

第5章 ライダー観測*

5.1 まえがき

昭和57年3月末から4月始めにメキシコのエル・チチョン火山が噴火して成層圏に多量のダストを注入したため、ライダーによる高々度エーロゾル観測は主としてこのダストの消長の追跡となった。解析結果については既に田端、高橋(1984)、Uchino et al. (1984)、Uchino (1985)に報告されているので本章では観測された代表的な資料を示す。

成層圏エーロゾルの観測では受信波が微弱なため雲のない夜間に光電子計数方式で行われる。従って、梅雨のように曇天の続く季節には観測資料が殆んどないことが多い。

5.2 使用したライダーの特性

使用したライダーの特性は次の通りである。

レーザー：ルビー

波 長：694.3 nm

出 力：最大6 J、通常1～2 J/pulses

パルス幅：30 ns

繰 返 し：2 PPM

高度分解能：1 km

5.3 観測資料の処理

ライダーによるエーロゾルの観測値(光電子計数値)は大気中のすべての分子・粒子からの後方散乱の時・空間的相対値であり、ライダー方程式から直接物理量を求めることは殆んど不可能である。Grams その他(1967)はラジオゾンデ等から計算した大気分子の後方散乱の鉛直分布と、ライダーで得られた後方散乱の鉛直分布の中でエーロゾルが殆んど存在しない層で両者を一致させて基準点とし、他の高度の物理量を求める方法を用いた。この方法は一般にマッチングと呼ばれている。(国内参考文献 内藤(1981)、岩坂(1983)がある。) その後 Russell・その他(1979)はこの方法を改良したとも云える加重平均法を発表した。この章に示す資料は主として後者によった。観測値から必要とする物理量を用いるために用いた定数・気象要素等は次の通りである。

z : 高さ

$\beta(z)$: 大気分子とエーロゾルの後方散乱係数

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$\beta_M(z)$: 大気分子による後方散乱係数

$\beta_A(z)$: エロゾルによる後方散乱係数

σ_M : レーリー後方散乱断面積 ($1.771 \times 10^{-27} \text{ cm}^2$)

$N(z)$: 大気分子密度

$R(z)$: 散乱比

$\sigma(R(z))$: 散乱比の標準偏差

$\sigma(\beta_A(z))$: エロゾルによる後方散乱係数の標準偏差

$\tau_A(z)$: エロゾルに対するレーザー光の消散係数

$\tau_M(z)$: 大気分子に対するレーザー光の消散係数

B : 高度 Z_1 から Z_2 までの $\beta_A(z)$ の積分値

$$\beta(z) = \beta_A(z) + \beta_M(z)$$

$$\beta_M(z) = \sigma_M \cdot N(z)$$

$$R(z) = \frac{\beta_A(z) + \beta_M(z)}{\beta_M(z)} = 1 + \frac{\beta_A(z)}{\beta_M(z)}$$

この中で $N(z)$ の計算には高層気象台のその日のレーウィンゾンデの値と、ゾンデの到達高度より上層には綾里 ($39^\circ 02' \text{N}$, $141^\circ 50' \text{E}$) の気象ロケットゾンデの10年間平均値を用いた。 $\tau_A(z)$ の計算にはエロゾルの粒径分布・屈折率等が既知であることが必要であるが便宜的に Swissler その他(1983)の提出した関係を参考に

$$\tau_A(z) = 50 \beta_A(z)$$

とした。オゾンによる吸収は一定鉛直モデルを使用した。 $R(z)$ 、 $\sigma(R(z))$ 、 $\beta_A(z)$ 、 $\sigma(\beta_A(z))$ 等は Russel ら(1979)の加重平均法を用いて計算し、逐次近似を行って10回目の値を採用した。

以上の方法で計算した $R(z)$ の中には不適当なマッチングその他の原因で明らかに誤りと思われる $R(z) < 1$ の場合も見られるが、観測装置、データ処理法の両面から今後の検討課題である。

5.4 資料について

5.1 表に示すライダーによる高々度エロゾル資料の計算において、記号は 5.3 で定義したもの、 $\beta_A(z)$ の単位は $\text{cm}^{-1} \cdot \text{sr}^{-1}$ 、 B の計算における積分範囲は $16.5 \sim 30.5 \text{ km}$ 、 $R(z) < 1$ の時には $R(z) = 1$ と仮定して積分した。数値の表示は例えば 1.23×10^{-4} は $1.23 - 4$ と表示した。地上気象要素と圏界面高度は高層気象台の21時のレーウィンゾンデ観測による。

5.1 図に B の変化を示す。

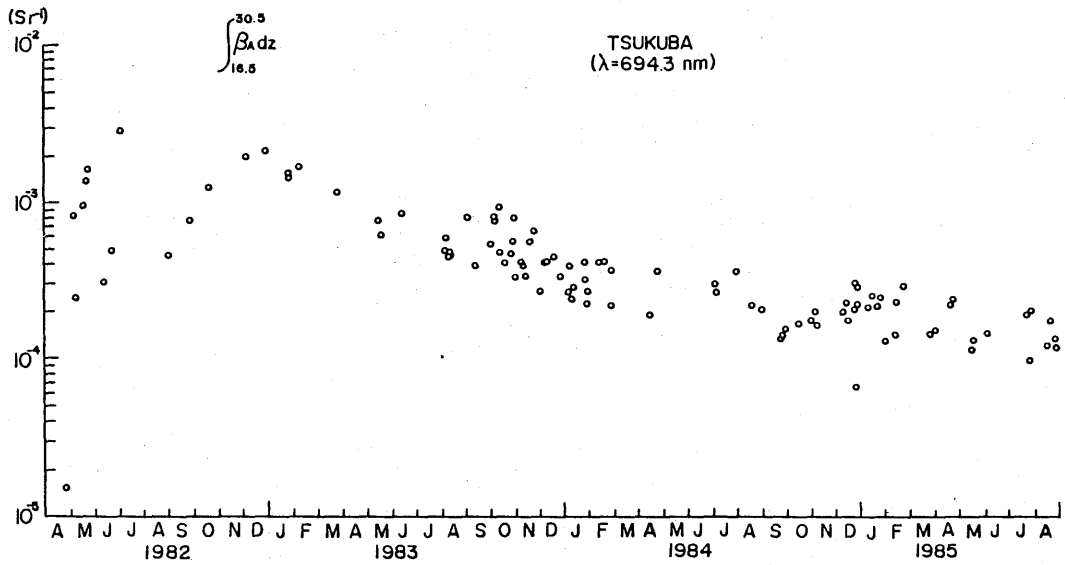


図5.1 高度16.5 kmから30.5 kmまで $\beta_A(z)$ を z について積分した B の変化

year 1982 month 4 day 25
 time 19: 47
 weather 6, St, ①
 tropopause altitude ($\times 10^3$ gpm) 12.2
 number of shots 150

$B1.5 \times 10^{-5}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5	1.14	3.51	- 2	1.56	-10	3.88	-11
1 4.5	1.57	4.85	- 2	5.48	-10	4.50	-11
1 5.5	1.57	4.98	- 2	4.67	-10	3.99	-11
1 6.5	0.99	3.45	- 2	-6.61	-12	2.41	-11
1 7.5	0.97	3.60	- 2	-1.65	-11	2.13	-11
1 8.5	0.97	3.82	- 2	-1.36	-11	1.94	-11
1 9.5	1.08	4.44	- 2	3.24	-11	1.88	-11
2 0.5	1.00	4.57	- 2	-7.28	-13	1.65	-11
2 1.5	1.07	5.21	- 2	2.04	-11	1.61	-11
2 2.5	1.10	5.90	- 2	2.48	-11	1.54	-11
2 3.5	1.11	6.56	- 2	2.39	-11	1.47	-11
2 4.5	1.03	6.97	- 2	6.23	-12	1.35	-11
2 5.5	1.12	8.16	- 2	1.90	-11	1.34	-11
2 6.5	1.01	8.71	- 2	1.88	-12	1.23	-11
2 7.5	1.09	1.02	- 1	1.03	-11	1.22	-11
2 8.5	0.98	1.08	- 1	-2.16	-12	1.11	-11
2 9.5	1.14	1.33	- 1	1.24	-11	1.17	-11
3 0.5	0.90	1.31	- 1	-7.70	-12	9.93	-12
3 1.5	1.37	1.85	- 1	2.40	-11	1.20	-11

year 1982 month 5 day 5
 time 20: 56
 weather 0, -, ①
 tropopause altitude ($\times 10^3$ gpm) 11.2
 number of shots 50

$B8.4 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.33	1.36	- 1	4.30	-10	1.76	-10
1 3.5	1.58	1.62	- 1	6.46	-10	1.80	-10
1 4.5	1.69	1.74	- 1	6.64	-10	1.67	-10
1 5.5	1.72	1.78	- 1	5.98	-10	1.47	-10
1 6.5	1.77	1.85	- 1	5.48	-10	1.32	-10
1 7.5	1.79	1.89	- 1	4.77	-10	1.14	-10
1 8.5	2.08	2.22	- 1	5.50	-10	1.13	-10
1 9.5	2.19	2.37	- 1	5.23	-10	1.04	-10
2 0.5	5.37	5.76	- 1	1.62	- 9	2.12	-10
2 1.5	7.15	7.85	- 1	1.94	- 9	2.47	-10
2 2.5	8.67	9.86	- 1	2.06	- 9	2.64	-10
2 3.5	4.32	5.25	- 1	7.56	-10	1.19	-10
2 4.5	1.13	1.69	- 1	2.48	-11	3.29	-11
2 5.5	1.30	2.00	- 1	4.95	-11	3.30	-11
2 6.5	1.37	2.23	- 1	5.14	-11	3.12	-11
2 7.5	1.13	2.11	- 1	1.51	-11	2.46	-11
2 8.5	0.82	1.87	- 1	-1.78	-11	1.87	-11
2 9.5	1.41	2.91	- 1	3.50	-11	2.49	-11
3 0.5	1.16	2.80	- 1	1.16	-11	2.06	-11
3 1.5	1.15	3.10	- 1	9.66	-12	1.94	-11

year 1982 month 5 day 8

time 22 : 08

weather 3, Cu, ①

tropopause altitude [$\times 10^3$ gpm] 12.9

number of shots 50

$B 2.48 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.30	1.40	- 1	3.89	-10	1.84	-10
1 3.5	1.77	1.92	- 1	8.51	-10	2.12	-10
1 4.5	1.52	1.67	- 1	4.86	-10	1.57	-10
1 5.5	1.70	1.91	- 1	5.64	-10	1.52	-10
1 6.5	2.30	2.61	- 1	7.93	-10	1.58	-10
1 7.5	1.96	2.30	- 1	5.43	-10	1.30	-10
1 8.5	1.45	1.83	- 1	2.26	-10	9.11	-11
1 9.5	1.66	2.12	- 1	2.97	-10	9.56	-11
2 0.5	2.96	3.67	- 1	7.56	-10	1.41	-10
2 1.5	0.86	1.47	- 1	-4.66	-11	4.82	-11
2 2.5	1.13	1.94	- 1	3.54	-11	5.49	-11
2 3.5	1.13	2.16	- 1	2.97	-11	4.99	-11
2 4.5	0.92	2.20	- 1	-1.43	-11	3.84	-11
2 5.5	1.45	3.19	- 1	6.83	-11	4.87	-11
2 6.5	1.19	3.15	- 1	2.48	-11	4.18	-11
2 7.5	1.34	3.74	- 1	3.89	-11	4.31	-11
2 8.5	0.90	3.32	- 1	-1.02	-11	3.35	-11
2 9.5	1.71	5.27	- 1	6.35	-11	4.71	-11
3 0.5	0.72	3.70	- 1	-2.13	-11	2.84	-11
3 1.5	1.63	6.42	- 1	4.15	-11	4.21	-11

year 1982 month 5 day 17

time 19 : 57

weather 3, Ac, ①

tropopause altitude [$\times 10^3$ gpm] 10.9

number of shots 150

$B 9.6 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5							
1 5.5	1.01	4.47	- 2	9.00	-12	3.67	-11
1 6.5	1.40	6.21	- 2	2.87	-10	4.36	-11
1 7.5	1.43	6.42	- 2	2.65	-10	3.88	-11
1 8.5	1.07	5.00	- 2	3.78	-11	2.54	-11
1 9.5	1.16	5.50	- 2	6.92	-11	2.37	-11
2 0.5	1.56	7.45	- 2	2.05	-10	2.68	-11
2 1.5	4.88	2.22	- 1	1.20	- 9	6.71	-11
2 2.5	9.88	4.65	- 1	2.33	- 9	1.19	-10
2 3.5	11.32	5.94	- 1	2.31	- 9	1.31	-10
2 4.5	14.61	8.76	- 1	2.64	- 9	1.67	-10
2 5.5	3.57	2.51	- 1	4.26	-10	4.12	-11
2 6.5	1.00	9.01	- 2	-6.14	-13	1.28	-11
2 7.5	1.06	1.01	- 1	6.76	-12	1.22	-11
2 8.5	0.97	1.02	- 1	-3.04	-12	1.06	-11
2 9.5	1.06	1.18	- 1	4.94	-12	1.04	-11
3 0.5	0.94	1.19	- 1	-4.24	-12	9.05	-12
3 1.5	1.01	1.36	- 1	3.67	-13	8.86	-12

