Measurements of OH, H_2SO_4, MSA, HO_2, and HO_2+RO_2, aboard the C-130 for PASE

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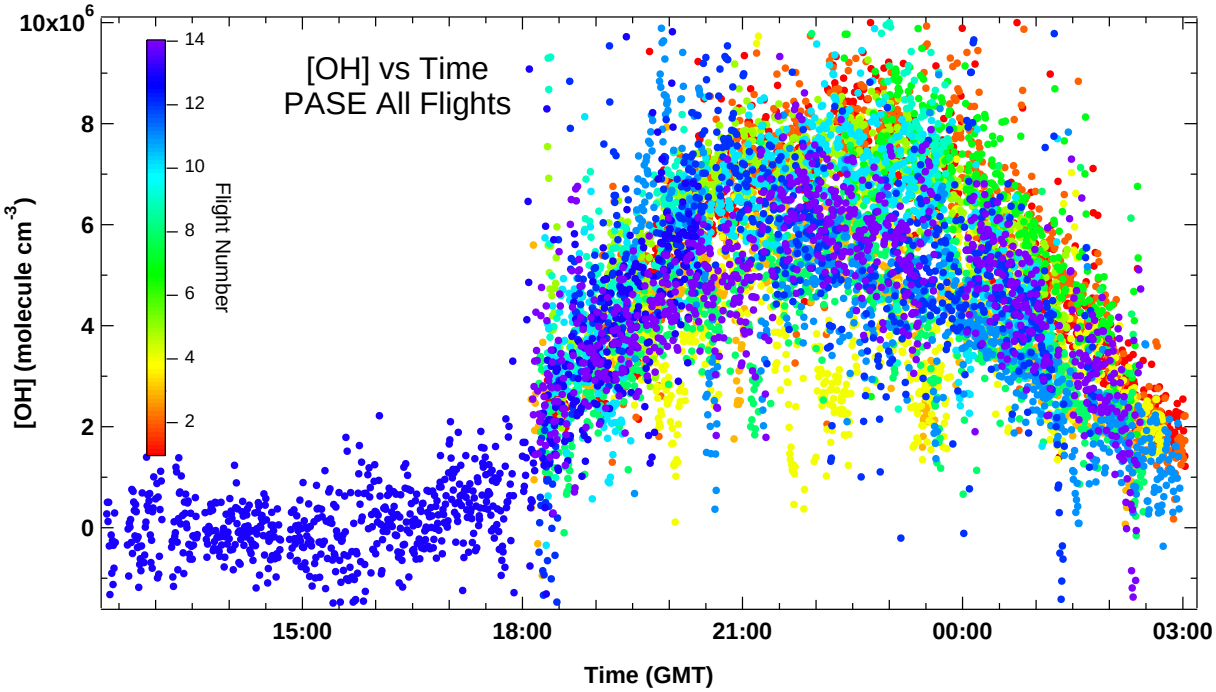
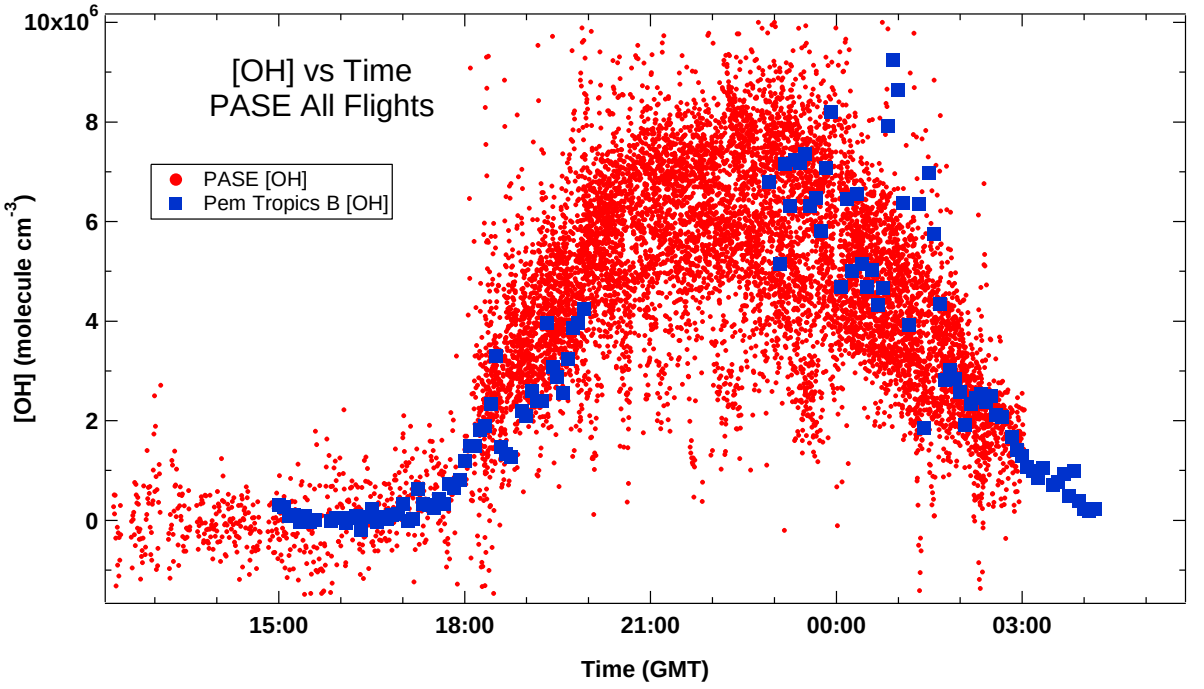
Foundation
re Discoveries Begin

