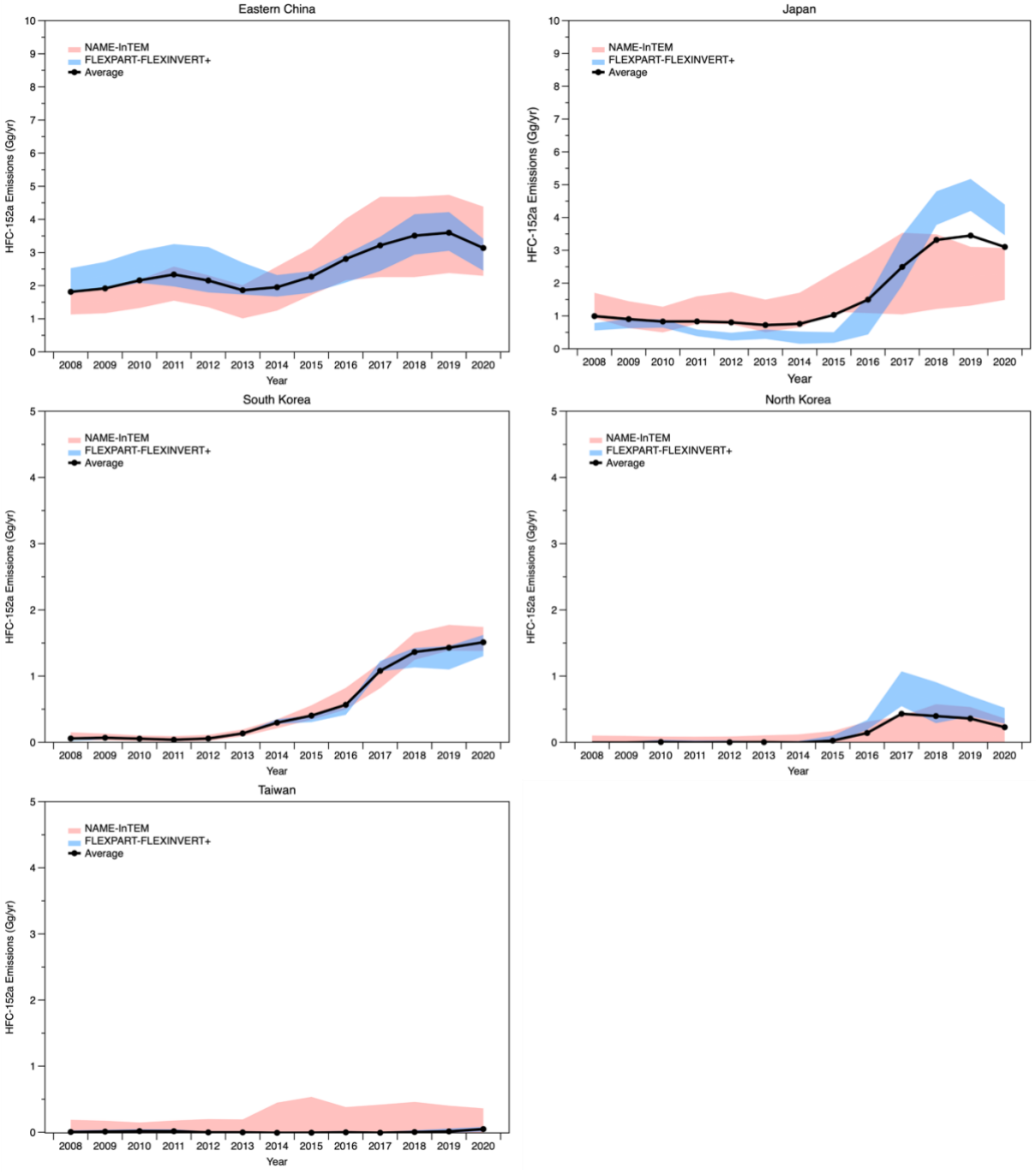

Figure S6: Same as Fig. S2, but for HFC-152a.

