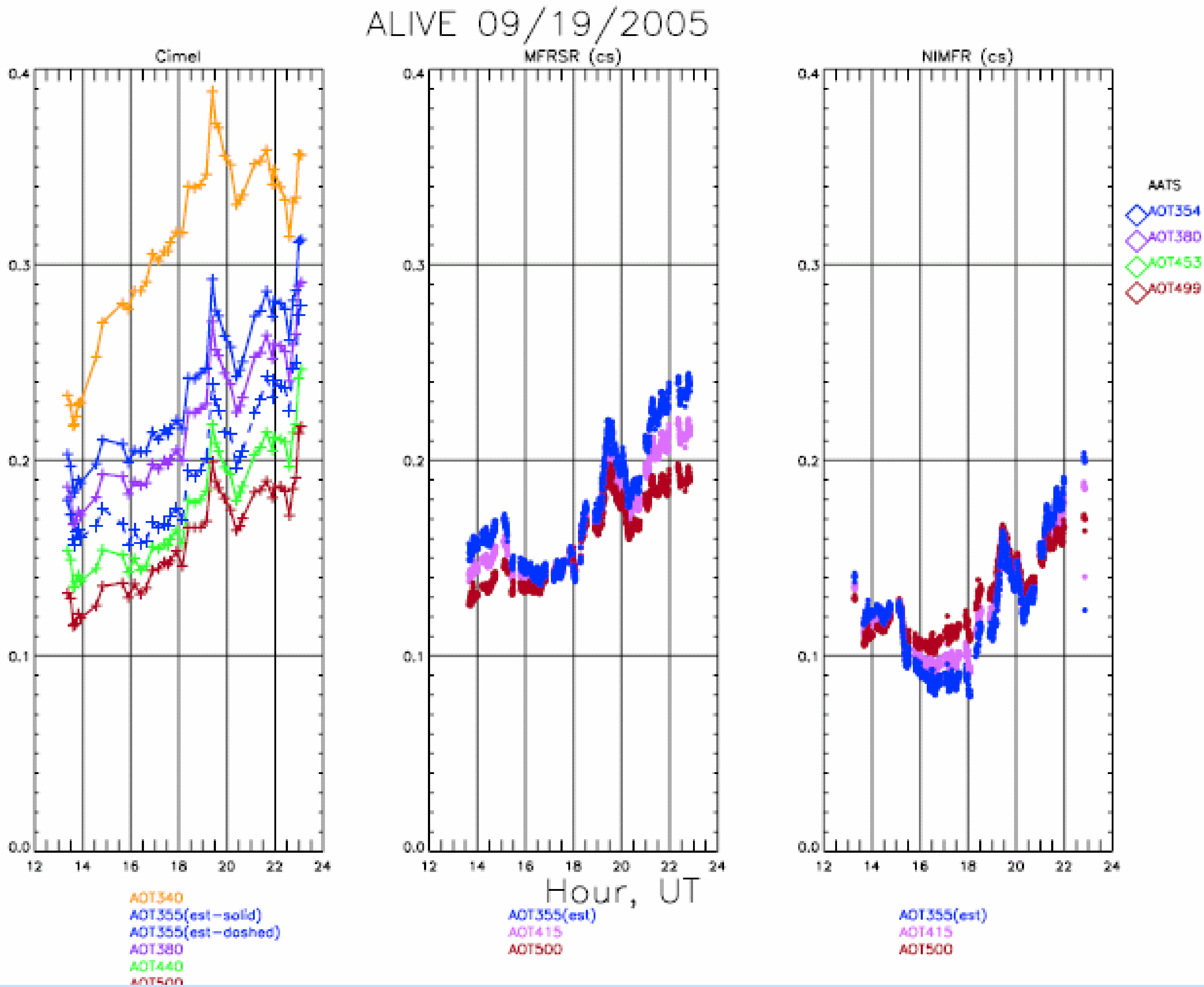
# MFRSR AOD during ALIVE

Connor Flynn, PNNL

ARM
Atmospheric Radiation Measurement

Numerous sources of AOD present during ALIVE

- MFRSR C1
- MFRSR E13
- NIMFR E13
- Cimel Sunphotometer, initially
- RSS
- And MSRSR-VIS and MFRSR-UV


