Acrobatics to Squeeze Aerosols and Their Direct Forcing from the CERES CRS Product

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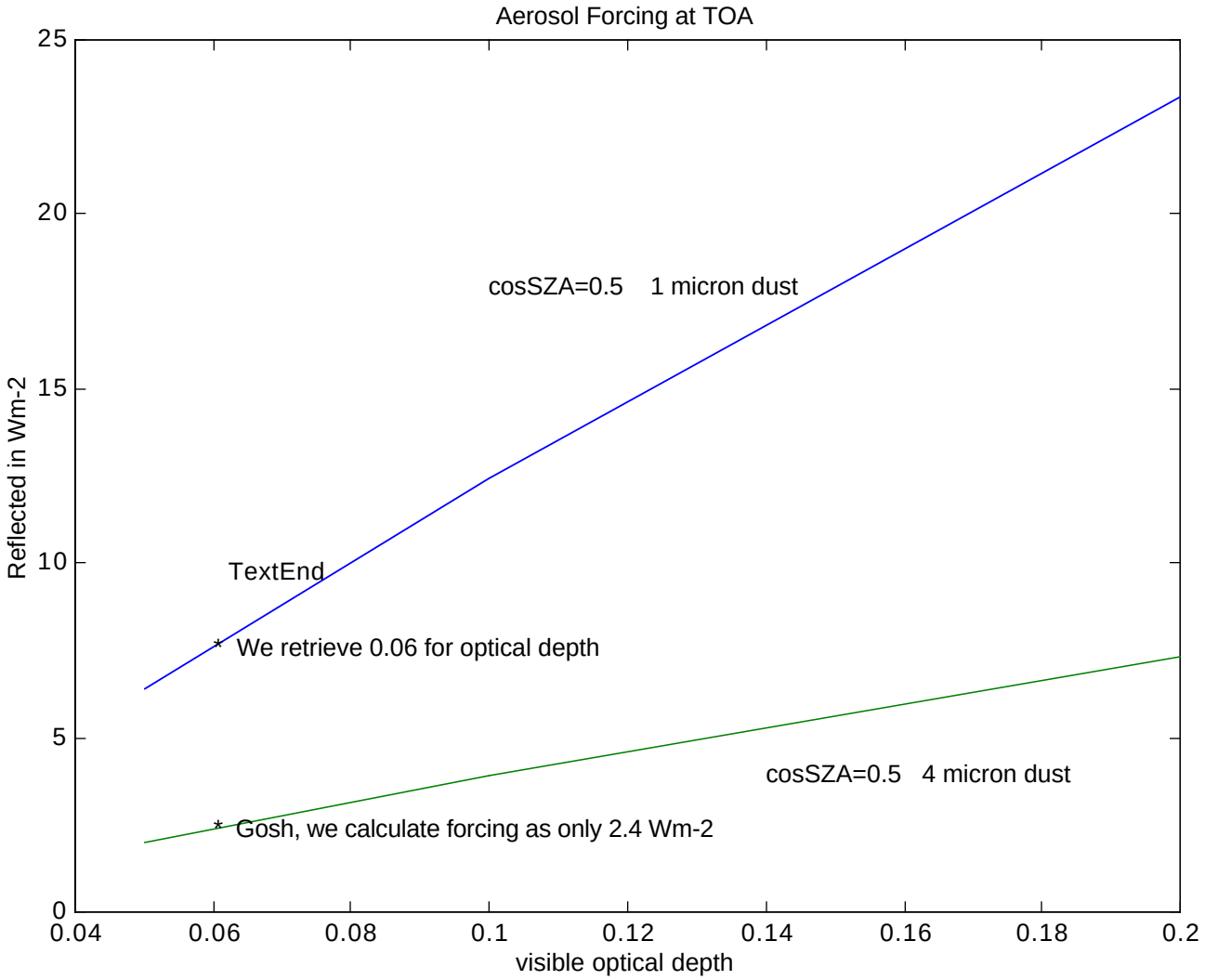
Co-I Report to CERES STM (Newport News, 1-3 May 2001)