PASE HOx Measurements and Modeling

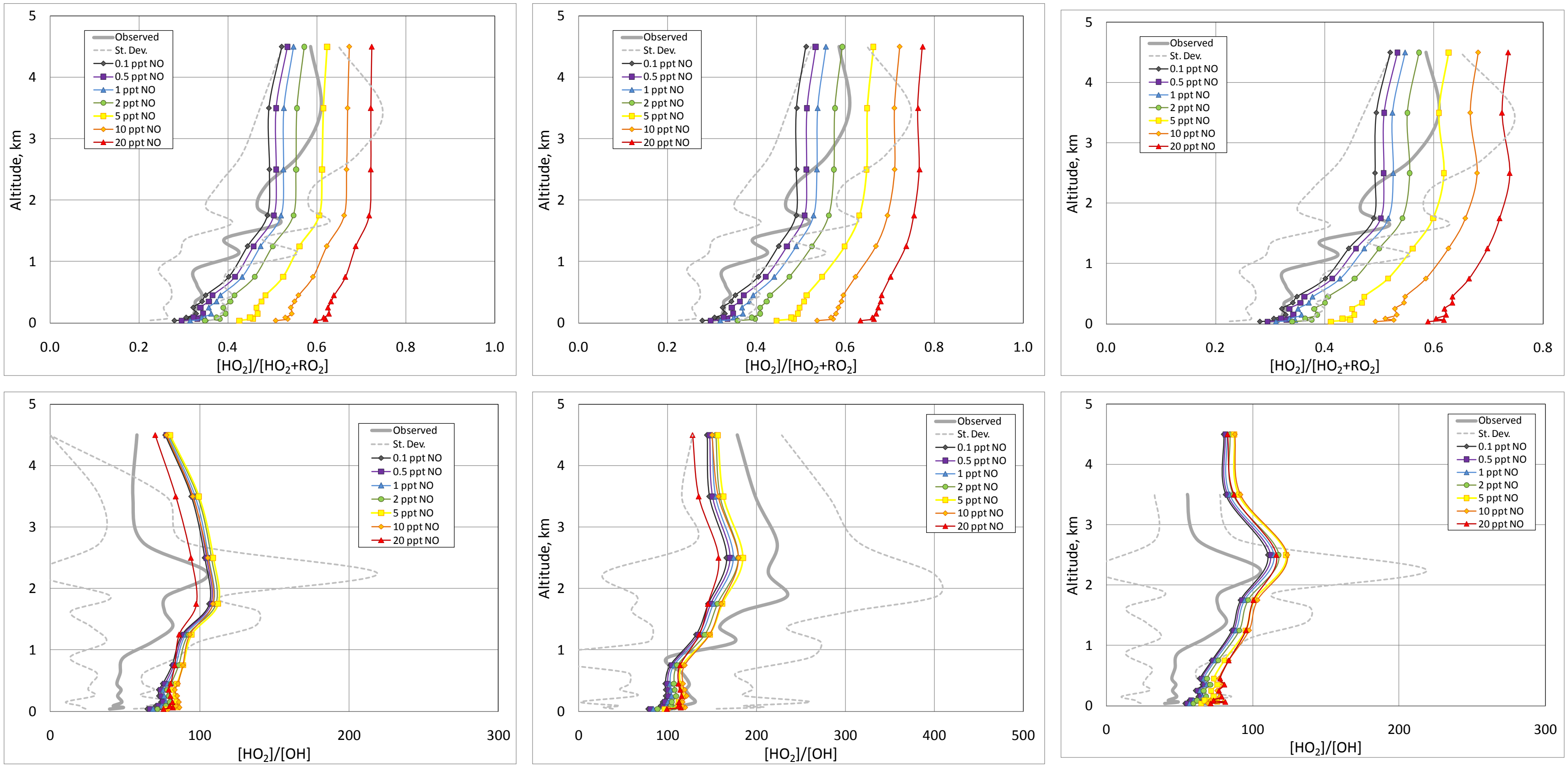

[OH] vs Time
PASE All Flights
10x10^6
[OH] (molecule cm^-3)
Flight Number
14
12
10
8
6
4
2
0
2
4
6
8
15:00
18:00
21:00
00:00
03:00
Time (GMT)


[OH] vs Time
PASE All Flights
10x10^6
[OH] (molecule cm^-3)
PASE [OH]
Pem Tropics B [OH]
0
2
4
6
8
15:00
18:00
21:00
00:00
03:00
Time (GMT)