ALIVE 09/19/2005
Cimel
MFRSR (cs)
NIMFR (cs)
0.0
0.1
0.2
0.3
0.4
12
14
16
18
20
22
24
Hour, UT
AATS
AOT354
AOT380
AOT453
AOT499
AOT340
AOT355(est-solid)
AOT355(est-dashed)
AOT380
AOT440
AOT500
AOT355(est)
AOT415
AOT500
AOT355(est)
AOT415
AOT500

# Numerous reasons…

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- Comparison was of low-level products:
  - Cimel version 1.5
  - MFRSR/NIMFR “c0” level
- Instrument malfunction also played a role:
  - NIMFR cable-strain or overheating
- But investigation also revealed basic errors in MFRSR instrument corrections:
  - Offset corrections improperly applied
  - Potentially affects all ARM MFRSR data. Effect is often negligible, but perhaps not always.

# MFRSR basic measurements

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- Fb = first band + offset
- Bb = Blocked Beam + offset
- Sb = second band + offset
- Th_raw = total hemispheric + offset

- Dirhz = (fb+sb)/2 - bb
- Dif = th – dirhz (– offset)
- Th = dirhz + dif

# Finer details…

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- Dirnor = dirhz / cos(sza)
  - Or better dirnor = dirhz/cos(apparent sza)
- Cordirnor = dirnor/cos_corr
- Cordirhz = cordirnor * cos(apparent sza)
- Cordif = dif/dif_corr
- And measure offsets in field using night-time measurements

