Supplementary Material

Figure and Tables

Figure S1. Wordcloud of the science themes based on the AAF-supported seven field campaign between 2013-2018.

Table S1. Information about the merged AAF data product.

Variables/ Input file names	Units	Instruments
aaf2dsh_c1[aaf2dsh.c1]		2-Dimensional Stereo Probe (2D-S) , H channel
twodsh_alt(time)	m	
twodsh_lat(time)	degree_N	
twodsh_lon(time)	degree_E	
twodsh_number_concentration(time, aaf2dsh_optical_diameter)	count/L/um	
twodsh_total_number_concentration(time)	count/L	
aaf2dsv_c1[aaf2dsv.c1]		2-Dimensional Stereo Probe (2D-S) , V channel
twodsv_alt(time)	m	
twodsv_lat(time)	degree_N	
twodsv_lon(time)	degree_E	
twodsv_number_concentration(time, aaf2dsv_optical_diameter)	count/L/um	
twodsv_total_number_concentration(time)	count/L	
aafams_b1[aafams.b1]		High-Resolution Time-of-flight Aeroso Mass Spectrometer (HR-ToF-AMS)
ams_CVI_enhancement_factor(time)	1	
ams_Chl(time)	ug/m^3	
ams_Chl_err(time)	ug/m^3	
ams_NH4(time)	ug/m^3	
ams_NH4_err(time)	ug/m^3	
ams_NO3(time)	ug/m^3	
ams_NO3_err(time)	ug/m^3	
ams_Org(time)	ug/m^3	
ams_Org_err(time)	ug/m^3	
ams_SO4(time)	ug/m^3	
ams_SO4_err(time)	ug/m^3	
ams_alt(time)	m	
ams_flag(time)	1	
ams_lat(time)	degree_N	
ams_lon(time)	degree_E	
aafccn2cola_b1[aafccn2cola.b1]		Dual-Column Cloud Condensation Nuclei Counter (CCN) , Column A
ccna_N_CCN(time)	1/cm^3	
ccna_P_sample(time)	hPa	
ccna_T_inlet(time)	degC	
ccna_T_sample(time)	degC	
ccna_alt(time)	m	
ccna_lat(time)	degree_N	
ccna_lon(time)	degree_E	
ccna_supersaturation_calculated(time)	%	

ccna_temp_unstable(time)	unitless	
aafccn2colb_b1[aafccn2colb.b1]		Dual-Column Cloud Condensation Nuclei Counter (CCN) , Column B
ccnb_N_CCN(time)	1/cm^3	
ccnb_P_sample(time)	hPa	
ccnb_T_inlet(time)	degC	
ccnb_T_sample(time)	degC	
ccnb_alt(time)	m	
ccnb_lat(time)	degree_N	
ccnb_lon(time)	degree_E	
ccnb_supersaturation_calculated(time)	%	
ccnb_temp_unstable(time)	unitless	
aafcpcfcvi_a1[aafcpcfcvi.a1]		Condensation Particle Counter (CPC), Model 3772, after CVI inlet, a1 level data
aafcpcfcvi_concentration(time)	1/cm^3	
aafcpcfcvi_b1[aafcpcfcvi.b1]		Condensation Particle Counter (CPC), Model 3772, after CVI inlet, b1 level data (preferred data if available)
cpcfcvi_alt(time)	m	
cpcfcvi_concentration(time)	1/cm^3	
cpcfcvi_lat(time)	degree_N	
cpcfcvi_lon(time)	degree_E	
aafcpcfiso_a1[aafcpcfiso.a1]		Condensation Particle Counter (CPC), Model 3772, after ISOK inlet, a1 level data
aafcpcfiso_concentration(time)	1/cm^3	
aafcpcfiso_b1[aafcpcfiso.b1]		Condensation Particle Counter (CPC), Model 3772, after ISOK inlet, b1 level data (preferred data if available)
cpcfiso_alt(time)	m	
cpcfiso_concentration(time)	1/cm^3	
cpcfiso_lat(time)	degree_N	
cpcfiso_lon(time)	degree_E	
aafcpcu_a1[aafcpcu.a1]		Ultrafine Condensation Particle Counter (UCPC), Model 3025A, after ISOK inlet, a1 level data
aafcpcu_concentration(time)	1/cm^3	
aafcpcu_b1[aafcpcu.b1]		Ultrafine Condensation Particle Counter (UCPC), Model 3025A, after ISOK inlet, b1 level data (preferred data if available)
cpcu_alt(time)	m	
cpcu_concentration(time)	1/cm^3	
cpcu_lat(time)	degree_N	
cpcu_lon(time)	degree_E	
aaffcdp_c1[aaffcdp.c1]		Fast-Cloud Droplet Probe (F-CDP)
fcdp_alt(time)	m	
fcdp_lat(time)	degree_N	
fcdp_lon(time)	degree_E	
fcdp_number_concentration(time, aaffcdp_optical_diameter)	count/L/um	
fcdp_total_number_concentration(time)	count/L	
aaffims_b1[aaffims.b1]		

