Terra CRS Surface Flux Accuracy in Edition 2

CERES/ARM Cloud Science Team Meeting
Williamsburg, Virginia 2 November 2004

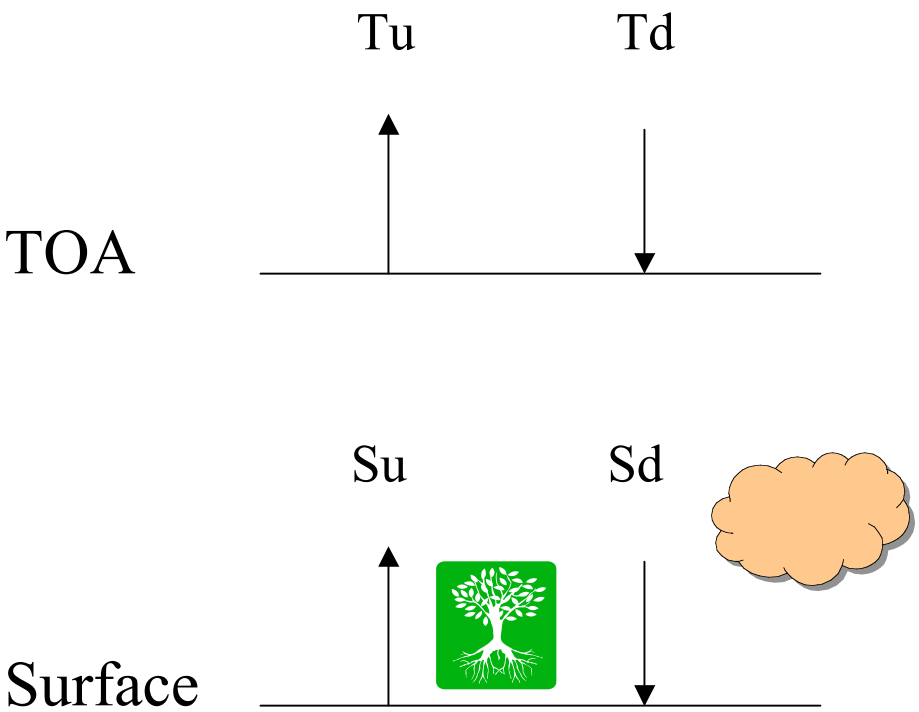
Surface and Atmosphere Radiation Budget (SARB) group:
T. P. Charlock (NASA LaRC) - *shows various stuff after Rutan*
Fred G. Rose (AS&M) - *presents later today*
David A. Rutan (AS&M) - ***presents topic at hand with nicer slides***
Zhonghai Jin (AS&M) - coupled radiative transfer

Lisa H. Coleman, Thomas E. Caldwell, Scott Zentz (SAIC)
- Data Management Team
Seiji Kato (H.U.) - cloud optical depth distribution
David Fillmore and Bill Collins (NCAR) - MATCH
Wenying Su (H.U.)- surface UV in gridded "SYN" product

SARB & SOFA WGs -- informal presentations & discussion tomorrow

Access to CAVE on line surface and CERES validation,
point and click Fu-Liou and COART calculations:
www-cave.larc.nasa.gov/cave/ or goggle "CERES CAVE"

Ghost in Halloween closet: Anomalous absorption?

