



Supplement of

Organic enrichment in droplet residual particles relative to out of cloud over the northwestern Atlantic: analysis of airborne ACTIVATE data

Hossein Dadashazar et al.

Correspondence to: Hossein Dadashazar (hosseind@arizona.edu)

The copyright of individual parts of the supplement might differ from the article licence.

Table S1. Average concentrations of submicrometer aerosol species measured by an airborne AMS for different seasons associated with ACTIVATE deployments 1-4. Also shown are mass fractions of each AMS species relative to total AMS mass, in addition to the ratio of m/z 44 to total organic mass (i.e., f₄₄). Non-CAO and CAO categories include samples collected between January and March. CVI = droplet residual particle measurements in cloud; BCB = below cloud base, ACT = above cloud top, BBL = below boundary layer top, ABL = above boundary layer top. Corresponding standard deviations and number of points are provided in Table S2.

		(Non-CAO/CAO/May-Jun/Aug-Sep)				
		CVI	BCB	ACT	BBL	ABL
Organic ($\mu\text{g m}^{-3}$)	-	-	1.07/0.67/1.49/3.27	0.61/0.19/2.62/3.04	2.59/1.16/3.49/4.46	0.94/0.57/5.28/5.57
Sulfate ($\mu\text{g m}^{-3}$)	-	-	0.93/0.79/1.71/1.35	0.53/0.26/1.23/1.11	0.80/0.57/1.17/1.77	0.51/0.45/1.26/2.13
Nitrate ($\mu\text{g m}^{-3}$)	-	-	0.40/0.21/0.07/0.16	0.19/0.05/0.14/0.11	0.79/0.93/0.17/0.21	0.14/0.32/0.26/0.19
Ammonium ($\mu\text{g m}^{-3}$)	-	-	0.45/0.32/0.36/0.36	0.28/0.10/0.41/0.37	0.67/0.65/0.38/0.53	0.26/0.30/0.51/0.63
Chloride ($\mu\text{g m}^{-3}$)	-	-	0.03/0.02/0.03/0.03	0.02/0.01/0.02/0.02	0.05/0.01/0.02/0.02	0.01/0.01/0.02/0.02
Organic _{MF}	0.55/0.60/0.68/0.61	0.40/0.34/0.35/0.48	0.28/0.29/0.42/0.51	0.50/0.39/0.63/0.57	0.44/0.32/0.65/0.54	
Sulfate _{MF}	0.24/0.19/0.14/0.14	0.39/0.45/0.53/0.39	0.42/0.46/0.43/0.34	0.24/0.20/0.26/0.33	0.35/0.36/0.24/0.35	
Nitrate _{MF}	0.05/0.05/0.05/0.05	0.08/0.07/0.02/0.03	0.08/0.07/0.03/0.03	0.11/0.22/0.03/0.03	0.06/0.14/0.03/0.03	
Ammonium _{MF}	0.09/0.08/0.07/0.09	0.13/0.13/0.10/0.08	0.20/0.16/0.12/0.10	0.14/0.18/0.08/0.07	0.14/0.16/0.07/0.08	
Chloride _{MF}	0.06/0.08/0.06/0.10	0.01/0.01/0.01/0.01	0.01/0.02/0.01/0.01	0.01/0.01/0.01/0.00	0.01/0.03/0.00/0.00	
f ₄₄	0.33/0.34/0.24/0.37	0.15/0.13/0.11/0.14	0.26/0.16/0.12/0.15	0.16/0.14/0.12/0.14	0.17/0.14/0.11/0.14	

Table S2. Standard deviations and the number of points for parameters measured by the AMS instrument. Note that numbers of points refer to entire legs for which calculations were conducted using raw data rather than the raw data points per leg. Non-CAO and CAO categories include samples collected between January and March. CVI = droplet residual particle measurements in cloud; BCB = below cloud base, ACT = above cloud top, BBL = below boundary layer top, ABL = above boundary layer top. Corresponding average values are provided in Table S1.

