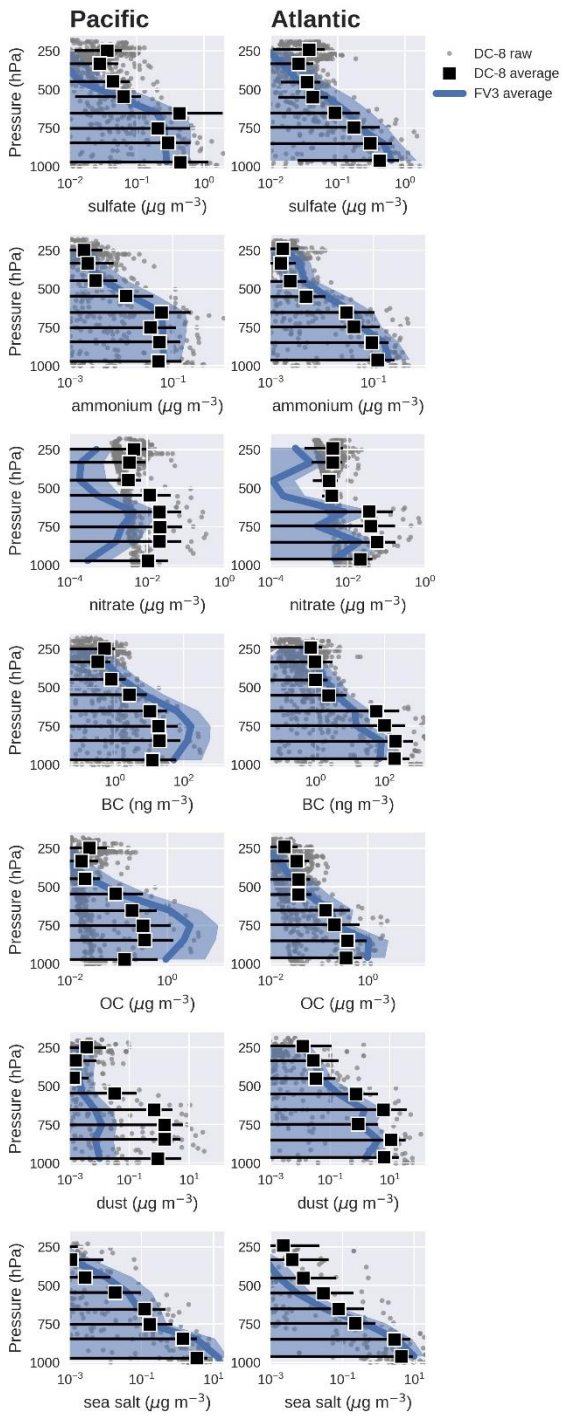
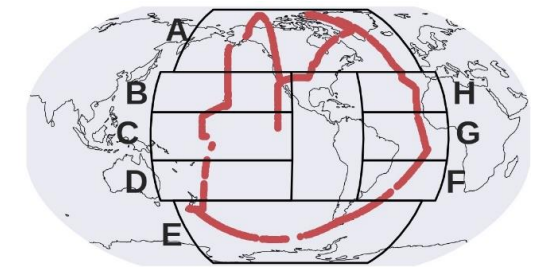


ATom-1: Overview

/scratch1/BMC/gsd-fv3-dev/NCEPDEV/global/Kate.Zhang/fv3gfs/comrot/NASA_C96_fire/v2_na1/