# Langley calibration by ARM

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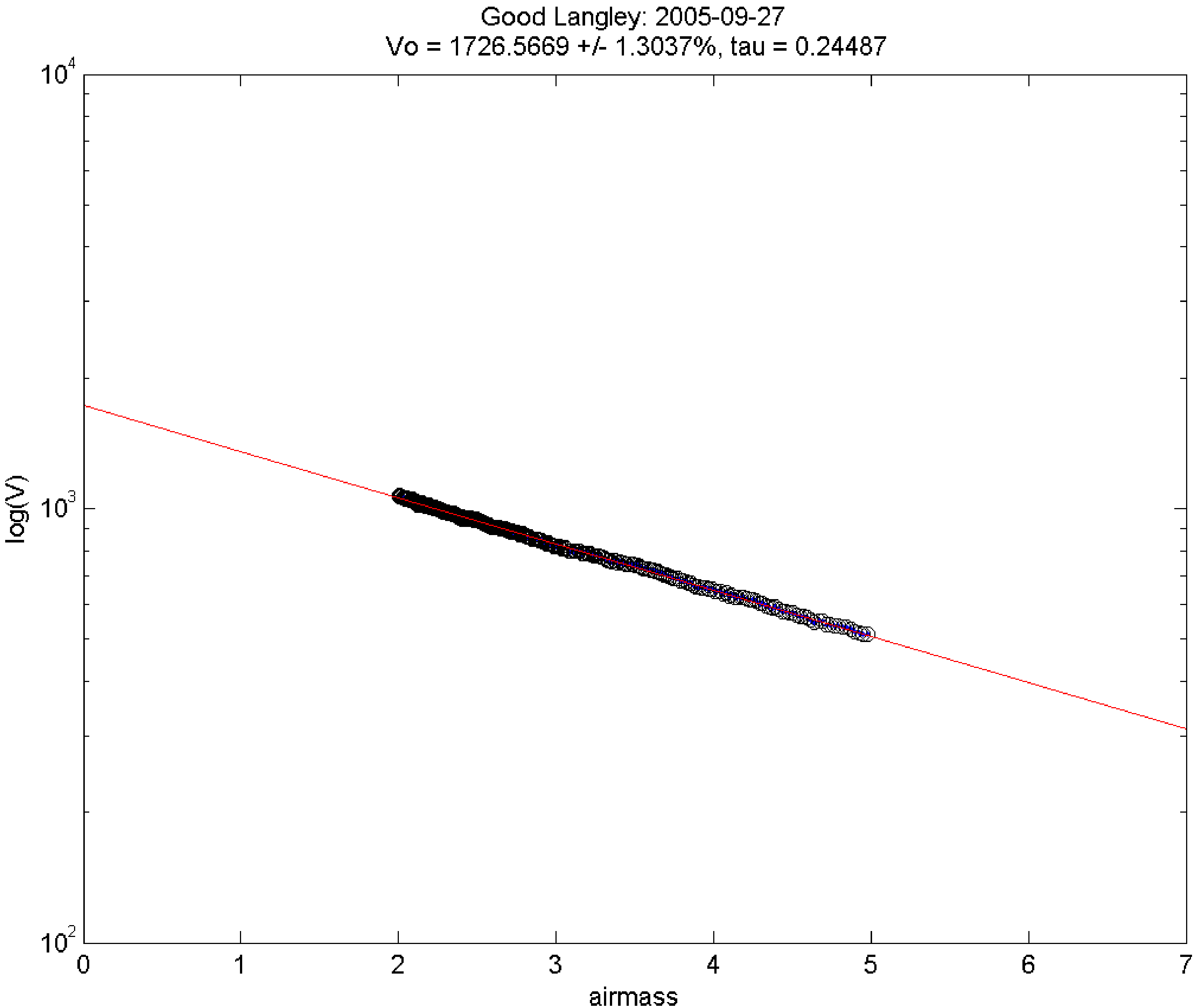
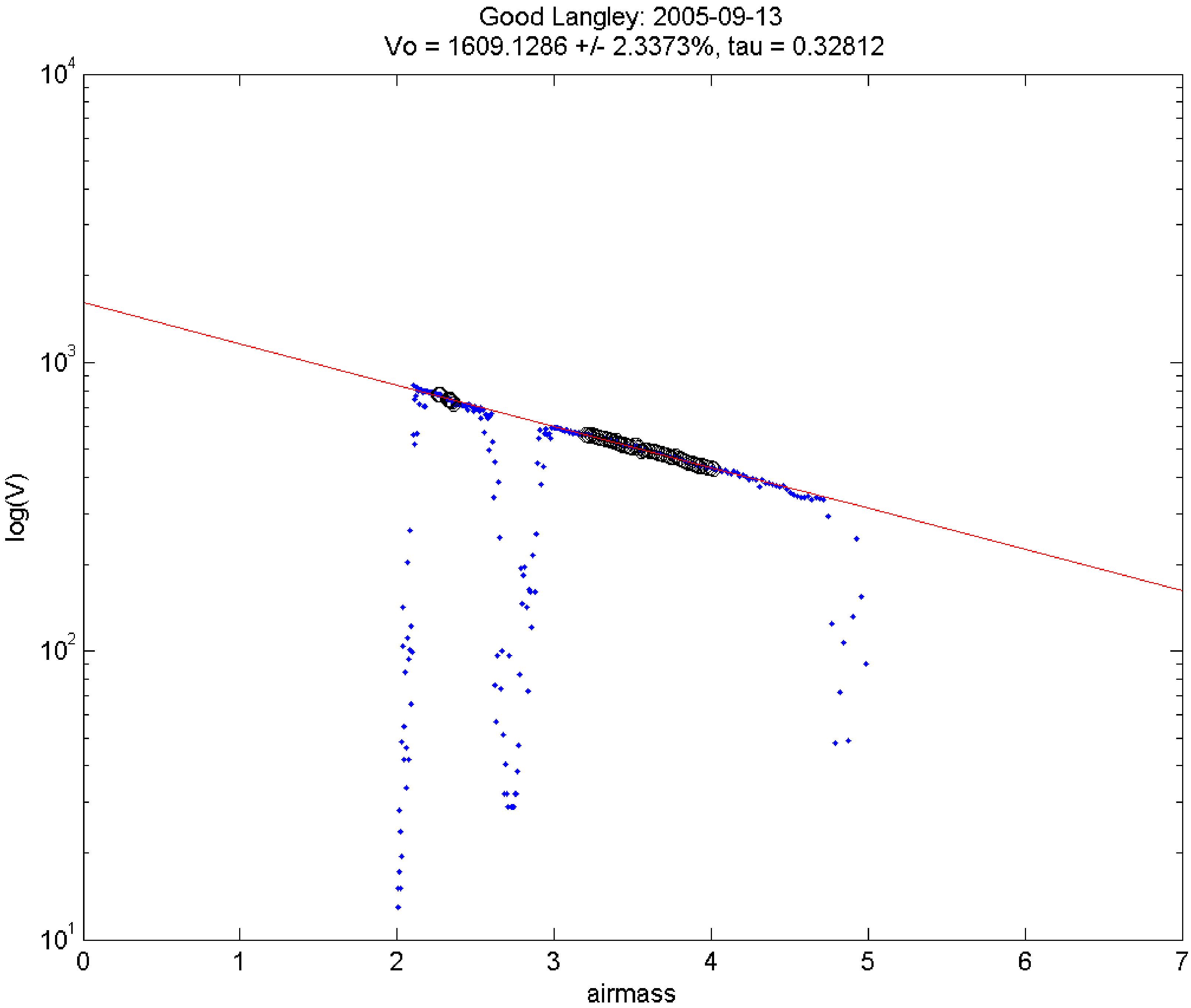
- Cordirnor_1au = cordirnor * earth-sun^2
- "Io" calculated as the intercept of a Langley plot of log(cordirnor_1au) vs airmass where airmass has been corrected for both refraction and the spherical shape of the atmosphere.