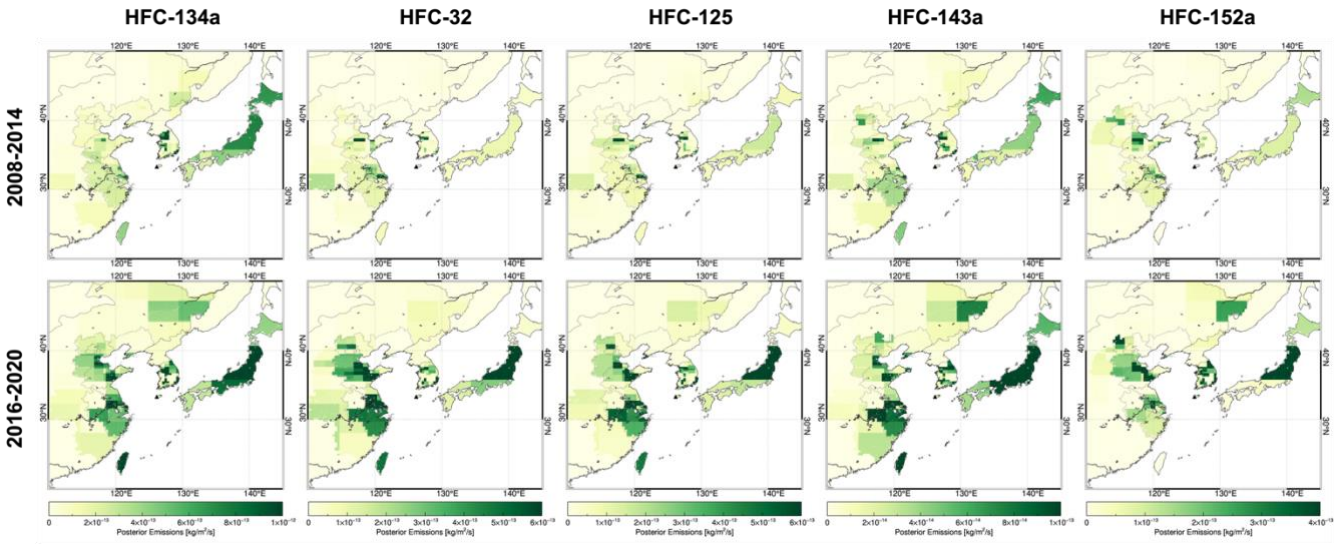

Figure S7: Averaged HFCs emissions distributions for 2008–2014 and 2016–2020 derived by NAME-InTEM.