fims_alt(time)	m	Fast Integrated Mobility Spectrometer (FIMS)
fims_geometric_diameter_bounds(fims_geometric_diameter, bound)	nm	
fims_heated_flag(time)	1	
fims_lat(time)	degree_N	
fims_lon(time)	degree_E	
fims_number_concentration(time, fims_geometric_diameter)	1/cm^3	
fims_pressure(time)	hPa	
fims_temperature(time)	degC	
aafhvps_c1[aafhvps.c1]		High Volume Precipitation Spectrometer Version 3 (HVPS-3)
hvps_alt(time)	m	
hvps_lat(time)	degree_N	
hvps_lon(time)	degree_E	
hvps_number_concentration(time, aafhvps_optical_diameter)	count/L/um	
hvps_total_number_concentration(time)	count/L	
aafinletcvi_c1[aafinletcvi.c1]		Counterflow Virtual Impactor (CVI) Inlet
inletcvi_alt(time)	m	
inletcvi_cvi_cut_size(time)	um	
inletcvi_enhancement_factor(time)	1	
inletcvi_inlet_dilution_factor(time)	1	
inletcvi_inlet_selector(time)	1	
inletcvi_lat(time)	degree_N	
inletcvi_lon(time)	degree_E	
aafinletisok_a1[aafinletisok.a1]		Aerosol Isokinetic Inlet
inletisok_cabin_temperature(time)	degC	
inletisok_pressure_isok_inlet(time)	hPa	
inletisok_relative_humidity_isok_inlet(time)	%	
inletisok_temperature_isok_inlet(time)	degC	
aafmergedaerosolsd_c1[aafmergedaerosolsd.c1]		Merged aerosol size distribution (prefered)
aerosolsd_alt(time)	m	
aerosolsd_cas_flag(time)	1	
aerosolsd_cloud_flag(time)	1	
aerosolsd_cvi_flag(time)	1	
aerosolsd_fcdp_flag(time)	1	
aerosolsd_fims_flag(time)	1	
aerosolsd_geometric_diameter_bounds(merged_optical_diameter, bound)	nm	
aerosolsd_lat(time)	degree_N	

aerosolsd_lon(time)	degree_E	
aerosolsd_number_concentration(time, merged_geometric_diameter)	1/cm^3	
aerosolsd_optical_diameter_bounds(merged_geometric_diameter, bound)	um	
aerosolsd_pcasp_flag(time)	1	
aafmergedcldsd_c1[aafmergedcldsd.c1]		Merged cloud size distribution (prefered)
cldsd_alt(time)	m	
cldsd_lat(time)	degree_N	
cldsd_lon(time)	degree_E	
cldsd_number_concentration(time, cldsd_optical_diameter)	count/L/um	
cldsd_optical_diameter_bounds(cldsd_optical_diameter, bound)	um	
cldsd_total_number_concentration(time)	count/L	
aafnaviwg_c1[aafnaviwg.c1]		Multiple sensors from the atmospheric state and aircraft state session in Table 2
alt(time)	m	
ambient_temp(time)	degC	
angle_of_attack(time)	degree	
cabin_pressure(time)	hPa	
cabin_temperature(time)	degC	
dewpoint_temperature(time)	degC	
dynamic_pressure(time)	hPa	
ground_speed(time)	m/s	
indicated_airspeed(time)	m/s	
lat(time)	degree_N	
leg_number(time)	unitless	
lon(time)	degree_E	
pitch(time)	degree	
potential_temperature(time)	degC	
press_alt(time)	m	
qc_flag(time)	unitless	
radar_alt(time)	m	
relative_humidity_ice(time)	%	
relative_humidity_water(time)	%	
roll(time)	degree	
side_slip(time)	degree	
solar_zenith_ground(time)	degree	
static_pressure(time)	hPa	
sun_azimuth_aircraft(time)	degree	
sun_azimuth_ground(time)	degree	