Good Langley: 2005-09-27
Vo = 1726.5669 +/- 1.3037%, tau = 0.24487
log(V)
10^4
10^3
10^2
0
1
2
3
4
5
6
7
airmass


Good Langley: 2005-09-13
Vo = 1609.1286 +/- 2.3373%, tau = 0.32812
log(V)
airmass
10^4
10^3
10^2
10^1
0
1
2
3
4
5
6
7

# Langleys run for C1 and E13

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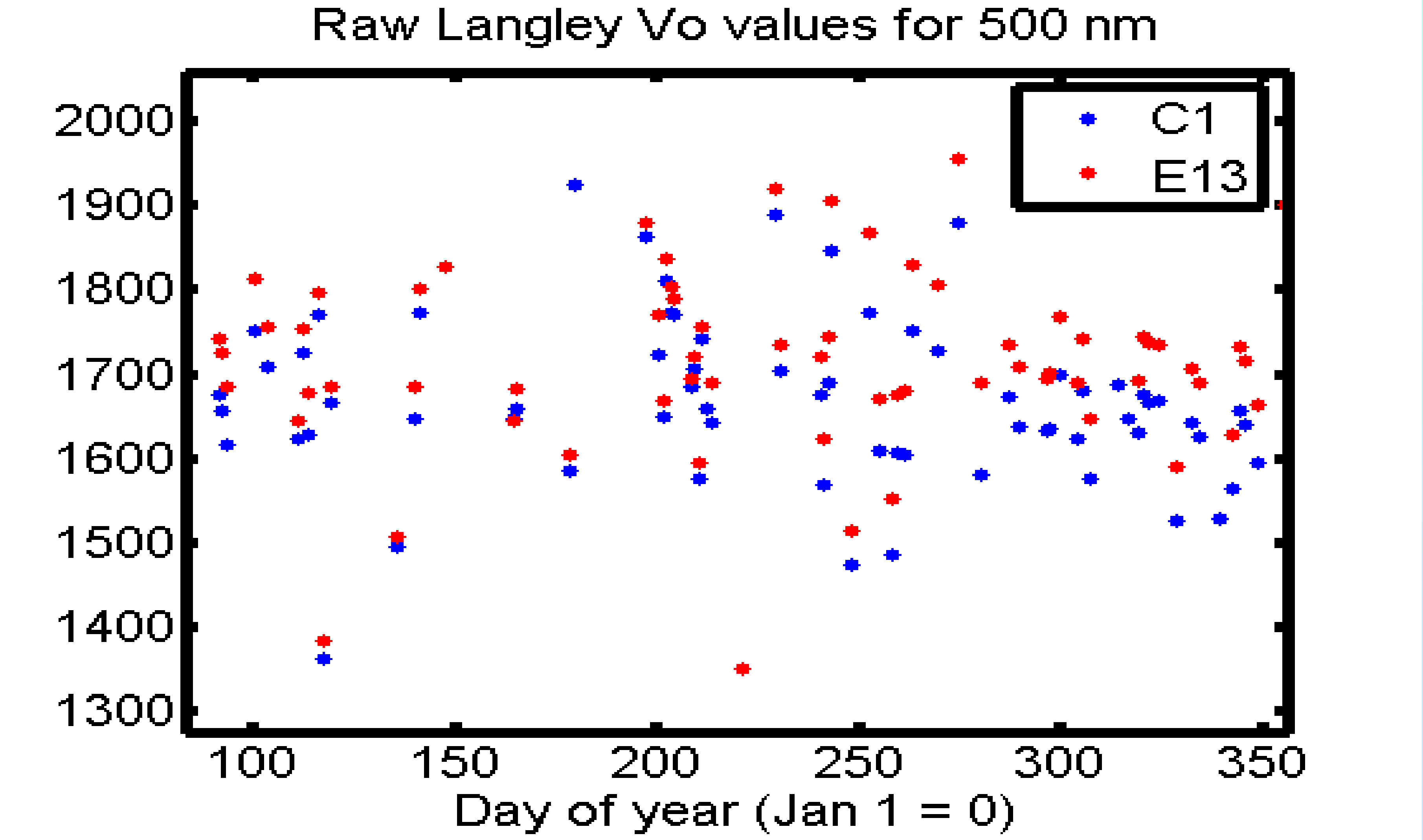
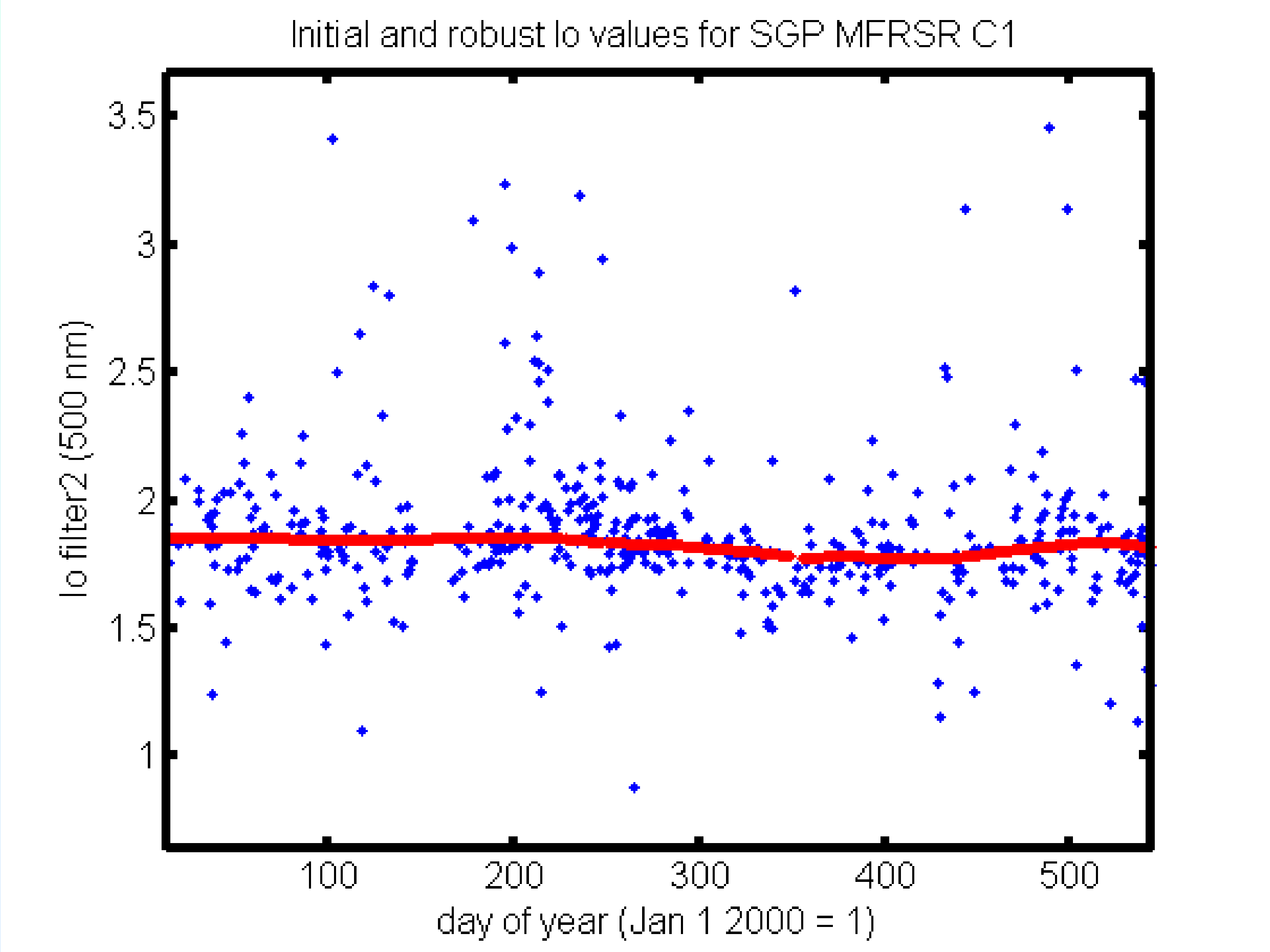