year 1982 month 5 day 23time 19: 47weather 3, St, ①tropopause altitude [$\times 10^3$ gpm] 10.6number of shots 100 $B1.6 \times 10^{-3}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5							
1 5.5	0.95	7.70	- 2	-4.36	-11	6.49	-11
1 6.5	1.55	1.26	- 1	3.98	-10	9.06	-11
1 7.5	1.91	1.55	- 1	5.55	-10	9.44	-11
1 8.5	1.17	9.69	- 2	8.88	-11	5.04	-11
1 9.5	1.26	1.05	- 1	1.14	-10	4.58	-11
2 0.5	2.57	2.13	- 1	5.79	-10	7.78	-11
2 1.5	8.47	6.97	- 1	2.35	- 9	2.17	-10
2 2.5	12.88	1.11	0	3.18	- 9	2.94	-10
2 3.5	28.76	2.76	0	6.39	- 9	6.33	-10
2 4.5	12.72	1.40	0	2.30	- 9	2.74	-10
2 5.5	2.16	2.63	- 1	1.95	-10	4.41	-11
2 6.5	1.34	1.75	- 1	4.83	-11	2.52	-11
2 7.5	1.51	2.02	- 1	6.31	-11	2.48	-11
2 8.5	1.17	1.70	- 1	1.78	-11	1.79	-11
2 9.5	1.12	1.74	- 1	1.09	-11	1.57	-11
3 0.5	0.95	1.64	- 1	-3.99	-12	1.26	-11
3 1.5	0.92	1.72	- 1	-5.46	-12	1.14	-11

year 1982 month 6 day 12time 19: 55weather 0, -, ①tropopause altitude [$\times 10^3$ gpm] 14.3number of shots 100 $B3.1 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5	0.95	4.06	- 2	-5.82	-11	4.78	-11
1 4.5	1.18	5.07	- 2	1.85	-10	5.12	-11
1 5.5	1.39	6.03	- 2	3.39	-10	5.14	-11
1 6.5	1.75	7.67	- 2	5.55	-10	5.55	-11
1 7.5	2.18	9.71	- 2	7.24	-10	5.84	-11
1 8.5	1.83	8.57	- 2	4.35	-10	4.42	-11
1 9.5	1.39	7.02	- 2	1.73	-10	3.07	-11
2 0.5	2.00	1.01	- 1	3.73	-10	3.72	-11
2 1.5	4.10	2.01	- 1	9.96	-10	6.34	-11
2 2.5	1.22	7.84	- 2	5.94	-11	2.13	-11
2 3.5	0.99	7.32	- 2	-1.70	-12	1.71	-11
2 4.5	1.01	8.11	- 2	1.80	-12	1.60	-11
2 5.5	0.91	8.39	- 2	-1.52	-11	1.40	-11
2 6.5	1.11	1.06	- 1	1.58	-11	1.51	-11
2 7.5	1.26	1.26	- 1	3.15	-11	1.54	-11
2 8.5	1.02	1.24	- 1	2.41	-12	1.30	-11
2 9.5	1.04	1.41	- 1	3.12	-12	1.26	-11
3 0.5	1.21	1.70	- 1	1.59	-11	1.31	-11
3 1.5	1.17	1.88	- 1	1.09	-11	1.24	-11

year 1982 month 6 day 22

time 20 : 22

weather 4, Ci, ①

tropopause altitude [$\times 10^3$ gpm] 14.7

number of shots 50

$B4.9 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5							
1 5.5							
1 6.5	1.00	2.01	- 2	0.00	0	1.50	-11
1 7.5	1.38	2.78	- 2	2.38	-10	1.66	-11
1 8.5	1.58	3.28	- 2	3.09	-10	1.63	-11
1 9.5	1.89	4.06	- 2	3.96	-10	1.66	-11
2 0.5	2.64	5.82	- 2	6.20	-10	2.00	-11
2 1.5	2.14	5.34	- 2	3.66	-10	1.60	-11
2 2.5	5.80	1.41	- 1	1.30	- 9	3.51	-11
2 3.5	2.90	8.85	- 2	4.40	-10	1.95	-11
2 4.5	2.48	8.51	- 2	2.92	-10	1.62	-11
2 5.5	2.39	8.97	- 2	2.35	-10	1.47	-11
2 6.5	2.42	9.89	- 2	2.06	-10	1.39	-11
2 7.5	2.39	1.07	- 1	1.72	-10	1.29	-11
2 8.5	2.40	1.17	- 1	1.49	-10	1.22	-11
2 9.5	2.25	1.23	- 1	1.14	-10	1.11	-11
3 0.5	2.04	1.27	- 1	8.09	-11	9.79	-12
3 1.5	1.85	1.33	- 1	5.67	-11	8.80	-12
3 2.5	2.04	1.56	- 1	5.96	-11	8.89	-12

year 1982 month 7 day 2

time 20 : 10

weather 0, -, ①

tropopause altitude [$\times 10^3$ gpm] 13.5

number of shots 50

$B2.8 \times 10^{-3}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	0.92	1.68	- 1	-1.10	-10	2.24	-10
1 3.5	1.29	2.37	- 1	3.40	-10	2.76	-10
1 4.5	1.49	2.74	- 1	4.91	-10	2.74	-10
1 5.5	1.92	3.53	- 1	7.90	-10	3.03	-10
1 6.5	2.15	3.96	- 1	8.42	-10	2.91	-10
1 7.5	2.68	4.95	- 1	1.06	- 9	3.12	-10
1 8.5	2.58	4.79	- 1	8.32	-10	2.53	-10
1 9.5	1.65	3.11	- 1	2.90	-10	1.40	-10
2 0.5	1.61	3.07	- 1	2.30	-10	1.16	-10
2 1.5	2.60	4.94	- 1	5.15	-10	1.59	-10
2 2.5	2.243	4.23	0	5.88	- 9	1.16	- 9
2 3.5	4.406	8.85	0	1.01	- 8	2.07	- 9
2 4.5	3.956	8.82	0	7.73	- 9	1.77	- 9
2 5.5	5.57	1.36	0	7.78	-10	2.30	-10
2 6.5	1.86	4.98	- 1	1.26	-10	7.27	-11
2 7.5	1.90	5.23	- 1	1.14	-10	6.61	-11
2 8.5	1.90	5.43	- 1	9.62	-11	5.81	-11
2 9.5	0.89	3.19	- 1	-9.74	-12	2.93	-11
3 0.5	0.89	3.41	- 1	-8.71	-12	2.69	-11
3 1.5	1.97	6.51	- 1	6.59	-11	4.41	-11
3 2.5	1.47	5.63	- 1	2.71	-11	3.27	-11

year 1982 month 9 day 1
 time 19: 25
 weather 0, -, ○
 tropopause altitude [$\times 10^3$ gpm] 16.0
 number of shots 100

$B4.6 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5							
1 5.5							
1 6.5	100	3.17	- 2	-224	-12	2.53	-11
1 7.5	1.54	4.83	- 2	3.64	-10	3.16	-11
1 8.5	1.86	6.05	- 2	4.84	-10	3.27	-11
1 9.5	1.33	5.12	- 2	1.51	-10	2.34	-11
2 0.5	2.20	8.11	- 2	4.71	-10	3.10	-11
2 1.5	6.45	2.12	- 1	1.81	- 9	6.70	-11
2 2.5	2.31	1.08	- 1	3.68	-10	2.99	-11
2 3.5	1.33	8.38	- 2	7.90	-11	1.98	-11
2 4.5	1.21	8.85	- 2	4.33	-11	1.79	-11
2 5.5	1.45	1.11	- 1	7.72	-11	1.88	-11
2 6.5	2.72	1.81	- 1	2.51	-10	2.62	-11
2 7.5	2.17	1.76	- 1	1.47	-10	2.20	-11
2 8.5	2.47	2.12	- 1	1.57	-10	2.26	-11
2 9.5	1.95	2.10	- 1	8.68	-11	1.92	-11
3 0.5	3.57	3.27	- 1	2.02	-10	2.56	-11
3 1.5	2.69	3.14	- 1	1.14	-10	2.11	-11
3 2.5	2.20	3.17	- 1	6.94	-11	1.83	-11

year 1982 month 9 day 27
 time 18: 49
 weather 0, -, ○
 tropopause altitude [$\times 10^3$ gpm] 16.1
 number of shots 150

$B7.7 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5							
1 5.5							
1 6.5	1.19	1.65	- 1	1.43	-10	1.27	-10
1 7.5	1.55	2.15	- 1	3.56	-10	1.40	-10
1 8.5	1.65	2.30	- 1	3.59	-10	1.26	-10
1 9.5	1.49	2.08	- 1	2.26	-10	9.65	-11
2 0.5	2.45	3.42	- 1	5.56	-10	1.31	-10
2 1.5	8.96	1.25	0	2.60	- 9	4.07	-10
2 2.5	8.18	1.16	0	1.98	- 9	3.19	-10
2 3.5	2.82	4.10	- 1	4.23	-10	9.52	-11
2 4.5	3.41	4.99	- 1	4.73	-10	9.77	-11
2 5.5	2.06	3.12	- 1	1.78	-10	5.22	-11
2 6.5	2.31	3.54	- 1	1.87	-10	5.04	-11
2 7.5	2.17	3.41	- 1	1.44	-10	4.20	-11
2 8.5	1.73	2.87	- 1	7.73	-11	3.03	-11
2 9.5	1.65	2.86	- 1	5.90	-11	2.60	-11
3 0.5	1.67	3.02	- 1	5.23	-11	2.35	-11
3 1.5	0.96	2.10	- 1	-2.62	-12	1.40	-11
3 2.5	1.43	3.00	- 1	2.47	-11	1.71	-11

year 1982 month 10 day 20

time 18 : 37

weather 0, -, ○

tropopause altitude ($\times 10^3$ gpm) 16.7

number of shots 100

$B 1.2 \times 10^{-3}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5							
1 5.5	0.95	9.23	- 2	-4.10	-11	8.05	-11
1 6.5	1.24	1.20	- 1	1.75	-10	8.91	-11
1 7.5	1.63	1.58	- 1	3.97	-10	9.95	-11
1 8.5	1.91	1.87	- 1	4.81	-10	9.78	-11
1 9.5	2.55	2.49	- 1	6.81	-10	1.09	-10
2 0.5	4.77	4.67	- 1	1.39	- 9	1.71	-10
2 1.5	4.79	4.75	- 1	1.21	- 9	1.50	-10
2 2.5	9.40	9.47	- 1	2.25	- 9	2.52	-10
2 3.5	15.08	1.59	0	3.26	- 9	3.65	-10
2 4.5	11.11	1.24	0	1.97	- 9	2.41	-10
2 5.5	3.37	4.04	- 1	3.99	-10	6.78	-11
2 6.5	2.84	3.53	- 1	2.65	-10	5.08	-11
2 7.5	1.40	1.97	- 1	4.91	-11	2.41	-11
2 8.5	1.15	1.77	- 1	1.60	-11	1.85	-11
2 9.5	1.13	1.87	- 1	1.18	-11	1.67	-11
3 0.5	0.89	1.69	- 1	-8.43	-12	1.29	-11
3 1.5	1.23	2.27	- 1	1.48	-11	1.49	-11
3 2.5	1.01	2.17	- 1	2.76	-13	1.22	-11

year 1982 month 12 day 8

time 20 : 24

weather 1, Ac, ○

tropopause altitude ($\times 10^3$ gpm) 14.3

number of shots 200

$B 2.0 \times 10^{-3}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5	1.01	1.24	- 1	7.98	-12	1.21	-10
1 5.5	1.35	1.66	- 1	2.88	-10	1.37	-10
1 6.5	2.15	2.65	- 1	8.01	-10	1.84	-10
1 7.5	3.56	4.39	- 1	1.51	- 9	2.59	-10
1 8.5	5.63	6.99	- 1	2.30	- 9	3.47	-10
1 9.5	7.46	9.46	- 1	2.73	- 9	3.99	-10
2 0.5	9.17	1.20	0	2.95	- 9	4.33	-10
2 1.5	12.13	1.67	0	3.45	- 9	5.16	-10
2 2.5	12.89	1.88	0	3.13	- 9	4.95	-10
2 3.5	8.66	1.34	0	1.69	- 9	2.94	-10
2 4.5	6.15	9.85	- 1	9.73	-10	1.86	-10
2 5.5	4.16	6.93	- 1	5.06	-10	1.11	-10
2 6.5	1.92	3.50	- 1	1.26	-10	4.79	-11
2 7.5	1.50	2.95	- 1	5.89	-11	3.47	-11
2 8.5	1.11	2.44	- 1	1.08	-11	2.46	-11
2 9.5	0.92	2.31	- 1	-6.46	-12	1.97	-11
3 0.5	0.95	2.54	- 1	-3.48	-12	1.86	-11
3 1.5							

year 1982 month 12 day 28
time 17: 51
weather 9, Ac, ☉
tropopause altitude [$\times 10^3$ gpm] 12.0, 16.7
number of shots 150

$B \ 2.1 \times 10^{-3}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5	1.08	133	- 1	9.20	-11	1.45	-10
1 4.5	1.43	1.76	- 1	4.05	-10	1.64	-10
1 5.5	2.02	2.48	- 1	8.14	-10	1.97	-10
1 6.5	3.20	3.93	- 1	1.50	- 9	2.68	-10
1 7.5	5.02	6.22	- 1	2.34	- 9	3.61	-10
1 8.5	7.08	8.98	- 1	3.04	- 9	4.48	-10
1 9.5	8.35	1.10	0	3.03	- 9	4.52	-10
2 0.5	9.62	1.33	0	3.04	- 9	4.68	-10
2 1.5	11.84	1.73	0	3.28	- 9	5.22	-10
2 2.5	9.96	1.54	0	2.26	- 9	3.87	-10
2 3.5	8.04	1.30	0	1.57	- 9	2.89	-10
2 4.5	5.93	9.90	- 1	9.31	-10	1.87	-10
2 5.5	4.75	8.15	- 1	6.05	-10	1.31	-10
2 6.5	2.83	5.08	- 1	2.55	-10	7.06	-11
2 7.5	1.61	3.12	- 1	7.39	-11	3.75	-11
2 8.5	1.18	2.47	- 1	1.82	-11	2.56	-11
2 9.5	1.00	2.30	- 1	2.31	-13	2.04	-11
3 0.5	1.36	3.08	- 1	2.76	-11	2.35	-11
3 1.5							

year 1983 month 1 day 27
time 18: 21
weather 0, -, ☉
tropopause altitude [$\times 10^3$ gpm] 9.1, 18.7
number of shots 100