Essential starting points:

- Clear sky screen (Minnis Cloud WG)
- “VIRS200+” TOA SW fluxes (Loeb ADM WG)
- VIRS aerosol optical thickness AOT (Stowe-Ignatov)
- Fu-Liou code
- Collins-Rasch assimilation


Aerosol Forcing at TOA
Reflected in Wm-2
visible optical depth
cosSZA=0.5 1 micron dust
TextEnd
* We retrieve 0.06 for optical depth
cosSZA=0.5 4 micron dust
* Gosh, we calculate forcing as only 2.4 Wm-2
0
5
10
15
20
25
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2

SARB output for clear-sky footprint on CRS includes:

Pu = pristeen flux, untuned (Fu-Liou calculation with no aerosols)
Cu = clear flux, untuned (Fu-Liou with aerosol)
Ct = clear flux, tuned (constrained Fu-Liou)
Co = clear flux observed by CERES

AOTu = input aerosol optical thickness (Collins-Rasch or Stowe-Ignatov)
AOTt = tuned AOT from constrainment

Three estimates of direct forcing at TOA:

F1 = Cu-Pu a raw calculation

F2 = Ct-Pu constrained estimate

F3 = Co-Pu another estimate (okay if the ocean optics are good)

AOTo = “observed” AOT that fits CERES, Fu-Liou, and assumed optical properties

AOTo = (Co-Pu)/(dTOA/dAOT) = (Co-Pu)/[(Cu-Pu)/AOTu]

Results for 1 May 2001 with “VIRS200+” ADM module

Pu = pristeen flux, untuned
Cu = clear flux, untuned with aerosol
Ct = clear flux, tuned
Co = clear flux observed by CERES

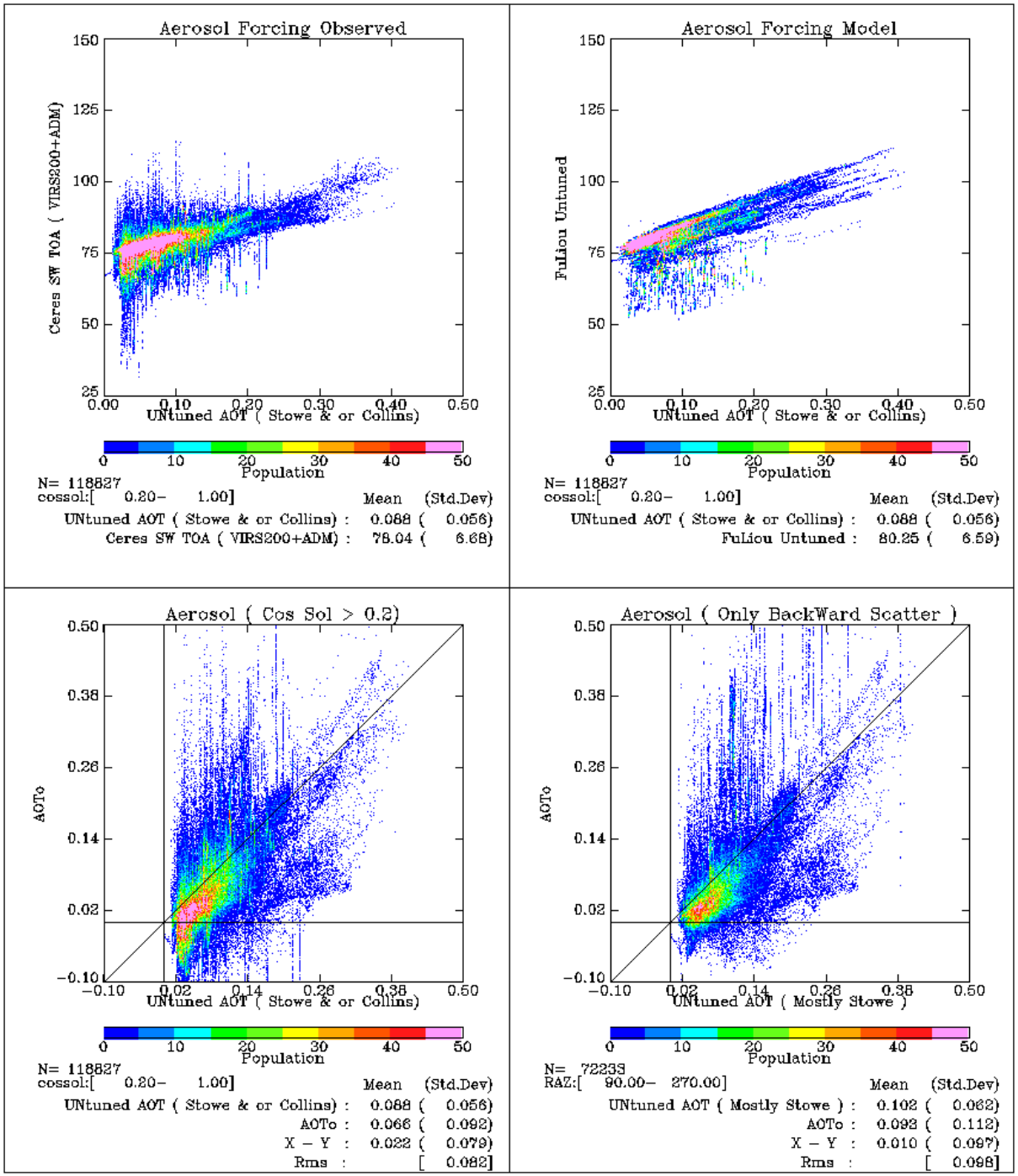
AOTu = input aerosol optical thickness (some Collins, some Stowe)
AOTt = tuned AOT from constrainment