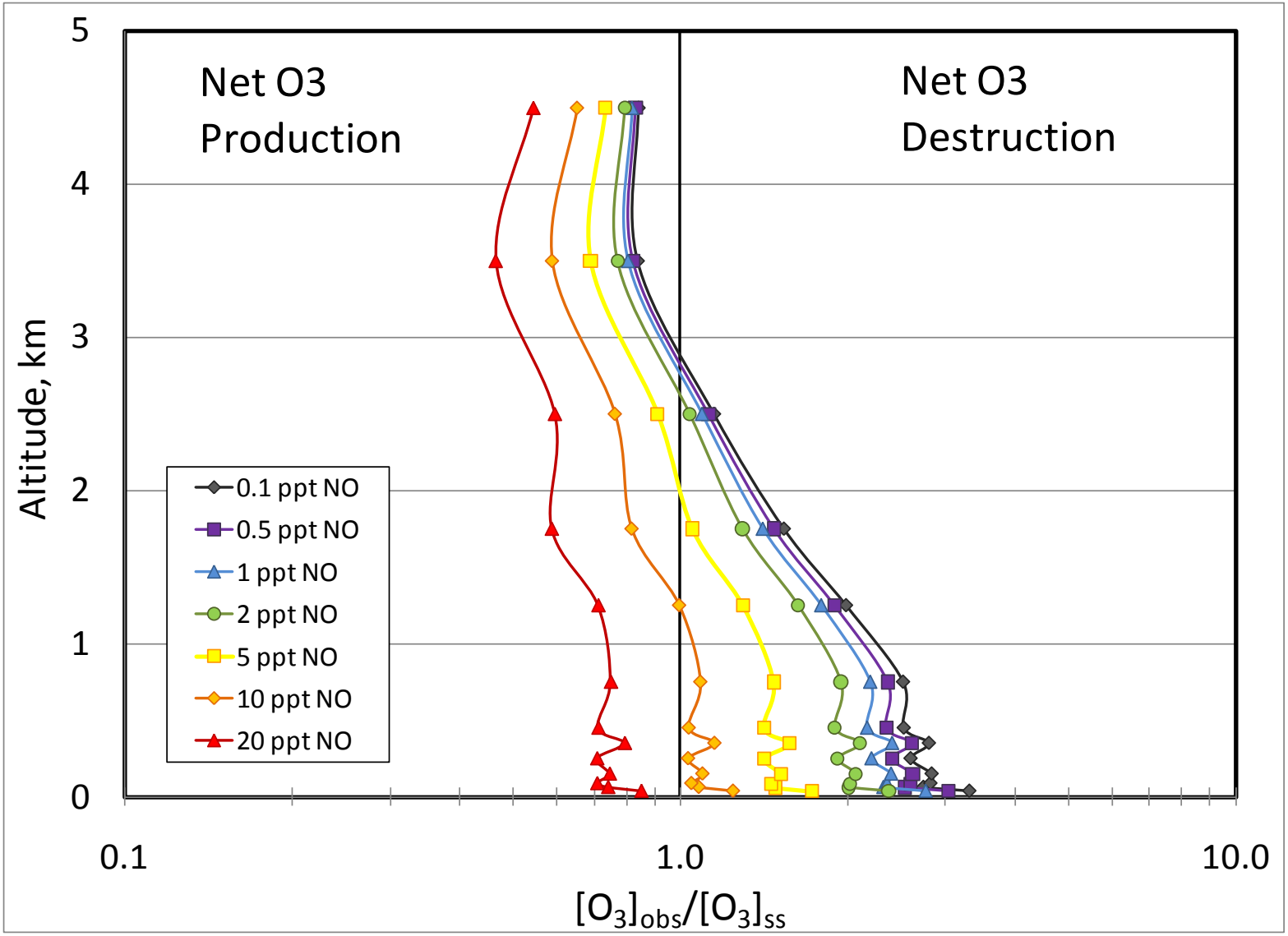
Unconstrained | Original OH | Revised OH