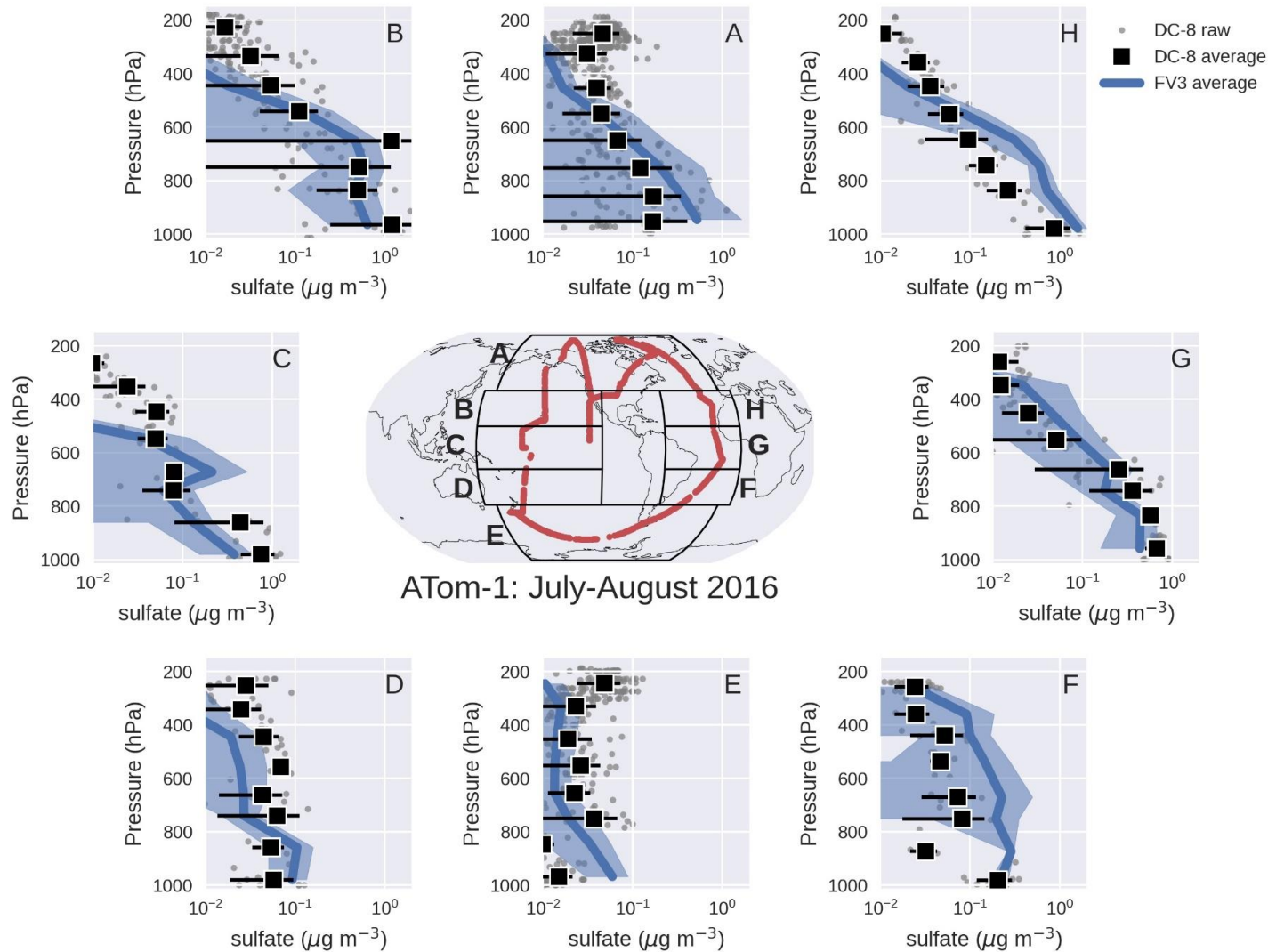


		regional								global
		C	B	A	D	E	F	G	H	
ozone	RMSE (ppb)	14.61	4.00	11.11	11.16	19.47	6.54	11.85	6.53	7.19
	MPE (%)	40.15	2.98	21.25	37.70	18.22	13.47	-16.37	6.81	14.26
	r	0.51	0.98	1.00	0.99	0.98	0.93	0.52	0.97	1.00
sulfate	RMSE ($\mu\text{g m}^{-3}$)	0.18	0.32	0.15	0.03	0.02	0.12	0.12	0.35	0.04
	MPE (%)	-59.85	-53.46	15.01	-56.98	-35.92	176.05	-21.25	65.62	-15.21
	r	0.85	0.86	0.96	0.46	-0.55	0.40	0.97	0.97	0.96
ammonium	RMSE ($\mu\text{g m}^{-3}$)	0.01	0.03	0.05	0.02	0.01	0.05	0.07	0.08	0.02
	MPE (%)	-59.45	5.23	151.04	228.70	321.06	173.06	-28.98	99.50	50.33
	r	0.97	0.94	0.97	0.76	0.21	0.64	0.89	0.95	0.99
nitrate	RMSE ($\mu\text{g m}^{-3}$)	0.00	0.03	0.00	0.00	0.00	0.02	0.15	0.01	0.02
	MPE (%)	-99.83	-96.87	-78.22	-94.12	-95.19	-96.87	-99.41	-91.95	-87.00
	r	0.19	0.79	0.99	0.23	-0.83	0.99	0.78	0.36	0.85
BC	RMSE (ng m^{-3})	0.96	220.89	7.25	0.57	0.50	23.68	475.48	14.62	17.24
	MPE (%)	-72.98	310.72	192.42	2.08	4.63	38.32	-68.26	58.02	11.51
	r	0.93	0.95	0.98	0.83	0.57	0.46	0.89	0.99	0.92
OC	RMSE ($\mu\text{g m}^{-3}$)	0.02	4.08	0.08	0.02	0.02	0.27	0.96	0.77	0.72
	MPE (%)	-93.87	310.30	27.50	-56.49	-14.23	113.10	-70.98	149.93	163.23
	r	0.71	0.97	0.95	-0.04	-0.74	0.87	0.83	0.97	0.98
dust	RMSE ($\mu\text{g m}^{-3}$)	14.61	4.00	11.11	11.16	19.47	6.54	11.85	6.53	7.19
	MPE (%)	40.15	2.98	21.25	37.70	18.22	13.47	-16.37	6.81	14.26
	r	0.51	0.98	1.00	0.99	0.98	0.93	0.52	0.97	1.00
sea salt	RMSE ($\mu\text{g m}^{-3}$)	0.18	0.32	0.15	0.03	0.02	0.12	0.12	0.35	0.04
	MPE (%)	-59.85	-53.46	15.01	-56.98	-35.92	176.05	-21.25	65.62	-15.21
	r	0.85	0.86	0.96	0.46	-0.55	0.40	0.97	0.97	0.96