sun_elev_aircraft(time)	degree	
total_temp(time)	degC	
true_airspeed(time)	m/s	
true_heading(time)	degree	
vert_wind_speed(time)	m/s	
vertical_velocity(time)	m/s	
wgs_alt(time)	m	
wind_direction(time)	degree	
wind_speed(time)	m/s	
aafneph_b1[aafneph.b1]		3-Wavelength Integrating Nephelometer, Model 3563
neph_Bbs_B(time)	1/Mm	
neph_Bbs_G(time)	1/Mm	
neph_Bbs_R(time)	1/Mm	
neph_Bs_B(time)	1/Mm	
neph_Bs_G(time)	1/Mm	
neph_Bs_R(time)	1/Mm	
neph_P_sample(time)	hPa	
neph_RH_sample(time)	%	
neph_T_inlet(time)	degC	
neph_T_sample(time)	degC	
aafo3_c1[aafo3.c1]		O3 - Model 49i
o3_alt(time)	m	
o3_lat(time)	degree_N	
o3_lon(time)	degree_E	
o3_o3(time)	ppbv	
aafpcasp_a1[aafpcasp.a1]		Passive Cavity Aerosol Spectrometer-100X (PCASP)
pcasp_sample_flow_rate(time)	cm^3/s	
pcasp_sheath_flow_rate(time)	cm^3/s	
pcasp_size_distribution(time, aafpcasp_optical_diameter)	count/s	
aafpsap1s_b1[aafpsap1s.b1]		3-Wavelength Particle Soot/Absorption Photometer (PSAP)
psap_Ba_B_Weiss(time)	1/Mm	
psap_Ba_B_raw(time)	1/Mm	
psap_Ba_G_Weiss(time)	1/Mm	
psap_Ba_G_raw(time)	1/Mm	
psap_Ba_R_Weiss(time)	1/Mm	
psap_Ba_R_raw(time)	1/Mm	
psap_alt(time)	m	
psap_lat(time)	degree_N	
psap_lon(time)	degree_E	
aafso2_c1[aafso2.c1]		SO2 - Model 43i

so2_alt(time)	m	
so2_lat(time)	degree_N	
so2_lon(time)	degree_E	
so2_so2(time)		
aafsp2rbc10s_c1[aafsp2rbc10s.c1]		Single Particle Soot Photometer (SP2)
sp2_N_dN_rBC(time, diameter_geo)	count/cm^3	
sp2_alt(time)	m	
sp2_diameter_geo_bounds(diameter_geo, bound)	um	
sp2_lat(time)	degree_N	
sp2_lon(time)	degree_E	
sp2_rBC(time)		
aafuhsas_a1[aafuhsas.a1]		Ultra-High Sensitivity Aerosol Spectrometer (UHSAS)
uhsas_flow(time)	cc/min	
uhsas_lower_size_limit(bin_number)	nm	
uhsas_sample_flow_rate(time)	cc/min	
uhsas_sample_pressure(time)	kPa	
uhsas_sheath_flow(time)	cc/min	
uhsas_size_distribution(time, bin_number)	count	

Table S2. Information of the data availability for each field campaign (green: data available; yellow: N/A).