HO_2 / HO_2 + RO_2

HO_2 / OH

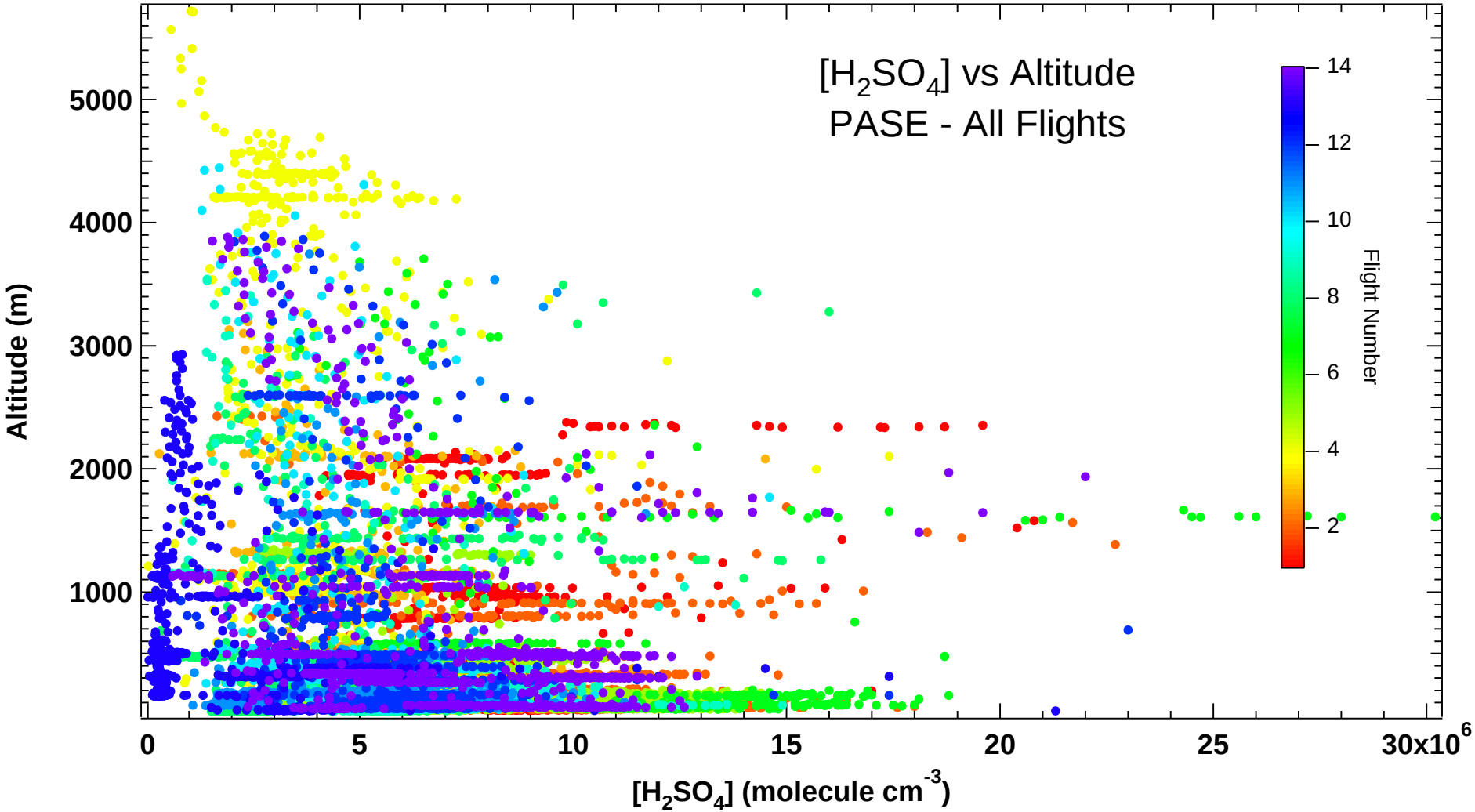


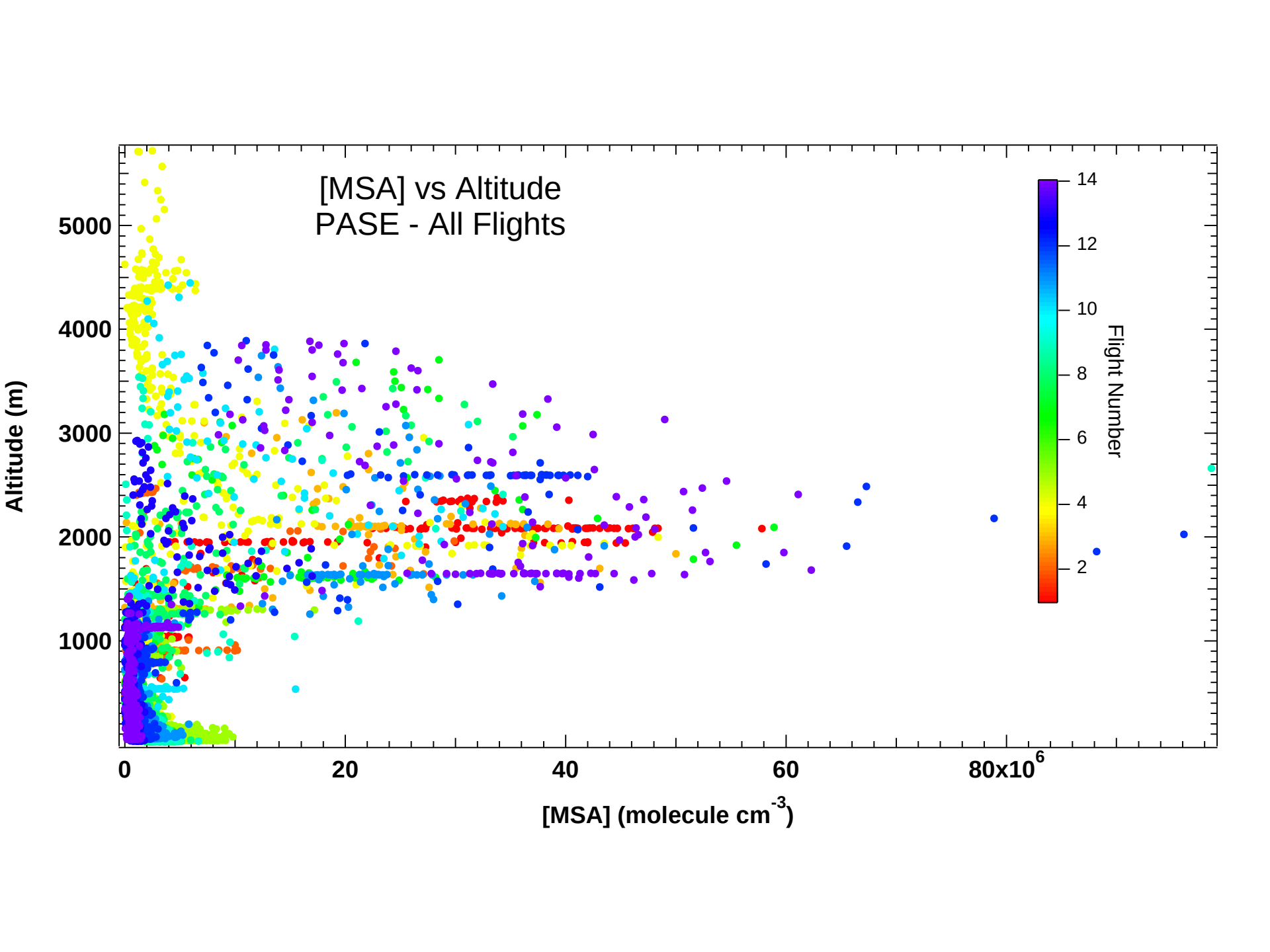