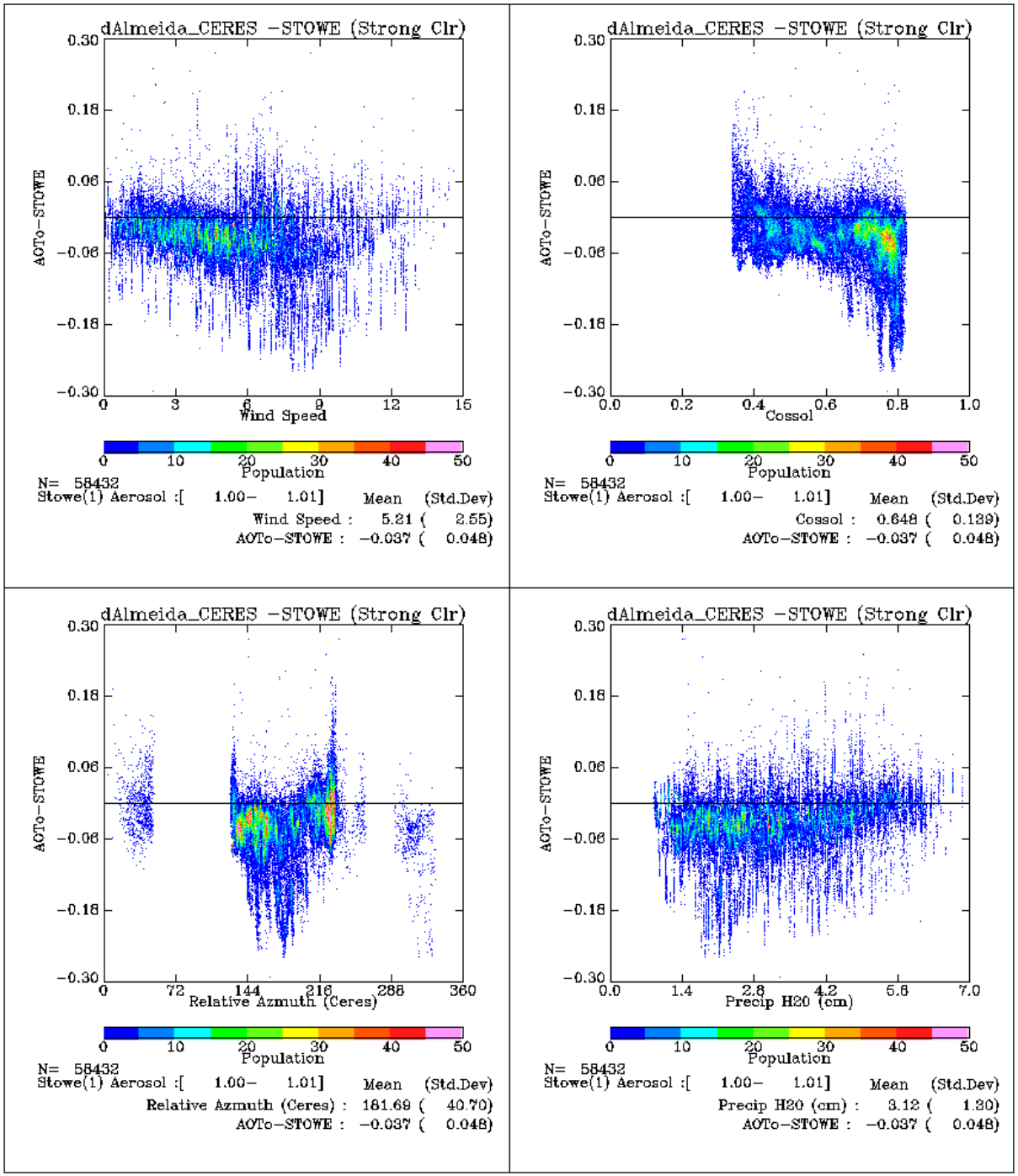
Forcings for clear footprints with NO FORWARD SCATTERING:

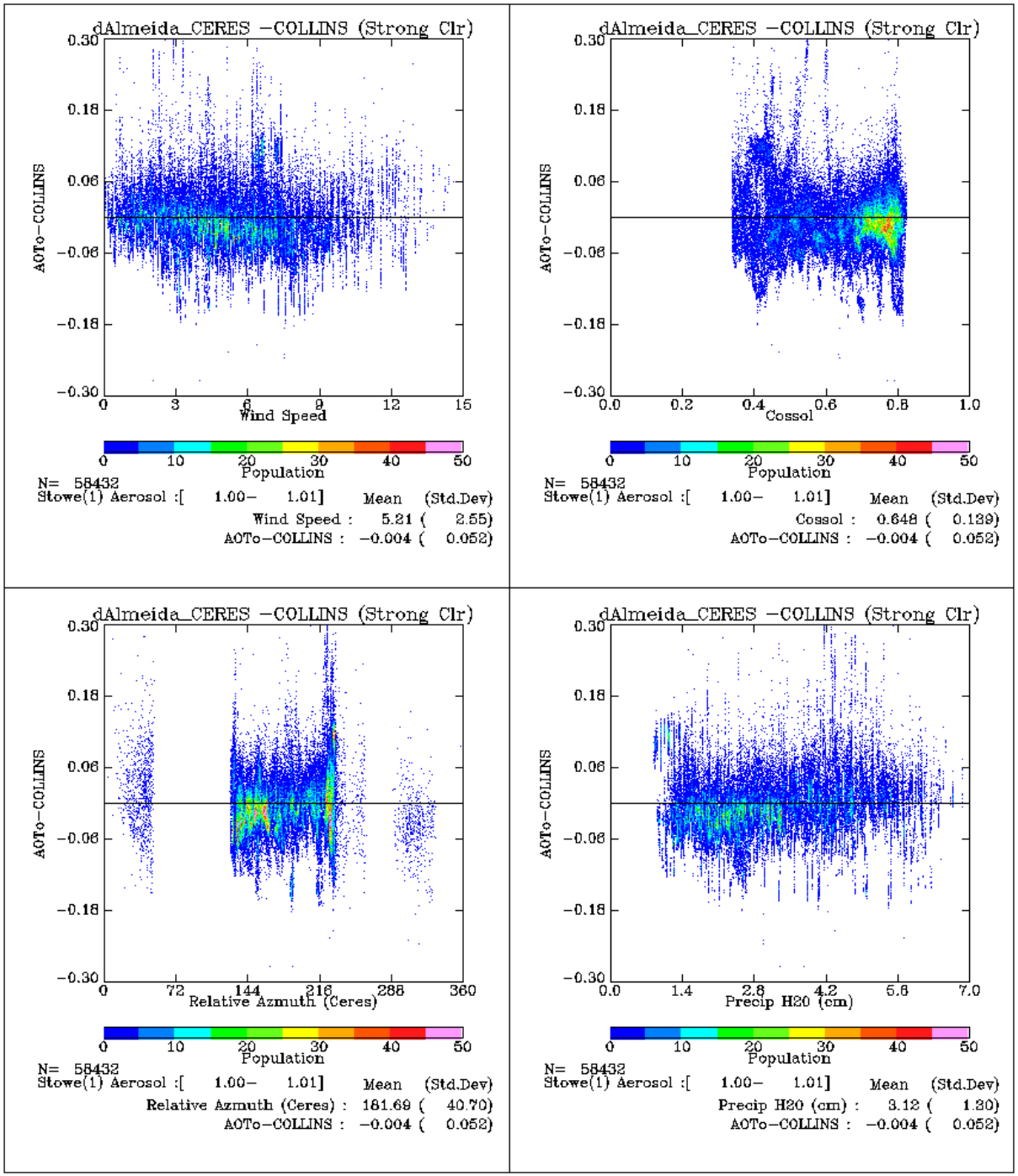
mean	insolation weighted	type of forcing	
8.14 Wm-2	7.81 Wm-2	F1 = Cu-Pu	a raw calculation
6.38 Wm-2	5.50 Wm-2	F2 = Ct-Pu	constrained estimate
7.14 Wm-2	5.29 Wm-2	F3 = Co-Pu	another estimate

