Sixteen Years of AOD Measurements at the Southern Great Plains - Central Facility

Joe Michalsky (NOAA/ESRL)

Jim Schlemmer (SUNY data)

Connor Flynn (PNNL, algorithm developer for ARM products), **Annette Koontz** (PNNL, implements the algorithms that Connor writes)

Bill Jackson (ORNL guy that reprocesses the data over and over)

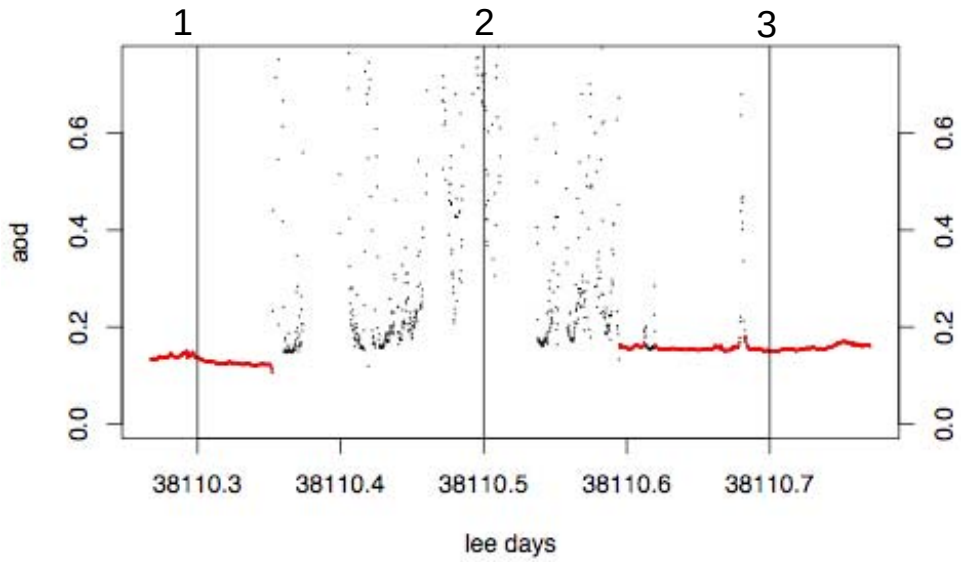
Gary Hodges (CIRES, MFRSR mentor)

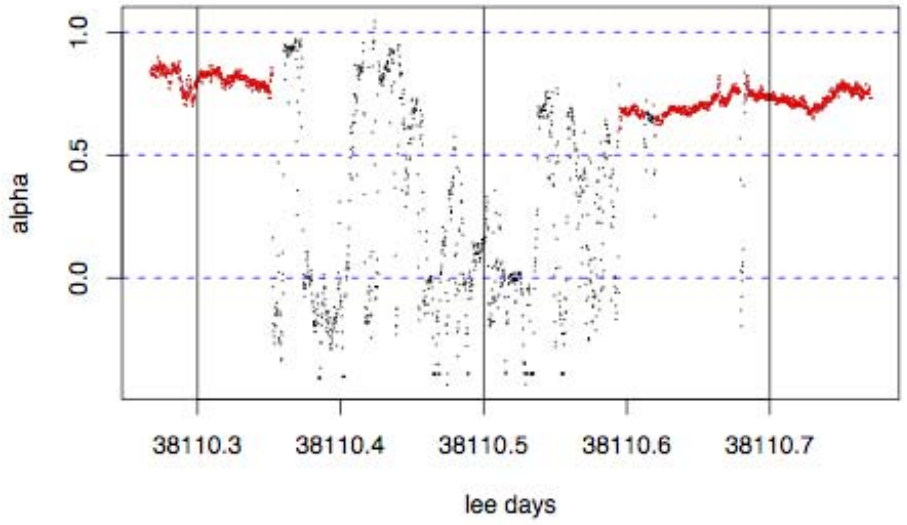
Steve Schwartz (BNL, spiritual advisor)

Dave Breedlove, Dan Nelson, Craig Webb, Mark Klassen (SGP operations guys that keep things running)

- Cloud screening
- Daily-averaged AOD
- Angstrom coefficient
- Annual averages

4 May 2004

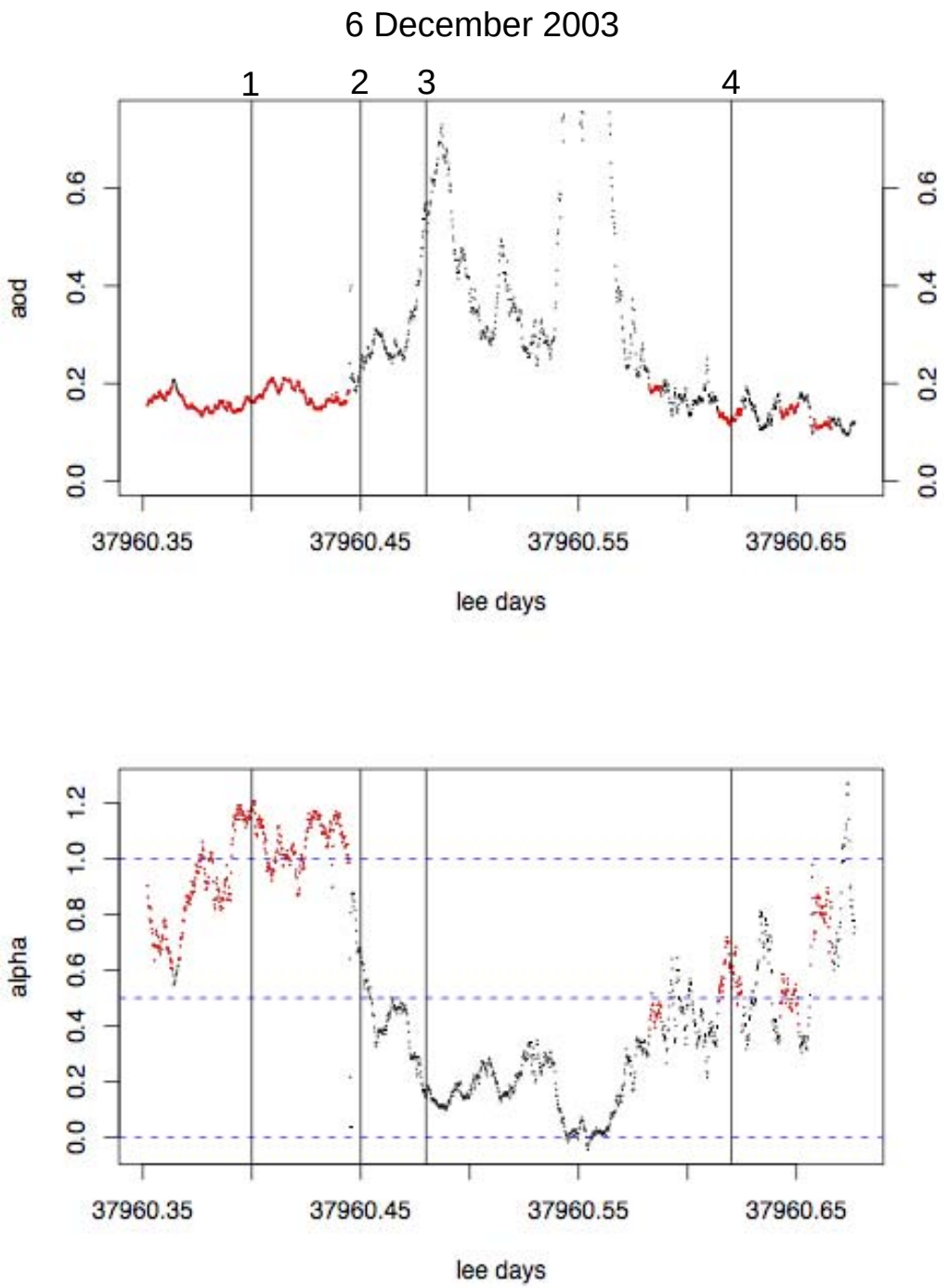




(1)

(2)

(3)