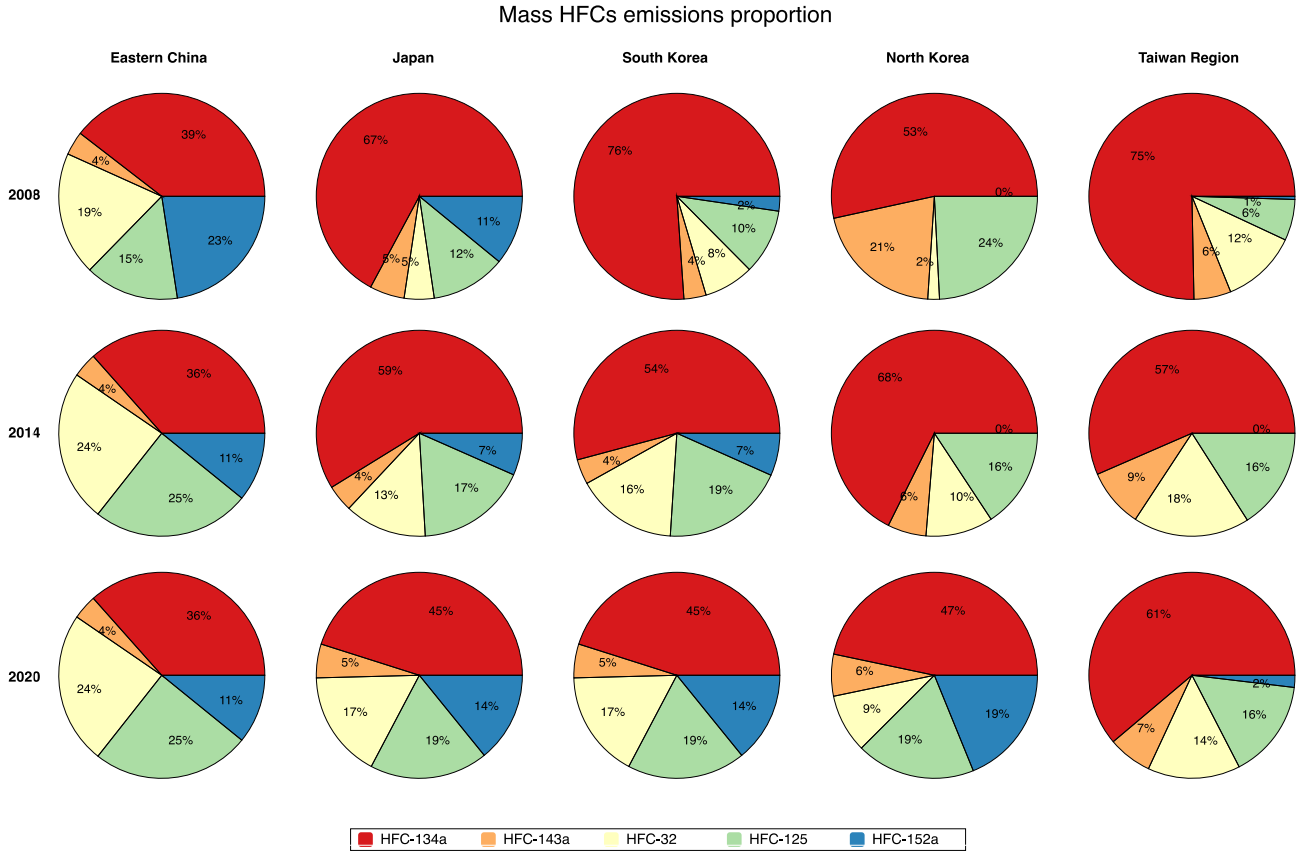

Figure S8: The proportion of each HFC emission in each country for 2008, 2014, and 2020.

In 2008, HFC-134a was the substance that accounted for the largest percentage of mass emissions in most countries except North Korea. Eastern China shows little change in the proportion of each HFC over time (slight increases in HFC-32 and HFC-125 and decreases in HFC-152a). However, the most notable point in the other countries is the decline in the share of HFC-134a, which accounted for about 70% of the total in 2008 to less than half in 2020, and the increase in the proportion of other HFCs, including HFC-152a (e.g., the proportion of HFC-134a in South Korea decreased from 76% in 2008 to 45% in 2020, and the proportion of HFC-152a increased from 2% to 14%). In 2020, HFC-32 and HFC-125 account for about the similar percentage.

