

**Supplementary table 1**

Below are noted the known issues with the FAAM aircraft instrument operation during the campaign

Instrument	Operation notes
AIMMS	May have iced up for approx 10 min on 22nd July 18:20:30
CIP100	Significant image noise on the 23rd and 24th July
PCASP	On the 16th July, 10Hz resulted in numerous communications dropouts that are flagged in data. 5Hz measurement from 19th can still lead to occasional dropouts and concentration spikes.
non-deiced temperature	There were times when this probe suffered from icing should be automatically flagged in the data.
CPC	There were some data losses on the 20th and 23rd July, and 1st August

Supplementary table 2		Key	operational	Partially operational / more analysis required	Not operational								
		Manchester cloud physics aircraft instruments					Manchester aerosol aircraft instruments						Leeds aircraft
Date	Flight number	2DS	3VCPI	HVPS-3	HALOHOLO	BCP-D (Operated by FAAM)	AMS	LAAP-TOF	SP-2	GRIMM (CVI)	CPC (CVI)	UHSAS (CVI)	INP filters
16/07/2022	C297					Full analysis required to see if any useful data can be retrieved.	pump overheated	vacuum pressure issue				Full analysis required to see if any useful data can be retrieved.	
19/07/2022	C298						operational error	vacuum pressure issue					Only PTFE filters collected
20/07/2022	C299							laser alignment issue		incomplete data	incomplete data		Only PTFE filters collected
22/07/2022	C300												
23/07/2022	C301		2DS Image Noise					From now, available data in both aerosol mode and cloud residuals		From now, available data in both aerosol mode and cloud residuals	From now, available data in both aerosol mode and cloud residuals	From now, available data in both aerosol mode and cloud residuals	
24/07/2022	C302									incomplete data	incomplete data		
25/07/2022	C303												
26/07/2022	C304						pump overheated	From now, Excimer laser safety issue					
27/07/2022	C305								From now, available data in both aerosol mode and cloud residuals				
29/07/2022	C306												
30/07/2022	C307						From now, available data in both aerosol mode and cloud residuals						
31/07/2022	C308	Rack power supply issue	Low CPI laser voltage							Rack power supply issue			
01/08/2022	C309												
02/08/2022	C310												
03/08/2022	C311						Time of flight Power Supply issue						
04/08/2022	C312						Time of flight Power Supply issue						
06/08/2022	C313												
07/08/2022	C314												
08/08/2022	C315						Turbo pump issue						

Supplementary table 3		Key	operational	Partially operational / more analysis required	Not operational							
Date	Flight number	Oklahoma radar		NMT langmuir		Manchester Main laboratory	Manchester Kiva 2	Manchester Langmuir	Aerosol PLAIR Rapid-Eplus	Leeds langmuir	Leeds Socorro and Magdalena	
		PX1000	SR1	E-field mill	LEFA	Weather Station	Weather Station	Aerosol PSD GRIMM	Aerosol PLAIR Rapid-Eplus	Digitel	Camera 1	Camera 2
15/07/2022	no flight						from 03:41	Installed			testing	testing
16/07/2022	C297		16:25-18:50						Installed			
17/07/2022	no flight									Installed and sampling		
18/07/2022	no flight					from 21:53			Maintenance		testing	testing
19/07/2022	C298		15:40-17:23	distant lightning 22:03-23:59	distant lightning 22:03-23:59							
20/07/2022	C299											
21/07/2022	no flight			T-storm 02:44-04:00								
22/07/2022	C300										Images from 19Z only	
23/07/2022	C301	16:20-22:32		T-storm 18:31-20:00	T-storm 19:21-20:21					Filter stack changeover		
24/07/2022	C302	15:51-20:14		T-storm 05:30-07:30								
25/07/2022	C303	15:48-21:05		T-storm 17:45-18:30	T-storm 17:58-19:00							
26/07/2022	C304	16:00-19:59		T-storm 19:42-20:30	T-storm 19:50-20:50							
27/07/2022	C305	16:00-20:15		T-storm 16:45-20:00	T-storm 17:44-18:44							
28/07/2022	no flight			T-storm 17:40-21:30	T-storm 19:50-23:50					Filter stack changeover - pump did not start up again		
29/07/2022	C306	15:51-20:05	16:00-19:15	A couple flashes 19:40-19:50								
30/07/2022	C307	15:53-20:17	16:55-20:13	T-storm 17:12-20:00	Tstorm 17:34-21:43							
31/07/2022	C308	16:07-20:07	17:50-18:55	T-storm 18:34-23:00	T-storm 18:44-23:59							
01/08/2022	C309	15:59-20:26	17:00-20:08									
02/08/2022	C310	15:54-20:22	19:02-20:08		data 21:00-23:00							
03/08/2022	C311	15:56-17:59	20:54-21:03	T-storm 21:44-22:00	T-storm 21:47-22:46							
04/08/2022	C312	16:36-23:01										
05/08/2022	no flight		Troubleshooting							Filter stack changeover		
06/08/2022	C313	16:04-20:13	18:20-19:28	T-storm 18:34-19:00	Data 19:04-20:04							
07/08/2022	C314	16:57-23:23	17:10-20:13	T-storm 18:12-19:38	T-storm 18:41-20:41				Maintenance			
08/08/2022	C315	16:32-19:27	16:55-18:53		Data 22:37-23:59							