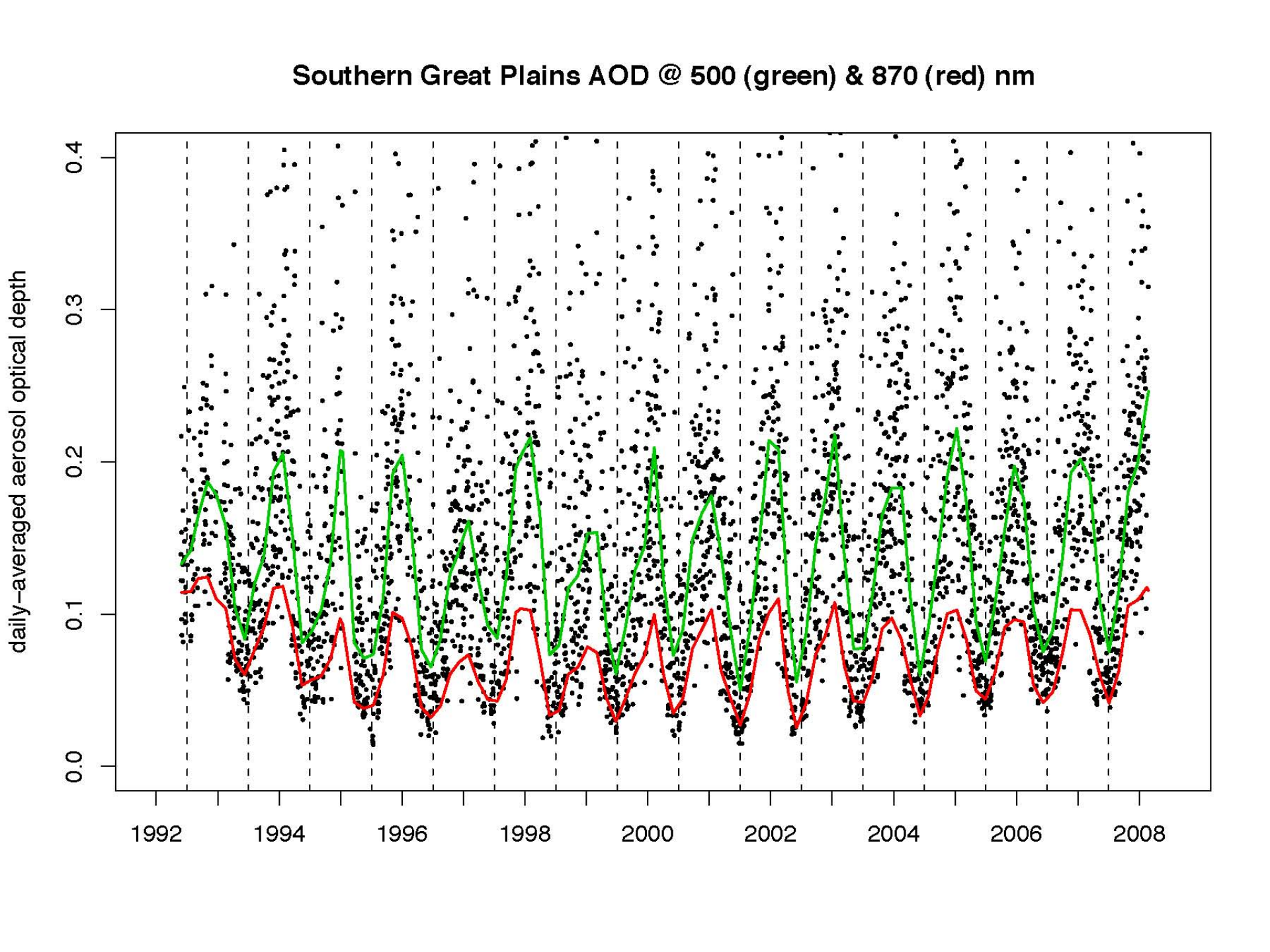

6 December 2003
1
2
3
4
aod
0.0
0.2
0.4
0.6
37960.35
37960.45
37960.55
37960.65
lee days
alpha
0.0
0.2
0.4
0.6
0.8
1.0
1.2
37960.35
37960.45
37960.55
37960.65
lee days

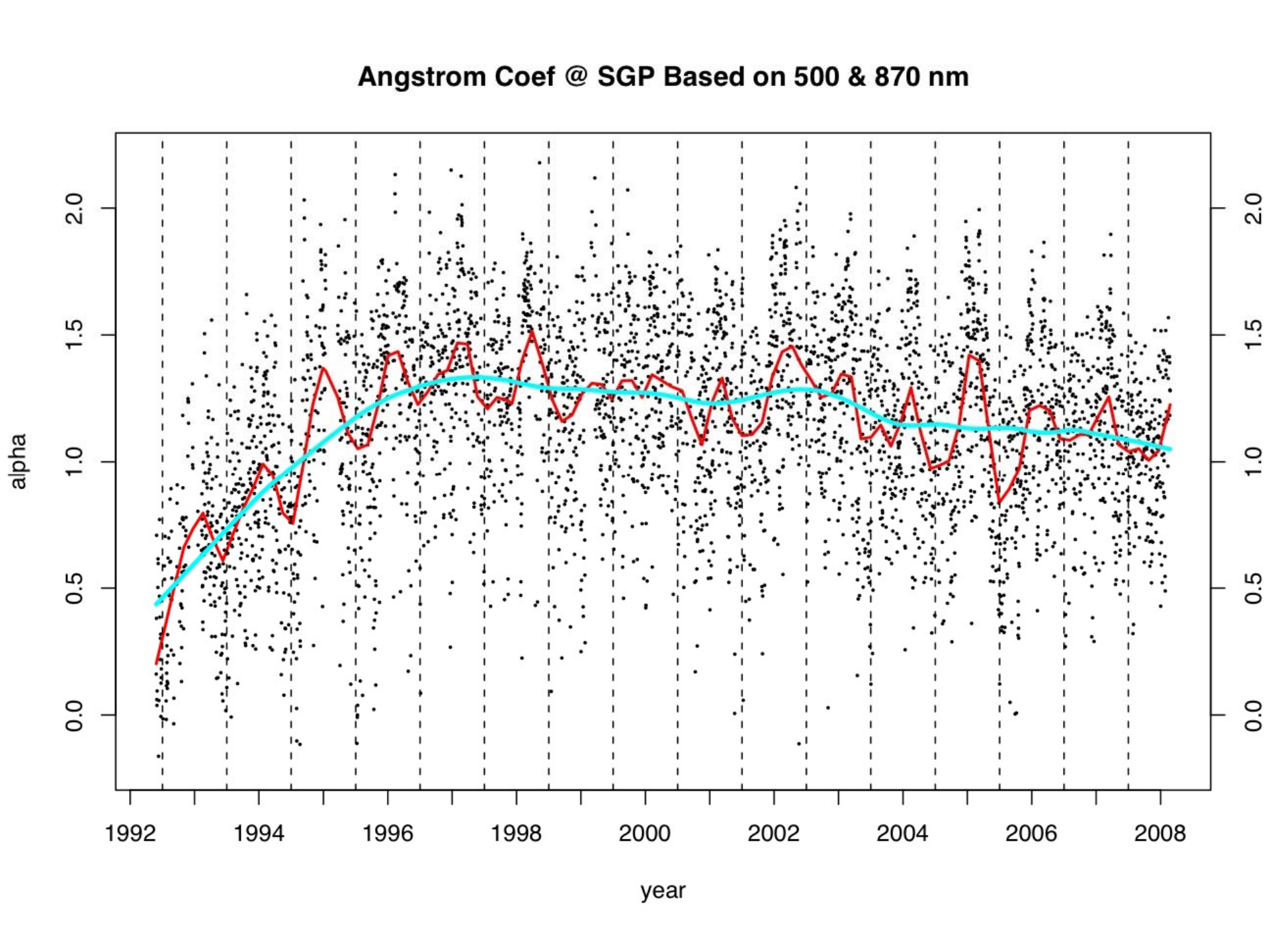
(1)