$B \ 1.4 \times 10^{-3}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.44	2.71	- 1	5.42	-10	3.33	-10
1 3.5	2.24	4.21	- 1	1.31	- 9	4.44	-10
1 4.5	3.48	6.54	- 1	2.27	- 9	5.97	-10
1 5.5	4.96	9.39	- 1	3.09	- 9	7.32	-10
1 6.5	6.55	1.26	0	3.71	- 9	8.43	-10
1 7.5	7.53	1.50	0	3.70	- 9	8.46	-10
1 8.5	8.59	1.77	0	3.69	- 9	8.58	-10
1 9.5	6.71	1.44	0	2.37	- 9	5.99	-10
2 0.5	4.02	9.11	- 1	1.07	- 9	3.23	-10
2 1.5	3.74	8.77	- 1	8.39	-10	2.68	-10
2 2.5	2.28	5.88	- 1	3.31	-10	1.52	-10
2 3.5	1.54	4.51	- 1	1.19	-10	9.96	-11
2 4.5	1.32	4.29	- 1	6.00	-11	8.13	-11
2 5.5	1.03	3.94	- 1	4.15	-12	6.31	-11
2 6.5	0.96	4.17	- 1	-6.15	-12	5.68	-11
2 7.5	1.77	6.80	- 1	8.99	-11	7.93	-11
2 8.5	0.91	4.97	- 1	-8.91	-12	4.97	-11
2 9.5	0.90	5.54	- 1	-8.83	-12	4.74	-11
3 0.5	0.76	5.61	- 1	-1.78	-11	4.12	-11
3 1.5	0.98	7.23	- 1	-1.45	-12	4.55	-11
3 2.5	1.26	9.29	- 1	1.38	-11	5.01	-11

year 1983 month 2 day 8
 time 19: 30
 weather 0, -, O
 tropopause altitude [$\times 10^3$ gpm] 8.8, 15.9
 number of shots 50

$B 1.6 \times 10^{-3}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma (\beta_A(z))$	
1 2.5	2.02	4.32	- 1	1.20	- 9	5.12	-10
1 3.5	2.55	5.47	- 1	1.60	- 9	5.65	-10
1 4.5	3.48	7.48	- 1	2.20	- 9	6.63	-10
1 5.5	4.54	9.84	- 1	2.73	- 9	7.59	-10
1 6.5	6.68	1.47	0	3.70	- 9	9.52	-10
1 7.5	8.08	1.81	0	4.02	- 9	1.03	- 9
1 8.5	9.00	2.08	0	3.85	- 9	9.98	-10
1 9.5	7.30	1.74	0	2.58	- 9	7.11	-10
2 0.5	6.28	1.54	0	1.83	- 9	5.31	-10
2 1.5	4.87	1.22	0	1.15	- 9	3.62	-10
2 2.5	2.53	6.63	- 1	3.86	-10	1.67	-10
2 3.5	2.37	6.38	- 1	2.95	-10	1.37	-10
2 4.5	1.64	4.74	- 1	1.19	-10	8.73	-11
2 5.5	1.97	5.75	- 1	1.53	-10	9.05	-11
2 6.5	1.47	4.72	- 1	6.41	-11	6.45	-11
2 7.5	2.17	6.83	- 1	1.35	-10	7.88	-11
2 8.5	1.04	4.17	- 1	3.66	-12	4.12	-11
2 9.5	1.63	6.23	- 1	5.36	-11	5.26	-11
3 0.5	1.21	5.48	- 1	1.53	-11	3.97	-11
3 1.5							

year 1983 month 3 day 25
 time 19: 09
 weather 10, Sc, ©
 tropopause altitude [$\times 10^3$ gpm] 10.4
 number of shots 50

$B 1.2 \times 10^{-3}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma (\beta_A(z))$	
1 2.5	1.06	2.65	- 1	6.81	-11	3.29	-10
1 3.5	0.99	2.50	- 1	-1.56	-11	2.73	-10
1 4.5	1.21	3.09	- 1	2.04	-10	2.95	-10
1 5.5	1.41	3.60	- 1	3.37	-10	2.98	-10
1 6.5	2.19	5.59	- 1	8.51	-10	3.99	-10
1 7.5	4.75	1.20	0	2.30	- 9	7.35	-10
1 8.5	7.02	1.78	0	3.14	- 9	9.27	-10
1 9.5	7.04	1.81	0	2.63	- 9	7.89	-10
2 0.5	5.00	1.33	0	1.47	- 9	4.89	-10
2 1.5	3.28	9.24	- 1	7.07	-10	2.86	-10
2 2.5	3.07	9.05	- 1	5.44	-10	2.38	-10
2 3.5	1.11	4.26	- 1	2.43	-11	9.58	-11
2 4.5	0.60	3.11	- 1	-7.62	-11	5.98	-11
2 5.5	1.13	5.14	- 1	2.08	-11	8.30	-11
2 6.5	1.27	6.12	- 1	3.79	-11	8.51	-11
2 7.5	1.93	8.78	- 1	1.10	-10	1.04	-10
2 8.5	1.78	9.14	- 1	7.90	-11	9.30	-11
2 9.5	2.33	1.20	0	1.16	-10	1.05	-10
3 0.5	1.18	8.90	- 1	1.38	-11	6.65	-11
3 1.5							

year 1983 month 5 day 17

time 19 : 32

weather 1, Cu, O

tropopause altitude ($\times 10^3$ gpm) 12.2

number of shots 50

B 6.2 $\times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.97	2.59	- 1	1.26	- 9	3.37	-10
1 3.5	2.28	3.02	- 1	1.42	- 9	3.33	-10
1 4.5	2.03	2.73	- 1	9.63	-10	2.56	-10
1 5.5	2.15	2.93	- 1	9.50	-10	2.42	-10
1 6.5	2.60	3.60	- 1	1.15	- 9	2.58	-10
1 7.5	3.69	5.17	- 1	1.65	- 9	3.17	-10
1 8.5	4.19	6.03	- 1	1.66	- 9	3.12	-10
1 9.5	3.04	4.61	- 1	8.96	-10	2.02	-10
2 0.5	2.95	4.67	- 1	7.19	-10	1.72	-10
2 1.5	2.08	3.60	- 1	3.43	-10	1.14	-10
2 2.5	1.58	3.08	- 1	1.57	-10	8.28	-11
2 3.5	1.03	2.44	- 1	6.56	-12	5.59	-11
2 4.5	0.87	2.40	- 1	-2.55	-11	4.69	-11
2 5.5	1.71	4.10	- 1	1.19	-10	6.84	-11
2 6.5	1.18	3.56	- 1	2.50	-11	5.09	-11
2 7.5	1.09	3.78	- 1	1.09	-11	4.62	-11
2 8.5	0.84	3.64	- 1	-1.65	-11	3.81	-11
2 9.5	1.10	4.78	- 1	9.31	-12	4.28	-11
3 0.5	0.93	4.86	- 1	-5.07	-12	3.73	-11
3 1.5	0.90	5.38	- 1	-6.33	-12	3.53	-11

year 1983 month 6 day 14

time 19 : 36

weather 0, -, O

tropopause altitude ($\times 10^3$ gpm) 12.3

number of shots 50

B 8.5 $\times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	3.36	2.47	- 1	3.11	- 9	3.24	-10
1 3.5	3.16	2.37	- 1	2.45	- 9	2.67	-10
1 4.5	3.73	2.93	- 1	2.66	- 9	2.83	-10
1 5.5	3.78	3.16	- 1	2.33	- 9	2.63	-10
1 6.5	3.76	3.36	- 1	1.97	- 9	2.39	-10
1 7.5	3.79	3.60	- 1	1.70	- 9	2.19	-10
1 8.5	3.96	3.98	- 1	1.53	- 9	2.05	-10
1 9.5	4.46	4.72	- 1	1.52	- 9	2.07	-10
2 0.5	3.87	4.31	- 1	1.07	- 9	1.59	-10
2 1.5	3.61	4.17	- 1	8.31	-10	1.32	-10
2 2.5	2.53	3.04	- 1	4.18	-10	8.28	-11
2 3.5	2.06	2.56	- 1	2.49	-10	5.98	-11
2 4.5	1.51	1.96	- 1	1.02	-10	3.95	-11
2 5.5	1.06	1.50	- 1	1.09	-11	2.55	-11
2 6.5	1.16	1.68	- 1	2.29	-11	2.45	-11
2 7.5	1.18	1.80	- 1	2.29	-11	2.24	-11
2 8.5	0.99	1.66	- 1	-8.85	-13	1.77	-11
2 9.5	0.86	1.61	- 1	-1.29	-11	1.48	-11
3 0.5	1.14	2.11	- 1	1.09	-11	1.66	-11
3 1.5	1.20	2.36	- 1	1.33	-11	1.59	-11
3 2.5	0.96	2.23	- 1	-2.38	-12	1.29	-11

year 1983 month 8 day 7

time 21 : 39

weather 0. - , ○

tropopause altitude [$\times 10^3$ gpm] 15.4

number of shots 50

$B 5.9 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5	0.98	2.19	- 1	-1.98	-11	2.70	-10
1 4.5	1.06	2.37	- 1	6.66	-11	2.53	-10
1 5.5	1.35	3.01	- 1	3.24	-10	2.81	-10
1 6.5	1.52	3.41	- 1	4.08	-10	2.68	-10
1 7.5	2.77	6.19	- 1	1.18	- 9	4.12	-10
1 8.5	3.79	8.49	- 1	1.55	- 9	4.70	-10
1 9.5	3.22	7.31	- 1	1.02	- 9	3.37	-10
2 0.5	2.59	6.01	- 1	6.21	-10	2.35	-10
2 1.5	2.40	5.70	- 1	4.68	-10	1.91	-10
2 2.5	2.08	5.15	- 1	3.06	-10	1.46	-10
2 3.5	1.28	3.54	- 1	6.78	-11	8.46	-11
2 4.5	1.50	4.21	- 1	1.02	-10	8.65	-11
2 5.5	1.19	3.74	- 1	3.31	-11	6.56	-11
2 6.5	1.67	5.20	- 1	9.97	-11	7.71	-11
2 7.5	1.47	5.10	- 1	5.86	-11	6.37	-11
2 8.5	1.75	6.22	- 1	8.08	-11	6.68	-11
2 9.5	1.59	6.37	- 1	5.44	-11	5.86	-11
3 0.5	1.34	6.24	- 1	2.72	-11	4.93	-11
3 1.5							

year 1983 month 8 day 13

time 19 : 06

weather 3. Ci, ○

tropopause altitude [$\times 10^3$ gpm] 14.4

number of shots 100

$B 4.5 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	0.93	6.70	- 2	-9.73	-11	9.24	-11
1 3.5	1.26	9.12	- 2	3.23	-10	1.11	-10
1 4.5	1.42	1.03	- 1	4.49	-10	1.10	-10
1 5.5	1.73	1.26	- 1	6.66	-10	1.15	-10
1 6.5	2.21	1.63	- 1	9.47	-10	1.27	-10
1 7.5	2.93	2.20	- 1	1.27	- 9	1.44	-10
1 8.5	2.98	2.31	- 1	1.11	- 9	1.28	-10
1 9.5	2.38	1.94	- 1	6.48	-10	9.07	-11
2 0.5	2.01	1.74	- 1	3.89	-10	6.71	-11
2 1.5	2.05	1.85	- 1	3.47	-10	6.12	-11
2 2.5	1.76	1.74	- 1	2.16	-10	4.89	-11
2 3.5	1.14	1.34	- 1	3.29	-11	3.19	-11
2 4.5	1.12	1.44	- 1	2.52	-11	2.94	-11
2 5.5	0.94	1.40	- 1	-1.13	-11	2.44	-11
2 6.5	1.02	1.64	- 1	2.28	-12	2.44	-11
2 7.5	1.06	1.86	- 1	7.00	-12	2.37	-11
2 8.5	0.95	1.94	- 1	-5.37	-12	2.12	-11
2 9.5	0.98	2.22	- 1	-2.00	-12	2.08	-11
3 0.5	1.01	2.52	- 1	1.14	-12	2.02	-11
3 1.5	1.02	2.83	- 1	1.16	-12	1.95	-11
3 2.5	1.02	3.19	- 1	1.45	-12	1.89	-11

year 1983 month 9 day 3

time 20: 56

weather 6, Cu, ①

tropopause altitude [$\times 10^3$ gpm] 16.2

number of shots 50

$B 8.1 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.72	4.41	- 1	1.01	- 9	6.18	-10
1 3.5	1.66	4.28	- 1	8.21	-10	5.30	-10
1 4.5	1.59	4.10	- 1	6.39	-10	4.46	-10
1 5.5	1.64	4.26	- 1	5.98	-10	3.98	-10
1 6.5	2.95	7.65	- 1	1.55	- 9	6.08	-10
1 7.5	3.82	9.94	- 1	1.86	- 9	6.55	-10
1 8.5	4.42	1.16	0	1.91	- 9	6.46	-10
1 9.5	3.25	8.72	- 1	1.04	- 9	4.02	-10
2 0.5	3.21	8.77	- 1	8.47	-10	3.37	-10
2 1.5	2.60	7.38	- 1	5.20	-10	2.39	-10
2 2.5	2.45	7.22	- 1	4.01	-10	1.99	-10
2 3.5	1.81	5.80	- 1	1.91	-10	1.36	-10
2 4.5	1.72	5.85	- 1	1.46	-10	1.18	-10
2 5.5	1.62	5.92	- 1	1.06	-10	1.02	-10
2 6.5	1.43	5.85	- 1	6.27	-11	8.60	-11
2 7.5	0.93	4.80	- 1	-9.14	-12	6.03	-11
2 8.5	2.40	9.82	- 1	1.50	-10	1.05	-10
2 9.5	1.26	7.09	- 1	2.36	-11	6.52	-11
3 0.5	2.00	1.03	0	7.84	-11	8.14	-11
3 1.5							

