

CLIMATE RESEARCH FACILITY

Aircraft measurements during GoAmazon2014/5 – G1 and HALO inter-comparison





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Introduction

- Large aerosol variability pristine background and smoky and urban polluted plumes.
- Clouds and precipitation over the Amazon region have very large susceptibility to aerosols: warm cloud base and humid conditions – thermodynamic invigoration
- The GoAmazon2014 IOPs obtained unique datasets in chemistry, aerosols and clouds for studying how the anthropogenic plumes from Manaus impact aerosol formation and properties at the downwind areas and then impact cloud and convection.

Objectives

- Evolution and interaction of Manaus plume and biogenic aerosols
- Remote sensing validation
- Aerosol Cloud Interactions
- Explore how Manaus plumes impact aerosol properties in the downwind areas and how changed aerosols impact convection, clouds and precipitation in the influenced area

GoAmazon2014/5 (IARA/ACRDICON-CHUVA)

- Location: Manaus, Brazil
 - Manaus Eduardo Gomes, SBEG, Runway 8,858 ft × 148 ft
- G1 Aircraft Mission Dates
 - IOP1: 40 days. Feb. 15 March 26, 2014 (16 flights 42.8 hrs)
 - IOP2: 40 days. Sep. 1 Oct. 10, 2014 (19 flights 53.7 hrs)
- HALO Aircraft Mission Dates
 - Sep. 1 Oct. 4 , 2014 (14 flights 96 hrs)





G1 and **HALO** Coordinated flights



Sep. 9, 2014



Sep. 21, 2014



Sep. 16, 2014



Oct. 1 , 2014

G1 and HALO coordinated flight on Sep. 21, 2014 (AC 14)







HALO Flight

L5

4

-60



Vertical profiles of ambient Temperature, RH_w and Pressure



- G1 and HALO measurements inter-comparison criteria:
 - Sampling at the similar altitude layer (< 5000 m)
 - Sampling time difference less than 30 mins
 - Under STP condition

Vertical profiles of particle number concentration by CPC and UHSAS





Difference between HALO and G1 is about 20-30%

Vertical profiles of aerosol size distribution



- G1 UHSAS valid size range is from 70 -700 nm.
- At high concentration, G1 UHSAS seemed to underestimate the number concentration.

Vertical profiles of aerosol number concentration



Vertical profile of CCN activation fraction (SS= 0.25%)





AMS data inter-comparison between G1 and T3



CCN closure using G1 UHSAS Size Distribution

Assumption:

- Using bulk aerosol chemical properties.
- The κ_{Org} is estimated from O:C ratio. (Mei et al. ACP, 2013)



- Underestimation of CCN number concentration for both experiment SS.
- Underestimation of CCN happened at lower altitude/higher concentration.

CCN closure using G1 FIMS Size Distribution



- Organic aerosols in Amazon may have different hygroscopicities than those we regular observed in US.
- The aerosol hygroscopicity is more uniform in higher altitude.

Vertical profiles of Trace Gas Concentrations



Vertical transport sustains aerosol concentration in BL



The coordinated flight on Sep. 9, 2014 (AC 08)



G1 and HALO coordinated flight on Sep. 9, 2014 (AC 08)

G1 Flight

HALO Flight



Vertical profiles of particle number concentration by CPC and UHSAS



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Vertical profiles of aerosol number concentration



Vertical transport may contribute to BL aerosol concentration near Manaus city



Vertical profiles of organic aerosol concentration



Validation of HR-Tof-AMS measurement in G1





UHSAS and **PCASP** issues



Cloud probe inter-comparison



- Based on the inter-comparison results, G1 and HALO measurements are in a good agreement.
 - > Atmospheric state parameters
 - > Aerosol properties from CPCs, UHSAS

Ozone and CO concentrations

Chemical composition between G1 and T3 site

- Need further investigation
 - > UHSAS: Size dependent counting efficiency
 - Discrepancy between UHSAS and FIMS at high number concentration
 - Chemical composition from HALO
 - ➤ Gas phase concentration for NO and NOx.
 - Cloud probe: CIP

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Sep. 9, 2014, LWC comparison



Sep. 21, 2014, LWC comparison



Vertical profiles of aerosol number concentration





March 17, 2014 G1 Flight

CPC concentrations

- Manaus: Leg0, Leg0r. Leg 1 (r: denotes return path).
- T3: Leg 4
- Phase 1: mostly clear-sky at 500 m altitude
- Phase 2: mostly cloudy around 1 km altitude



Phase 1 UHSAS clear-sky

Phase 2 UHSAS clear-sky



• Plume has 2-3 times higher aerosols than background



• Storm clouds were coincident with plume well. Clean cloud samples are only a few and they are not part of storm clouds