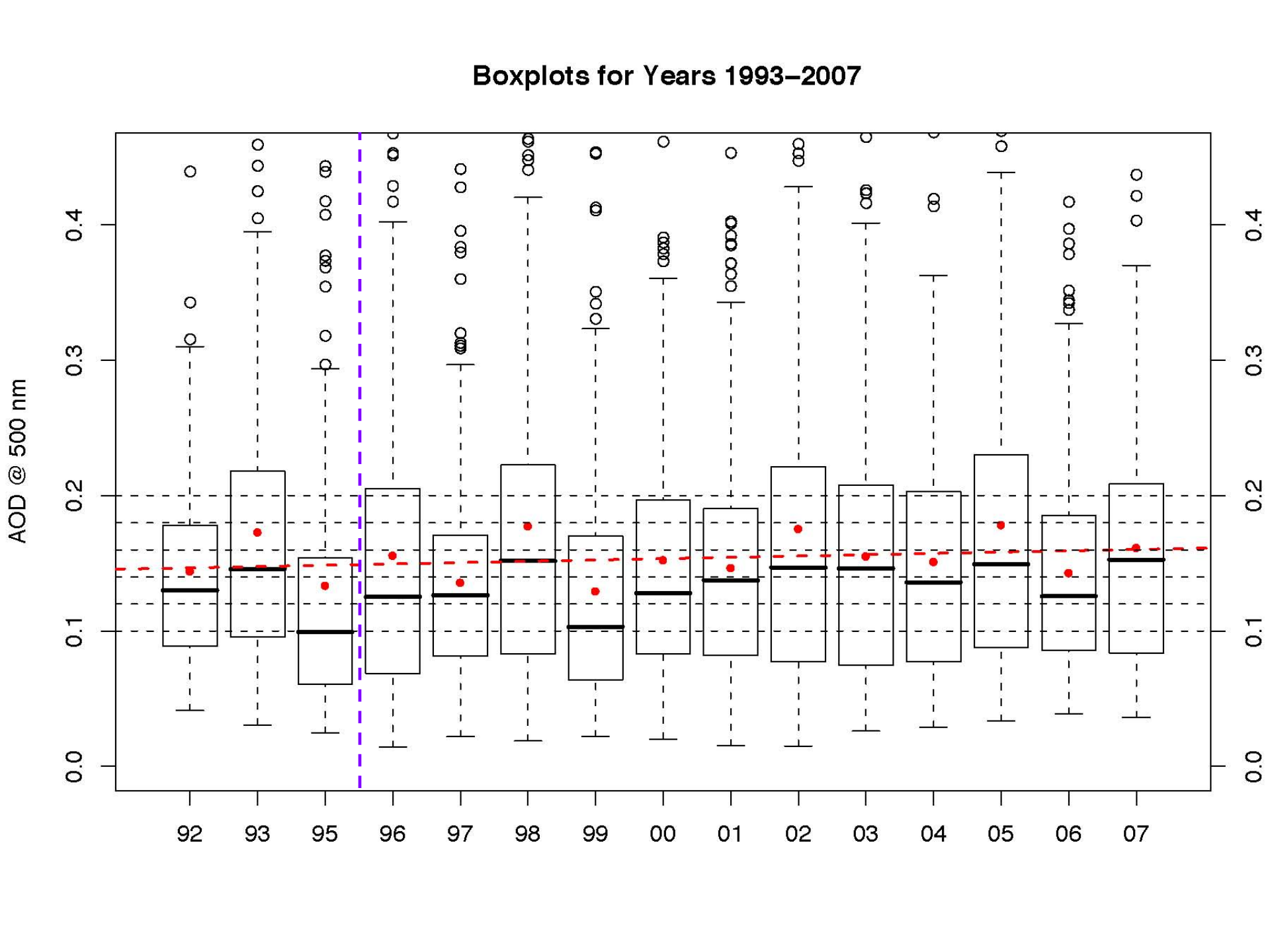
(2)

(3)

(4)


Southern Great Plains AOD @ 500 (green) & 870 (red) nm
daily−averaged aerosol optical depth
0.0
0.1
0.2
0.3
0.4
1992
1994
1996
1998
2000
2002
2004
2006
2008


Angstrom Coef @ SGP Based on 500 & 870 nm
alpha
year
0.0
0.5
1.0
1.5
2.0
1992
1994
1996
1998
2000
2002
2004
2006
2008


Boxplots for Years 1993–2007
AOD @ 500 nm
0.0
0.1
0.2
0.3
0.4
92
93
95
96
97
98
99
00
01
02
03
04
05
06
07

Data Sheet

SCHOTT

OG570

Density	
ρ [g/cm³]	2.56

Reflection factor	
P_i	0.92

Bubble content	
Bubble class	3

Reference thickness	
d [mm]	3

Chemical resistance	
FR class	0
SR class	1.0
AR class	1.0

Spectral values guaranteed			
λc (τi = 0.50) [nm]	=	570	± 6
λs (τis = 1·10-5) [nm]	=	500	
λp (τip = 0.93) [nm]	=	640	

Transformation temperature	
Tg [°C]	510

Thermal expansion	
$\alpha_{20/300°C}$ [10^{-6}/K]	7.9
$\alpha_{20/200°C}$ [10^{-6}/K]	9.0
$\alpha_{20/20°C}$ [10^{-6}/K]	

Refractive index n		
λ [nm]	Element	n
587.6	He	1.51
852.1	Cs	1.51
1014	Hg	1.50

Temperature coefficient	
T_K [nm/°C]	0.12

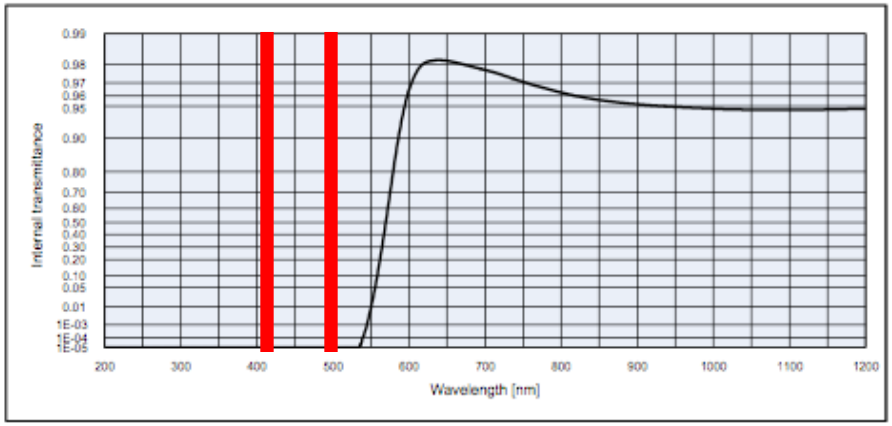
Notes
Colloidally colored glass
Long pass filter
All data without tolerances are to be understood to be reference values. Guaranteed values are only those values listed in the section "Spectral values guaranteed".