year 1983 month 9 day 13

time 20: 30

weather 3, Sc, ①

tropopause altitude [$\times 10^3$ gpm] 15.7

number of shots 75

$B 3.9 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	0.91	9.95	- 2	-1.26	-10	1.37	-10
1 3.5	0.96	1.06	- 1	-5.41	-11	1.27	-10
1 4.5	1.06	1.18	- 1	6.31	-11	1.23	-10
1 5.5	1.61	1.78	- 1	5.49	-10	1.61	-10
1 6.5	1.81	2.03	- 1	6.17	-10	1.55	-10
1 7.5	2.72	3.05	- 1	1.12	- 9	1.97	-10
1 8.5	2.54	2.92	- 1	8.46	-10	1.60	-10
1 9.5	2.30	2.74	- 1	5.97	-10	1.25	-10
2 0.5	2.08	2.60	- 1	4.16	-10	9.97	-11
2 1.5	1.71	2.30	- 1	2.31	-10	7.48	-11
2 2.5	1.23	1.89	- 1	6.26	-11	5.23	-11
2 3.5	1.46	2.32	- 1	1.08	-10	5.43	-11
2 4.5	0.87	1.78	- 1	-2.51	-11	3.53	-11
2 5.5	0.84	1.91	- 1	-2.74	-11	3.26	-11
2 6.5	1.38	2.91	- 1	5.56	-11	4.22	-11
2 7.5	1.68	3.62	- 1	8.42	-11	4.49	-11
2 8.5	1.41	3.59	- 1	4.41	-11	3.83	-11
2 9.5	1.07	3.44	- 1	6.66	-12	3.14	-11
3 0.5	1.24	4.14	- 1	1.86	-11	3.24	-11
3 1.5	0.80	3.67	- 1	-1.36	-11	2.47	-11

year 1983 month 10 day 5
time 22: 03
weather 5, Ac, ⊕
tropopause altitude [$\times 10^3$ gpm] 14.1
number of shots 50

$B 8.0 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$	$\beta_A [z]$	$\sigma [\beta_A(z)]$
1 2.5	1.78	2.68 - 1	1.06 - 9	3.64 -10
1 3.5	2.04	3.09 - 1	1.22 - 9	3.61 -10
1 4.5	1.87	2.85 - 1	8.92 -10	2.92 -10
1 5.5	2.55	3.92 - 1	1.35 - 9	3.39 -10
1 6.5	3.16	4.91 - 1	1.63 - 9	3.69 -10
1 7.5	4.23	6.68 - 1	2.06 - 9	4.25 -10
1 8.5	3.83	6.19 - 1	1.51 - 9	3.29 -10
1 9.5	3.44	5.70 - 1	1.10 - 9	2.56 -10
2 0.5	2.86	4.89 - 1	6.93 -10	1.82 -10
2 1.5	2.76	4.86 - 1	5.50 -10	1.51 -10
2 2.5	3.11	5.58 - 1	5.68 -10	1.50 -10
2 3.5	2.32	4.41 - 1	3.01 -10	1.01 -10
2 4.5	1.44	3.09 - 1	8.58 -11	6.04 -11
2 5.5	2.08	4.38 - 1	1.82 -10	7.38 -11
2 6.5	0.88	2.51 - 1	-1.66 -11	3.56 -11
2 7.5	1.37	3.66 - 1	4.55 -11	4.50 -11
2 8.5	1.23	3.70 - 1	2.41 -11	3.89 -11
2 9.5	1.72	5.05 - 1	6.45 -11	4.55 -11
3 0.5	0.77	3.39 - 1	-1.79 -11	2.62 -11
3 1.5	1.16	4.78 - 1	1.04 -11	3.16 -11
3 2.5	0.85	4.47 - 1	-8.58 -12	2.54 -11

year 1983 month 10 day 11
time 18: 26
weather 0⁺, Ac, ⊙
tropopause altitude [$\times 10^3$ gpm] 16.7
number of shots 200

$B 9.2 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$	$\beta_A [z]$	$\sigma [\beta_A(z)]$
1 2.5	1.29	2.63 - 2	3.91 -10	3.36 -11
1 3.5	1.41	2.98 - 2	4.89 -10	3.35 -11
1 4.5	1.49	3.31 - 2	5.09 -10	3.27 -11
1 5.5	1.58	3.76 - 2	5.26 -10	3.24 -11
1 6.5	2.43	6.20 - 2	1.13 - 9	4.58 -11
1 7.5	4.31	1.31 - 1	2.14 - 9	8.05 -11
1 8.5	4.95	1.94 - 1	2.14 - 9	1.02 -10
1 9.5	4.89	2.35 - 1	1.76 - 9	1.04 -10
2 0.5	3.80	2.12 - 1	1.07 - 9	7.94 -11
2 1.5	2.93	1.80 - 1	6.10 -10	5.62 -11
2 2.5	1.91	1.30 - 1	2.48 -10	3.52 -11
2 3.5	1.99	1.42 - 1	2.27 -10	3.22 -11
2 4.5	1.62	1.27 - 1	1.21 -10	2.46 -11
2 5.5	1.62	1.35 - 1	1.03 -10	2.24 -11
2 6.5	1.45	1.34 - 1	6.42 -11	1.91 -11
2 7.5	1.50	1.48 - 1	6.05 -11	1.81 -11
2 8.5	1.40	1.53 - 1	4.31 -11	1.63 -11
2 9.5	1.80	2.01 - 1	7.13 -11	1.78 -11
3 0.5	1.59	2.02 - 1	4.50 -11	1.54 -11
3 1.5	1.35	2.03 - 1	2.29 -11	1.32 -11
3 2.5	1.25	2.16 - 1	1.42 -11	1.21 -11

year 1983 month 10 day 25
 time 17 : 11
 weather 3, Cu, ☉
 tropopause altitude [$\times 10^3$ gpm] 11.9, 16.9
 number of shots 250

B 4.6×10^{-4}

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.42	422	- 2	5.41	-10	5.35	-11
1 3.5	1.81	556	- 2	9.00	-10	5.91	-11
1 4.5	1.78	5.76	- 2	7.45	-10	5.33	-11
1 5.5	1.91	6.57	- 2	7.55	-10	5.27	-11
1 6.5	2.59	9.53	- 2	1.14	- 9	6.58	-11
1 7.5	2.28	9.33	- 2	7.73	-10	5.50	-11
1 8.5	2.73	1.20	- 1	8.78	-10	5.97	-11
1 9.5	2.18	1.07	- 1	5.16	-10	4.59	-11
2 0.5	1.89	1.02	- 1	3.22	-10	3.65	-11
2 1.5	2.65	1.45	- 1	5.12	-10	4.44	-11
2 2.5	2.39	1.44	- 1	3.68	-10	3.78	-11
2 3.5	2.23	1.48	- 1	2.73	-10	3.27	-11
2 4.5	1.52	1.21	- 1	1.00	-10	2.33	-11
2 5.5	1.69	1.42	- 1	1.14	-10	2.34	-11
2 6.5	1.32	1.34	- 1	4.46	-11	1.88	-11
2 7.5	1.69	1.73	- 1	8.39	-11	2.08	-11
2 8.5	1.29	1.63	- 1	3.01	-11	1.68	-11
2 9.5	1.18	1.74	- 1	1.56	-11	1.53	-11
3 0.5	1.55	2.25	- 1	4.17	-11	1.70	-11
3 1.5	1.45	2.43	- 1	2.88	-11	1.57	-11
3 2.5	1.48	2.76	- 1	2.64	-11	1.53	-11

year 1983 month 11 day 11
 time 17 : 21
 weather 7, Cu, ☉
 tropopause altitude [$\times 10^3$ gpm] 8.7, 15.2
 number of shots 100

B 3.9×10^{-4}

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	0.90	6.76	- 2	-1.30	-10	8.51	-11
1 3.5	1.08	8.21	- 2	8.77	-11	9.09	-11
1 4.5	1.48	1.13	- 1	4.67	-10	1.09	-10
1 5.5	1.96	1.50	- 1	7.94	-10	1.24	-10
1 6.5	2.38	1.85	- 1	9.60	-10	1.28	-10
1 7.5	3.10	2.46	- 1	1.25	- 9	1.45	-10
1 8.5	2.61	2.20	- 1	8.27	-10	1.12	-10
1 9.5	2.32	2.08	- 1	5.76	-10	9.06	-11
2 0.5	2.07	2.03	- 1	3.90	-10	7.36	-11
2 1.5	1.28	1.52	- 1	8.71	-11	4.72	-11
2 2.5	1.12	1.54	- 1	3.27	-11	4.06	-11
2 3.5	1.43	1.99	- 1	9.66	-11	4.46	-11
2 4.5	1.17	1.94	- 1	3.22	-11	3.72	-11
2 5.5	1.03	2.02	- 1	5.62	-12	3.30	-11
2 6.5	1.19	2.47	- 1	2.69	-11	3.45	-11
2 7.5	1.38	3.01	- 1	4.53	-11	3.58	-11
2 8.5	1.26	3.21	- 1	2.67	-11	3.26	-11
2 9.5	1.46	3.93	- 1	4.01	-11	3.43	-11
3 0.5	0.74	3.08	- 1	-1.94	-11	2.30	-11
3 1.5	1.27	4.60	- 1	1.74	-11	2.95	-11

year 1983 month 11 day 24

time 18: 01

weather 0, -, ○

tropopause altitude [$\times 10^3$ gpm] 15.0

number of shots 93

$B 6.4 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$	$\beta_A [z]$	$\sigma [\beta_A(z)]$
1 2.5	0.93	1.17 - 1	-8.95 -11	1.51 -10
1 3.5	1.06	1.33 - 1	6.37 -11	1.51 -10
1 4.5	1.32	1.67 - 1	3.17 -10	1.65 -10
1 5.5	1.99	2.50 - 1	8.41 -10	2.13 -10
1 6.5	2.60	3.30 - 1	1.15 - 9	2.36 -10
1 7.5	3.32	4.25 - 1	1.40 - 9	2.56 -10
1 8.5	3.36	4.37 - 1	1.22 - 9	2.25 -10
1 9.5	3.10	4.14 - 1	9.11 -10	1.79 -10
2 0.5	1.97	2.82 - 1	3.52 -10	1.02 -10
2 1.5	2.31	3.36 - 1	3.97 -10	1.02 -10
2 2.5	2.56	3.84 - 1	4.04 -10	9.95 -11
2 3.5	2.81	4.36 - 1	3.96 -10	9.53 -11
2 4.5	2.39	4.02 - 1	2.64 -10	7.61 -11
2 5.5	1.95	3.65 - 1	1.55 -10	5.99 -11
2 6.5	1.38	3.12 - 1	5.35 -11	4.40 -11
2 7.5	2.38	4.90 - 1	1.69 -10	5.97 -11
2 8.5	1.50	3.95 - 1	5.20 -11	4.11 -11
2 9.5	1.76	4.84 - 1	6.77 -11	4.32 -11
3 0.5	1.18	4.22 - 1	1.38 -11	3.24 -11
3 1.5	1.18	4.73 - 1	1.20 -11	3.11 -11

year 1983 month 12 day 1

time 18: 08

weather 0, -, ○

tropopause altitude [$\times 10^3$ gpm] 94, 16.2

number of shots 120

$B 2.7 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$	$\beta_A [z]$	$\sigma [\beta_A(z)]$
1 2.5	1.11	7.85 - 2	1.29 -10	9.63 -11
1 3.5	1.05	7.55 - 2	4.69 -11	8.06 -11
1 4.5	1.00	7.41 - 2	2.83 -12	6.89 -11
1 5.5	1.15	8.59 - 2	1.20 -10	6.99 -11
1 6.5	1.88	1.39 - 1	6.17 -10	9.73 -11
1 7.5	2.47	1.85 - 1	8.73 -10	1.09 -10
1 8.5	2.11	1.67 - 1	5.47 -10	8.17 -11
1 9.5	2.06	1.71 - 1	4.45 -10	7.14 -11
2 0.5	1.69	1.53 - 1	2.51 -10	5.57 -11
2 1.5	1.35	1.38 - 1	1.07 -10	4.25 -11
2 2.5	1.19	1.40 - 1	4.96 -11	3.58 -11
2 3.5	1.17	1.51 - 1	3.60 -11	3.30 -11
2 4.5	1.12	1.65 - 1	2.15 -11	2.99 -11
2 5.5	0.85	1.56 - 1	-2.33 -11	2.43 -11
2 6.5	0.87	1.78 - 1	-1.77 -11	2.38 -11
2 7.5	1.08	2.26 - 1	9.55 -12	2.58 -11
2 8.5	1.29	2.78 - 1	2.80 -11	2.72 -11
2 9.5	0.98	2.71 - 1	-1.53 -12	2.29 -11
3 0.5	1.42	3.69 - 1	3.04 -11	2.67 -11
3 1.5	1.14	3.70 - 1	8.87 -12	2.30 -11
3 2.5	1.32	4.48 - 1	1.69 11	2.40 -11