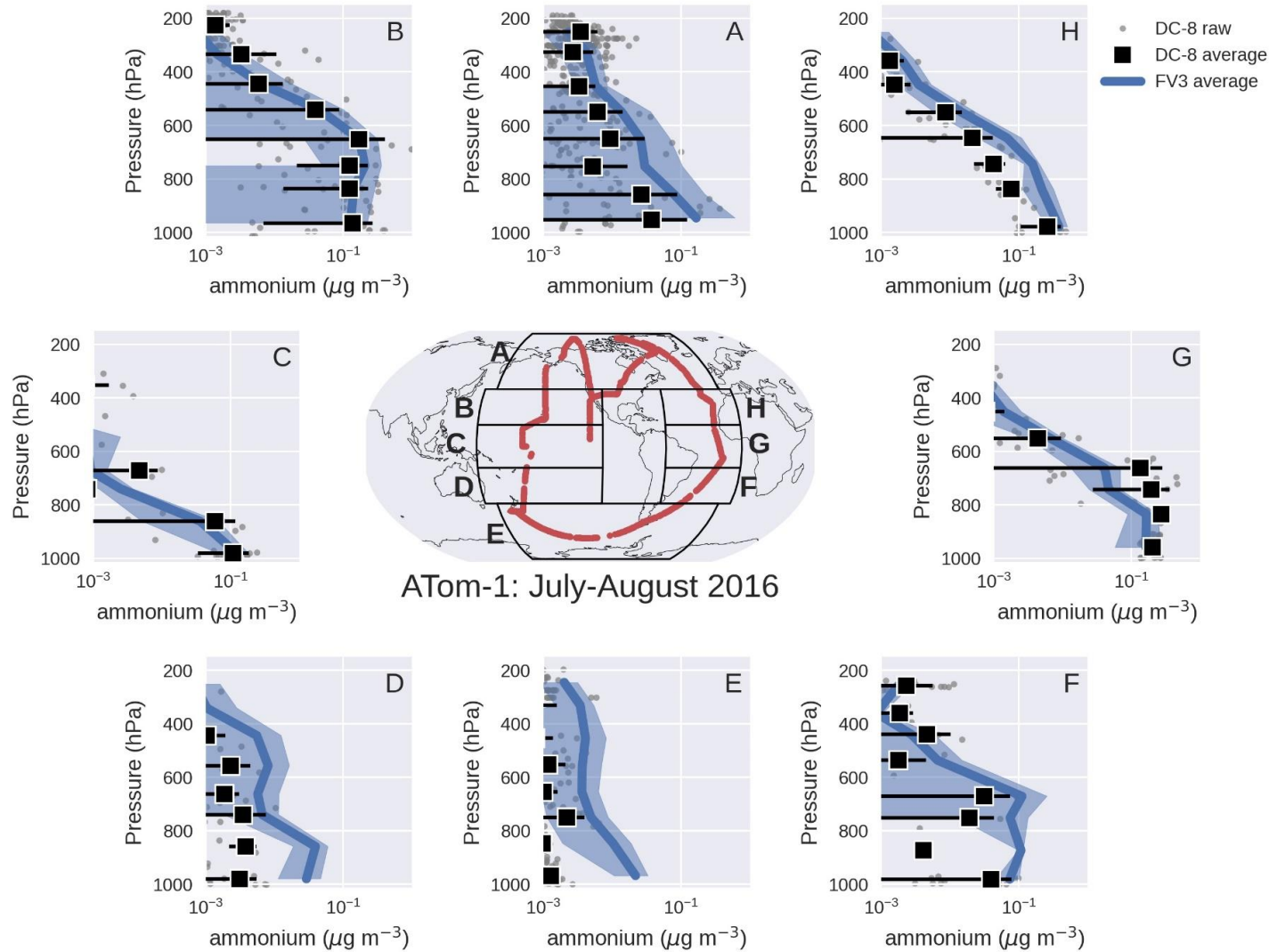
ATom-1: July-August 2016

ATom-1: sulfate



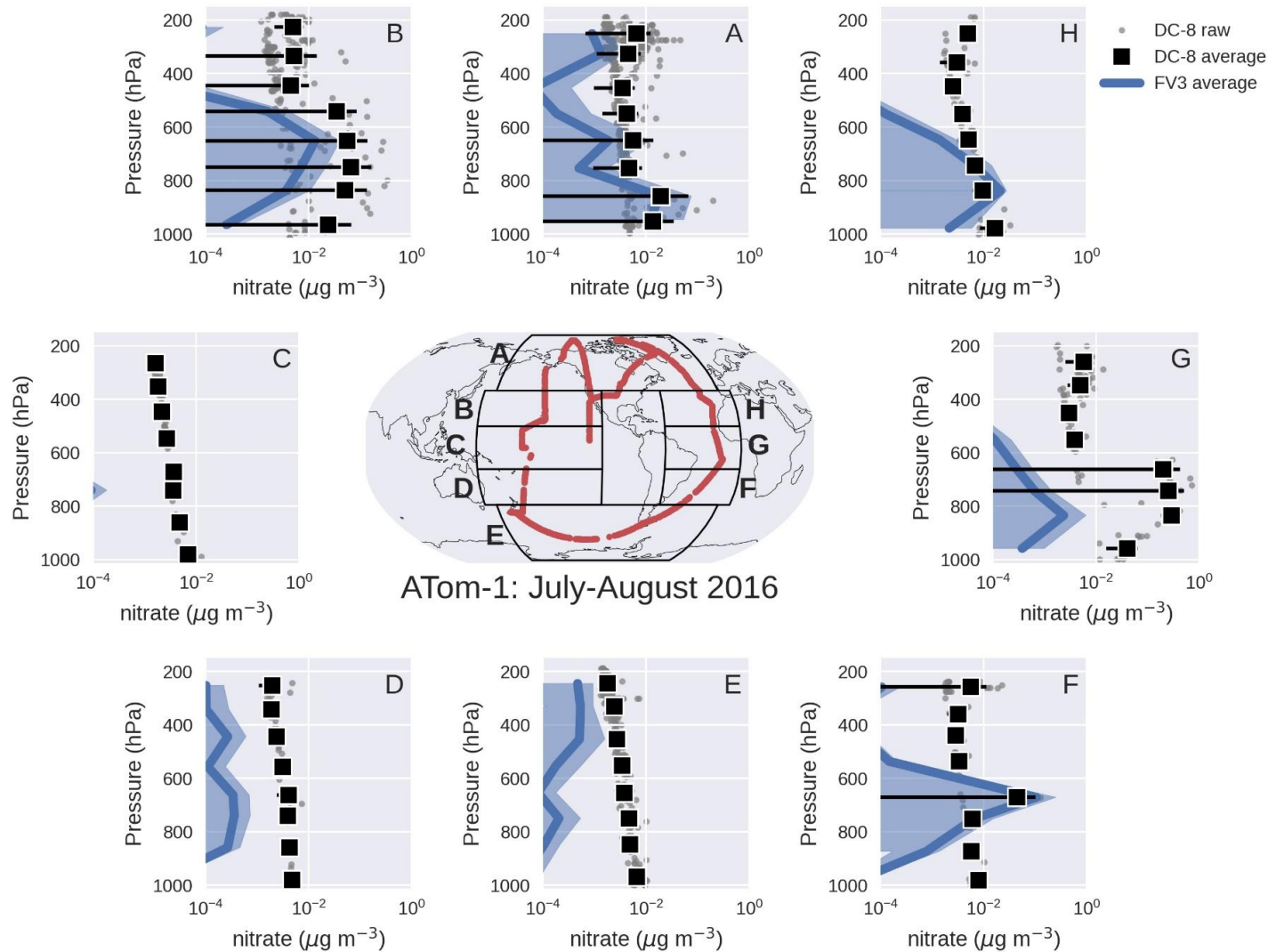
- Sulfate still underestimated over the remote oceans (C, D).
- Sulfate also underestimated in the upper free troposphere over the Southern Ocean (E): downward transport from stratosphere, or isentropic mixing from lower latitudes. Both plausible.
- Sulfate slightly overestimated in the lower troposphere over the continent and the outflows (A, H).
- Natural source of sulfate greatly improved in the new GOCART, but still need some fine tune (DMS chemistry). Anthropogenic sulfur emissions might be off.