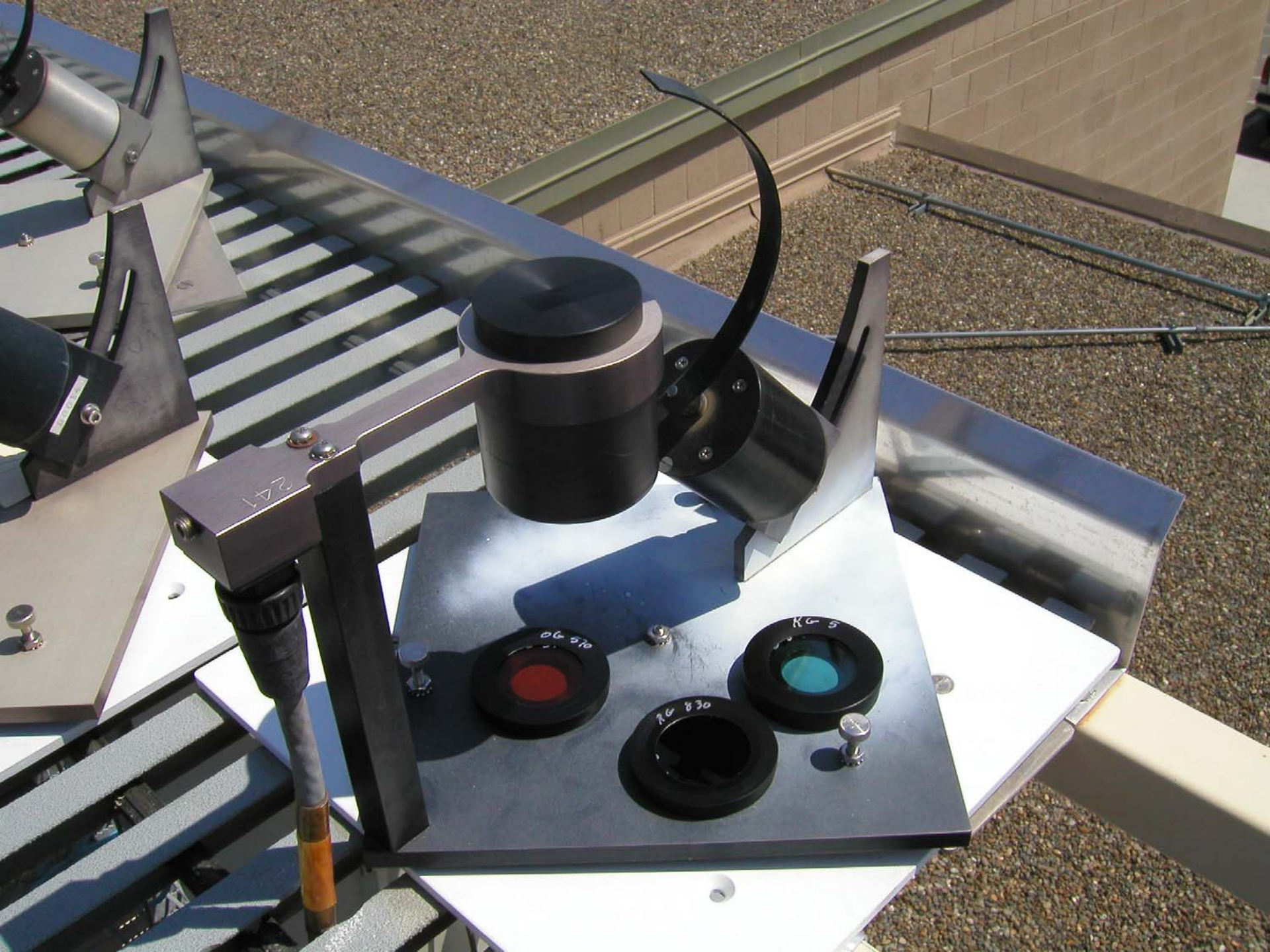
Colorimetric evaluation

Illuminant	A (Planck T = 2856 K)		
d [mm]	1	2	3
x	0.600	0.619	0.627
y	0.394	0.380	0.372
Y	56	49	46
λ_d [nm]	596	598	600
P_e	0.96	1.00	1.00

Illuminant	Planck T = 3200 K		
d [mm]	1	2	3
x	0.595	0.616	0.624
y	0.398	0.384	0.375
Y	53	47	44
λ_d [nm]	595	598	599
P_e	0.96	1.00	1.00

Illuminant	D65 (T_c = 6504 K)		
d [mm]	1	2	3
x	0.566	0.600	0.611
y	0.412	0.399	0.389
Y	43	36	33
λ_d [nm]	591	595	597
P_e	0.94	1.00	1.00