year 1983 month 12 day 9

time 17: 08

weather 0, -, ○

tropopause altitude [$\times 10^3$ gpm] 109, 132

number of shots 300

 $B 4.2 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	184	142	- 1	1.04	- 9	1.74	-10
1 3.5	232	181	- 1	1.41	- 9	1.92	-10
1 4.5	238	190	- 1	1.27	- 9	1.73	-10
1 5.5	246	202	- 1	1.15	- 9	1.59	-10
1 6.5	276	234	- 1	1.19	- 9	1.57	-10
1 7.5	312	274	- 1	1.23	- 9	1.59	-10
1 8.5	325	297	- 1	1.12	- 9	1.48	-10
1 9.5	225	220	- 1	5.20	-10	9.14	-11
2 0.5	176	185	- 1	2.68	-10	6.50	-11
2 1.5	129	150	- 1	8.71	-11	4.51	-11
2 2.5	131	162	- 1	7.82	-11	4.16	-11
2 3.5	151	194	- 1	1.11	-10	4.25	-11
2 4.5	141	199	- 1	7.61	-11	3.73	-11
2 5.5	105	178	- 1	7.48	-12	2.86	-11
2 6.5	110	203	- 1	1.41	-11	2.80	-11
2 7.5	121	238	- 1	2.48	-11	2.80	-11
2 8.5	132	277	- 1	3.23	-11	2.80	-11
2 9.5	105	272	- 1	4.28	-12	2.36	-11
3 0.5	109	309	- 1	6.95	-12	2.30	-11
3 1.5	121	366	- 1	1.32	-11	2.34	-11

year 1983 month 12 day 19

time 17: 36

weather 0, -, ○

tropopause altitude [$\times 10^3$ gpm] 100, 158

number of shots 150

 $B 4.5 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	131	260	- 1	3.63	-10	3.04	-10
1 3.5	158	315	- 1	5.97	-10	3.23	-10
1 4.5	197	392	- 1	8.68	-10	3.52	-10
1 5.5	249	498	- 1	1.17	- 9	3.89	-10
1 6.5	297	597	- 1	1.31	- 9	3.97	-10
1 7.5	336	680	- 1	1.36	- 9	3.93	-10
1 8.5	280	577	- 1	8.84	-10	2.83	-10
1 9.5	195	414	- 1	4.03	-10	1.75	-10
2 0.5	167	365	- 1	2.42	-10	1.33	-10
2 1.5	162	366	- 1	1.88	-10	1.11	-10
2 2.5	150	357	- 1	1.27	-10	9.09	-11
2 3.5	131	334	- 1	6.90	-11	7.37	-11
2 4.5	162	418	- 1	1.15	-10	7.77	-11
2 5.5	196	515	- 1	1.52	-10	8.17	-11
2 6.5	183	520	- 1	1.14	-10	7.14	-11
2 7.5	200	594	- 1	1.17	-10	6.97	-11
2 8.5	159	545	- 1	5.96	-11	5.50	-11
2 9.5	064	346	- 1	-3.10	-11	2.99	-11
3 0.5	122	554	- 1	1.62	-11	4.12	-11
3 1.5	183	784	- 1	5.29	-11	5.00	-11
3 2.5	100	614	- 1	1.75	-13	3.37	-11

year 1983 month 12 day 26

time 17 : 18

weather 0, -, ○

tropopause altitude ($\times 10^3$ gpm) 8.5, 21.4

number of shots 191

$B 3.3 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	159	1.30	- 1	6.85	-10	1.51	-10
1 3.5	177	1.47	- 1	7.75	-10	1.47	-10
1 4.5	199	1.67	- 1	8.64	-10	1.45	-10
1 5.5	206	1.77	- 1	8.00	-10	1.32	-10
1 6.5	207	1.83	- 1	6.88	-10	1.16	-10
1 7.5	225	2.03	- 1	6.87	-10	1.11	-10
1 8.5	226	2.11	- 1	5.99	-10	9.97	-11
1 9.5	252	2.41	- 1	6.08	-10	9.65	-11
2 0.5	277	2.75	- 1	6.12	-10	9.46	-11
2 1.5	220	2.34	- 1	3.61	-10	7.03	-11
2 2.5	127	1.62	- 1	6.80	-11	4.12	-11
2 3.5	105	1.52	- 1	1.02	-11	3.34	-11
2 4.5	0.98	1.60	- 1	-3.29	-12	2.98	-11
2 5.5	1.16	1.95	- 1	2.55	-11	3.13	-11
2 6.5	0.85	1.80	- 1	-2.05	-11	2.46	-11
2 7.5	1.10	2.33	- 1	1.15	-11	2.73	-11
2 8.5	0.99	2.45	- 1	-7.17	-13	2.45	-11
2 9.5	0.96	2.70	- 1	-3.60	-12	2.33	-11
3 0.5	1.56	3.93	- 1	4.14	-11	2.91	-11
3 1.5							

year 1984 month 1 day 6

time 17 : 26

weather 4, Ci, ⊙

tropopause altitude ($\times 10^3$ gpm) 8.6

number of shots 110

$B 2.7 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	199	2.00	- 1	1.18	- 9	2.36	-10
1 3.5	241	2.44	- 1	1.43	- 9	2.48	-10
1 4.5	266	2.74	- 1	1.45	- 9	2.39	-10
1 5.5	248	2.62	- 1	1.10	- 9	1.95	-10
1 6.5	208	2.27	- 1	6.92	-10	1.45	-10
1 7.5	212	2.38	- 1	6.11	-10	1.30	-10
1 8.5	239	2.75	- 1	6.51	-10	1.28	-10
1 9.5	240	2.85	- 1	5.66	-10	1.15	-10
2 0.5	1.61	2.09	- 1	2.08	-10	7.11	-11
2 1.5	1.24	1.78	- 1	7.05	-11	5.20	-11
2 2.5	1.06	1.70	- 1	1.42	-11	4.24	-11
2 3.5	1.31	2.14	- 1	6.59	-11	4.59	-11
2 4.5	1.36	2.38	- 1	6.52	-11	4.36	-11
2 5.5	0.96	2.06	- 1	-6.86	-12	3.29	-11
2 6.5	0.87	2.17	- 1	-1.76	-11	2.96	-11
2 7.5	0.90	2.47	- 1	-1.13	-11	2.88	-11
2 8.5	1.09	3.05	- 1	8.98	-12	3.06	-11
2 9.5	1.34	3.86	- 1	2.88	-11	3.31	-11
3 0.5	1.82	5.09	- 1	6.00	-11	3.74	-11
3 1.5	0.94	3.96	- 1	-4.06	-12	2.49	-11

year 1984 month 1 day 12

time 20 : 01

weather 0, -, ○

tropopause altitude [$\times 10^3$ gpm] 8.8, 14.9

number of shots 190

B 2.9×10^{-4}

Z [km]	R [z]	σ [R(z)]		β_A [z]		σ [β_A (z)]	
1 2.5	1.40	133	- 1	4.75	-10	1.59	-10
1 3.5	1.62	155	- 1	6.46	-10	1.62	-10
1 4.5	2.03	196	- 1	9.33	-10	1.77	-10
1 5.5	2.36	230	- 1	1.05	- 9	1.77	-10
1 6.5	2.60	258	- 1	1.06	- 9	1.70	-10
1 7.5	2.37	2.41	- 1	7.73	-10	1.35	-10
1 8.5	2.11	2.21	- 1	5.35	-10	1.06	-10
1 9.5	1.86	2.01	- 1	3.57	-10	8.30	-11
2 0.5	1.53	1.73	- 1	1.88	-10	6.16	-11
2 1.5	1.46	1.73	- 1	1.39	-10	5.20	-11
2 2.5	1.28	1.63	- 1	7.09	-11	4.20	-11
2 3.5	1.37	1.84	- 1	7.98	-11	3.95	-11
2 4.5	1.22	1.80	- 1	4.04	-11	3.32	-11
2 5.5	1.54	2.30	- 1	8.55	-11	3.62	-11
2 6.5	0.85	1.68	- 1	-2.01	-11	2.29	-11
2 7.5	0.95	1.98	- 1	-6.04	-12	2.30	-11
2 8.5	1.46	2.85	- 1	4.61	-11	2.85	-11
2 9.5	1.28	2.91	- 1	2.39	-11	2.49	-11
3 0.5	1.08	2.92	- 1	5.98	-12	2.14	-11
3 1.5	1.13	3.34	- 1	8.32	-12	2.10	-11
3 2.5	1.12	3.72	- 1	6.42	-12	2.00	-11

year 1984 month 1 day 26

time 17 : 32

weather 4, Ac, ○

tropopause altitude [$\times 10^3$ gpm] 8.5, 14.4

number of shots 340

B 3.1×10^{-4}

Z [km]	R [z]	σ [R(z)]		β_A [z]		σ [β_A (z)]	
1 2.5	1.70	155	- 1	8.37	-10	1.85	-10
1 3.5	1.78	1.64	- 1	8.10	-10	1.70	-10
1 4.5	1.86	1.73	- 1	7.80	-10	1.56	-10
1 5.5	2.42	2.28	- 1	1.08	- 9	1.73	-10
1 6.5	2.54	2.44	- 1	1.00	- 9	1.58	-10
1 7.5	2.63	2.57	- 1	9.23	-10	1.45	-10
1 8.5	2.21	2.22	- 1	5.88	-10	1.07	-10
1 9.5	1.79	1.85	- 1	3.32	-10	7.74	-11
2 0.5	1.73	1.84	- 1	2.54	-10	6.41	-11
2 1.5	1.54	1.71	- 1	1.62	-10	5.08	-11
2 2.5	1.38	1.61	- 1	9.78	-11	4.11	-11
2 3.5	1.49	1.80	- 1	1.06	-10	3.87	-11
2 4.5	1.30	1.68	- 1	5.64	-11	3.18	-11
2 5.5	1.31	1.81	- 1	4.85	-11	2.85	-11
2 6.5	1.18	1.80	- 1	2.48	-11	2.46	-11
2 7.5	1.09	1.86	- 1	1.08	-11	2.14	-11
2 8.5	0.86	1.73	- 1	-1.37	-11	1.74	-11
2 9.5	1.17	2.32	- 1	1.45	-11	1.99	-11
3 0.5	1.00	2.32	- 1	1.65	-13	1.71	-11
3 1.5							

year 1984 month 2 day 19
 time 18: 16
 weather 6, Ac, Ci
 tropopause altitude [$\times 10^3$ gpm] 9.3, 13.0, 15.4
 number of shots 144

$B 4.2 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	167	266	- 1	7.92	-10	3.16	-10
1 3.5	173	277	- 1	7.47	-10	2.85	-10
1 4.5	175	282	- 1	6.67	-10	2.52	-10
1 5.5	212	345	- 1	8.71	-10	2.68	-10
1 6.5	289	474	- 1	1.26	- 9	3.14	-10
1 7.5	262	437	- 1	9.29	-10	2.51	-10
1 8.5	230	394	- 1	6.43	-10	1.94	-10
1 9.5	281	486	- 1	7.45	-10	2.00	-10
2 0.5	158	297	- 1	2.01	-10	1.04	-10
2 1.5	267	491	- 1	4.98	-10	1.46	-10
2 2.5	154	322	- 1	1.37	-10	8.21	-11
2 3.5	188	398	- 1	1.93	-10	8.77	-11
2 4.5	148	353	- 1	8.97	-11	6.65	-11
2 5.5	112	314	- 1	1.85	-11	5.06	-11
2 6.5	101	326	- 1	1.37	-12	4.48	-11
2 7.5	132	425	- 1	3.72	-11	4.97	-11
2 8.5	0.90	3.72	- 1	-9.91	-12	3.78	-11
2 9.5	1.52	5.66	- 1	4.55	-11	4.92	-11
3 0.5	0.65	3.87	- 1	-2.64	-11	2.88	-11
3 1.5							

year 1984 month 2 day 27
 time 18: 00
 weather 0, -, O
 tropopause altitude [$\times 10^3$ gpm] 6.3, 17.0
 number of shots 65

$B 2.2 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	136	2.11	- 1	4.15	-10	2.43	-10
1 3.5	140	2.21	- 1	4.00	-10	2.19	-10
1 4.5	162	2.57	- 1	5.25	-10	2.19	-10
1 5.5	178	2.87	- 1	5.88	-10	2.16	-10
1 6.5	182	3.02	- 1	5.52	-10	2.03	-10
1 7.5	2.29	3.85	- 1	7.49	-10	2.22	-10
1 8.5	1.88	3.36	- 1	4.31	-10	1.65	-10
1 9.5	1.62	3.15	- 1	2.54	-10	1.29	-10
2 0.5	1.46	3.11	- 1	1.60	-10	1.09	-10
2 1.5	1.18	2.88	- 1	5.36	-11	8.69	-11
2 2.5	1.31	3.42	- 1	7.94	-11	8.83	-11
2 3.5	0.94	3.08	- 1	-1.24	-11	6.77	-11
2 4.5	0.72	2.93	- 1	-5.27	-11	5.53	-11
2 5.5	1.21	4.42	- 1	3.35	-11	7.16	-11
2 6.5	0.89	4.18	- 1	-1.59	-11	5.81	-11
2 7.5	0.92	4.82	- 1	-9.26	-12	5.70	-11
2 8.5	1.78	7.76	- 1	7.93	-11	7.86	-11
2 9.5	1.56	8.15	- 1	4.86	-11	7.07	-11
3 0.5	0.50	5.01	- 1	-3.75	-11	3.72	-11
3 1.5							

year 1984 month 4 day 14
time 19: 05
weather 3, Ac, ⊙
tropopause altitude [$\times 10^3$ gpm] 10.6, 16.0
number of shots 361