ATom-1: ammonium



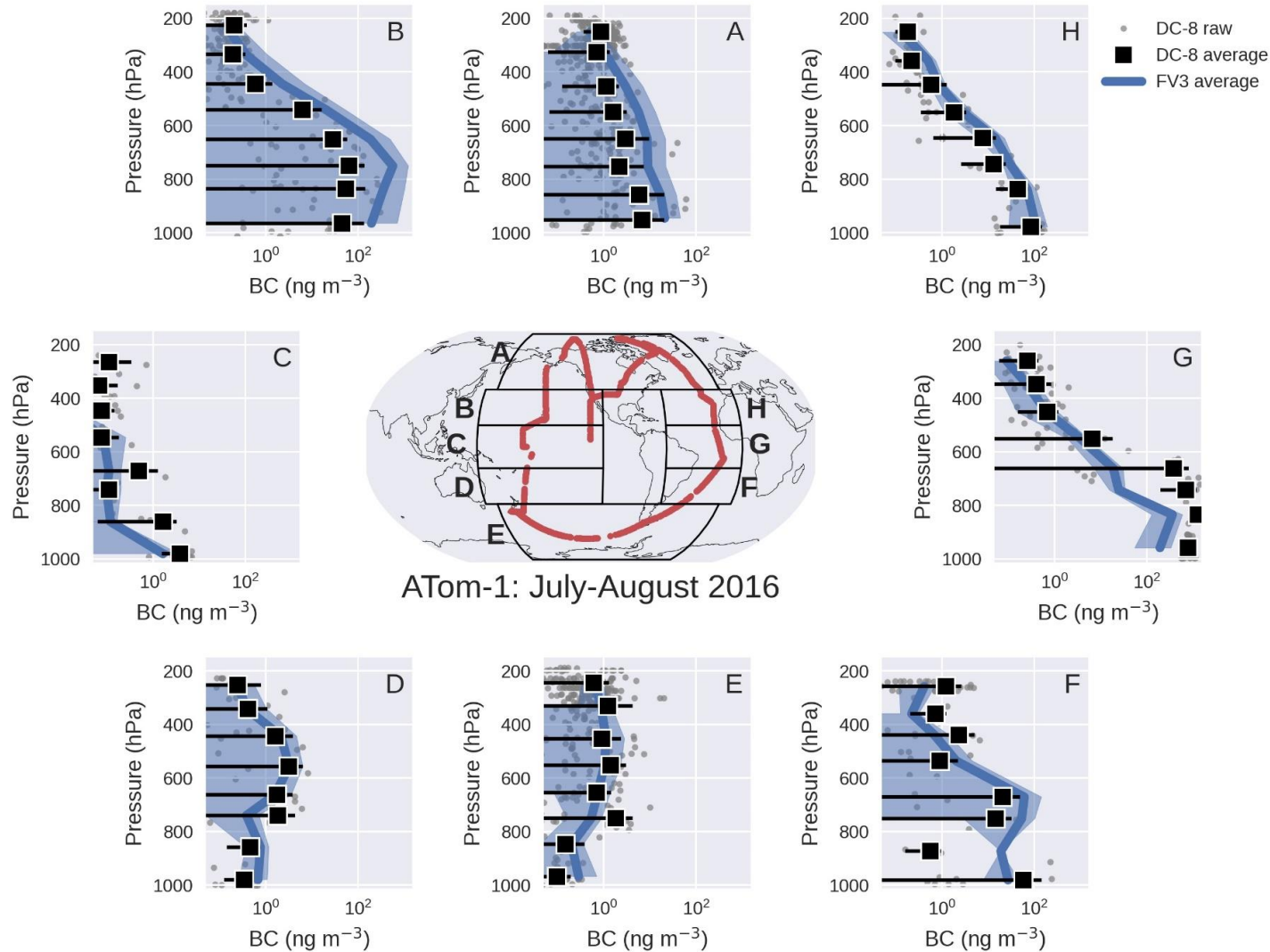
- Ammonium slightly overestimated in the lower troposphere over the continent and the outflows (A, H).
- Ammonium looks really good in the tropics (C, G).
- Ammonium overestimated in the Southern Hemisphere (D, E, F).
- Need to check ammonia/ammonium sources.

ATom-1: nitrate



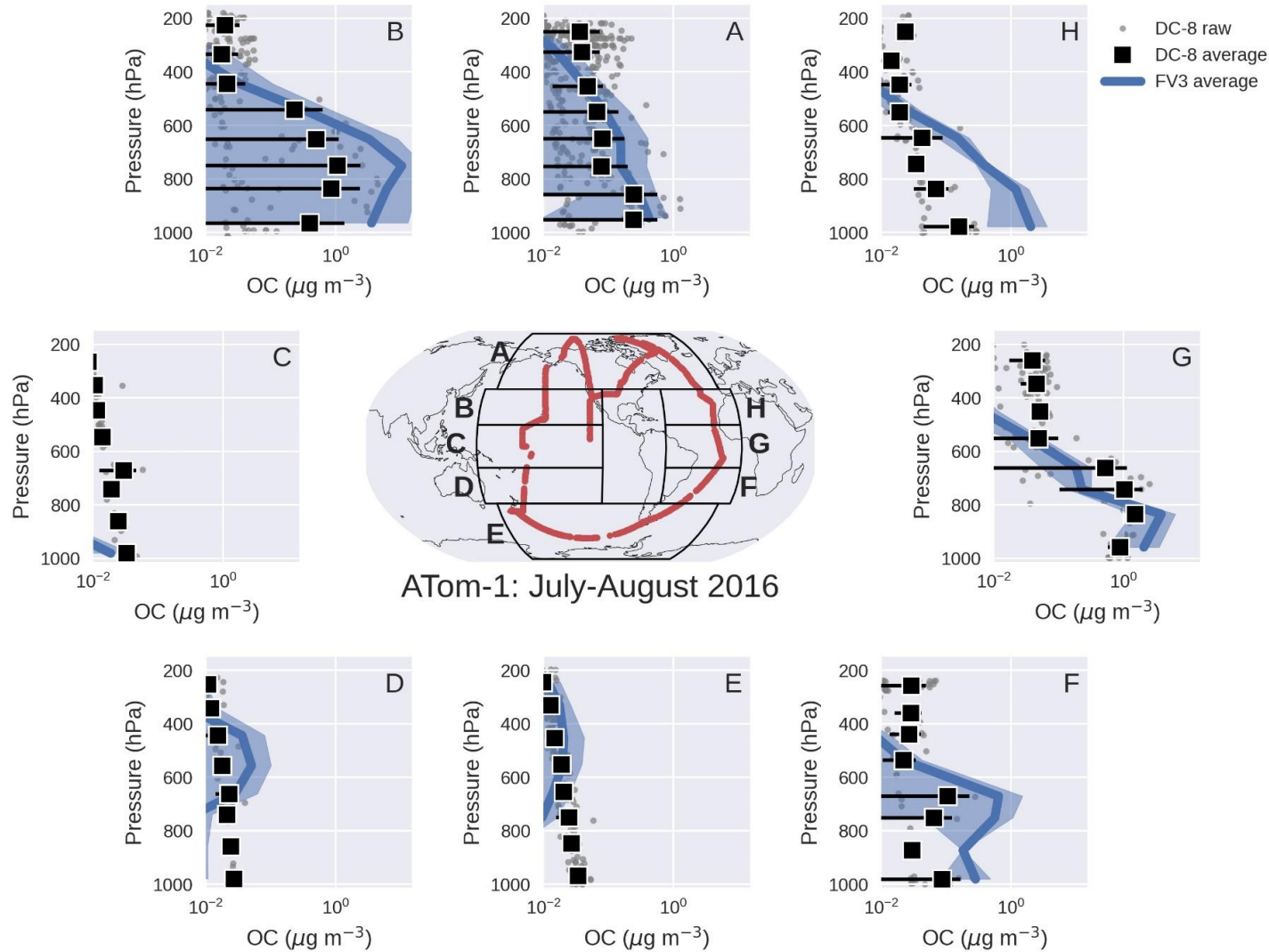
- Fine mode nitrate compared to AMS (PM1). Below LOD measurements replaced with 0.5 LOD.
- Nitrate over the continents or in the outflows (A, H) where the agreement is reasonable.
- Nitrate in the remote atmosphere: all underestimated. Possibly due to the lack of NO_x reservoir species such as PAN. Nevertheless, nitrate in the remote atmosphere is low ($<10 \text{ ng/m}^3$) so nitrate in the remote atmosphere is probably not a big concern.