# Robust I


Initial and robust Io values for SGP MFRSR C1
Io filter2 (500 nm)
day of year (Jan 1 2000 = 1)
3.5
3
2.5
2
1.5
1
100
200
300
400
500

# Io yields Tau => AOD

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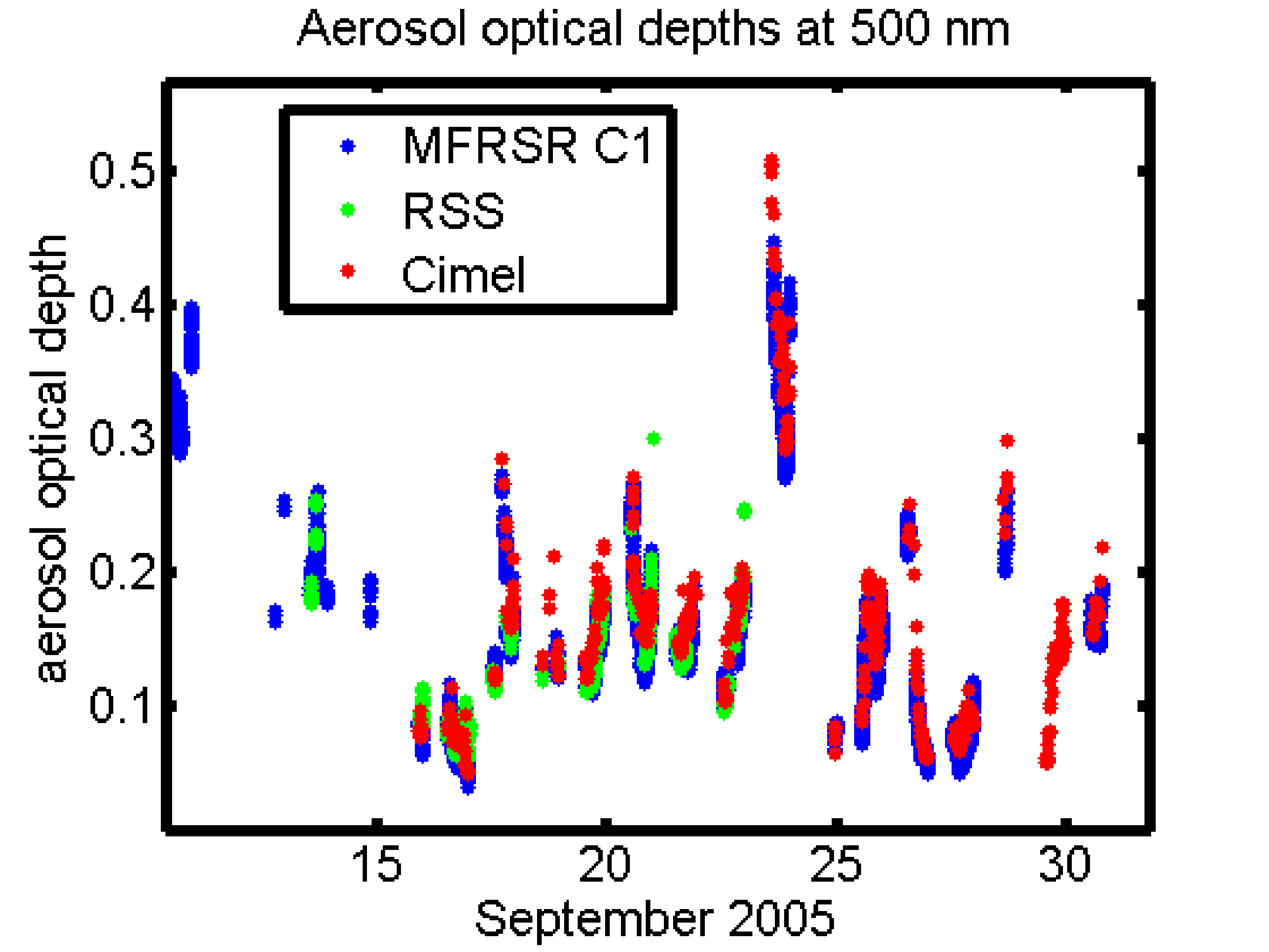
- $\tau_{total}$ = log(Io' / cordirnor_1au)/airmass
- $\tau_{aerosol} = \tau_{total} - \tau_{Rayleigh} - \tau_{ozone}$

- And we are also generating Langley calibrated spectral irradiances at 415 nm, 500 nm, 615 nm, 673 nm, and 870 nm using Gueymard's ESR. The broadband and 940 nm channels are only nominally calibrated via comparison with NIP and standard lamps.