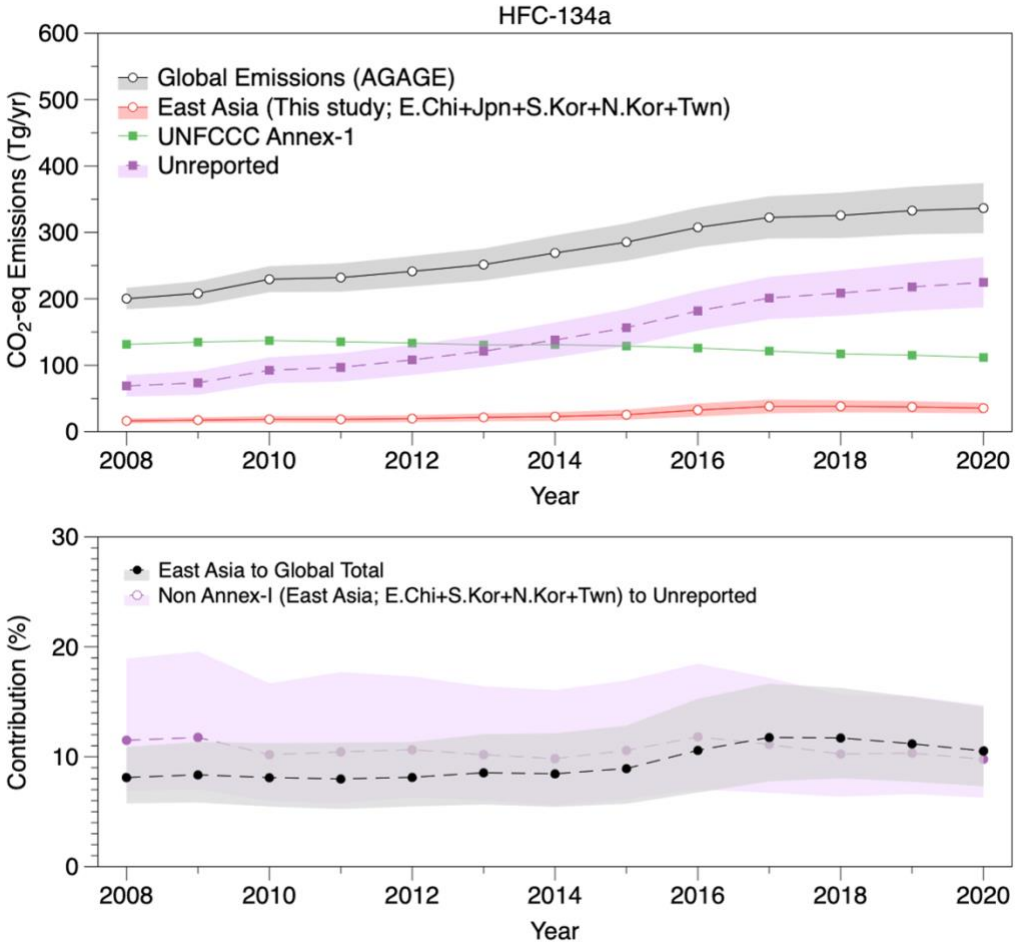

Figure S9: (top) Annual global total emissions of HFC-134a derived from atmospheric observations of the AGAGE program from 2008 to 2020 (black), inferred regional emissions in East Asia (red), (bottom) Proportional contributions of HFC-134a emissions in East Asia to the global total.