B 1.9×10^{-4}

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	193	2.01	- 1	1.14	- 9	2.45	-10
1 3.5	193	2.03	- 1	9.84	-10	2.13	-10
1 4.5	186	1.97	- 1	7.85	-10	1.79	-10
1 5.5	179	1.92	- 1	6.25	-10	1.51	-10
1 6.5	182	1.97	- 1	5.58	-10	1.34	-10
1 7.5	200	2.20	- 1	5.86	-10	1.28	-10
1 8.5	160	1.80	- 1	3.00	-10	8.90	-11
1 9.5	130	1.49	- 1	1.24	-10	6.18	-11
2 0.5	140	1.63	- 1	1.40	-10	5.78	-11
2 1.5	122	1.47	- 1	6.57	-11	4.45	-11
2 2.5	129	1.60	- 1	7.41	-11	4.13	-11
2 3.5	149	1.89	- 1	1.07	-10	4.14	-11
2 4.5	125	1.70	- 1	4.70	-11	3.20	-11
2 5.5	129	1.83	- 1	4.61	-11	2.95	-11
2 6.5	124	1.89	- 1	3.31	-11	2.61	-11
2 7.5	134	2.14	- 1	3.96	-11	2.52	-11
2 8.5	0.87	1.72	- 1	-1.29	-11	1.74	-11
2 9.5	1.58	2.81	- 1	4.99	-11	2.42	-11
3 0.5	1.14	2.46	- 1	1.03	-11	1.82	-11
3 1.5							

year 1984 month 7 day 3
time 21: 15
weather 0, -, ⊙
tropopause altitude [$\times 10^3$ gpm] 15.0
number of shots 70

B 3.0×10^{-4}

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.77	1.95	- 1	1.06	- 9	2.69	-10
1 3.5	1.18	1.32	- 1	2.21	-10	1.62	-10
1 4.5	3.97	4.41	- 1	3.22	- 9	4.76	-10
1 5.5	1.25	1.45	- 1	2.62	-10	1.49	-10
1 6.5	1.58	1.84	- 1	4.59	-10	1.45	-10
1 7.5	1.97	2.32	- 1	6.46	-10	1.54	-10
1 8.5	2.28	2.72	- 1	7.12	-10	1.52	-10
1 9.5	1.91	2.36	- 1	4.19	-10	1.09	-10
2 0.5	1.92	2.46	- 1	3.54	-10	9.46	-11
2 1.5	1.52	2.08	- 1	1.71	-10	6.77	-11
2 2.5	1.74	2.45	- 1	2.02	-10	6.71	-11
2 3.5	1.23	1.96	- 1	5.25	-11	4.55	-11
2 4.5	1.46	2.39	- 1	9.02	-11	4.72	-11
2 5.5	1.20	2.23	- 1	3.32	-11	3.78	-11
2 6.5	1.39	2.70	- 1	5.56	-11	3.89	-11
2 7.5	0.79	2.08	- 1	-2.55	-11	2.56	-11
2 8.5	1.31	3.12	- 1	3.20	-11	3.28	-11
2 9.5	0.97	2.92	- 1	-2.77	-12	2.62	-11
3 0.5	1.80	4.62	- 1	6.13	-11	3.57	-11
3 1.5							

year 1984 month 7 day 30

time 20 : 42

weather 5, Sc. ①

tropopause altitude [$\times 10^3$ gpm] 15.1

number of shots 50

$B 3.6 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.27	2.55	- 1	3.71	-10	3.56	-10
1 3.5	1.36	2.76	- 1	4.45	-10	3.39	-10
1 4.5	1.39	2.82	- 1	4.13	-10	3.02	-10
1 5.5	1.45	2.96	- 1	4.11	-10	2.72	-10
1 6.5	1.81	3.71	- 1	6.35	-10	2.93	-10
1 7.5	2.04	4.23	- 1	6.84	-10	2.79	-10
1 8.5	2.24	4.69	- 1	6.88	-10	2.61	-10
1 9.5	1.83	3.95	- 1	3.82	-10	1.83	-10
2 0.5	1.86	4.13	- 1	3.37	-10	1.61	-10
2 1.5	1.74	4.00	- 1	2.44	-10	1.33	-10
2 2.5	1.91	4.54	- 1	2.57	-10	1.28	-10
2 3.5	1.37	3.62	- 1	8.85	-11	8.66	-11
2 4.5	1.80	4.76	- 1	1.63	-10	9.71	-11
2 5.5	1.54	4.53	- 1	9.39	-11	7.82	-11
2 6.5	1.59	5.00	- 1	8.63	-11	7.36	-11
2 7.5	1.96	6.28	- 1	1.19	-10	7.83	-11
2 8.5	2.56	8.21	- 1	1.64	-10	8.65	-11
2 9.5	0.63	3.84	- 1	-3.35	-11	3.47	-11
3 0.5	1.06	5.72	- 1	4.77	-12	4.44	-11
3 1.5							

year 1984 month 8 day 17

time 19 : 00

weather 0, -, ①

tropopause altitude [$\times 10^3$ gpm] 15.9

number of shots 50

$B 2.1 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.00	9.31	- 2	2.71	-12	1.31	-10
1 3.5	1.04	9.78	- 2	5.35	-11	1.20	-10
1 4.5	0.83	7.95	- 2	-1.83	-10	8.51	-11
1 5.5	1.20	1.15	- 1	1.89	-10	1.07	-10
1 6.5	1.35	1.31	- 1	2.79	-10	1.04	-10
1 7.5	1.80	1.75	- 1	5.34	-10	1.17	-10
1 8.5	1.82	1.83	- 1	4.61	-10	1.02	-10
1 9.5	1.54	1.63	- 1	2.50	-10	7.58	-11
2 0.5	1.54	1.71	- 1	2.15	-10	6.77	-11
2 1.5	1.33	1.61	- 1	1.11	-10	5.37	-11
2 2.5	1.18	1.59	- 1	4.91	-11	4.45	-11
2 3.5	1.35	1.89	- 1	8.23	-11	4.51	-11
2 4.5	1.18	1.89	- 1	3.69	-11	3.83	-11
2 5.5	1.20	2.10	- 1	3.45	-11	3.64	-11
2 6.5	1.45	2.63	- 1	6.69	-11	3.88	-11
2 7.5	1.34	2.76	- 1	4.23	-11	3.49	-11
2 8.5	1.31	3.03	- 1	3.29	-11	3.27	-11
2 9.5	1.71	3.97	- 1	6.58	-11	3.67	-11
3 0.5	1.28	3.74	- 1	2.23	-11	2.98	-11
3 1.5	1.14	3.95	- 1	9.73	-12	2.69	-11

year 1984 month 8 day 31

time 21: 33

weather 5, Cu, O

tropopause altitude [$\times 10^3$ gpm] 14.9

number of shots 170

B 2.0 $\times 10^{-4}$

year 1984 month 9 day 22

time 19: 50

weather 1, Ci, O

tropopause altitude [$\times 10^3$ gpm] 10.6, 16.1

number of shots 200

B 1.1 $\times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	0.98	7.17	- 2	-2.24	-11	9.94	-11
1 3.5	1.06	7.76	- 2	7.33	-11	9.43	-11
1 4.5	1.04	7.64	- 2	3.99	-11	8.23	-11
1 5.5	1.11	8.26	- 2	1.05	-10	7.67	-11
1 6.5	1.31	9.80	- 2	2.45	-10	7.68	-11
1 7.5	1.64	1.23	- 1	4.17	-10	8.01	-11
1 8.5	1.71	1.31	- 1	3.87	-10	7.07	-11
1 9.5	1.47	1.17	- 1	2.16	-10	5.29	-11
2 0.5	1.69	1.36	- 1	2.64	-10	5.19	-11
2 1.5	1.53	1.29	- 1	1.73	-10	4.19	-11
2 2.5	1.41	1.26	- 1	1.13	-10	3.50	-11
2 3.5	1.39	1.32	- 1	9.20	-11	3.12	-11
2 4.5	1.35	1.38	- 1	7.10	-11	2.76	-11
2 5.5	1.33	1.46	- 1	5.67	-11	2.50	-11
2 6.5	1.32	1.58	- 1	4.65	-11	2.30	-11
2 7.5	1.16	1.60	- 1	2.01	-11	1.96	-11
2 8.5	1.44	2.00	- 1	4.59	-11	2.11	-11
2 9.5	1.14	1.93	- 1	1.26	-11	1.74	-11
3 0.5	1.24	2.23	- 1	1.88	-11	1.73	-11
3 1.5	0.99	2.20	- 1	-3.46	-13	1.46	-11
3 2.5	0.94	2.39	- 1	-3.27	-12	1.37	-11

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.08	4.94	- 2	1.02	-10	6.45	-11
1 3.5	1.07	4.98	- 2	7.69	-11	5.71	-11
1 4.5	1.08	5.14	- 2	7.86	-11	5.13	-11
1 5.5	1.28	6.18	- 2	2.43	-10	5.31	-11
1 6.5	1.44	7.13	- 2	3.24	-10	5.21	-11
1 7.5	1.61	8.24	- 2	3.86	-10	5.13	-11
1 8.5	1.67	8.96	- 2	3.55	-10	4.67	-11
1 9.5	1.58	9.03	- 2	2.56	-10	3.98	-11
2 0.5	1.22	8.00	- 2	8.19	-11	3.01	-11
2 1.5	1.18	8.54	- 2	5.84	-11	2.71	-11
2 2.5	1.16	9.38	- 2	4.33	-11	2.51	-11
2 3.5	1.01	9.54	- 2	2.90	-12	2.18	-11
2 4.5	1.00	1.06	- 1	7.96	-13	2.07	-11
2 5.5	0.96	1.15	- 1	-7.54	-12	1.94	-11
2 6.5	0.92	1.28	- 1	-1.18	-11	1.84	-11
2 7.5	1.01	1.52	- 1	1.36	-12	1.87	-11
2 8.5	1.07	1.77	- 1	7.73	-12	1.86	-11
2 9.5	1.00	1.94	- 1	-1.45	-13	1.75	-11
3 0.5	0.92	2.10	- 1	-6.09	-12	1.62	-11
3 1.5	1.19	2.71	- 1	1.24	-11	1.79	-11
3 2.5	1.02	2.87	- 1	1.27	-12	1.63	-11

year 1984 month 9 day 28

time 18 : 20

weather 0, -, ○

tropopause altitude ($\times 10^3$ gpm) 16.4

number of shots 450

B 1.5×10^{-4}

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.05	2.84	- 2	6.68	-11	3.83	-11
1 3.5	1.09	2.99	- 2	1.04	-10	3.53	-11
1 4.5	1.12	3.15	- 2	1.28	-10	3.23	-11
1 5.5	1.24	3.55	- 2	2.19	-10	3.12	-11
1 6.5	1.41	4.13	- 2	3.15	-10	3.11	-11
1 7.5	1.68	5.08	- 2	4.41	-10	3.18	-11
1 8.5	1.67	5.35	- 2	3.60	-10	2.80	-11
1 9.5	1.57	5.44	- 2	2.56	-10	2.38	-11
2 0.5	1.41	5.38	- 2	1.53	-10	2.00	-11
2 1.5	1.37	5.70	- 2	1.17	-10	1.81	-11
2 2.5	1.02	5.16	- 2	4.78	-12	1.40	-11
2 3.5	1.07	5.92	- 2	1.67	-11	1.36	-11
2 4.5	1.01	6.35	- 2	1.08	-12	1.25	-11
2 5.5	0.98	7.01	- 2	-4.18	-12	1.17	-11
2 6.5	0.93	7.76	- 2	-9.34	-12	1.11	-11
2 7.5	1.04	9.22	- 2	4.35	-12	1.14	-11
2 8.5	1.00	1.02	- 1	-1.13	-13	1.08	-11
2 9.5	1.19	1.28	- 1	1.74	-11	1.16	-11
3 0.5	1.13	1.41	- 1	9.80	-12	1.09	-11
3 1.5	1.11	1.60	- 1	7.05	-12	1.06	-11
3 2.5	1.17	1.88	- 1	9.85	-12	1.07	-11

year 1984 month 10 day 15

time 18 : 39

weather 4, Sc, Ci

tropopause altitude ($\times 10^3$ gpm) 14.1

number of shots 181

B 1.66×10^{-4}

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.10	1.04	- 1	1.29	-10	1.36	-10
1 3.5	1.12	1.06	- 1	1.31	-10	1.21	-10
1 4.5	1.20	1.16	- 1	2.00	-10	1.14	-10
1 5.5	1.39	1.35	- 1	3.29	-10	1.14	-10
1 6.5	1.40	1.39	- 1	2.91	-10	1.01	-10
1 7.5	1.66	1.68	- 1	4.00	-10	1.02	-10
1 8.5	1.64	1.72	- 1	3.33	-10	8.87	-11
1 9.5	1.66	1.80	- 1	2.91	-10	7.92	-11
2 0.5	1.12	1.38	- 1	4.27	-11	5.10	-11
2 1.5	1.53	1.88	- 1	1.67	-10	5.91	-11
2 2.5	1.15	1.64	- 1	3.92	-11	4.43	-11
2 3.5	1.60	2.25	- 1	1.37	-10	5.16	-11
2 4.5	1.16	1.99	- 1	3.16	-11	3.88	-11
2 5.5	1.10	2.14	- 1	1.64	-11	3.54	-11
2 6.5	0.80	2.02	- 1	-2.81	-11	2.84	-11
2 7.5	1.31	2.97	- 1	3.70	-11	3.58	-11
2 8.5	1.00	2.88	- 1	-4.25	-13	2.97	-11
2 9.5	0.85	3.06	- 1	-1.29	-11	2.70	-11
3 0.5	1.43	4.45	- 1	3.24	-11	3.36	-11
3 1.5	1.70	5.51	- 1	4.50	-11	3.56	-11
3 2.5	0.84	4.59	- 1	-8.85	-12	2.54	-11

