ATom-4 Flight 04 2018-05-01 Kona to Fiji

DC-8 preparing to leave Hawaii
R Commane photo

ATom-4 Flight 04 departed Kona at 18:55:21. UTC on 2018-05-01.

The preflight was very warm. Quite a few instruments (CIT-CIMS, QCLS, PANTHER, possibly Picarro), had lower quality data at the start of this flight. The cabin did not cool down quickly, so the instruments came back to nominal performance slowly (one hour or more in some cases).

We initiated some modifications to the flight plan. In order to compensate for a higher payload weight, we specified 2000 feet-per-minute climb from the bottom of the dives. This rate was normal in ATom-1,2 but had been lowered to 1500 in ATom-3.

We also adjusted the route to cut across the streamlines as directly as we could, which brought the track to be nearly direct Kona – Nadi. These two adjustments gave us excellent cross sections of the mid-Pacific deep tropics. Operationally, it gave us maximum flexibility to make our way through the intense SPCZ setup north of Fiji. We ended up dodging storms that topped out over 50 kft. Dave and Nils were amazing dong this part, aided by the really outstanding met support from NOAA on the ground and Karen on the plane.

With a lot of cloud during that transit, we experienced an acrid odor traced to the ACM, which runs very hot in ATom due to the VPMs (identified by Lorenzo). It was an interesting 30 min on the DC8.

Notable features of this flight included a flux leg with excellent conditions, possibly inverted $CHBr_3$ concentrations compared to expectations on the stacked legs (more aloft).

Large areas with apparent new particle formation were observed.

There was no sharp gradient denoting the ITCZ. Instead the air gradually transition from N to S H air, between the N. subtropical front and the SPCZ. The air was all funneling into the very large convective area downstream to the West.

In flight notes:

We observed a small enhancement in SO_2 (volcanic?) on departure.

Amy reported an ash cloud sigmet just after we left. We polled all the aerosol teams and nobody had any evidence of ash.

Really beautiful tracer images of the MBL, cloud detrainment layer, and trade wind inversion on dip #1. Both down and up ! High CO, CO_2, and SP2 in the MBL.

2nd dip also, but more continuous, less obvious that we have a strong detrainment layer, a shoulder, but almost bottom-to-top (29 kft) well mixed.

Dip 3 was different; the high CO and CH_4 signals in the MBL are gone. We are leaving the NH.

New particle formation for 450 mb and higher (!) after Dip 1 and Dip 2.

Getting into convection after dip 3 .

Received information re sigmet for convection NE of Fiji. Thought we would need detour.

More new particle formation 500 mb climbing after dip 3.

At the high point #4: record clean air, 5 nm particles only, all other particles really low CO= 60 ppb, quite low for NH. Finally we found clean air in the N. Pacific... ; the transition to cleaner air in the MBL occurred around 11 N, looks to be about where it was predicted

Pushed flux legs to dip 5 due to showers in the area of dip 4.

Dip 4: CO, CO_2, CH_4 nearly well mixed top to bottom! O3 -> 10 ppb.
No sign of pollutants...but there is plenty of excess $CHBr_3$.

Dip 5 will be flux legs at 500, 1200 and 1800 feet; cloud base at 2000 feet.
Wind speed 7 m/s, tiny BLQ
DMS, O_3, and H_2O vertical gradients were readily measurable through the stack.
$CHBr_3$ gradient opposite of expectations ...$CHBr_3$ looks like a sink(!) (or advection in the upper MBL) and O3 like a source at the bottom. Maybe inverted gradient also for benzene.

Starting at 4 S Lat, getting stronger as we go to 10 S: CO profiles are now inverted, with higher concentrations above. Sources aloft from
Asia according to the chem forecast. CH_4, benzene, acetonitrile, etc profiles are also inverted. All of this, familiar for the S Tropics. NH air is mixed in aloft.

Implies we are seeing a mix of NH and SH air, processed through deep convection to remove aerosols

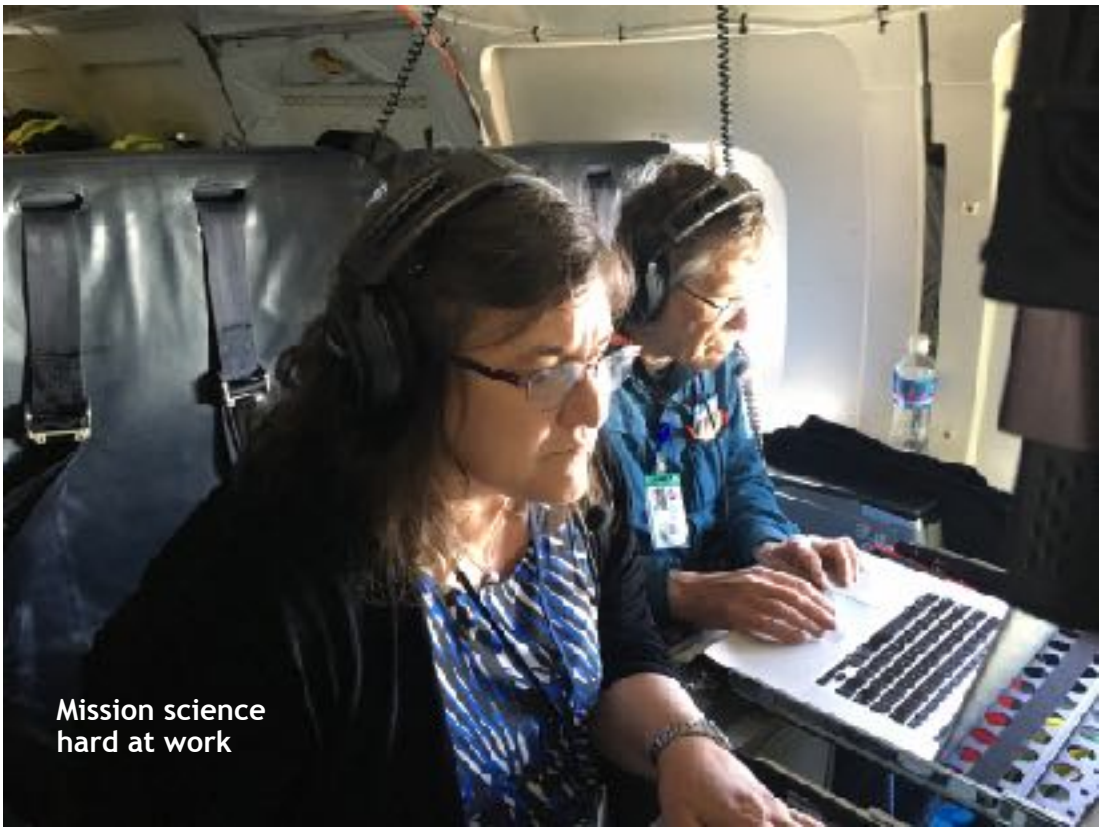
The SO_2 down low seems like it has a marine origin (DMS?)

very strong convection in the SPCZ all just N of Fiji, extensive. (as noted above)


Convection 4N


Arriving Fiji


Cloud Streets
9S, 169.6 W



Mission science
hard at work

Landing path
took us over Fiji