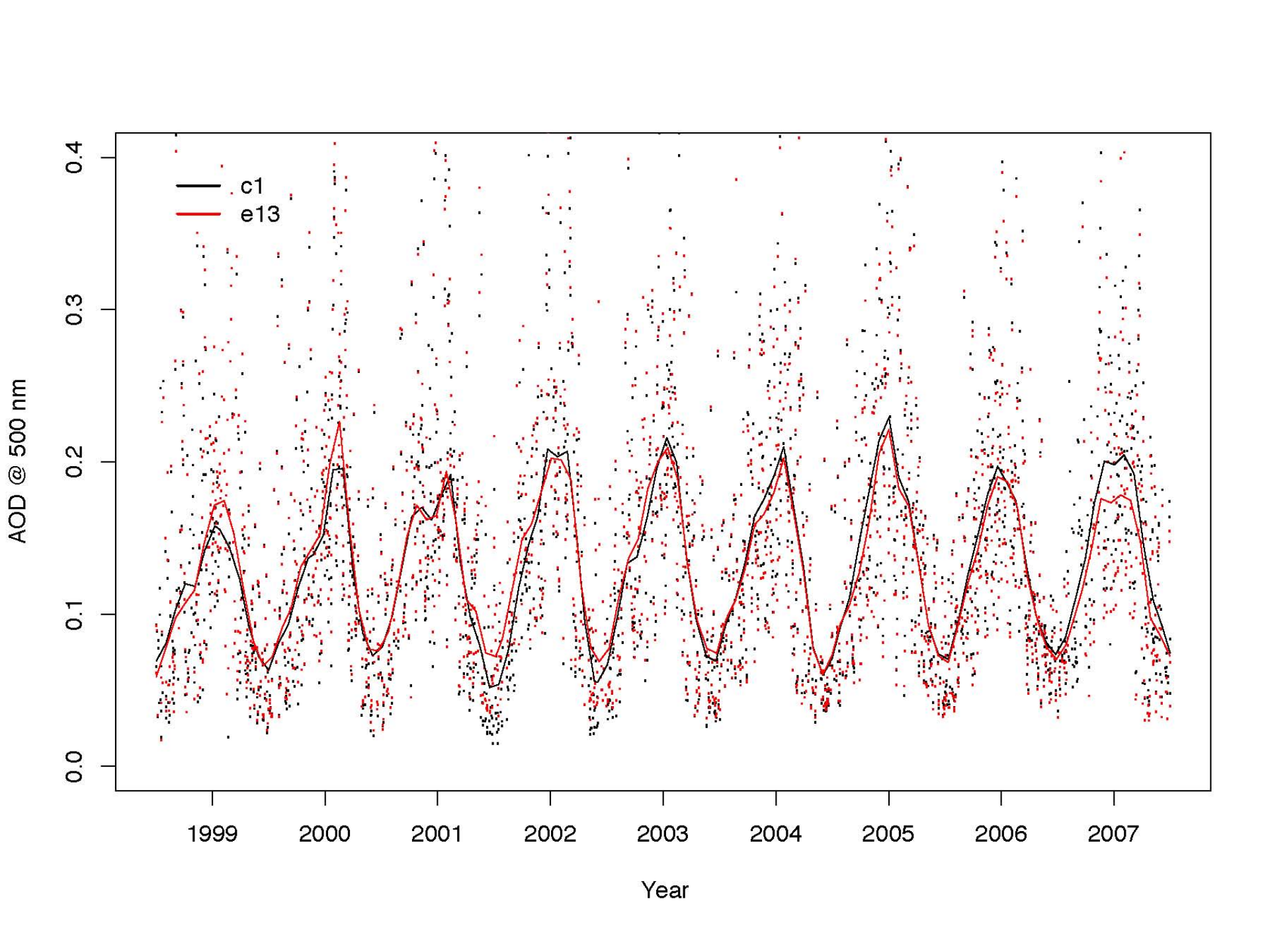

RG 5
RG 830

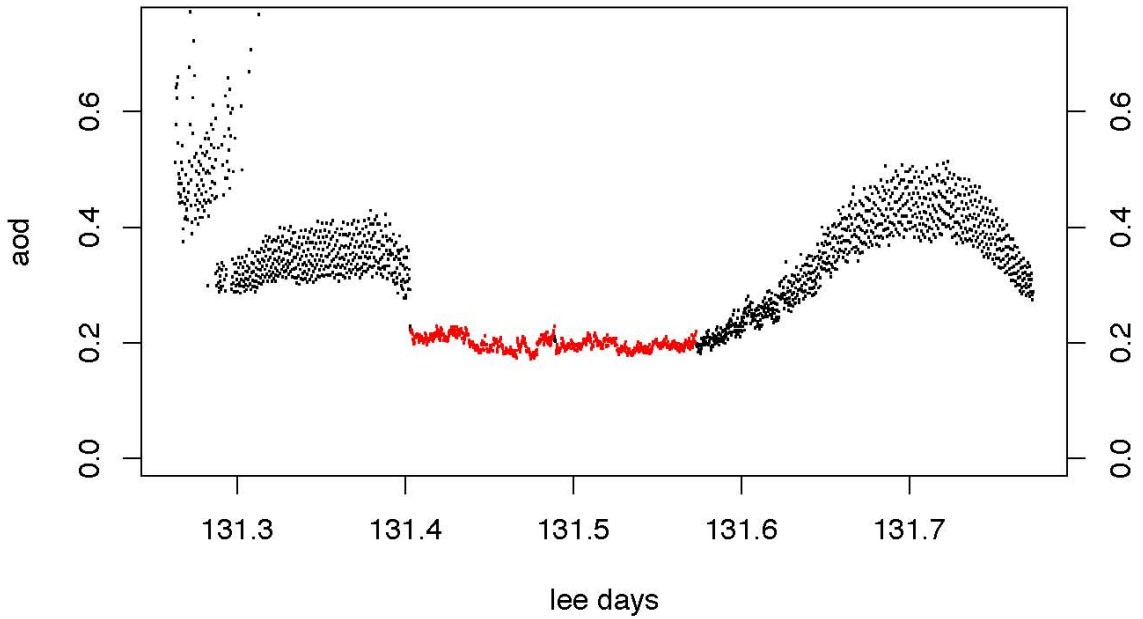
				415 nm					
38776.82708	0.59433	2796	2991	1821	1733	1977	917	2531	1411
38776.82719	0.59437	2791	2988	1819	1732	1975	917	2530	1411
38776.82731	0.59441	2783	2989	1821	1733	1977	918	2533	1413
38776.82743	0.59445	2772	2992	1821	1734	1979	919	2537	1415
38776.82754	0.59448	2759	2987	1819	1732	1977	918	2534	1413
38776.82766	0.59452	2745	2979	1814	1728	1972	915	2527	1409
38776.82777	0.59456	2729	0	2	0	1	0	0	0
38776.82789	0.59459	2713	0	2	0	0	0	0	0
38776.82800	0.59463	2696	0	2	0	0	0	0	0
38776.82812	0.59466	2679	0	2	0	0	0	0	0
38776.82824	0.59470	2662	0	2	0	0	0	0	0
38776.82835	0.59473	2644	0	6	0	1	0	1	1
38776.82847	0.59477	2626	2527	20	3	1970	920	2554	1431
38776.82858	0.59480	2609	2527	19	3	1970	920	2553	1429
38776.82870	0.59483	2592	2524	18	3	1970	920	2553	1429
38776.82881	0.59487	2575	2528	18	3	1975	922	2560	1431