ATom-1: BC



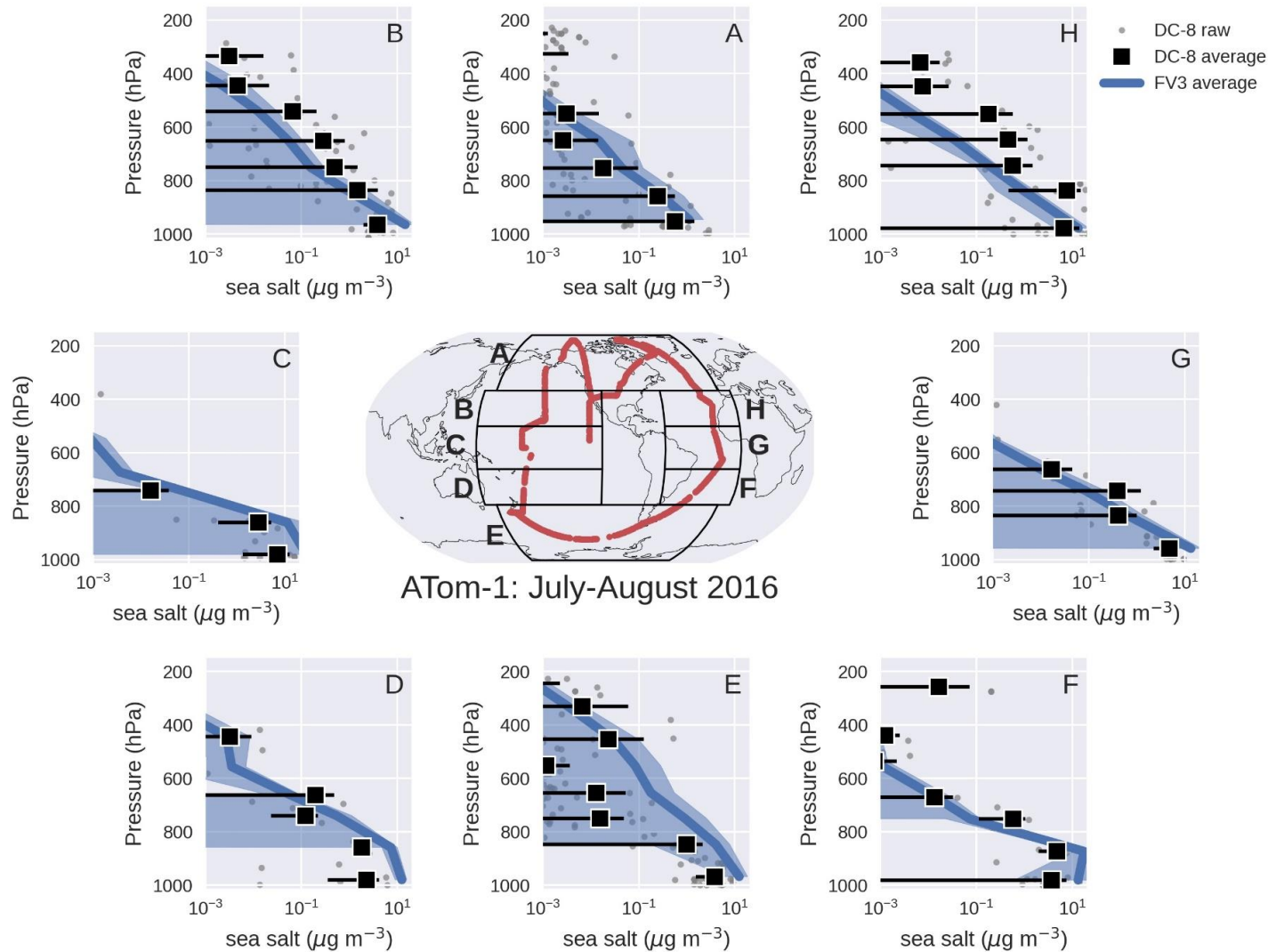
- BC vertical profile shape is remarkable! Previously BC was overestimated in the middle-upper troposphere, now this is largely improved.
- BC overestimated in the northern hemisphere (A, B).
- BC from African biomass burning plumes: appears to be underestimated now (G).

