

## Supporting Information for

### East Asian summer monsoon delivers large abundances of very-short-lived organic chlorine substances to the lower stratosphere

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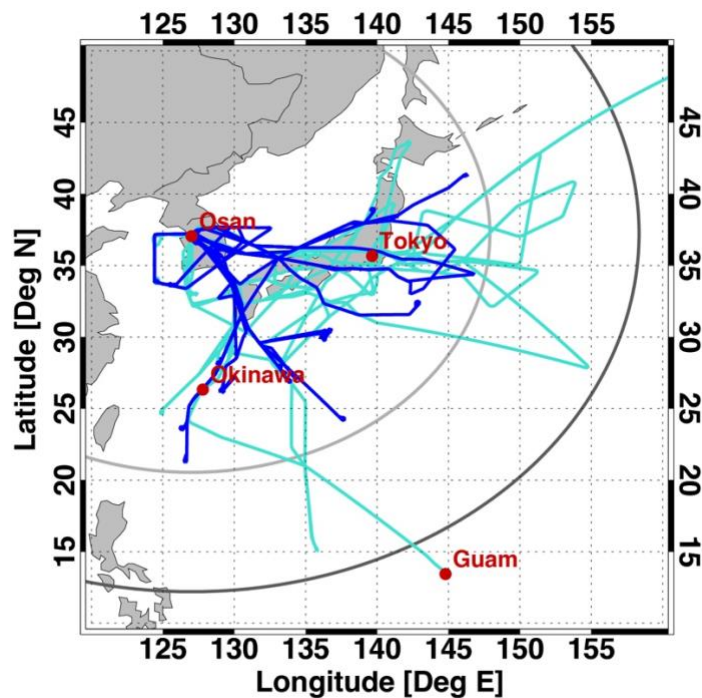
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## Supporting Information Text

### 1. ACCLIP campaign

The ACCLIP (Asian summer monsoon Chemical and CLimate Impact Project) campaign conducted *in situ* measurements of a wide range of trace gas and aerosol species in the UTLS using two high-altitude research aircraft: the National Science Foundation (NSF)/National Center for Atmospheric Research (NCAR) research aircraft Gulfstream V (GV) and the National Aeronautics and Space Administration (NASA) WB-57. The primary science goal is to investigate the impacts of Asian gas and aerosol emissions on global chemistry and climate via the linkage of Asian Summer Monsoon (ASM) convection (Pan et al., 2022). The campaign took place July–September 2022 with flight operations conducted from Osan Air Base in the Republic of Korea. Both research aircraft had extensive payloads of trace gas, aerosol and cloud measurements, with 17 sensors on the WB-57 and 16 on the GV. With the ACCLIP payload, the WB had a flight ceiling of ~19 km and primarily operated at altitudes between 13 and 19 km. The GV flight ceiling is near 15 km, and it sampled a vertical range of 500 m ASL to the ceiling. The two aircraft flew 15 (WB-57) and 14 (GV) research flights over the northwestern Pacific domain (Fig. S1) from July 31 to September 1, 2022, in support of ACCLIP science goals.

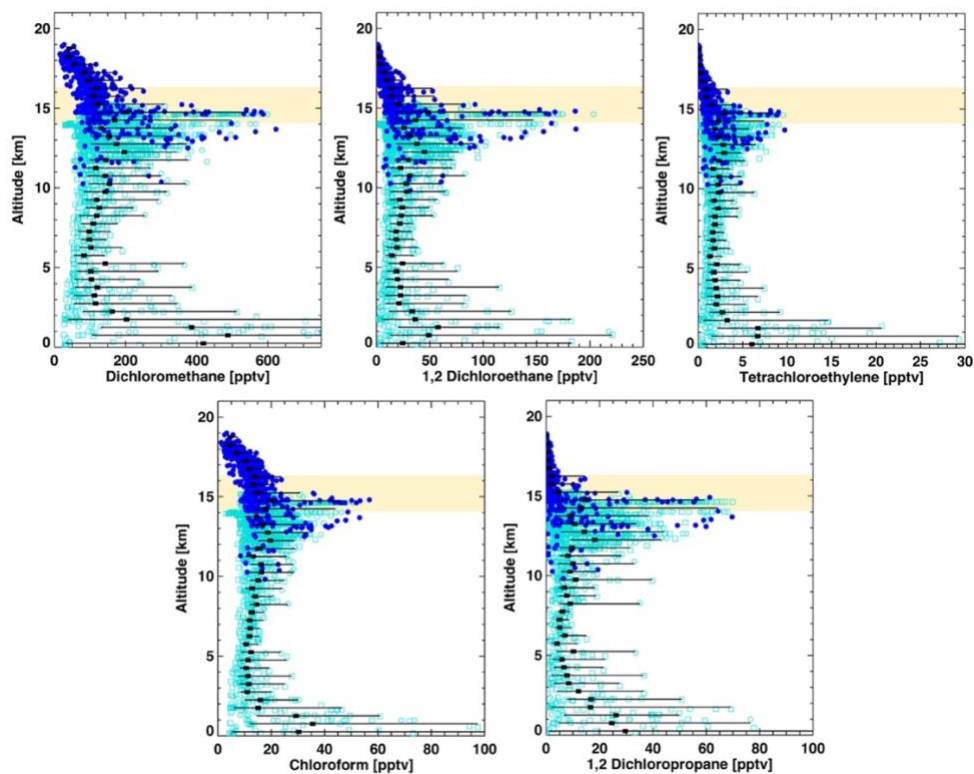


**Figure S1. Map of ACCLIP operational domain and research flight tracks.** The GV flight tracks (cyan) indicate the nominal range of 3000 nautical miles and ~ 8 hour duration. The WB-57 flight tracks (blue) correspond to a nominal range of 2000 nautical miles or ~ 6 hour duration. The range rings for the two aircraft are 1000 (light gray) and 1500 (dark gray) nautical miles respectively. The 29 research flights were conducted during July 31- September 1, 2022.

2. CI-VSLs measured during ACCLIP – Table S1

Table S1. CI-VSLs measured during ACCLIP.  
Compounds in bold have median concentrations above 1 pptv

	COMPOUND	TOGA	AWAS
1	<b>dichloromethane</b>	x	x
2	<b>1,2-dichloroethane</b>	x	x
3	<b>chloroform</b>	x	x
4	<b>1,2-dichloropropane</b>	x	x
5	<b>tetrachloroethene</b>	x	x
6	chlorobenzene	x	x
7	1,1,2-trichloroethane	x	
8	bromodichloromethane	x	x
9	bromochloromethane		x
10	trichloroethene	x	x
11	dibromochloromethane	x	x
12	cis-1,2-dichloroethene	x	
13	trans-1,2-dichloroethene	x	
14	1,1-dichloroethene	x	
15	chloroethene	x	
16	chloroethane	x	



**Figure S2. Vertical distributions of five CI-VSLs that make significant contributions to the total organic chlorine in the UTLS.** The data displayed are measurements from the WAS on the WB-57 (blue), AWAS on the GV (cyan squares), and TOFA-TOF on the GV (cyan circles) from all research flights. The mean value and the 5<sup>th</sup> to 95<sup>th</sup> percentiles for each 500-m layer are shown by the filled squares and the thin lines (black), respectively. The layer of 360–380 K potential temperature is shaded beige.