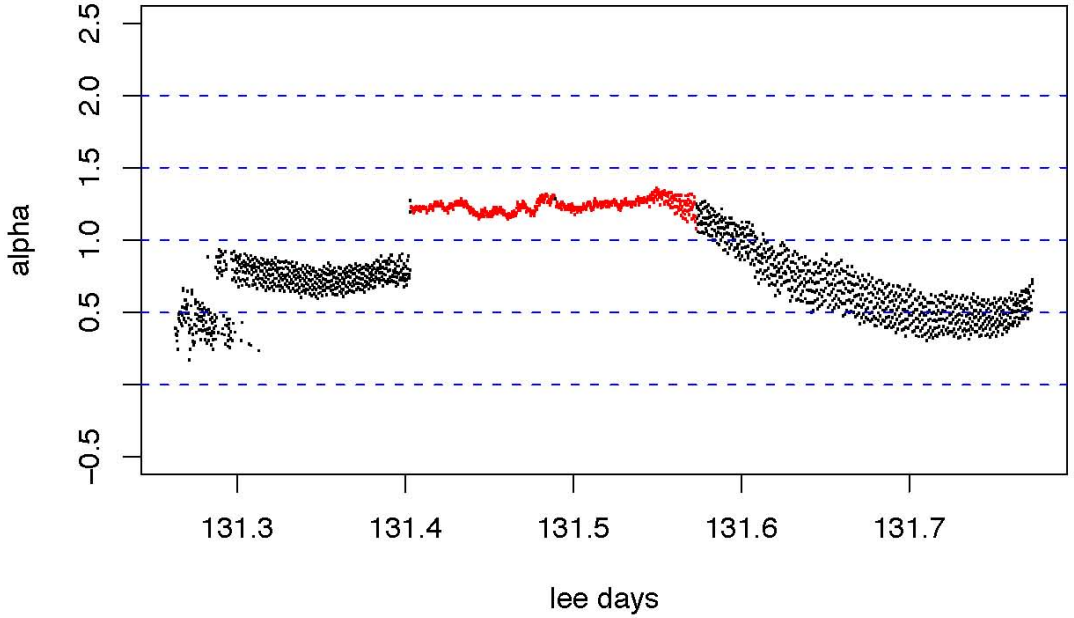
Full sun

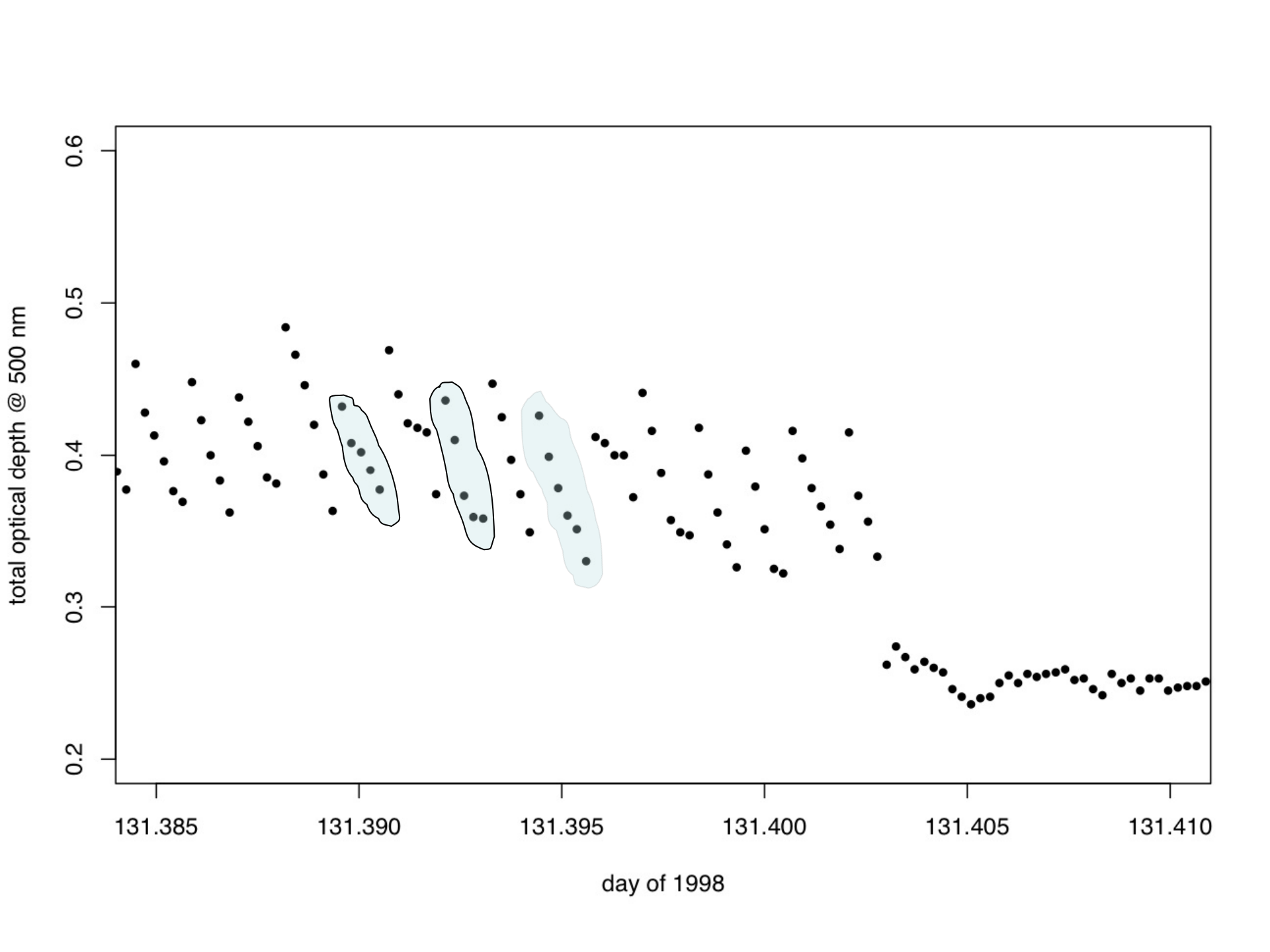
Dark

570-nm filter


c1
e13
AOD @ 500 nm
0.0
0.1
0.2
0.3
0.4
1999
2000
2001
2002
2003
2004
2005
2006
2007
Year