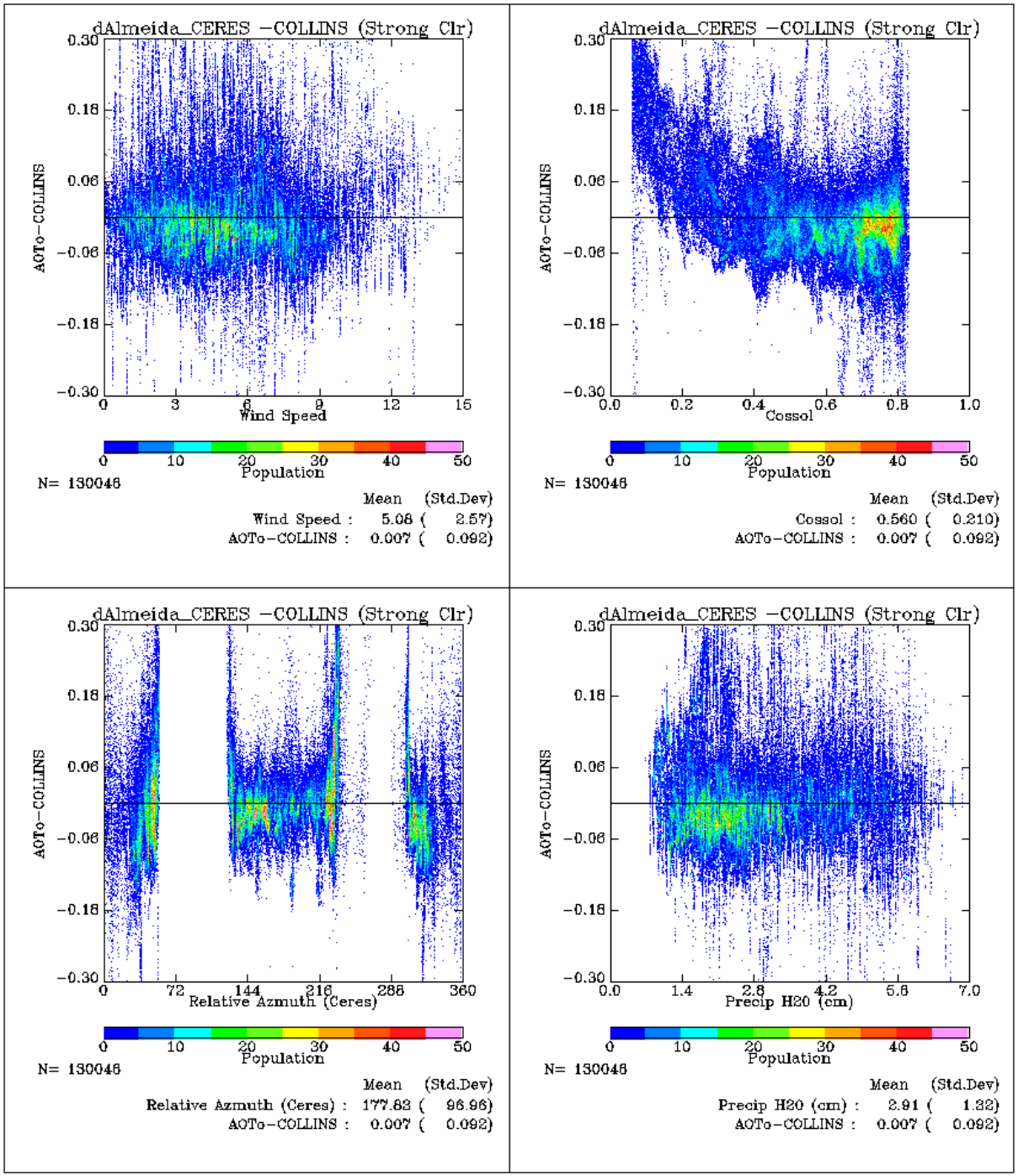
AOTo = “observed” AOT that fits CERES, Fu-Liou, and assumed optical properties