Ozone Tendency

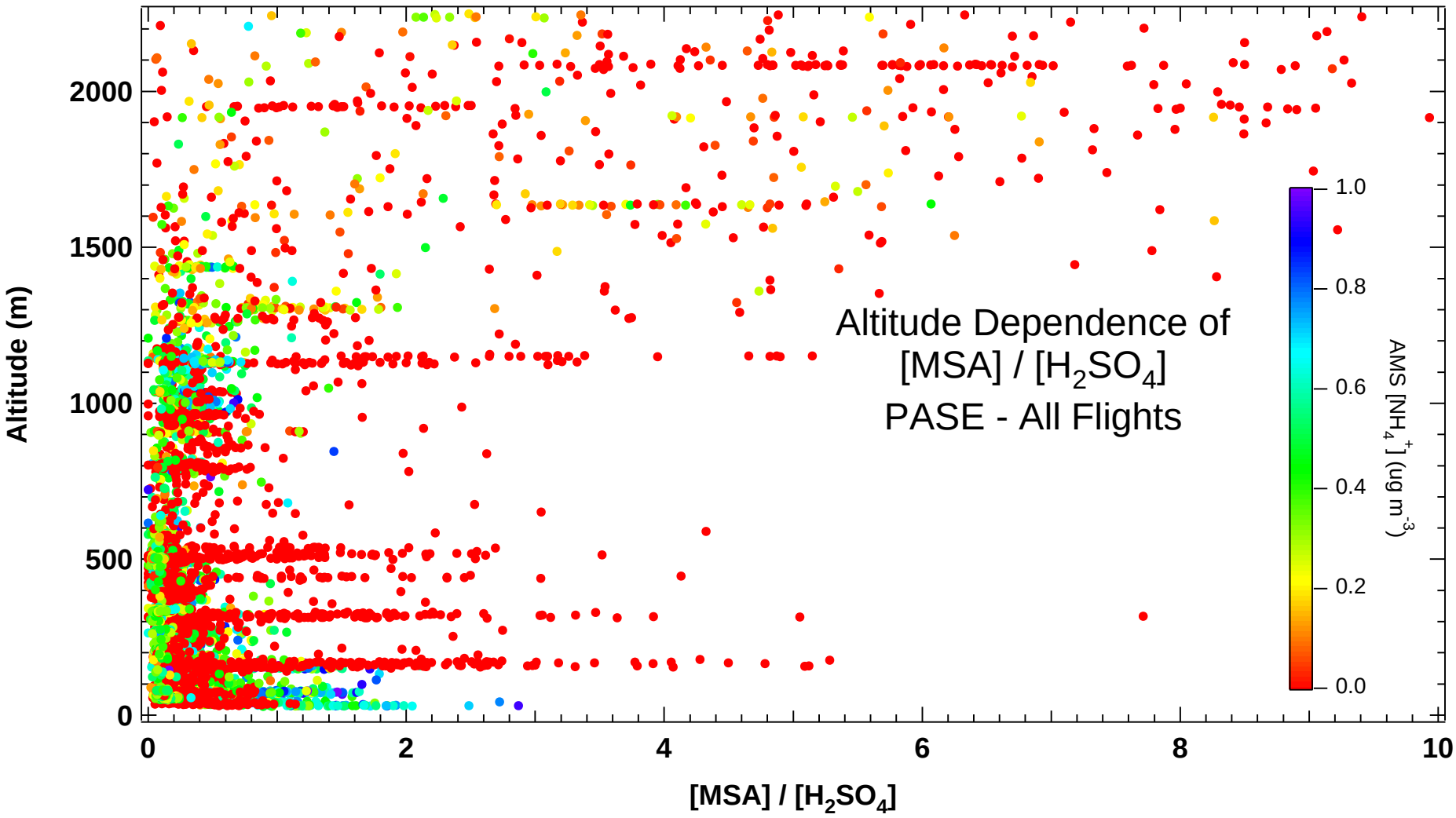


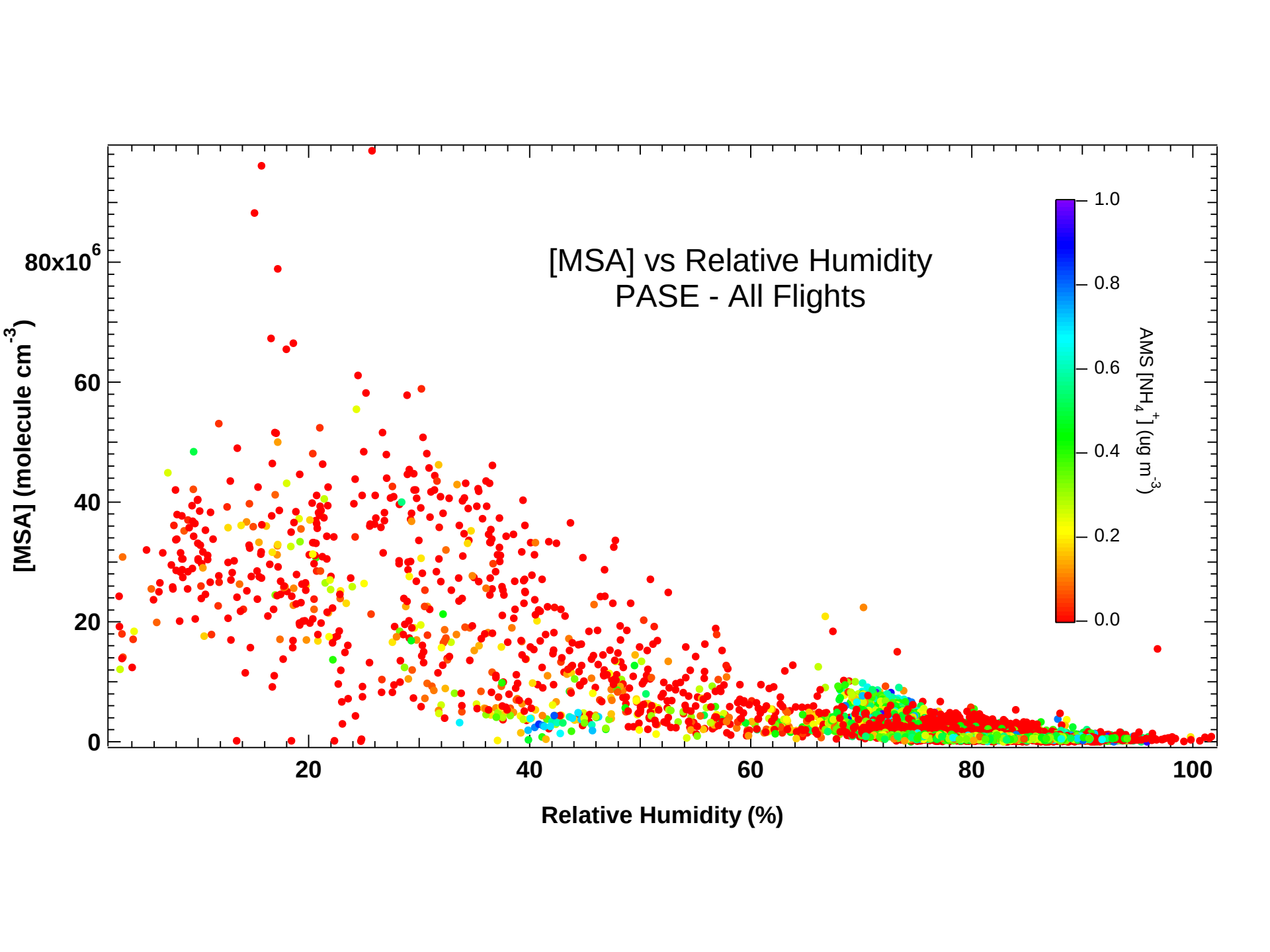
Sulfur Results