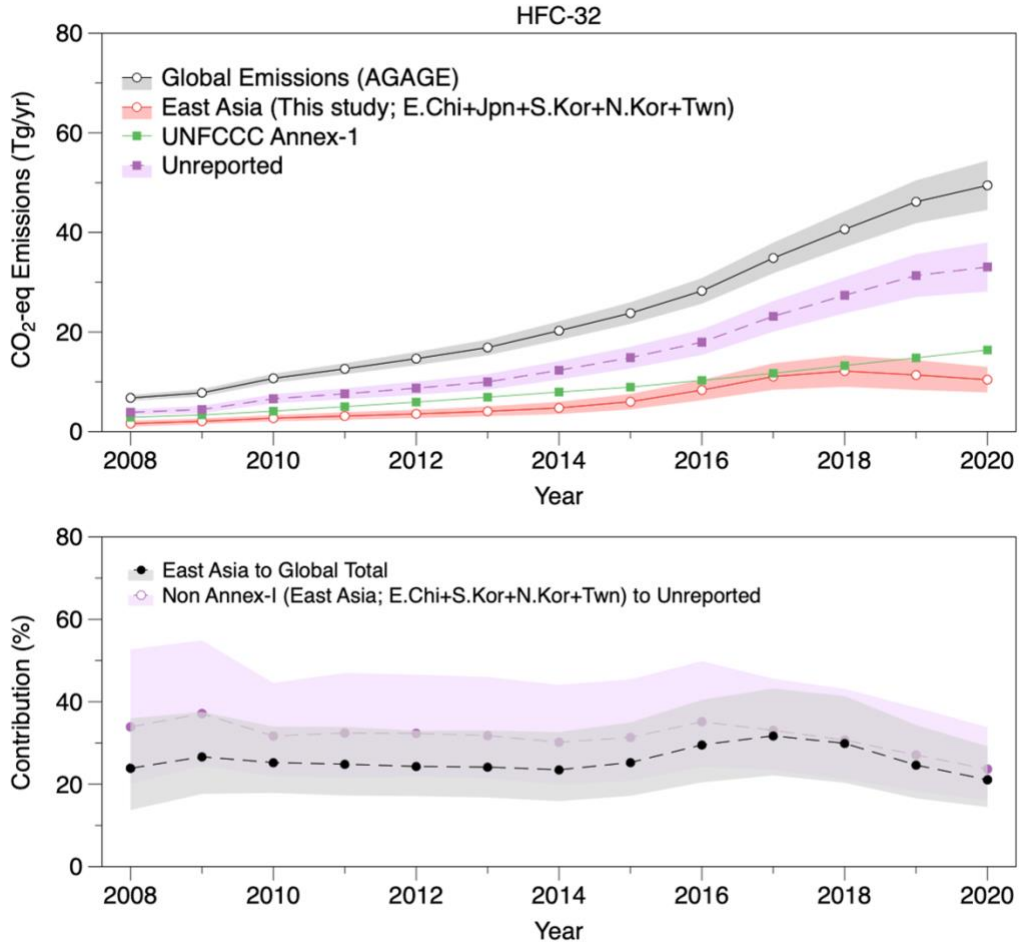

Figure S10: Same as Fig. S10, but for HFC-32

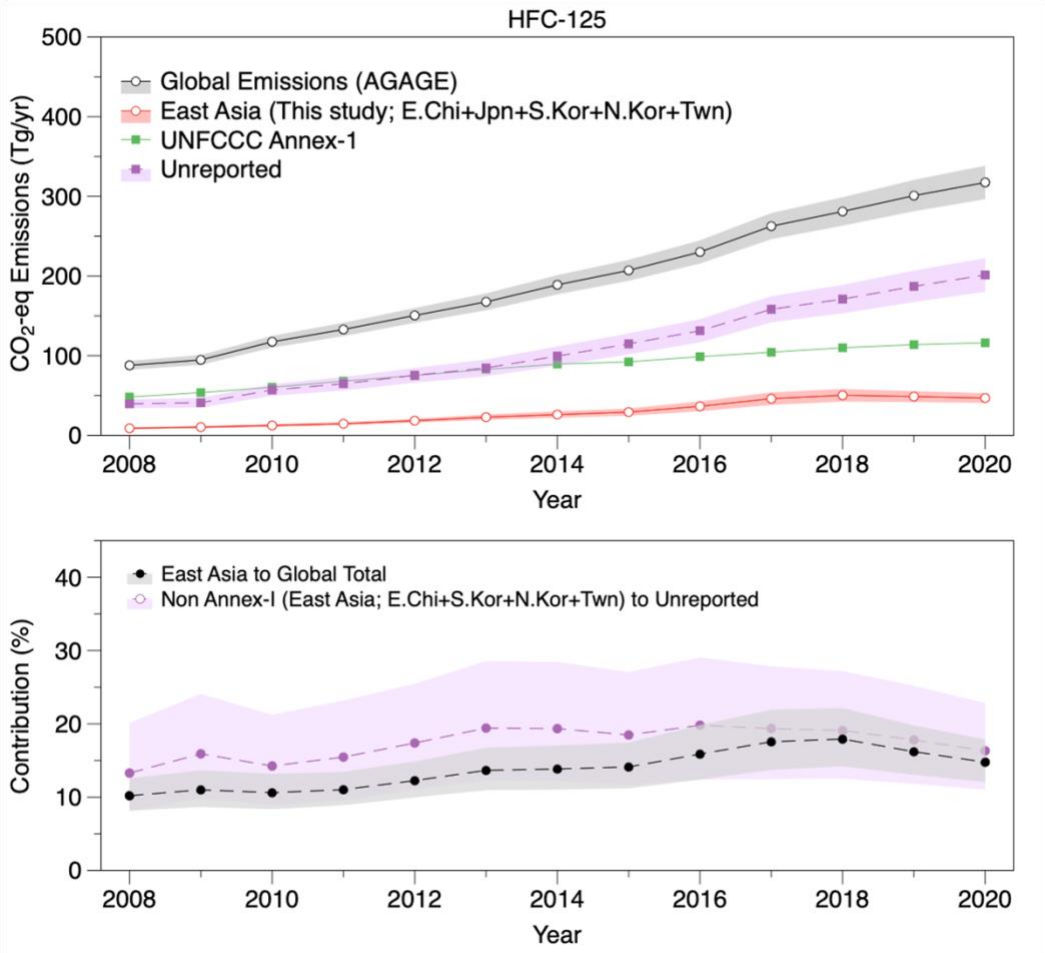