ATom-1: OC



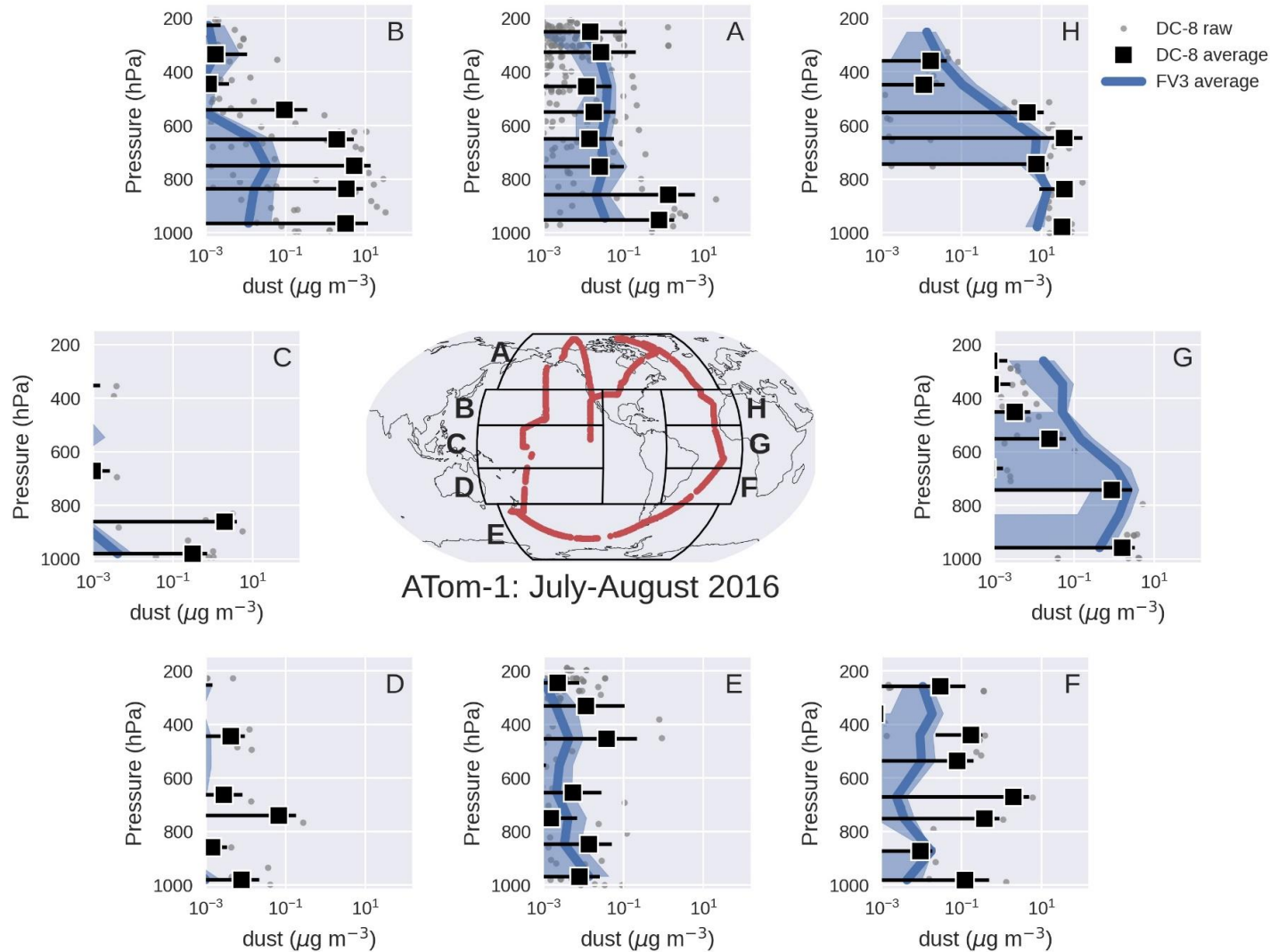
- OC overestimated in the northern hemisphere (A, B, H).
- BC from African biomass burning plumes: slightly overestimated (G). i.e. African biomass burning BC/OC ratio seems off.
- OC in the remote atmosphere: largely underestimated still, due to the lack of secondary production. This is a long-standing issue in FV3GFS and further stands out now.

ATom-1: sea salt



- Sea salt slightly overestimated near the surface (v2_na1). Note that in v1_na1 the near surface sea salt looks good.
- Sea salt vertical profiles over the subtropical Atlantic and Pacific (B, H) are off, but looks okay over the tropics (C, G). Not sure what to make of this. Check wet (dry) deposition?