Measurement	datastream	CACTI	ACE-ENA	HI-SCALE	ACAPEX	ACME-V	GoAmazon	BBOP
Meteorology	aafnaviwg.c1							
	aafdewpoint.a1							
Cloud	aaf2dsh.c1							N/A
	aaf2dsv.c1							N/A
	aaffcdp.c1							N/A
	aafhvps.c1							N/A
	aafmergedaerosolsd.c1				N/A	N/A	N/A	N/A
Aerosol	aafccn2cola.b1							
	aafccn2colb.b1							
	aafinletcvi.c1					N/A	N/A	N/A
	aafinletisok.a1					N/A	N/A	N/A
	aafcpcfcvi.b1							
	aafcpcfiso.b1							
	aafcpcu.b1							
	aafneph.b1			N/A				
	aafpsap.b1			N/A				
	aafuhsas.a1		N/A					

	aafpcasp.a1							
	aaffims.b1							
	aafmergedcldsd.c1				N/A	N/A	N/A	N/A
	aafams.b1				N/A	N/A		N/A
Trace gas	aafso2.a1				N/A	N/A		
	aafco.a1	N/A						
	aafnox.a1	N/A		N/A	N/A	N/A		
	aafo3.a1					N/A		
	aafsp2rbc10s.c1			N/A				

Table S3. A reference table of ARM primary measurements conresponding to the CF standard names.

Primary measurements	**CF standard name**
twodsh_total_number_concentration	number_concentration_of_cloud_liquid_water_particles_in_air
twodsv_total_number_concentration	number_concentration_of_cloud_liquid_water_particles_in_air
ams_Chl	mass_concentration_of_chlorine_dry_aerosol_particles_in_air
ams_NH4	mass_concentration_of_ammonium_dry_aerosol_particles_in_air
ams_Org	mass_concentration_of_particulate_organic_matter_dry_aerosol_particles_in_air
ams_SO4	mass_concentration_of_sulfate_ambient_aerosol_particles_in_air
ams_NO3	mass_concentration_of_nitrate_dry_aerosol_particles_in_air
ccna_N_CCN	number_concentration_of_cloud_condensation_nuclei_in_air
ccnb_N_CCN	number_concentration_of_cloud_condensation_nuclei_in_air
cpcfcvi_concentration	number_concentration_of_aerosol_particles_in_air
cpcfiso_concentration	number_concentration_of_aerosol_particles_in_air
cpcu_concentration	number_concentration_of_aerosol_particles_in_air
fcdp_total)number_concentration	number_concentration_of_cloud_liquid_water_particles_in_air
fims_number_concentration	number_size_distribution_of_aerosol_particles_in_air
hvps_total_number_concentration	number_concentration_of_cloud_liquid_water_particles_in_air
aerosolsd_number_concentration	atmosphere_number_content_of_aerosol_particles
cldsd_number_concentration	number_concentration_of_cloud_liquid_water_particles_in_air
alt	altitude
ambient_temp	air_temperature
dewpoint_temperature	dew_point_temperature
lat	latitude
lon	longitude
pitch	platform_pitch
press_alt	barometric_altitude
relative_humidity_water	relative_humidity
roll	platform_roll

static_pressure	air_pressure
vert_wind_speed	wind_speed
wind_direction	wind_from_direction
wind_speed	wind_speed
neph_Bbs_B	volume_backwards_scattering_coefficient_in_air_due_to_dried_aerosol_particles
neph_Bbs_G	volume_backwards_scattering_coefficient_in_air_due_to_dried_aerosol_particles
neph_Bbs_R	volume_backwards_scattering_coefficient_in_air_due_to_dried_aerosol_particles
neph_Bs_B	volume_scattering_coefficient_of_radiative_flux_in_air_due_to_ambient_aerosol_particles
neph_Bs_G	volume_scattering_coefficient_of_radiative_flux_in_air_due_to_ambient_aerosol_particles
neph_Bs_R	volume_scattering_coefficient_of_radiative_flux_in_air_due_to_ambient_aerosol_particles
o3	atmosphere_mass_content_of_ozone
psap_Ba_B_Weiss	mass_concentration_of_absorption_equivalent_black_carbon_of_dry_aerosol_particles_in_air
psap_Ba_G_Weiss	mass_concentration_of_absorption_equivalent_black_carbon_of_dry_aerosol_particles_in_air
psap_Ba_R_Weiss	mass_concentration_of_absorption_equivalent_black_carbon_of_dry_aerosol_particles_in_air
so2	atmosphere_mass_content_of_sulfur_dioxide
sp2_rBC	mass_concentration_of_absorption_equivalent_black_carbon_of_dry_aerosol_particles_in_air
uhsas_size_distribution	number_size_distribution_of_aerosol_particles_in_air

Description of a quickplot script

Users can open and review the data using Panoply, as show in Figure S2.