	(Non-CAO/CAO/May-Jun/Aug-Sep)				
	CVI	BCB	ACT	BBL	ABL
Organic ($\mu\text{g m}^{-3}$)	-	0.63/0.43/1.84/3.93	1.06/0.14/5.08/4.50	2.13/0.69/2.58/3.25	1.01/0.57/3.92/5.86
Sulfate ($\mu\text{g m}^{-3}$)	-	0.52/0.50/0.68/0.83	0.45/0.16/1.04/1.30	0.38/0.35/0.53/0.82	0.27/0.42/0.71/2.10
Nitrate ($\mu\text{g m}^{-3}$)	-	0.82/0.44/0.07/0.16	0.37/0.07/0.27/0.15	1.05/0.82/0.19/0.18	0.25/0.48/0.25/0.18
Ammonium ($\mu\text{g m}^{-3}$)	-	0.52/0.33/0.25/0.37	0.32/0.08/0.50/0.45	0.58/0.50/0.22/0.38	0.21/0.36/0.35/0.67
Chloride ($\mu\text{g m}^{-3}$)	-	0.03/0.02/0.02/0.03	0.05/0.01/0.02/0.03	0.06/0.01/0.02/0.02	0.01/0.01/0.01/0.02
Organic _{MF}	0.15/0.16/0.18/0.20	0.14/0.11/0.21/0.23	0.21/0.15/0.21/0.21	0.16/0.09/0.15/0.16	0.17/0.15/0.18/0.23
Sulfate _{MF}	0.12/0.14/0.13/0.12	0.15/0.15/0.21/0.22	0.18/0.16/0.18/0.19	0.15/0.07/0.16/0.18	0.15/0.16/0.17/0.22
Nitrate _{MF}	0.05/0.06/0.06/0.05	0.10/0.08/0.01/0.02	0.09/0.07/0.03/0.03	0.08/0.11/0.02/0.02	0.04/0.09/0.03/0.02
Ammonium _{MF}	0.10/0.09/0.10/0.14	0.06/0.06/0.05/0.07	0.10/0.08/0.08/0.09	0.05/0.04/0.04/0.04	0.08/0.06/0.04/0.05
Chloride _{MF}	0.08/0.08/0.08/0.14	0.01/0.01/0.01/0.01	0.02/0.01/0.01/0.02	0.01/0.01/0.01/0.01	0.01/0.05/0.00/0.00
f ₄₄	0.14/0.21/0.51/0.59	0.12/0.04/0.07/0.11	0.19/0.11/0.09/0.11	0.02/0.04/0.03/0.04	0.09/0.03/0.03/0.08
no. points	180/96/386/228	32/21/70/41	31/22/67/41	24/8/45/27	24/12/97/53

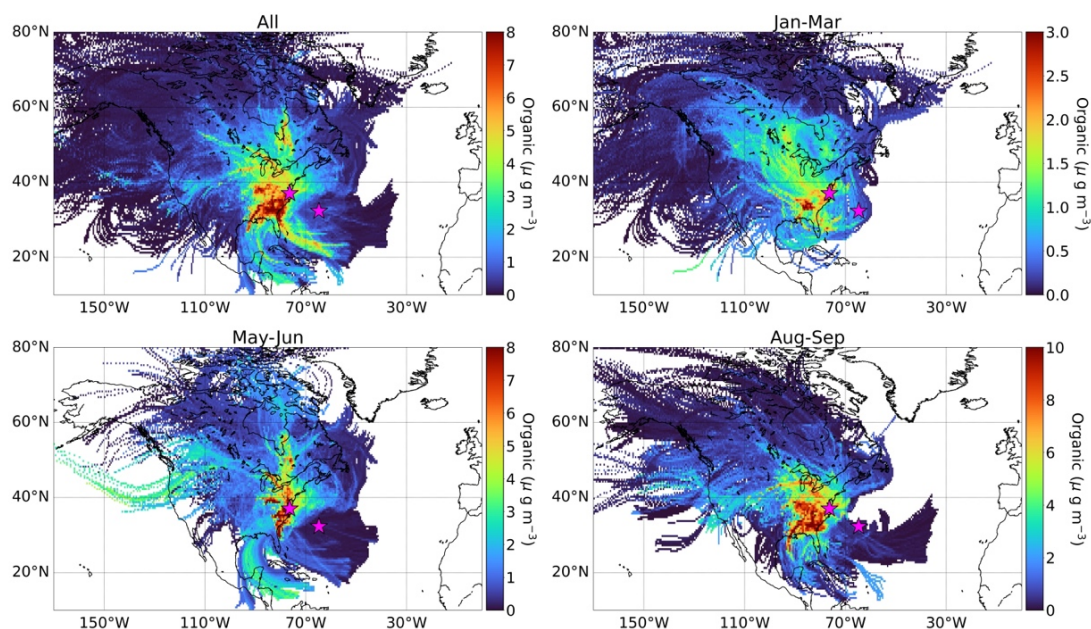
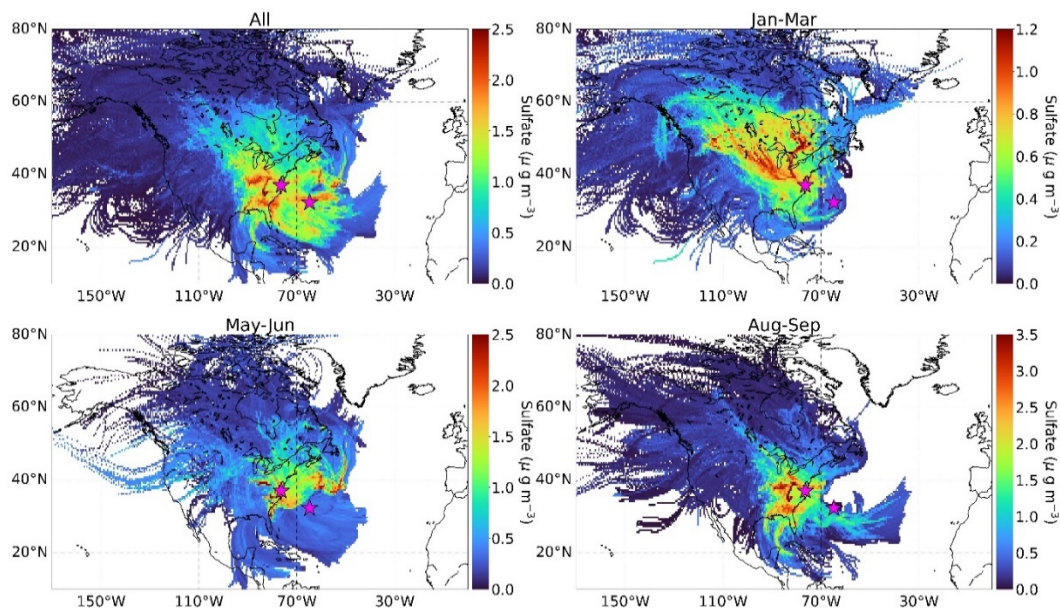