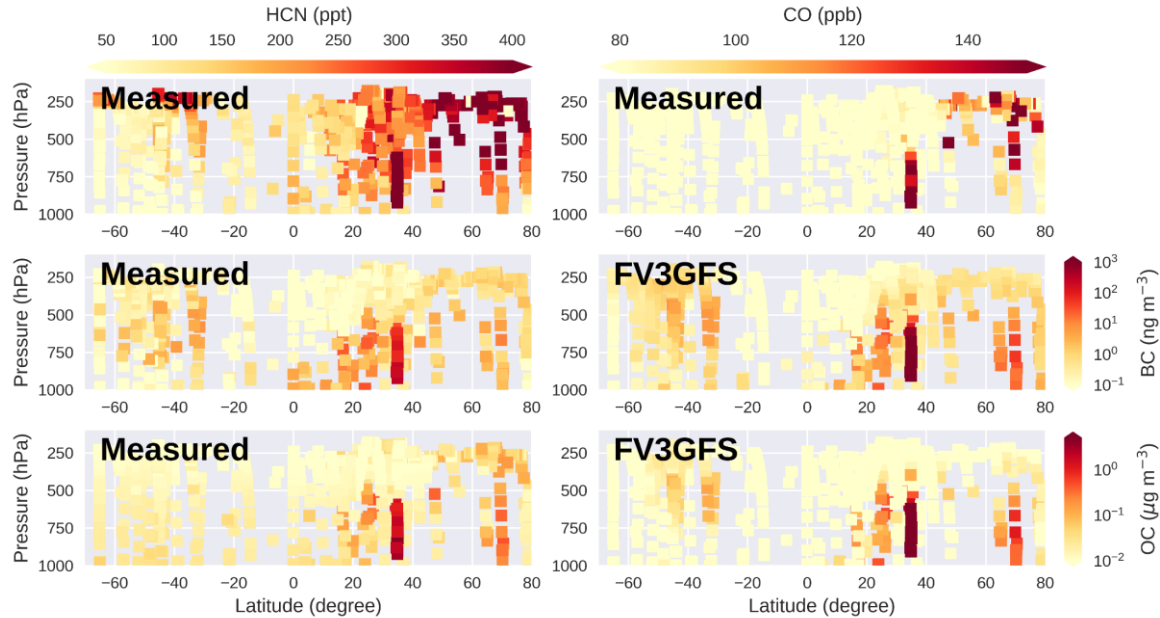
ATom-1: dust



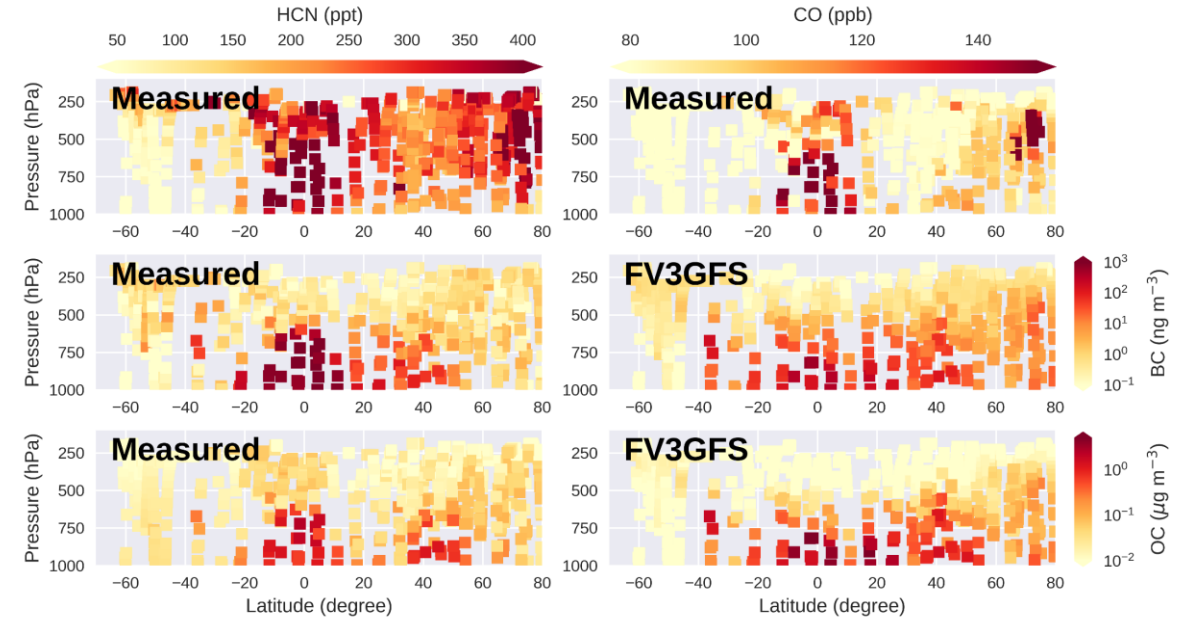
- Dust underestimated over the Pacific basin (A, B, C, D).
- Dust looks reasonable near the African source region (G) but overestimated in the middle-upper FT (G).
- Dust underestimated over the subtropical southern Atlantic (F) ← perhaps certain dust episodes not captured?

ATom-1 curtains: carbonaceous aerosols

ATom-1 (July-August 2016): Pacific curtains



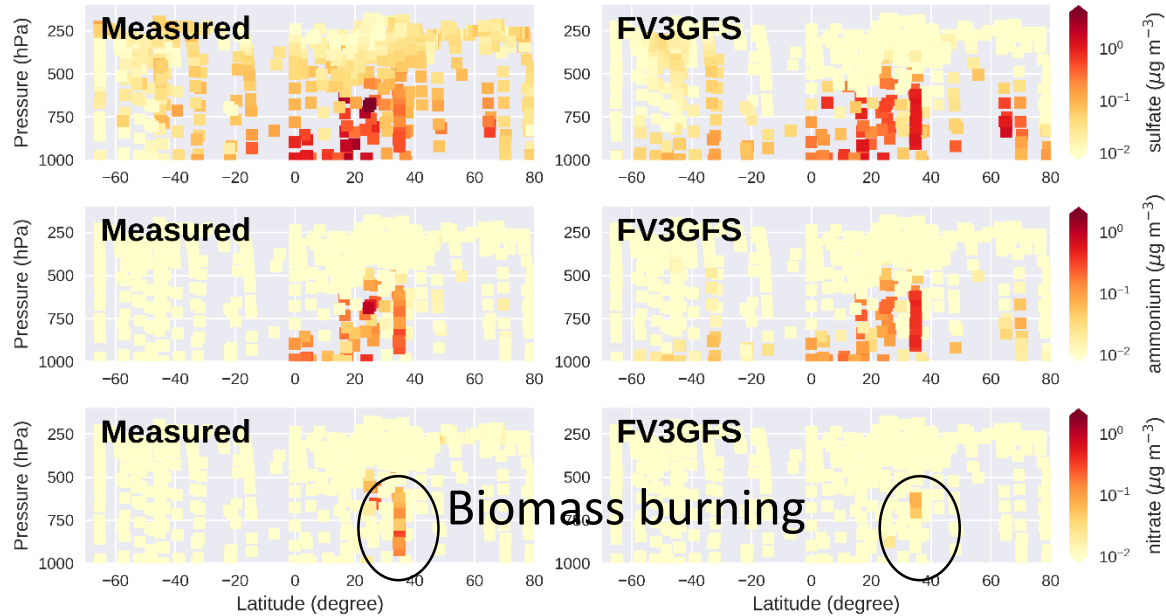
ATom-1 (July-August 2016): Atlantic curtains



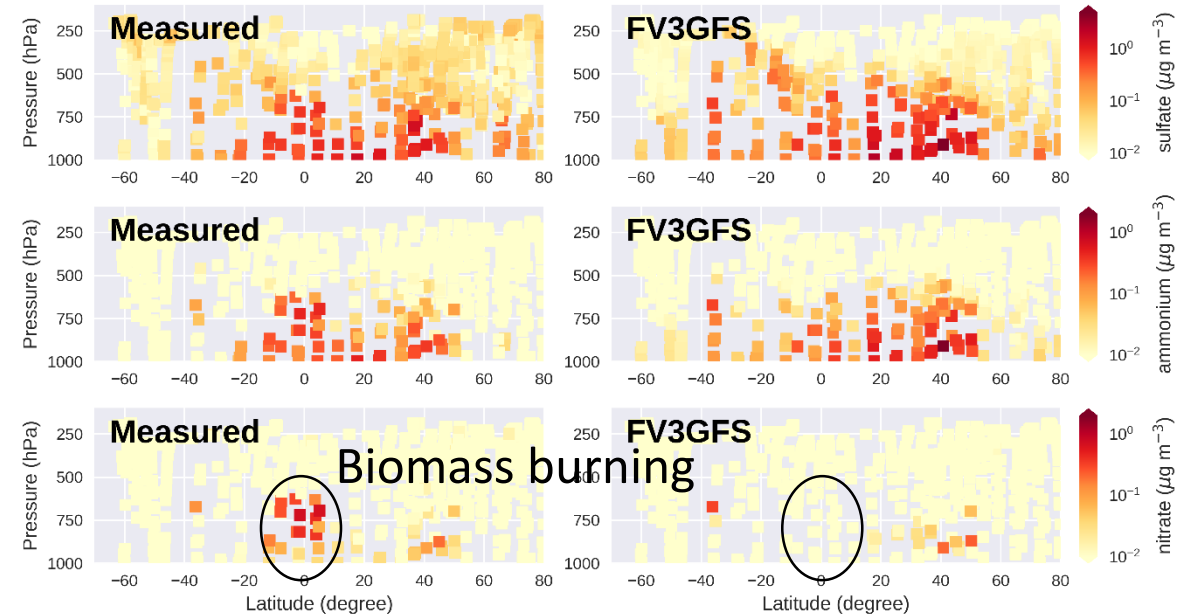
- Pacific: BC and OC both overestimated in biomass burning plumes (high HCN and high CO).
- Atlantic: BC underestimated in African biomass burning plumes but OC is overestimated. BC/OC ratio seems off.