Figure S11: Same as Fig. S10, but for HFC-32

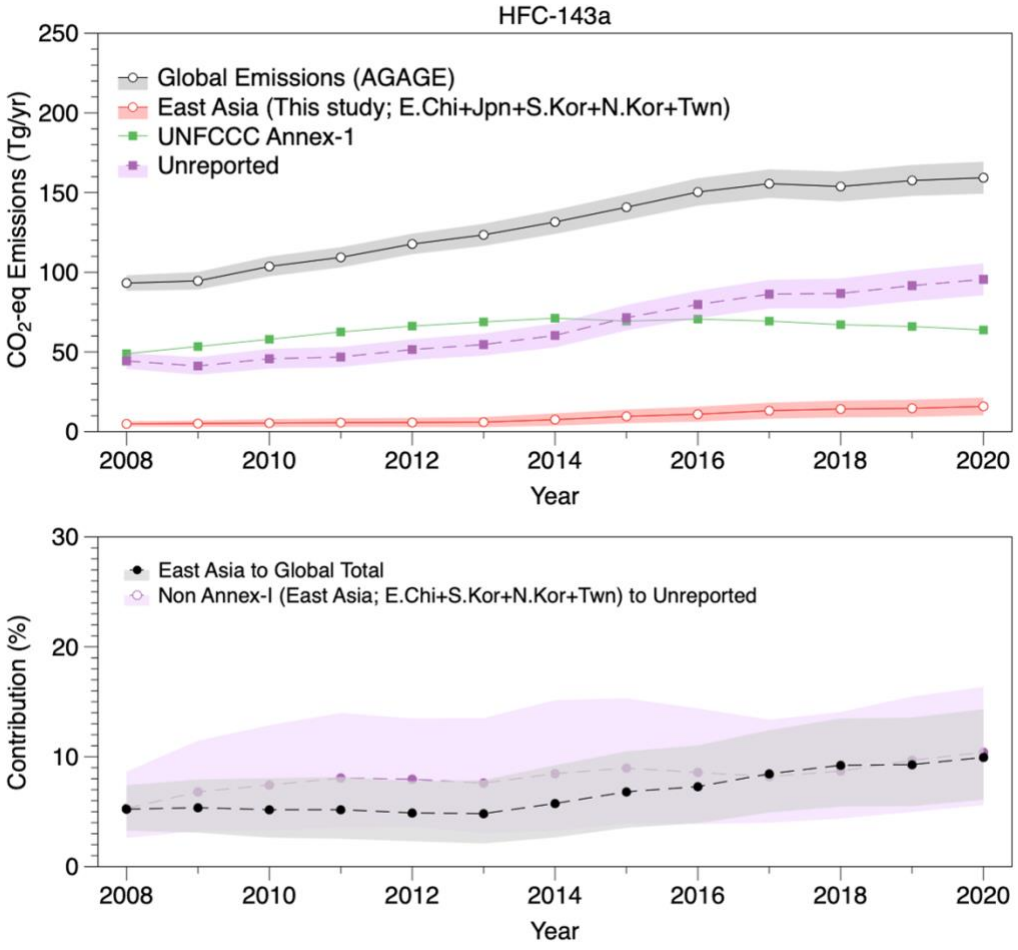

Figure S12: Same as Fig. S10, but for HFC-143a.