AOTo = (Co-Pu)/(dTOA/dAOT) = (Co-Pu)/[(Cu-Pu)/AOTu]


Aerosol Forcing Observed
Ceres SW TOA (VIRS200+ADM)
UNtuned AOT (Stowe & or Collins)
Population
N= 118827
cossol:[0.20- 1.00]
Mean (Std.Dev)
UNtuned AOT (Stowe & or Collins) : 0.088 (0.056)
Ceres SW TOA (VIRS200+ADM) : 78.04 (6.68)
Aerosol Forcing Model
Fuliou Untuned
UNtuned AOT (Stowe & or Collins)
Population
N= 118827
cossol:[0.20- 1.00]
Mean (Std.Dev)
UNtuned AOT (Stowe & or Collins) : 0.088 (0.056)
Fuliou Untuned : 80.25 (6.59)
Aerosol (Cos Sol > 0.2)
AOTo
UNtuned AOT (Stowe & or Collins)
Population
N= 118827
cossol:[0.20- 1.00]
Mean (Std.Dev)
UNtuned AOT (Stowe & or Collins) : 0.088 (0.056)
AOTo : 0.066 (0.092)
X - Y : 0.022 (0.079)
Rms : [0.082]
Aerosol (Only BackWard Scatter)
AOTo
UNtuned AOT (Mostly Stowe)
Population
N= 72233
RAZ:[90.00- 270.00]
Mean (Std.Dev)
UNtuned AOT (Mostly Stowe) : 0.102 (0.062)
AOTo : 0.093 (0.112)
X - Y : 0.010 (0.097)
Rms : [0.098]