Aerosol optical depths at 500 nm
MFRSR C1
RSS
Cimel
aerosol optical depth
0.1
0.2
0.3
0.4
0.5
15
20
25
30
September 2005

# Direct normal to diffuse ratio

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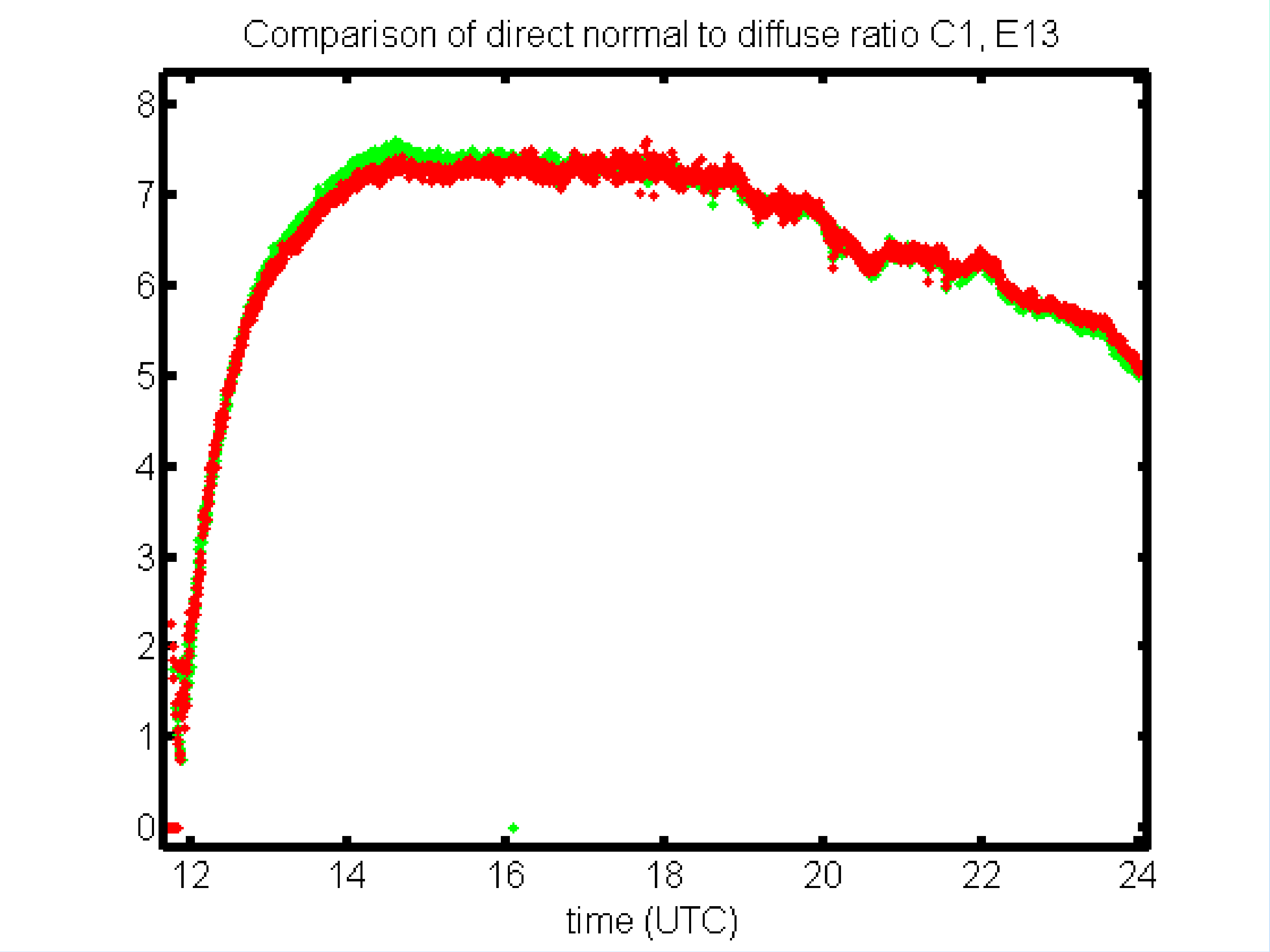

# Conclusion:

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- MFSRS C1, Cimel, and RSS agree to about 0.01 to 0.02 optical depth with poorer agreement toward mid-day.
- Although all MFRSR data will be reprocessed, this data is releasable and is available from the ALIVE IOP Archive.