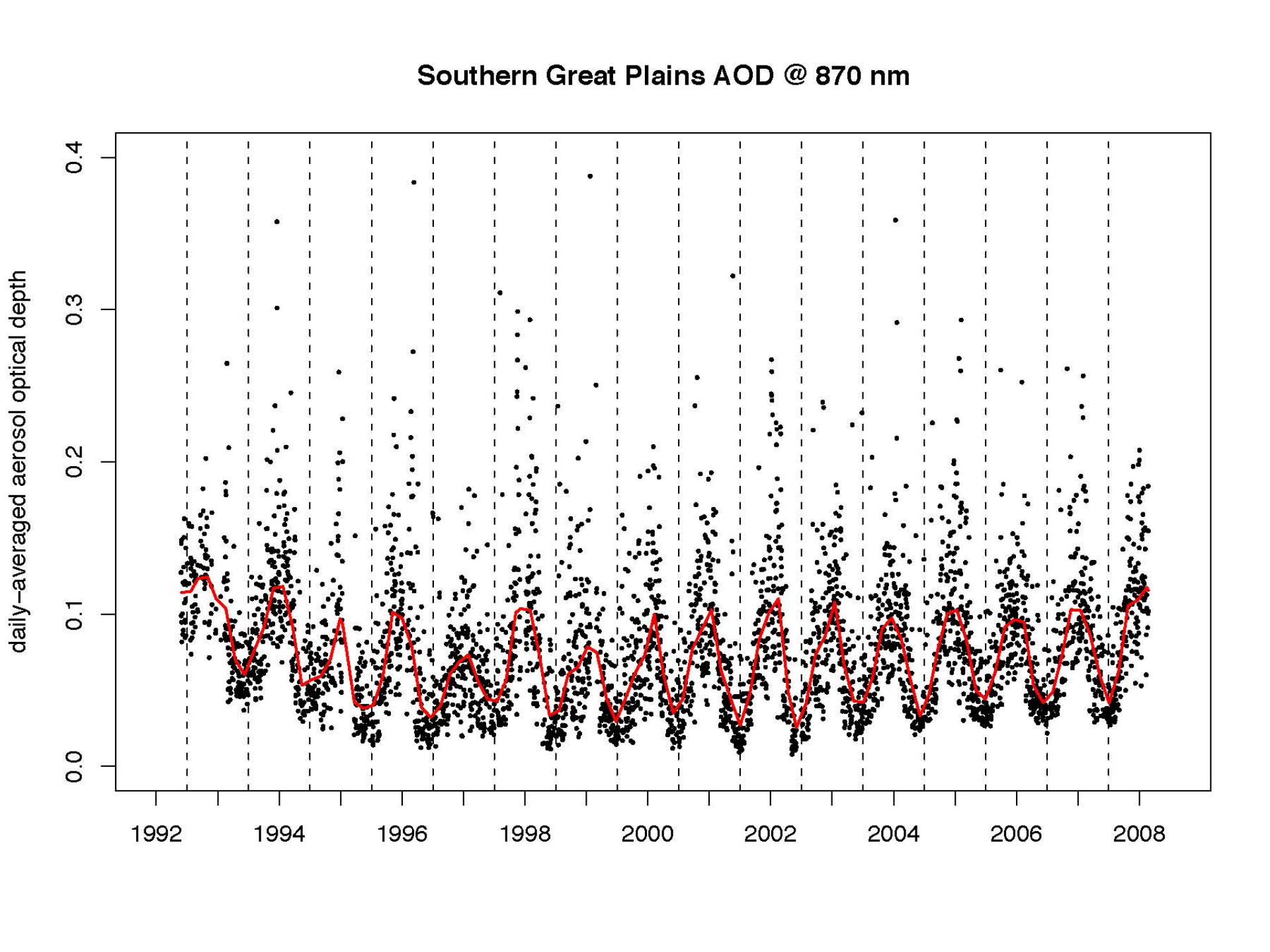

aod
0.0
0.2
0.4
0.6
131.3
131.4
131.5
131.6
131.7
lee days

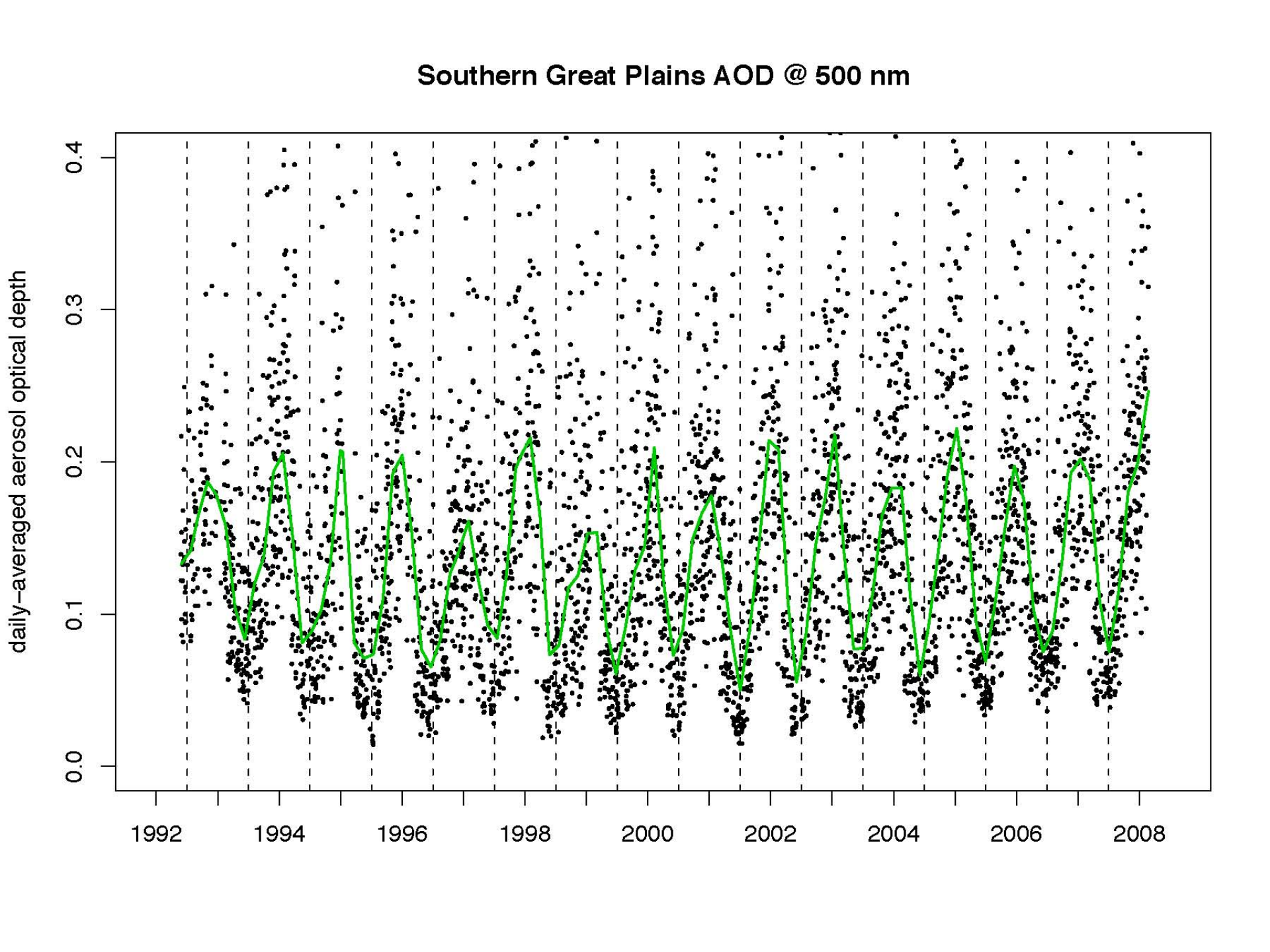

alpha
−0.5
0.5
1.0
1.5
2.0
2.5
131.3
131.4
131.5
131.6
131.7
lee days

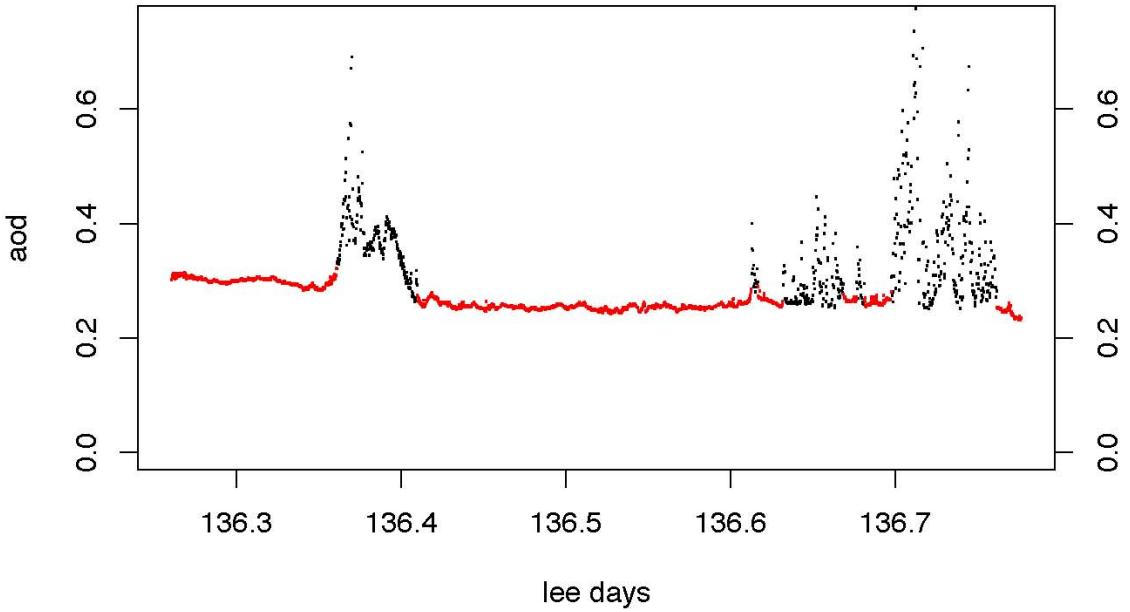

total optical depth @ 500 nm
0.2
0.3
0.4
0.5
0.6
131.385
131.390
131.395
131.400
131.405
131.410
day of 1998

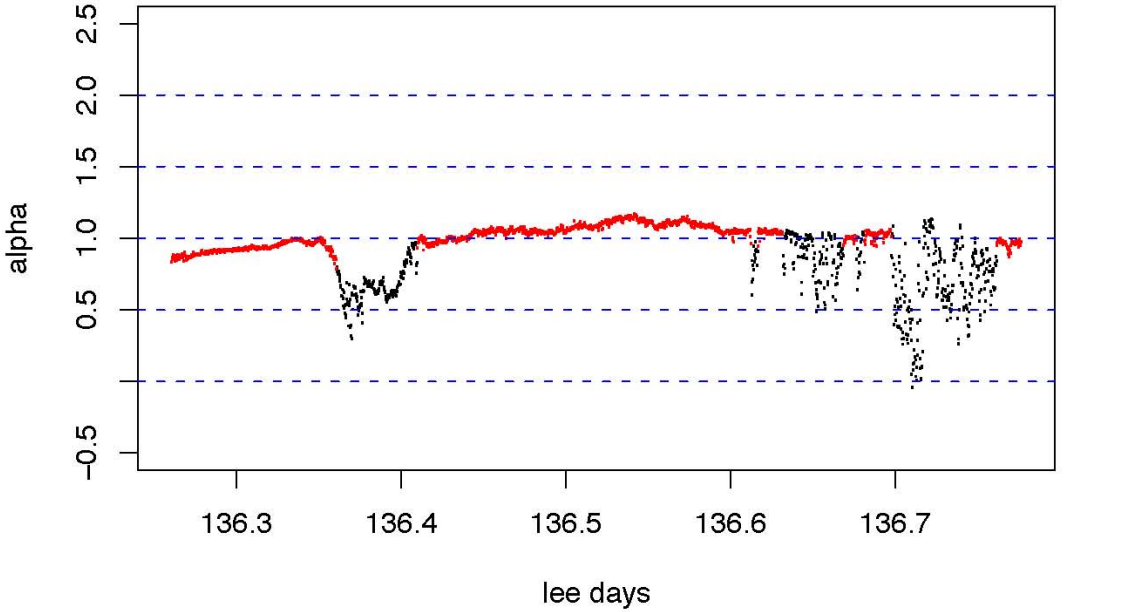
Some Things Left to Do

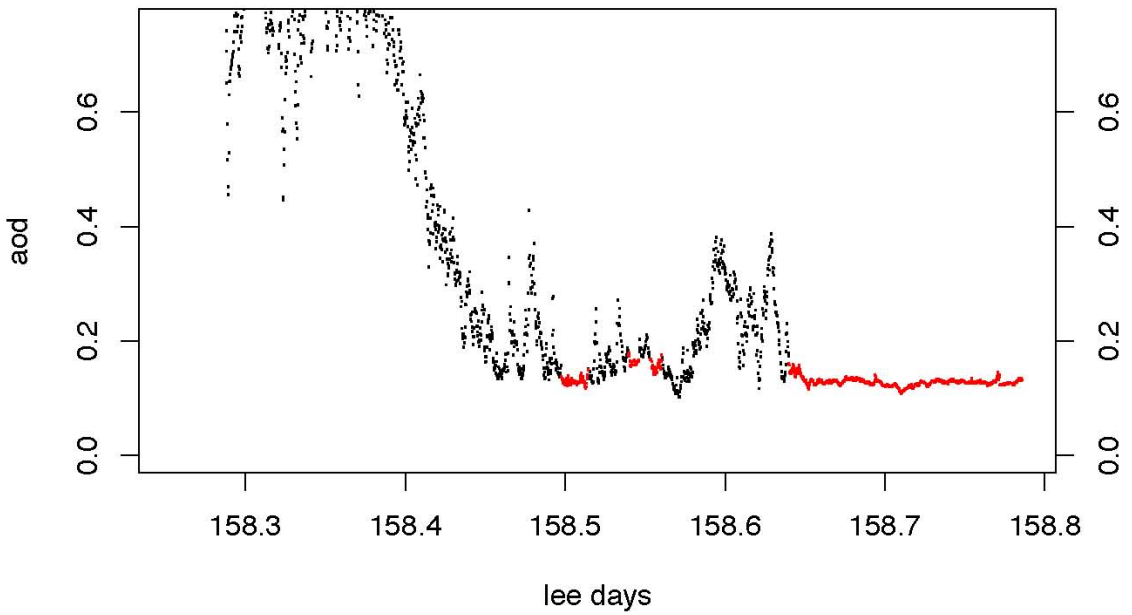
- Choose the best aods of the two data sets (eliminate filter leaks and alignment issues mainly)
- Examine diurnal behavior (e.g., are aerosols larger in morning?)
- Compare to daily averages of less frequent CIMEL measurements
- ----------
- Compare to satellite once-daily measurements
- Retrieve single scattering albedo
- Look at near-cloud aerosol behavior
- Look at cirrus and other thin cloud behavior