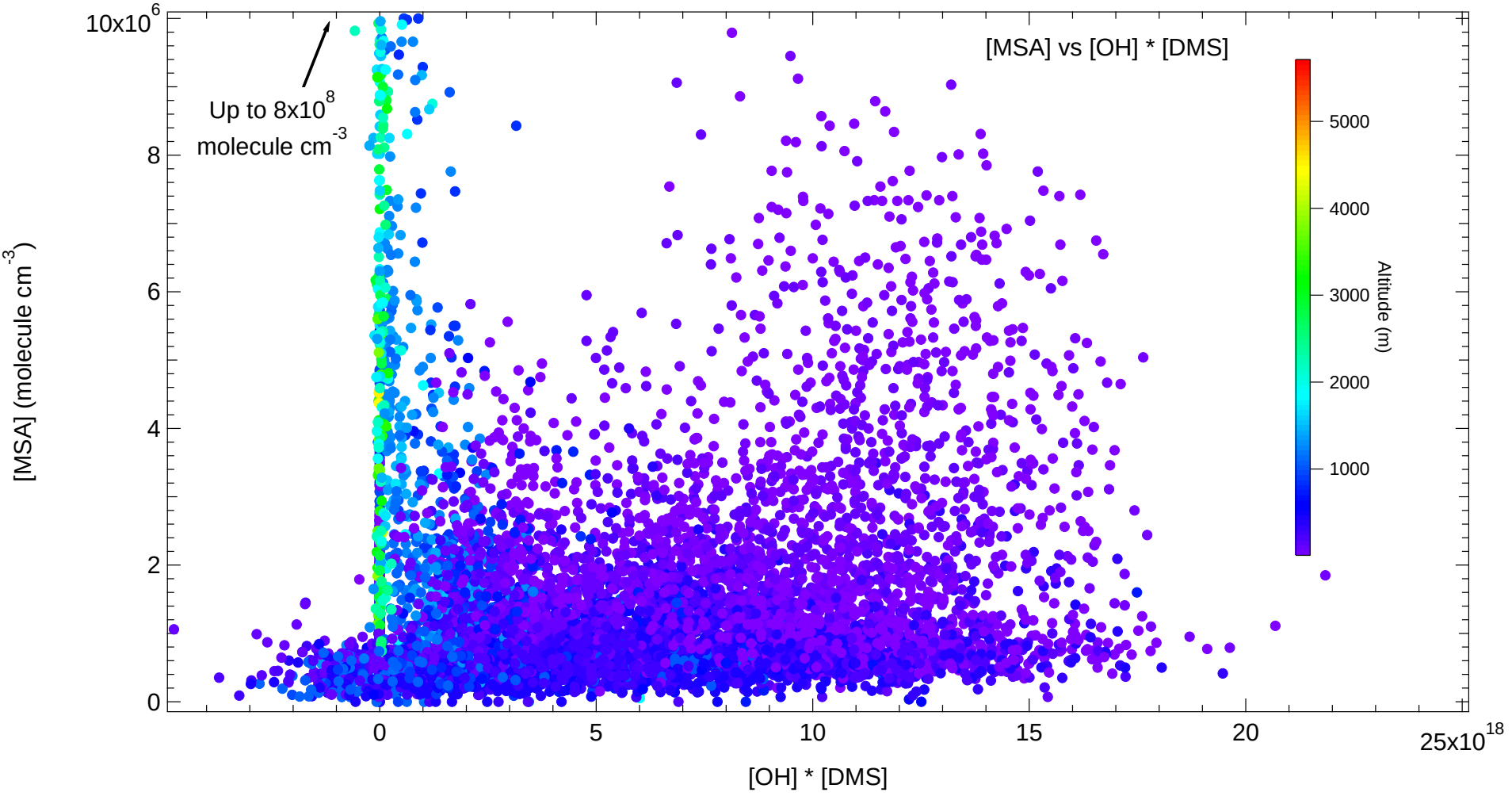
H_2SO_4 and MSA

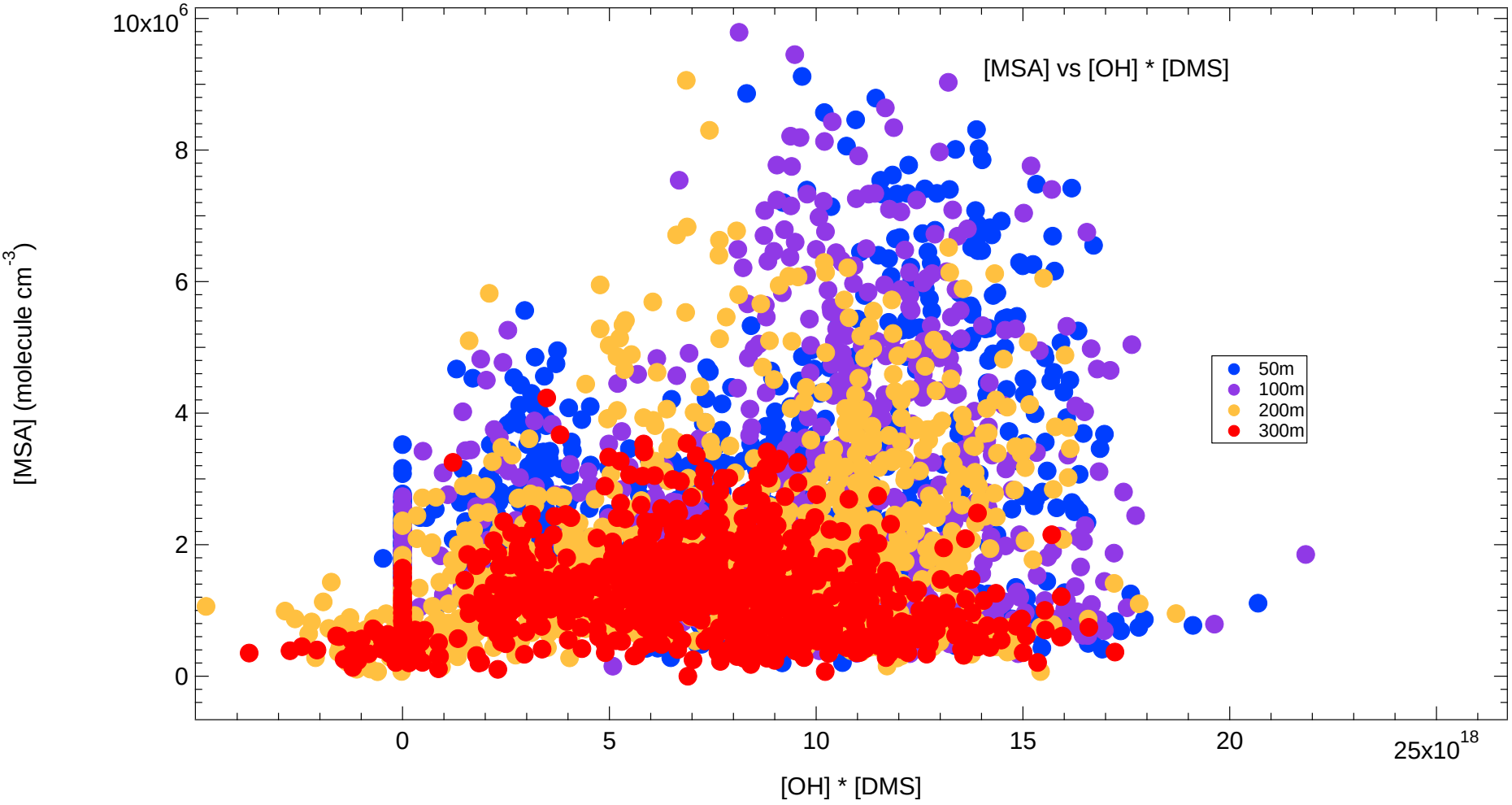

[H2SO4] vs Altitude
PASE - All Flights
Altitude (m)
5000
4000
3000
2000
1000
0
5
10
15
20
25
30x10^6
[H2SO4] (molecule cm^-3)
Flight Number
14
12
10
8
6
4
2