year 1984 month 10 day 30

time 18 : 09

weather 0, -, ○

tropopause altitude ($\times 10^3$ gpm) 158

number of shots 207

$B 1.7 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.21	8.28	- 2	2.57	-10	1.02	-10
1 3.5	1.27	8.75	- 2	2.94	-10	9.55	-11
1 4.5	1.34	9.32	- 2	3.29	-10	8.93	-11
1 5.5	1.49	1.05	- 1	4.14	-10	8.73	-11
1 6.5	1.77	1.25	- 1	5.54	-10	8.94	-11
1 7.5	1.87	1.35	- 1	5.27	-10	8.10	-11
1 8.5	1.69	1.25	- 1	3.64	-10	6.53	-11
1 9.5	1.49	1.14	- 1	2.08	-10	4.87	-11
2 0.5	1.27	1.03	- 1	9.83	-11	3.80	-11
2 1.5	1.20	1.03	- 1	6.26	-11	3.19	-11
2 2.5	1.32	1.18	- 1	8.34	-11	3.09	-11
2 3.5	1.22	1.18	- 1	4.91	-11	2.61	-11
2 4.5	1.10	1.17	- 1	1.85	-11	2.24	-11
2 5.5	1.10	1.27	- 1	1.70	-11	2.09	-11
2 6.5	0.91	1.24	- 1	-1.25	-11	1.73	-11
2 7.5	1.15	1.57	- 1	1.77	-11	1.89	-11
2 8.5	1.26	1.83	- 1	2.61	-11	1.87	-11
2 9.5	1.00	1.79	- 1	-3.09	-14	1.57	-11
3 0.5	0.96	1.94	- 1	-2.97	-12	1.45	-11
3 1.5							

year 1984 month 11 day 7

time 17 : 27

weather 0, -, ○

tropopause altitude ($\times 10^3$ gpm) 165

number of shots 450

$B 1.6 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.17	9.72	- 2	2.25	-10	1.27	-10
1 3.5	1.16	9.66	- 2	1.83	-10	1.10	-10
1 4.5	1.16	9.69	- 2	1.58	-10	9.65	-11
1 5.5	1.25	1.05	- 1	2.18	-10	9.07	-11
1 6.5	1.43	1.21	- 1	3.20	-10	9.00	-11
1 7.5	1.72	1.47	- 1	4.55	-10	9.19	-11
1 8.5	1.60	1.38	- 1	3.14	-10	7.24	-11
1 9.5	1.43	1.27	- 1	1.93	-10	5.63	-11
2 0.5	1.16	1.07	- 1	5.85	-11	4.00	-11
2 1.5	1.25	1.18	- 1	8.07	-11	3.75	-11
2 2.5	1.30	1.28	- 1	8.02	-11	3.39	-11
2 3.5	1.31	1.35	- 1	6.97	-11	3.00	-11
2 4.5	1.27	1.39	- 1	5.08	-11	2.62	-11
2 5.5	1.43	1.62	- 1	6.94	-11	2.63	-11
2 6.5	1.12	1.47	- 1	1.62	-11	2.04	-11
2 7.5	1.40	1.87	- 1	4.82	-11	2.22	-11
2 8.5	1.11	1.76	- 1	1.12	-11	1.80	-11
2 9.5	0.92	1.79	- 1	-7.11	-12	1.57	-11
3 0.5	0.87	1.97	- 1	-9.80	-12	1.48	-11
3 1.5							

year 1984 month 12 day 13
 time 19 : 10
 weather 10, Ac, ☉
 tropopause altitude [$\times 10^3$ gpm] 9.9, 15.9
 number of shots 50

$B 2.3 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5	1.30	3.37	- 1	2.88	-10	3.22	-10
1 5.5	1.45	3.79	- 1	3.71	-10	3.12	-10
1 6.5	1.71	4.51	- 1	5.06	-10	3.20	-10
1 7.5	1.62	4.36	- 1	3.68	-10	2.61	-10
1 8.5	1.75	4.81	- 1	3.83	-10	2.45	-10
1 9.5	1.82	5.12	- 1	3.50	-10	2.19	-10
2 0.5	1.71	5.03	- 1	2.58	-10	1.84	-10
2 1.5	0.94	3.25	- 1	-2.01	-11	1.02	-10
2 2.5	1.95	6.19	- 1	2.50	-10	1.64	-10
2 3.5	1.91	6.48	- 1	2.05	-10	1.46	-10
2 4.5	1.50	5.84	- 1	9.60	-11	1.12	-10
2 5.5	0.47	3.21	- 1	-8.72	-11	5.25	-11
2 6.5	1.07	5.73	- 1	9.20	-12	7.98	-11
2 7.5	1.10	6.52	- 1	1.13	-11	7.76	-11
2 8.5	1.41	8.38	- 1	4.16	-11	8.56	-11
2 9.5	1.36	9.33	- 1	3.14	-11	8.17	-11
3 0.5	1.11	9.52	- 1	7.89	-12	7.17	-11
3 1.5							

year 1984 month 12 day 26
 time 17 : 16
 weather 2, Ac, ☐
 tropopause altitude [$\times 10^3$ gpm] 10.9, 14.3, 21.1
 number of shots 108

$B 2.3 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.43	1.69	- 1	5.32	-10	2.07	-10
1 3.5	1.52	1.80	- 1	5.49	-10	1.91	-10
1 4.5	1.65	1.97	- 1	5.98	-10	1.82	-10
1 5.5	1.69	2.05	- 1	5.49	-10	1.62	-10
1 6.5	1.62	2.00	- 1	4.07	-10	1.33	-10
1 7.5	2.00	2.51	- 1	5.63	-10	1.41	-10
1 8.5	2.09	2.69	- 1	5.24	-10	1.29	-10
1 9.5	2.01	2.68	- 1	4.17	-10	1.10	-10
2 0.5	1.75	2.48	- 1	2.70	-10	8.89	-11
2 1.5	1.71	2.57	- 1	2.16	-10	7.76	-11
2 2.5	0.95	1.79	- 1	-1.41	-11	4.61	-11
2 3.5	0.97	1.99	- 1	-6.76	-12	4.43	-11
2 4.5	1.07	2.35	- 1	1.37	-11	4.44	-11
2 5.5	0.93	2.42	- 1	-1.18	-11	3.83	-11
2 6.5	1.17	3.12	- 1	2.28	-11	4.21	-11
2 7.5	1.28	3.69	- 1	3.23	-11	4.26	-11
2 8.5	1.03	3.73	- 1	3.11	-12	3.69	-11
2 9.5	1.08	4.40	- 1	7.09	-12	3.74	-11
3 0.5	0.69	4.19	- 1	-2.24	-11	3.06	-11
3 1.5	1.33	6.32	- 1	2.06	-11	3.96	-11

year 1985 month 1 day 9time 17 : 35weather 0, -, ○tropopause altitude [$\times 10^3$ gpm] 8.7, 16.7number of shots 189 $B 2.1 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.36	1.49	- 1	4.47	-10	1.83	-10
1 3.5	1.45	1.59	- 1	4.83	-10	1.71	-10
1 4.5	1.56	1.72	- 1	5.15	-10	1.59	-10
1 5.5	1.62	1.81	- 1	5.02	-10	1.46	-10
1 6.5	1.85	2.09	- 1	5.93	-10	1.45	-10
1 7.5	2.03	2.33	- 1	6.13	-10	1.38	-10
1 8.5	1.75	2.07	- 1	3.76	-10	1.04	-10
1 9.5	1.86	2.26	- 1	3.65	-10	9.61	-11
2 0.5	1.30	1.73	- 1	1.10	-10	6.30	-11
2 1.5	1.48	2.03	- 1	1.48	-10	6.24	-11
2 2.5	1.24	1.89	- 1	6.17	-11	4.92	-11
2 3.5	1.27	2.09	- 1	5.97	-11	4.56	-11
2 4.5	1.30	2.30	- 1	5.56	-11	4.30	-11
2 5.5	0.99	2.12	- 1	-9.83	-13	3.41	-11
2 6.5	1.12	2.57	- 1	1.64	-11	3.48	-11
2 7.5	0.90	2.54	- 1	-1.17	-11	2.94	-11
2 8.5	0.94	2.93	- 1	-5.74	-12	2.91	-11
2 9.5	0.96	3.39	- 1	-3.76	-12	2.88	-11
3 0.5	0.97	3.87	- 1	-1.86	-12	2.82	-11
3 1.5	0.95	4.40	- 1	-3.17	-12	2.75	-11

year 1985 month 1 day 21time 18 : 05weather 0, -, ○tropopause altitude [$\times 10^3$ gpm] 10.6, 18.7number of shots 131 $B 2.2 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.96	3.04	- 1	1.17	- 9	3.71	-10
1 3.5	2.02	3.15	- 1	1.07	- 9	3.29	-10
1 4.5	1.99	3.13	- 1	8.90	-10	2.80	-10
1 5.5	2.05	3.26	- 1	8.02	-10	2.48	-10
1 6.5	1.94	3.13	- 1	6.16	-10	2.05	-10
1 7.5	1.94	3.20	- 1	5.32	-10	1.80	-10
1 8.5	1.85	3.12	- 1	4.19	-10	1.53	-10
1 9.5	1.78	3.10	- 1	3.26	-10	1.30	-10
2 0.5	1.43	2.68	- 1	1.51	-10	9.39	-11
2 1.5	1.45	2.85	- 1	1.36	-10	8.55	-11
2 2.5	1.54	3.17	- 1	1.40	-10	8.21	-11
2 3.5	1.30	3.00	- 1	6.51	-11	6.58	-11
2 4.5	0.86	2.51	- 1	-2.66	-11	4.67	-11
2 5.5	1.13	3.31	- 1	2.02	-11	5.23	-11
2 6.5	0.91	3.30	- 1	-1.24	-11	4.48	-11
2 7.5	0.75	3.42	- 1	-2.91	-11	3.97	-11
2 8.5	1.52	5.50	- 1	5.14	-11	5.48	-11
2 9.5	1.27	5.78	- 1	2.27	-11	4.92	-11
3 0.5	0.92	5.80	- 1	-5.98	-12	4.24	-11
3 1.5							

year 1985 month 1 day 31
 time 18 : 58
 weather 0, -, ○
 tropopause altitude ($\times 10^3$ gpm) 98, 148
 number of shots 50

$B 1.3 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	148	2.16	- 1	5.70	-10	2.56	-10
1 3.5	153	2.25	- 1	5.41	-10	2.31	-10
1 4.5	165	2.46	- 1	5.78	-10	2.18	-10
1 5.5	168	2.55	- 1	5.20	-10	1.94	-10
1 6.5	166	2.59	- 1	4.33	-10	1.69	-10
1 7.5	170	2.74	- 1	3.89	-10	1.51	-10
1 8.5	153	2.59	- 1	2.50	-10	1.22	-10
1 9.5	162	2.86	- 1	2.49	-10	1.15	-10
2 0.5	0.94	2.01	- 1	-2.10	-11	6.85	-11
2 1.5	1.10	2.46	- 1	2.93	-11	7.04	-11
2 2.5	0.99	2.55	- 1	-1.56	-12	6.17	-11
2 3.5	1.08	2.96	- 1	1.60	-11	6.15	-11
2 4.5	1.06	3.29	- 1	1.02	-11	5.71	-11
2 5.5	1.15	3.82	- 1	2.30	-11	5.83	-11
2 6.5	1.66	5.32	- 1	8.56	-11	6.93	-11
2 7.5	0.97	4.48	- 1	-3.59	-12	4.98	-11
2 8.5	1.22	5.67	- 1	2.17	-11	5.49	-11
2 9.5	0.76	5.24	- 1	-1.98	-11	4.31	-11
3 0.5	0.61	5.49	- 1	-2.79	-11	3.91	-11
3 1.5							

year 1985 month 2 day 11
 time 17 : 47
 weather 0, -, ○
 tropopause altitude ($\times 10^3$ gpm) 9.1, 17.7
 number of shots 401