Figure S1. Concentration weighted trajectory maps for organic aerosol concentrations as measured by an AMS on the Falcon during different ACTIVATE deployments (All data, January-March 2020 and 2021, May-June 2021, August-September 2020). These are based on 29,164 cloud-free AMS data points. The pink stars represent NASA Langley Research Center (Hampton, Virginia) and Bermuda for reference. Color bar scales differ to show variability better within a given panel.

50



51

52 **Figure S2. Concentration weighted trajectory maps for sulfate aerosol concentrations as**
 53 **measured by an AMS on the Falcon during different ACTIVATE deployments (All data,**
 54 **January-March 2020 and 2021, May-June 2021, August-September 2020). These are based**
 55 **on 29,164 cloud-free AMS data points. The pink stars represent NASA Langley Research**
 56 **Center (Hampton, Virginia) and Bermuda for reference. Color bar scales differ to show**
 57 **variability better within a given panel.**

58

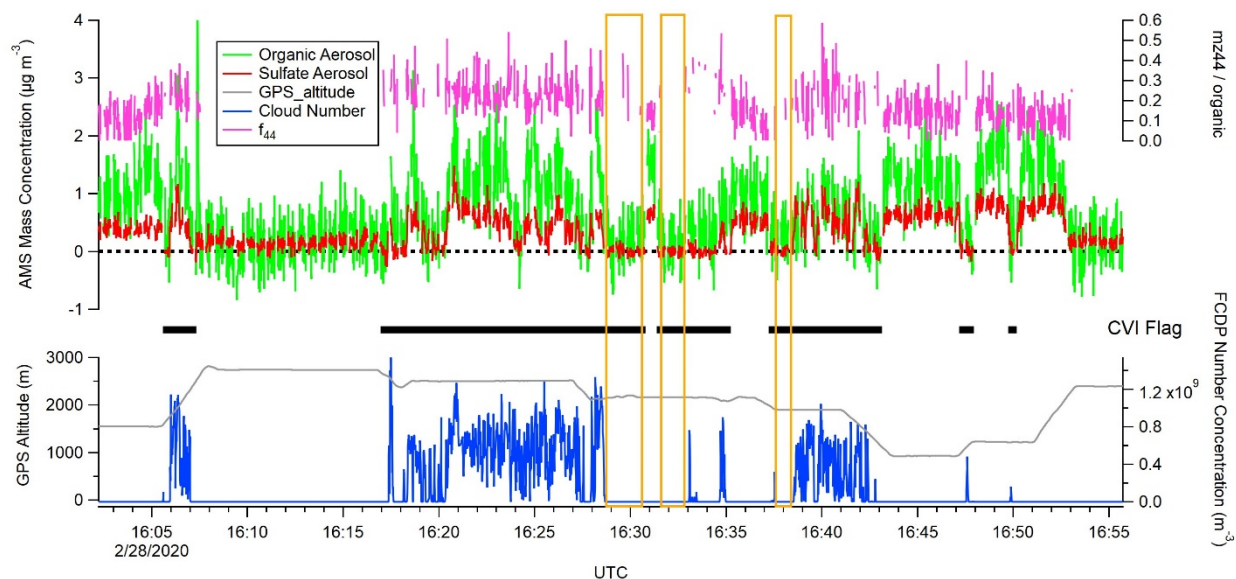


Figure S3. Time series from research flight 10 (28 February 2020) of (top) AMS mass concentrations of sulfate and organic in addition to f_{44} , and (bottom) Falcon altitude and FCDP droplet number concentration. The CVI Flag horizontal bar indicators represent when aerosol sampling was conducted downstream of the CVI, with the vertical orange bars indicating specifically those CVI times where sampling was out of cloud (i.e., data serving as blanks).