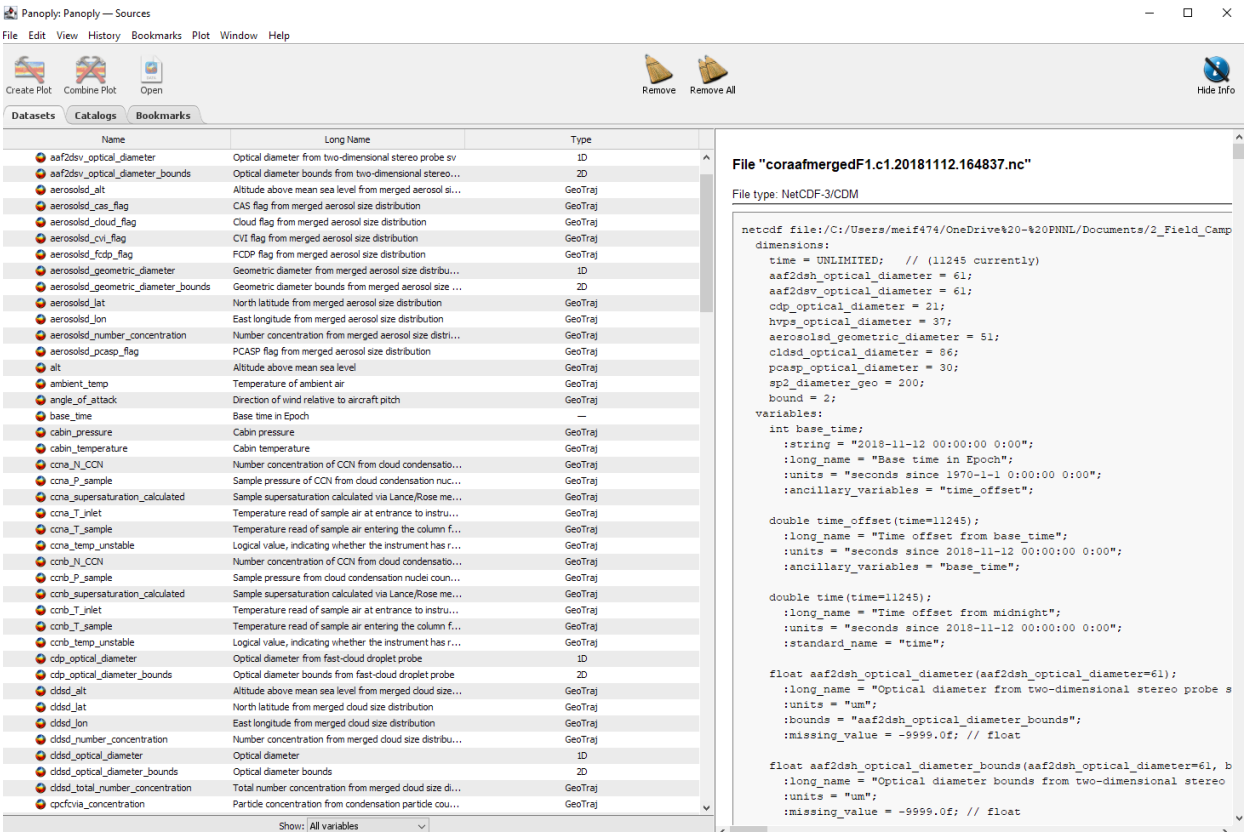

Figure S2. A screenshot of using Panoply to open this netCDF data.

A plotting script has been developed to create quicklook plots (as shown in Fig. S3) for 1D variables. User can request that script by contacting the authors. This script requires 3 input arguments: the directory where input files are located, the name of the input file or a substring to pattern match to identify more than one input file, and a list of all variables to plot.