$B 1.4 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.84	1.99	- 1	1.00	- 9	2.36	-10
1 3.5	1.79	1.94	- 1	8.00	-10	1.97	-10
1 4.5	1.71	1.87	- 1	6.23	-10	1.64	-10
1 5.5	1.81	2.00	- 1	6.26	-10	1.53	-10
1 6.5	1.73	1.93	- 1	4.87	-10	1.29	-10
1 7.5	1.74	1.97	- 1	4.31	-10	1.15	-10
1 8.5	1.42	1.66	- 1	2.06	-10	8.12	-11
1 9.5	1.38	1.65	- 1	1.59	-10	6.91	-11
2 0.5	1.17	1.48	- 1	6.04	-11	5.29	-11
2 1.5	1.16	1.53	- 1	4.86	-11	4.66	-11
2 2.5	1.14	1.60	- 1	3.47	-11	4.12	-11
2 3.5	1.33	1.93	- 1	7.29	-11	4.23	-11
2 4.5	1.25	1.97	- 1	4.64	-11	3.68	-11
2 5.5	1.20	2.09	- 1	3.24	-11	3.33	-11
2 6.5	1.11	2.20	- 1	1.49	-11	2.98	-11
2 7.5	1.39	2.81	- 1	4.46	-11	3.22	-11
2 8.5	0.95	2.58	- 1	-4.87	-12	2.53	-11
2 9.5	1.19	3.31	- 1	1.59	-11	2.78	-11
3 0.5	0.85	3.30	- 1	-1.10	-11	2.37	-11
3 1.5							

year 1985 month 2 day 22

time 18: 16

weather 0, -, ○

tropopause altitude [$\times 10^3$ gpm] 9.1, 14.1, 17.2

number of shots 212

$B 3.0 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	2.06	3.05	- 1	1.25	- 9	3.59	-10
1 3.5	2.15	3.19	- 1	1.18	- 9	3.27	-10
1 4.5	2.07	3.09	- 1	9.57	-10	2.76	-10
1 5.5	2.11	3.17	- 1	8.52	-10	2.43	-10
1 6.5	2.22	3.36	- 1	8.14	-10	2.25	-10
1 7.5	2.25	3.45	- 1	7.28	-10	2.01	-10
1 8.5	2.18	3.40	- 1	5.86	-10	1.69	-10
1 9.5	2.07	3.30	- 1	4.49	-10	1.38	-10
2 0.5	1.52	2.55	- 1	1.84	-10	9.01	-11
2 1.5	1.46	2.54	- 1	1.40	-10	7.71	-11
2 2.5	1.82	3.20	- 1	2.11	-10	8.27	-11
2 3.5	0.94	2.01	- 1	-1.31	-11	4.44	-11
2 4.5	1.31	2.75	- 1	5.85	-11	5.19	-11
2 5.5	1.75	3.66	- 1	1.21	-10	5.90	-11
2 6.5	1.11	2.94	- 1	1.51	-11	4.11	-11
2 7.5	1.40	3.77	- 1	4.71	-11	4.45	-11
2 8.5	0.92	3.39	- 1	-8.54	-12	3.43	-11
2 9.5	1.30	4.62	- 1	2.59	-11	4.00	-11
3 0.5	0.66	4.13	- 1	-2.49	-11	3.07	-11
3 1.5							

year 1985 month 3 day 24

time 18: 30

weather 0, -, ○

tropopause altitude [$\times 10^3$ gpm] 10.6, 21.3

number of shots 276

$B 1.4 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	1.42	2.51	- 1	4.55	-10	2.70	-10
1 3.5	1.35	2.39	- 1	3.28	-10	2.23	-10
1 4.5	1.31	2.33	- 1	2.45	-10	1.85	-10
1 5.5	1.51	2.70	- 1	3.46	-10	1.82	-10
1 6.5	1.57	2.82	- 1	3.24	-10	1.62	-10
1 7.5	1.50	2.74	- 1	2.44	-10	1.35	-10
1 8.5	1.43	2.68	- 1	1.79	-10	1.11	-10
1 9.5	1.69	3.18	- 1	2.46	-10	1.14	-10
2 0.5	1.56	3.04	- 1	1.77	-10	9.53	-11
2 1.5	1.49	3.01	- 1	1.29	-10	7.96	-11
2 2.5	1.47	3.14	- 1	1.05	-10	6.96	-11
2 3.5	1.29	2.98	- 1	5.50	-11	5.65	-11
2 4.5	1.06	2.77	- 1	9.31	-12	4.46	-11
2 5.5	0.72	2.39	- 1	-3.87	-11	3.31	-11
2 6.5	1.14	3.52	- 1	1.63	-11	4.16	-11
2 7.5	1.40	4.41	- 1	4.01	-11	4.46	-11
2 8.5	1.49	5.09	- 1	4.22	-11	4.40	-11
2 9.5	1.41	5.62	- 1	3.01	-11	4.16	-11
3 0.5	0.92	5.36	- 1	-5.20	-12	3.40	-11
3 1.5							

year 1985 month 4 day 1
time 21: 15
weather 0, -, ○
tropopause altitude ($\times 10^3$ gpm) 8.9, 15.1
number of shots 224

B 1.5×10^{-4}

Z [km]	R [z]	σ [R(z)]	β_A [z]	σ [β_A (z)]
1.2.5	0.99	1.09 - 1	-1.04 -11	1.31 -10
1 3.5	0.97	1.08 - 1	-2.71 -11	1.12 -10
1 4.5	1.06	1.18 - 1	5.67 -11	1.06 -10
1 5.5	1.19	1.33 - 1	1.52 -10	1.06 -10
1 6.5	1.30	1.47 - 1	2.01 -10	9.96 -11
1 7.5	1.56	1.78 - 1	3.27 -10	1.04 -10
1 8.5	1.52	1.77 - 1	2.61 -10	8.86 -11
1 9.5	1.52	1.82 - 1	2.21 -10	7.67 -11
2 0.5	1.60	1.96 - 1	2.14 -10	7.04 -11
2 1.5	1.56	2.00 - 1	1.71 -10	6.05 -11
2 2.5	1.23	1.73 - 1	5.81 -11	4.44 -11
2 3.5	1.20	1.81 - 1	4.31 -11	3.98 -11
2 4.5	1.12	1.86 - 1	2.34 -11	3.50 -11
2 5.5	1.29	2.23 - 1	4.74 -11	3.59 -11
2 6.5	0.89	1.93 - 1	-1.58 -11	2.66 -11
2 7.5	0.92	2.19 - 1	-9.45 -12	2.59 -11
2 8.5	1.18	2.83 - 1	1.86 -11	2.85 -11
2 9.5	0.71	2.46 - 1	-2.48 -11	2.13 -11
3 0.5	1.56	4.13 - 1	4.17 -11	3.06 -11
3 1.5	1.27	4.20 - 1	1.73 -11	2.66 -11
3 2.5	0.95	4.21 - 1	-2.58 -12	2.29 -11

year 1985 month 4 day 24
time 18: 50
weather 0, -, ○
tropopause altitude ($\times 10^3$ gpm) 9.3, 17.1
number of shots 339

B 2.4×10^{-4}

Z [km]	R [z]	σ [R(z)]	β_A [z]	σ [β_A (z)]
1 2.5	1.94	2.49 - 1	1.15 - 9	3.02 -10
1 3.5	1.76	2.27 - 1	8.21 -10	2.43 -10
1 4.5	1.62	2.10 - 1	5.91 -10	1.98 -10
1 5.5	1.49	1.94 - 1	4.06 -10	1.61 -10
1 6.5	1.62	2.12 - 1	4.51 -10	1.54 -10
1 7.5	1.91	2.53 - 1	5.60 -10	1.55 -10
1 8.5	1.69	2.28 - 1	3.59 -10	1.18 -10
1 9.5	1.93	2.61 - 1	4.12 -10	1.16 -10
2 0.5	1.41	2.01 - 1	1.52 -10	7.44 -11
2 1.5	1.52	2.21 - 1	1.63 -10	6.92 -11
2 2.5	1.48	2.25 - 1	1.25 -10	5.87 -11
2 3.5	1.63	2.56 - 1	1.41 -10	5.68 -11
2 4.5	1.51	2.51 - 1	9.59 -11	4.77 -11
2 5.5	1.67	2.89 - 1	1.09 -10	4.69 -11
2 6.5	1.41	2.74 - 1	5.69 -11	3.80 -11
2 7.5	1.27	2.77 - 1	3.26 -11	3.29 -11
2 8.5	0.92	2.48 - 1	-7.80 -12	2.53 -11
2 9.5	0.84	2.64 - 1	-1.44 -11	2.30 -11
3 0.5	1.14	3.49 - 1	1.05 -11	2.60 -11
3 1.5				

year 1985 month 5 day 16
time 19: 16
weather 0, -, ○
tropopause altitude ($\times 10^3$ gpm) 10.6, 12.2, 16.2
number of shots 290

$B 1.1 \times 10^{-4}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5	15 2	128	- 1	6.72	-10	1.66	-10
1 3.5	15 0	128	- 1	5.55	-10	1.42	-10
1 4.5	13 5	118	- 1	3.39	-10	1.13	-10
1 5.5	13 0	116	- 1	2.53	-10	9.69	-11
1 6.5	13 6	125	- 1	2.59	-10	8.95	-11
1 7.5	14 6	138	- 1	2.80	-10	8.45	-11
1 8.5	13 7	137	- 1	1.95	-10	7.17	-11
1 9.5	14 5	150	- 1	2.01	-10	6.75	-11
2 0.5	10 8	128	- 1	2.94	-11	4.85	-11
2 1.5	15 2	179	- 1	1.63	-10	5.66	-11
2 2.5	10 4	151	- 1	1.02	-11	4.04	-11
2 3.5	09 6	158	- 1	-8.94	-12	3.65	-11
2 4.5	10 1	181	- 1	1.97	-12	3.57	-11
2 5.5	08 7	187	- 1	-2.16	-11	3.13	-11
2 6.5	11 1	242	- 1	1.56	-11	3.47	-11
2 7.5	13 3	301	- 1	4.01	-11	3.67	-11
2 8.5	07 7	257	- 1	-2.39	-11	2.67	-11
2 9.5	15 9	423	- 1	5.22	-11	3.77	-11
3 0.5	11 6	407	- 1	1.21	-11	3.11	-11
3 1.5	16 5	552	- 1	4.27	-11	3.60	-11

year 1985 month 7 day 26
time 19: 44
weather 0, -, ○
tropopause altitude ($\times 10^3$ gpm) 15.9
number of shots 276

$B 9.65 \times 10^{-5}$

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5							
1 5.5	10 1	9.68	- 2	1.26	-11	9.10	-11
1 6.5	09 4	9.46	- 2	-4.48	-11	7.60	-11
1 7.5	11 6	1.19	- 1	1.07	-10	7.96	-11
1 8.5	14 0	1.46	- 1	2.25	-10	8.24	-11
1 9.5	15 3	1.67	- 1	2.50	-10	7.84	-11
2 0.5	13 0	1.58	- 1	1.21	-10	6.27	-11
2 1.5	09 6	1.38	- 1	-1.27	-11	4.58	-11
2 2.5	11 9	1.78	- 1	5.17	-11	4.91	-11
2 3.5	08 4	1.59	- 1	-3.74	-11	3.74	-11
2 4.5	11 0	2.07	- 1	2.00	-11	4.19	-11
2 5.5	11 6	2.38	- 1	2.75	-11	4.12	-11
2 6.5	14 4	3.06	- 1	6.47	-11	4.48	-11
2 7.5	13 2	3.27	- 1	4.03	-11	4.07	-11
2 8.5	07 2	2.68	- 1	-2.92	-11	2.82	-11
2 9.5	14 3	4.35	- 1	3.84	-11	3.92	-11
3 0.5	15 0	5.00	- 1	3.90	-11	3.87	-11
3 1.5							

year 1985 month 8 day 17

time 19 : 58

weather 0, -, ○

tropopause altitude [$\times 10^3$ gpm] 16.0

number of shots 210

B 1.2×10^{-4}

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5	0.98	1.10	- 1	-3.05	-11	1.36	-10
1 4.5	1.01	1.15	- 1	7.63	-12	1.25	-10
1 5.5	1.10	1.28	- 1	9.65	-11	1.21	-10
1 6.5	1.05	1.25	- 1	3.83	-11	1.00	-10
1 7.5	1.34	1.62	- 1	2.29	-10	1.09	-10
1 8.5	1.52	1.88	- 1	2.92	-10	1.06	-10
1 9.5	1.18	1.59	- 1	8.53	-11	7.49	-11
2 0.5	1.42	1.96	- 1	1.64	-10	7.71	-11
2 1.5	1.36	2.03	- 1	1.20	-10	6.74	-11
2 2.5	1.04	1.83	- 1	1.10	-11	5.14	-11
2 3.5	1.39	2.44	- 1	9.17	-11	5.79	-11
2 4.5	1.54	2.87	- 1	1.11	-10	5.83	-11
2 5.5	1.28	2.82	- 1	4.75	-11	4.86	-11
2 6.5	1.10	2.91	- 1	1.40	-11	4.28	-11
2 7.5	0.88	2.93	- 1	-1.54	-11	3.68	-11
2 8.5	1.04	3.62	- 1	3.95	-12	3.87	-11
2 9.5	1.10	4.28	- 1	8.67	-12	3.92	-11
3 0.5	0.72	4.06	- 1	-2.22	-11	3.20	-11
3 1.5							

year 1985 month 8 day 28

time 19 : 32

weather 0, -, ○

tropopause altitude [$\times 10^3$ gpm] 15.5

number of shots 370

B 1.18×10^{-4}

Z [km]	R [z]	$\sigma [R(z)]$		$\beta_A [z]$		$\sigma [\beta_A(z)]$	
1 2.5							
1 3.5							
1 4.5							
1 5.5	0.98	1.09	- 1	-1.72	-11	1.03	-10
1 6.5	1.15	1.29	- 1	1.14	-10	1.01	-10
1 7.5	1.19	1.37	- 1	1.27	-10	9.19	-11
1 8.5	1.67	1.92	- 1	3.77	-10	1.07	-10
1 9.5	1.36	1.66	- 1	1.67	-10	7.71	-11
2 0.5	1.26	1.64	- 1	1.02	-10	6.39	-11
2 1.5	1.13	1.60	- 1	4.25	-11	5.18	-11
2 2.5	1.33	1.95	- 1	9.03	-11	5.37	-11
2 3.5	1.36	2.15	- 1	8.46	-11	5.00	-11
2 4.5	1.02	1.93	- 1	4.66	-12	3.87	-11
2 5.5	0.96	2.06	- 1	-6.71	-12	3.52	-11
2 6.5	1.62	3.16	- 1	8.98	-11	4.60	-11
2 7.5	1.12	2.83	- 1	1.45	-12	3.51	-11
2 8.5	1.23	3.34	- 1	2.38	-11	3.54	-11
2 9.5	0.95	3.36	- 1	-4.39	-12	3.05	-11
3 0.5	0.73	3.39	- 1	-2.09	-11	2.64	-11
3 1.5							

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