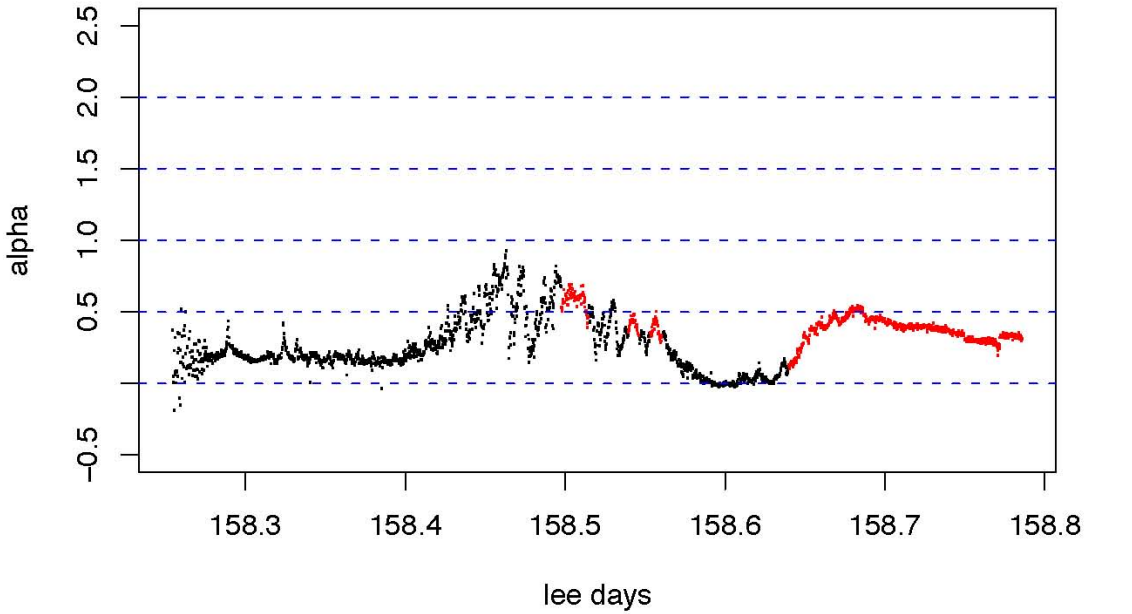

Southern Great Plains AOD @ 870 nm
daily−averaged aerosol optical depth
0.0
0.1
0.2
0.3
0.4
1992
1994
1996
1998
2000
2002
2004
2006
2008

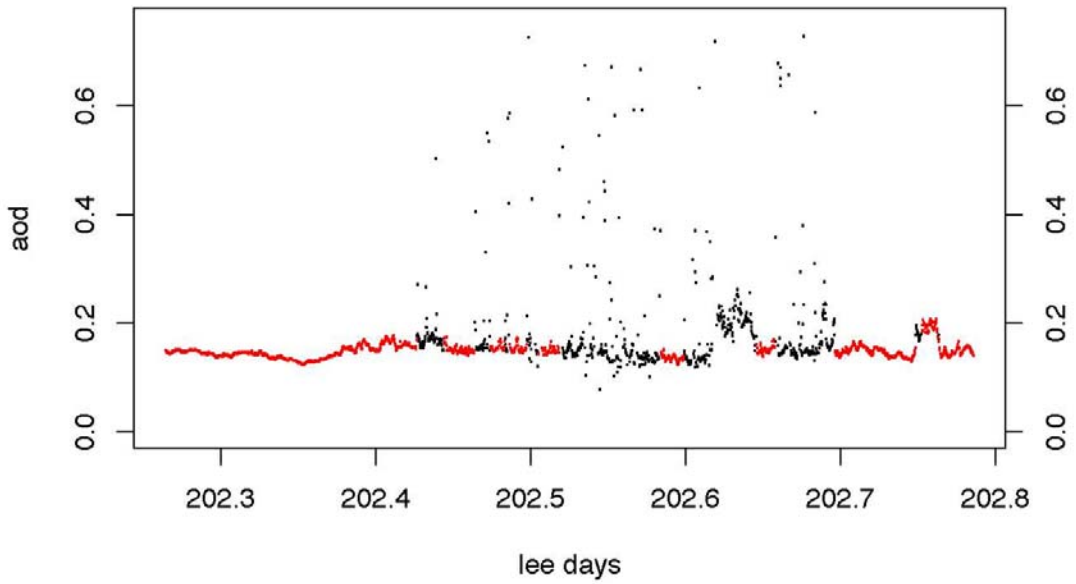

Southern Great Plains AOD @ 500 nm
daily−averaged aerosol optical depth
0.0
0.1
0.2
0.3
0.4
1992
1994
1996
1998
2000
2002
2004
2006
2008

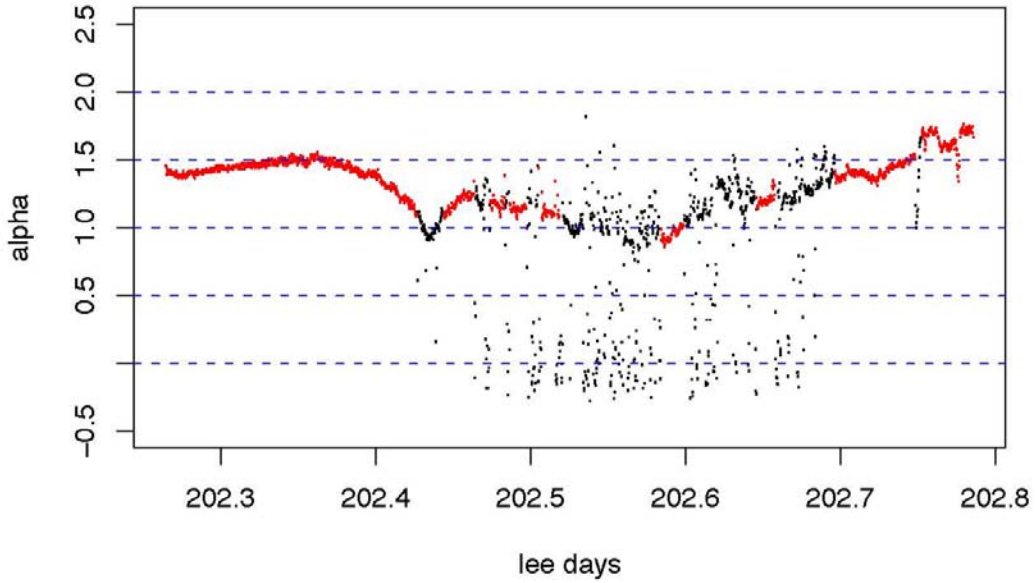

aod
0.0
0.2
0.4
0.6
136.3
136.4
136.5
136.6
136.7
lee days


alpha
−0.5
0.5
1.0
1.5
2.0
2.5
136.3
136.4
136.5
136.6
136.7
lee days


aod
0.0
0.2
0.4
0.6
158.3
158.4
158.5
158.6
158.7
158.8
lee days


alpha
−0.5
0.5
1.0
1.5
2.0
2.5
158.3
158.4
158.5
158.6
158.7
158.8
lee days


aod
0.0
0.2
0.4
0.6
202.3
202.4
202.5
202.6
202.7
202.8
lee days


alpha
−0.5
0.5
1.0
1.5
2.0
2.5
202.3
202.4
202.5
202.6
202.7
202.8
lee days