dAlmeida_CERES -STOWE (Strong Clr)
AOTo-STOWE
Wind Speed
Population
N= 58432
Stowe(1) Aerosol :[1.00- 1.01] Mean (Std.Dev)
Wind Speed : 5.21 (2.55)
AOTo-STOWE : -0.037 (0.048)
dAlmeida_CERES -STOWE (Strong Clr)
AOTo-STOWE
Cossol
Population
N= 58432
Stowe(1) Aerosol :[1.00- 1.01] Mean (Std.Dev)
Cossol : 0.648 (0.139)
AOTo-STOWE : -0.037 (0.048)
dAlmeida_CERES -STOWE (Strong Clr)
AOTo-STOWE
Relative Azmuth (Ceres)
Population
N= 58432
Stowe(1) Aerosol :[1.00- 1.01] Mean (Std.Dev)
Relative Azmuth (Ceres) : 181.69 (40.70)
AOTo-STOWE : -0.037 (0.048)
dAlmeida_CERES -STOWE (Strong Clr)
AOTo-STOWE
Precip H20 (cm)
Population
N= 58432
Stowe(1) Aerosol :[1.00- 1.01] Mean (Std.Dev)
Precip H20 (cm) : 3.12 (1.30)
AOTo-STOWE : -0.037 (0.048)


dAlmeida_CERES −COLLINS (Strong Clr)
AOTo−COLLINS
Wind Speed
Population
N= 58432
Stowe(1) Aerosol :[1.00− 1.01] Mean (Std.Dev)
Wind Speed : 5.21 (2.55)
AOTo−COLLINS : −0.004 (0.052)
dAlmeida_CERES −COLLINS (Strong Clr)
AOTo−COLLINS
Cossol
Population
N= 58432
Stowe(1) Aerosol :[1.00− 1.01] Mean (Std.Dev)
Cossol : 0.648 (0.139)
AOTo−COLLINS : −0.004 (0.052)
dAlmeida_CERES −COLLINS (Strong Clr)
AOTo−COLLINS
Relative Azmuth (Ceres)
Population
N= 58432
Stowe(1) Aerosol :[1.00− 1.01] Mean (Std.Dev)
Relative Azmuth (Ceres) : 181.69 (40.70)
AOTo−COLLINS : −0.004 (0.052)
dAlmeida_CERES −COLLINS (Strong Clr)
AOTo−COLLINS
Precip H20 (cm)
Population
N= 58432
Stowe(1) Aerosol :[1.00− 1.01] Mean (Std.Dev)
Precip H20 (cm) : 3.12 (1.30)
AOTo−COLLINS : −0.004 (0.052)


dAlmeida_CERES −COLLINS (Strong Clr)
AOTo−COLLINS
Wind Speed
Population
N= 130046
Mean (Std.Dev)
Wind Speed : 5.08 (2.57)
AOTo−COLLINS : 0.007 (0.092)
dAlmeida_CERES −COLLINS (Strong Clr)
AOTo−COLLINS
Cossol
Population
N= 130046
Mean (Std.Dev)
Cossol : 0.560 (0.210)
AOTo−COLLINS : 0.007 (0.092)
dAlmeida_CERES −COLLINS (Strong Clr)
AOTo−COLLINS
Relative Azmuth (Ceres)
Population
N= 130046
Mean (Std.Dev)
Relative Azmuth (Ceres) : 177.62 (96.96)
AOTo−COLLINS : 0.007 (0.092)
dAlmeida_CERES −COLLINS (Strong Clr)
AOTo−COLLINS
Precip H20 (cm)
Population
N= 130046
Mean (Std.Dev)
Precip H20 (cm) : 2.91 (1.32)
AOTo−COLLINS : 0.007 (0.092)