One example for plotting the variables “twodsv_total_number_concentration and vert_wind_speed” for all files in 2018 is below. It assumes the user has setup and activated the aafmerged_plot conda environment. Please contact authors if you need help to set up conda environment.

python3 plot_aafmerged.py -d /data/vap/gaustad/aafmerged/datastream/cor/coraafmergedF1.c1/ -f coraafmergedF1.c1.20181 -v twodsv_total_number_concentration vert_wind_speed

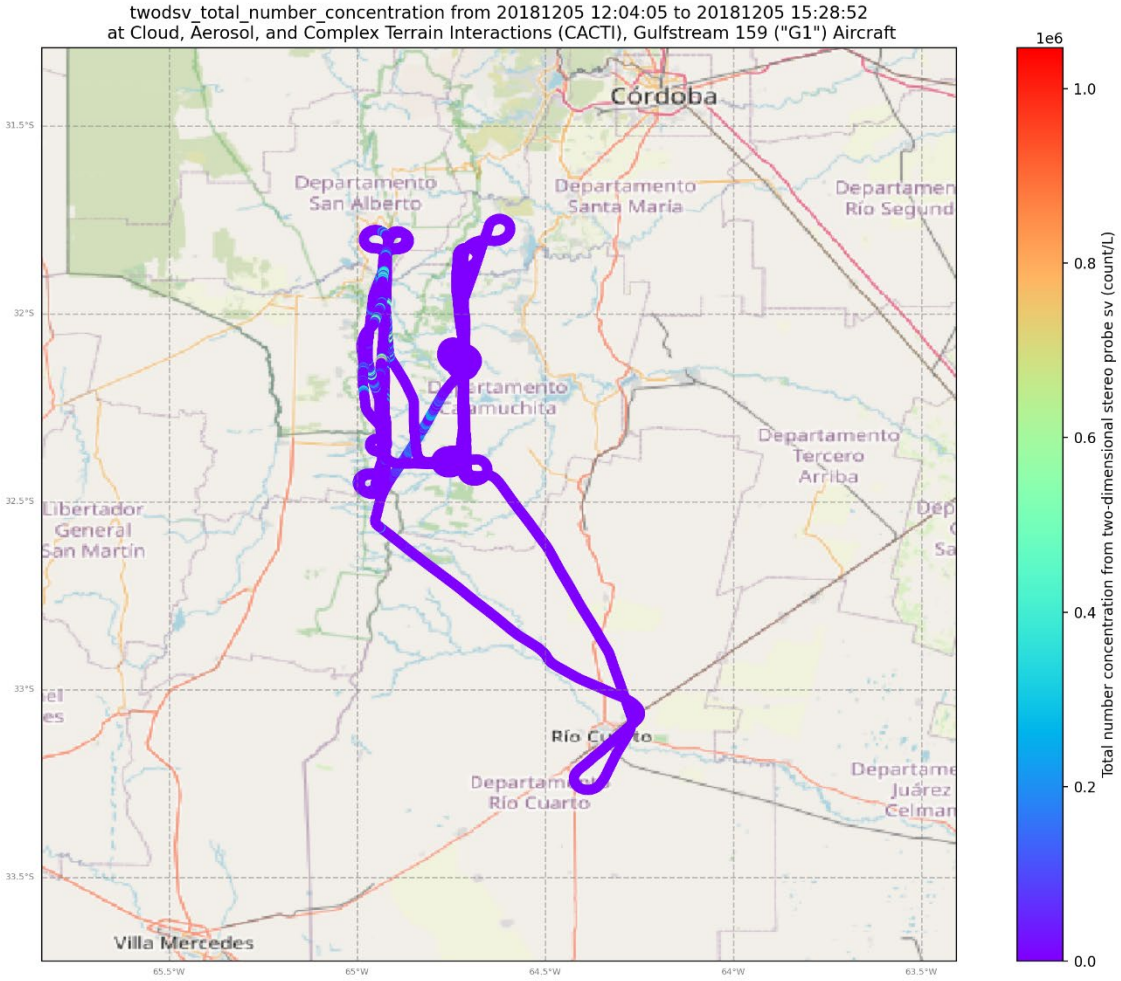

Figure S3. An example quicklook plot.