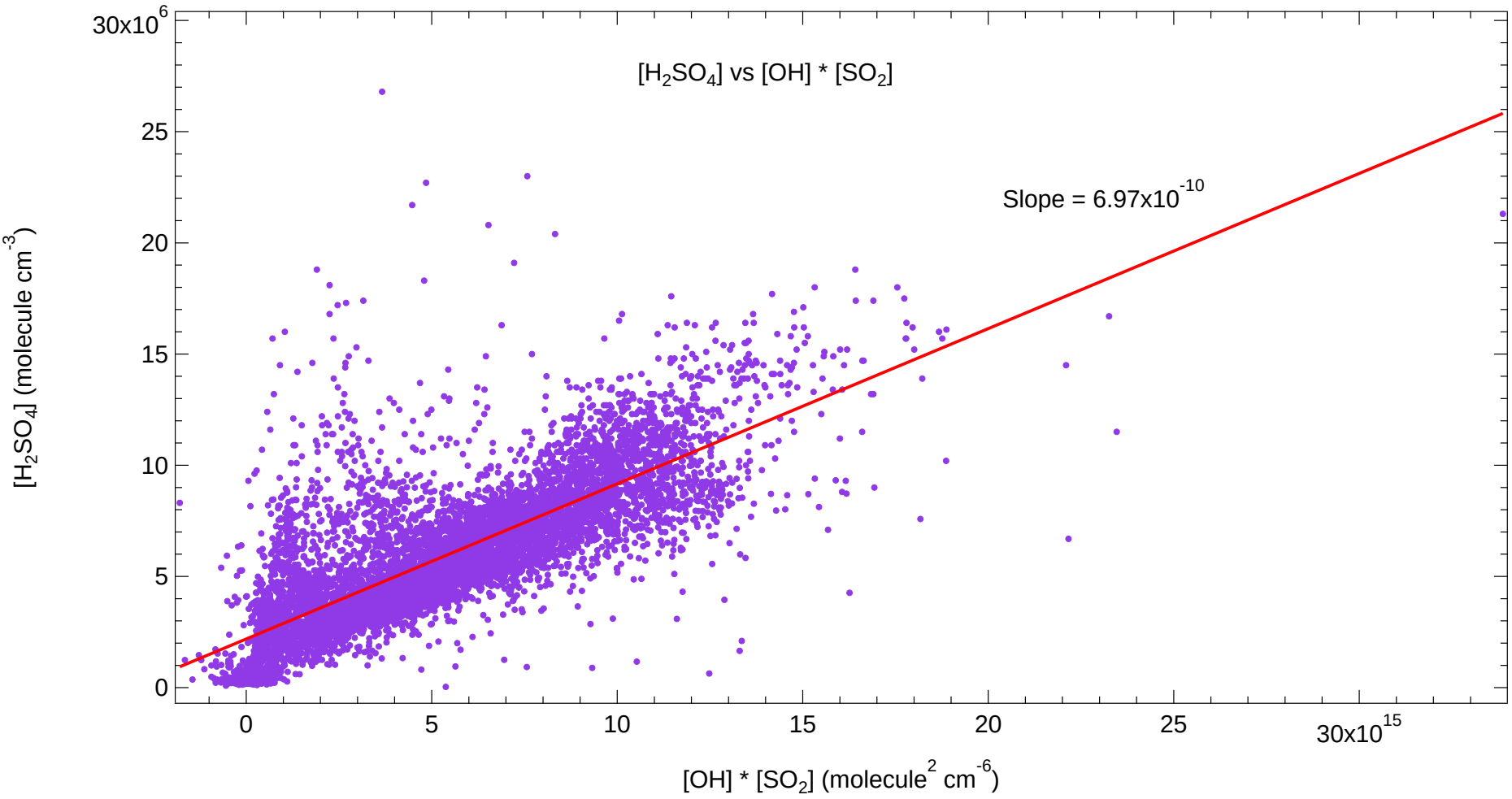

[MSA] vs Altitude
PASE - All Flights
Altitude (m)
5000
4000
3000
2000
1000
0
20
40
60
80x10^6
[MSA] (molecule cm^-3)
Flight Number
14
12
10
8
6
4
2


Altitude Dependence of
[MSA] / [H2SO4]
PASE - All Flights
Altitude (m)
0
500
1000
1500
2000
0
2
4
6
8
10
[MSA] / [H2SO4]
AMS [NH4+] (ug m-3)
0.0
0.2
0.4
0.6
0.8
1.0


[MSA] vs Relative Humidity
PASE - All Flights
[MSA] (molecule cm-3)
80x10^6
60
40
20
0
20
40
60
80
100
Relative Humidity (%)
AMS [NH4+] (ug m-3)
1.0
0.8
0.6
0.4
0.2
0.0


[MSA] vs [OH] * [DMS]
Up to 8x10^8 molecule cm^-3
10x10^6
8
6
4
2
0
[MSA] (molecule cm^-3)
0
5
10
15
20
25x10^18
[OH] * [DMS]
5000
4000
3000
2000
1000
Altitude (m)


[MSA] vs [OH] * [DMS]
50m
100m
200m
300m
10x10^6
8
6
4
2
0
[MSA] (molecule cm^-3)
0
5
10
15
20
25x10^18
[OH] * [DMS]


[H2SO4] vs [OH] * [SO2]
Slope = 6.97x10-10
30x10^6
25
20
15
10
5
0
[H2SO4] (molecule cm-3)
0
5
10
15
20
25
30x10^15
[OH] * [SO2] (molecule2 cm-6)

$$OH + SO_2 \rightarrow HOSO_2$$

$k_0^{300} = 3.0 \times 10^{-31}$ n = 3.3 NASA JPL 02-25

T = 285K P = 2.35×10^{19} molecule cm^{-3}

k = 8.2×10^{-12} cm^3 $molecule^{-1}$ s^{-1}

Steady State $\rightarrow$ Production = Loss

Production $k[OH][SO_2]$

Loss $k_L[H_2SO_4]$

$$[H_2SO_4] = \frac{k[OH][SO_2]}{k_L}$$

$$\text{Slope} = 7.0 \times 10^{-10} = \frac{k}{k_L} = \frac{8.2 \times 10^{-12}}{k_L}$$

$\rightarrow$ $k_L = 1.2 \times 10^{-2}$ s^{-1}

$\rightarrow$ 1/e Lifetime = 85 s for H_2SO_4