ATom-1 curtains: sulfate + ammonium + nitrate

ATom-1 (July-August 2016): Pacific curtains

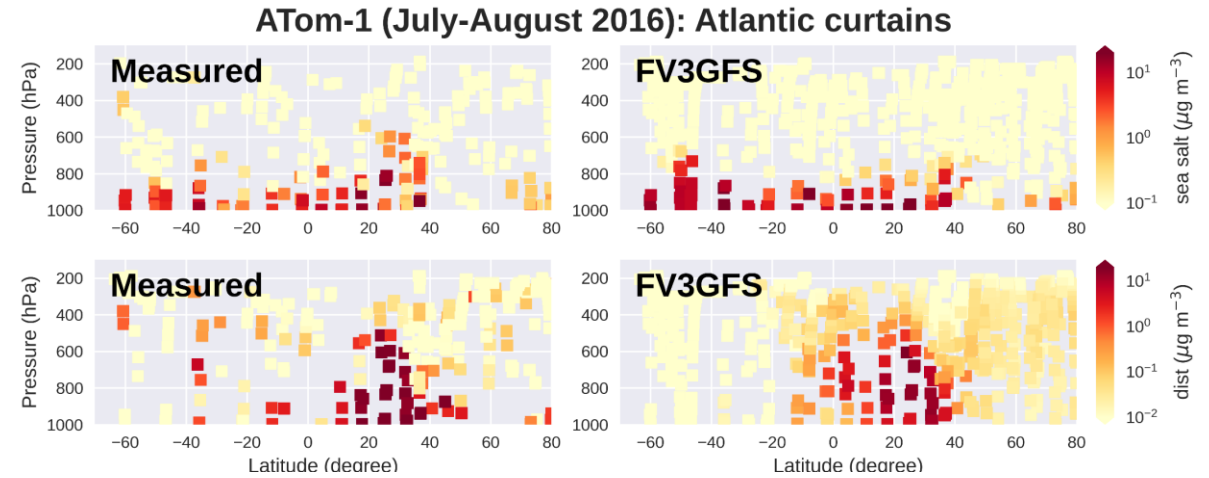
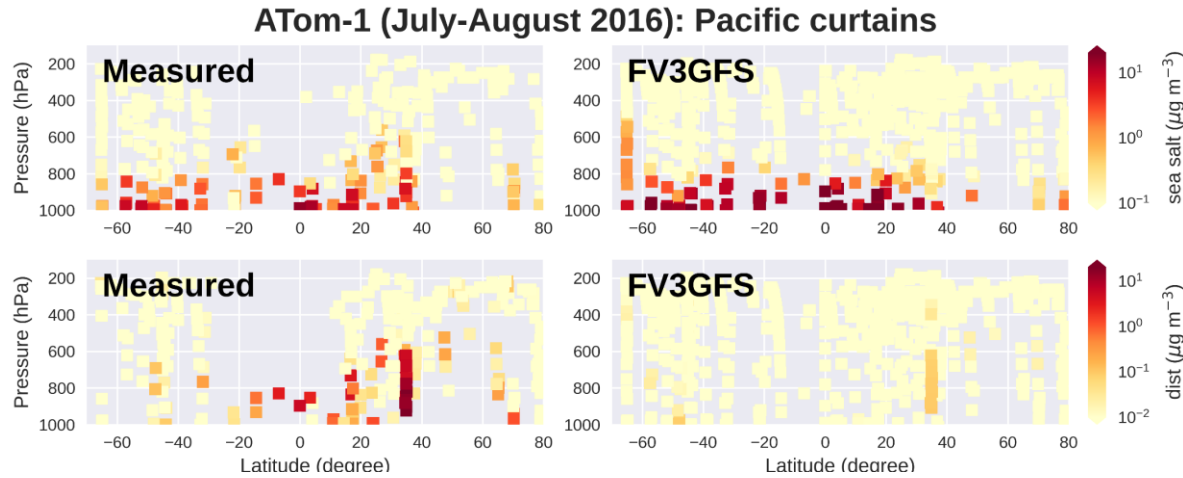


ATom-1 (July-August 2016): Atlantic curtains



- Pacific & Atlantic: sulfate underestimated in the remote atmosphere, but slightly overestimated near the source regions
- Pacific & Atlantic: ammonium is pretty good overall. Slightly overestimated near the source regions
- Pacific & Atlantic: nitrate is low in the model: missing NO_x reservoir species (e.g., PAN), also nitrate in biomass burning plumes is too low.

ATom-1 curtains: sea salt and dust



- Pacific & Atlantic: sea salt source strength seems a bit high.
- Dust: underestimated over the Pacific basin, but looks okay over the Atlantic basin.
- Dust transport & wet scavenging requires further attention.

ATom-1 summary

- Sulfate: natural process greatly improved in v2_na1, still too low. Anthropogenic sulfate biased high.
- Ammonium: pretty good. Anthropogenic ammonium overestimated.
- Nitrate: mostly underestimated due to the lack of NO_x reservoirs (e.g. PAN). Nitrate from biomass burning is too low.
- BC: wet scavenging greatly improved! Agreement in the middle-upper troposphere is great! Still, anthropogenic BC is overestimated but biomass burning BC seems too low.
- OC: overestimated in continental outflow & biomass burning plumes. Biomass burning BC/OC ratio seems off. Underestimated in the remote atmosphere due to the lack of secondary production.
- Sea salt: source strength seems high in v2_na1 but was good in v1_na1. Vertical profiles are off, suggesting issues in transport & wet scavenging.
- Dust: looks reasonable near the African source region but transport & wet scavenging need further tuning.