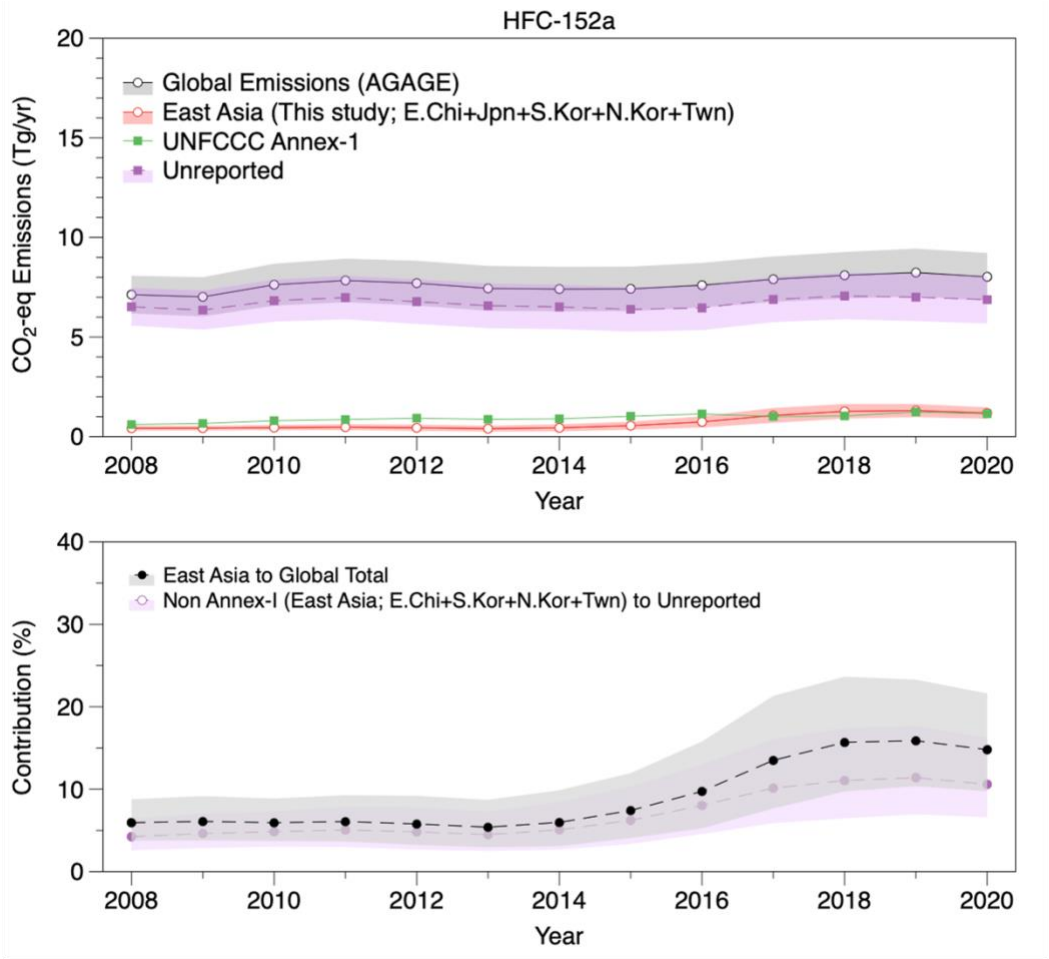

Figure S13: Same as Fig. S10, but for HFC-152a.

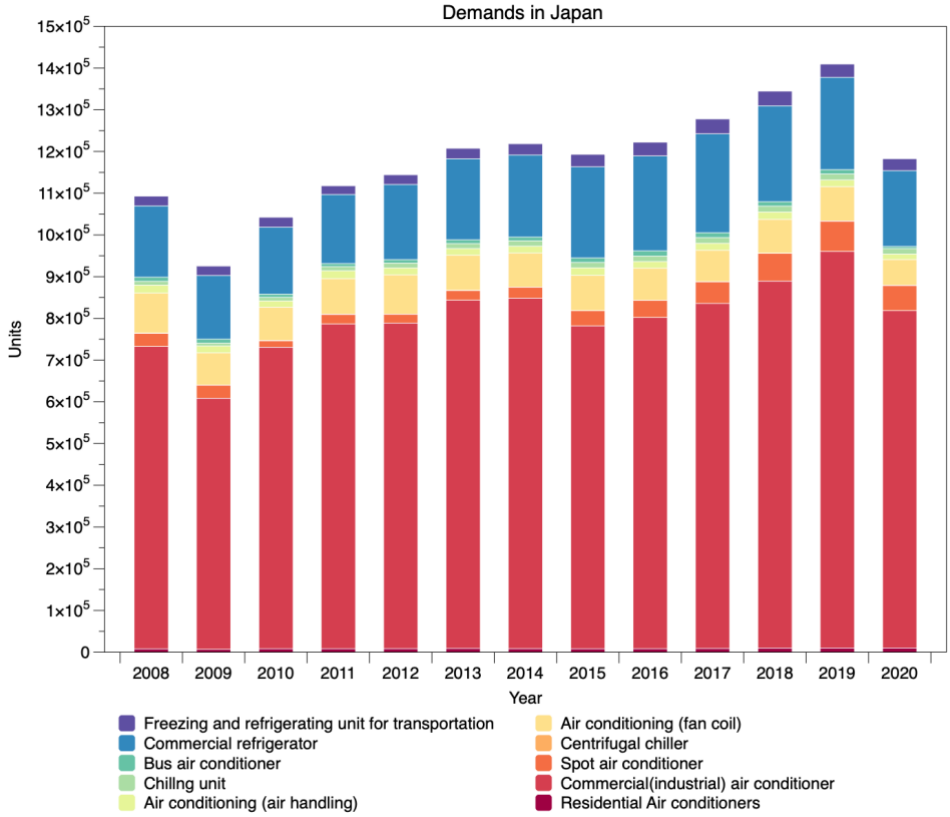

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Figure S14: Domestic demands in Japan of refrigerant products from 2008 to 2020. The statistical data of each category adopted from the Japan Refrigeration and Air conditioning Industry Association (JRAIA) (http://www.jraia.or.jp; last access was 3 December, 2022)