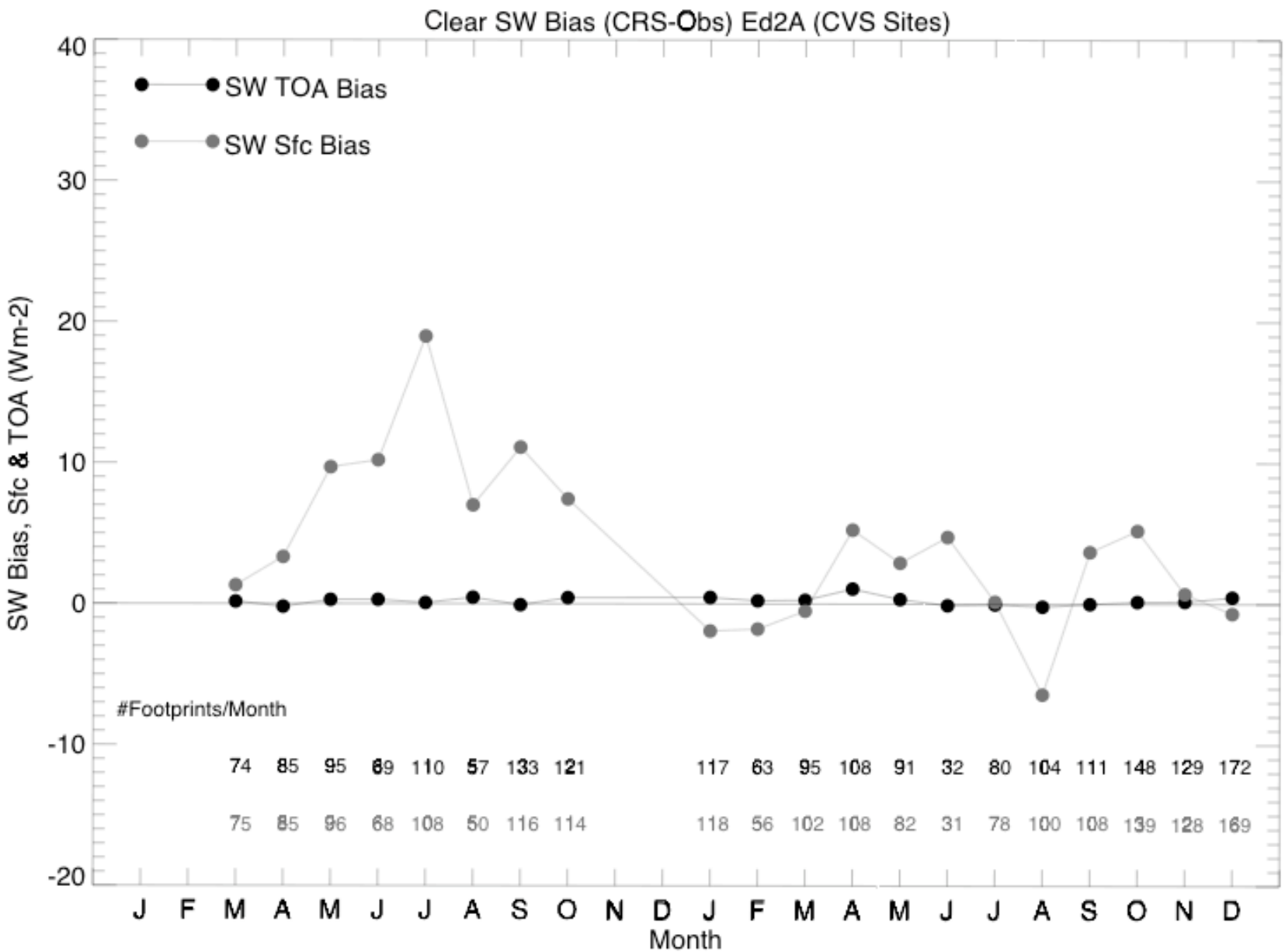


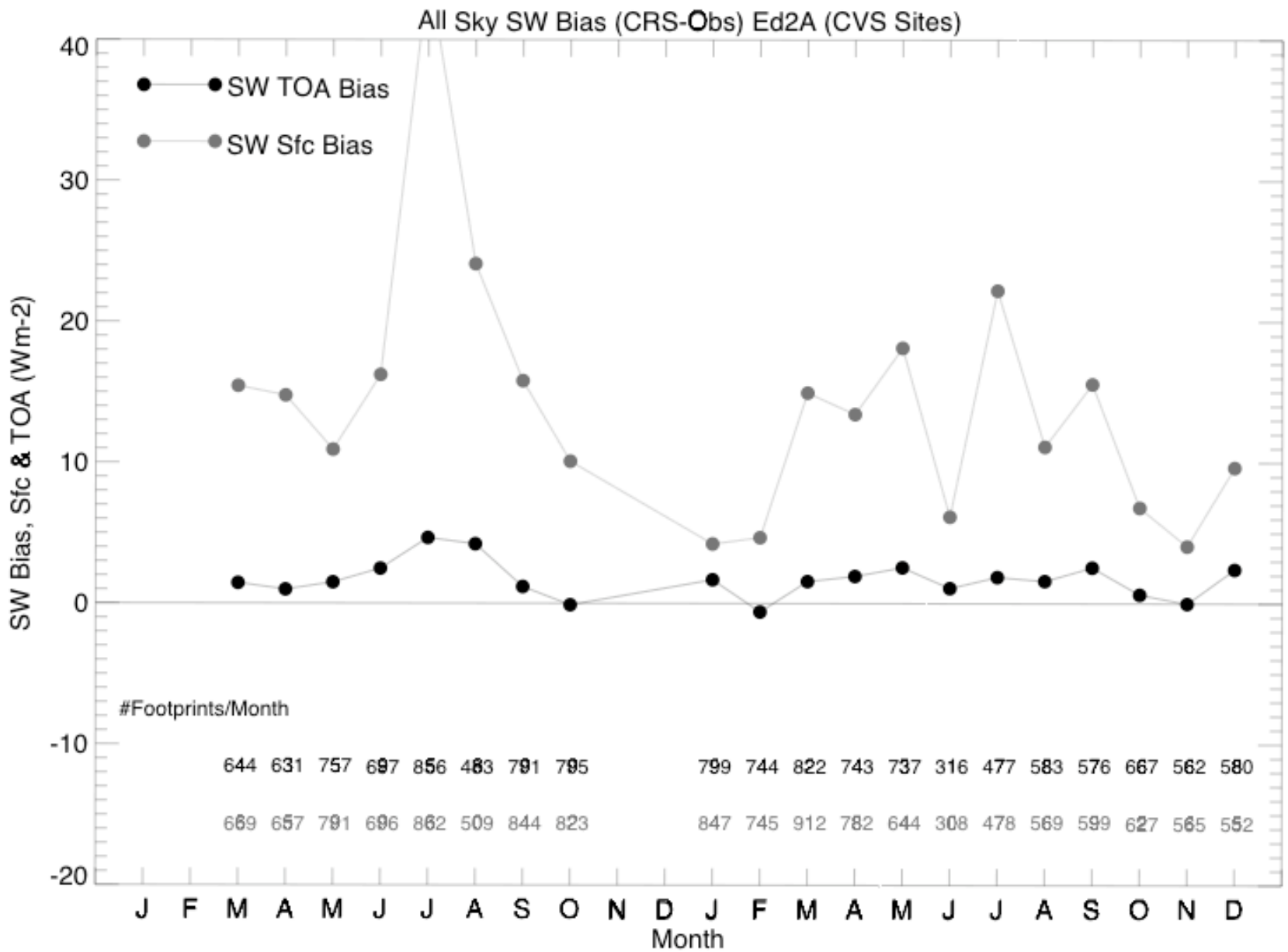
Divergence of SW = Tu-Td-Su+Sd

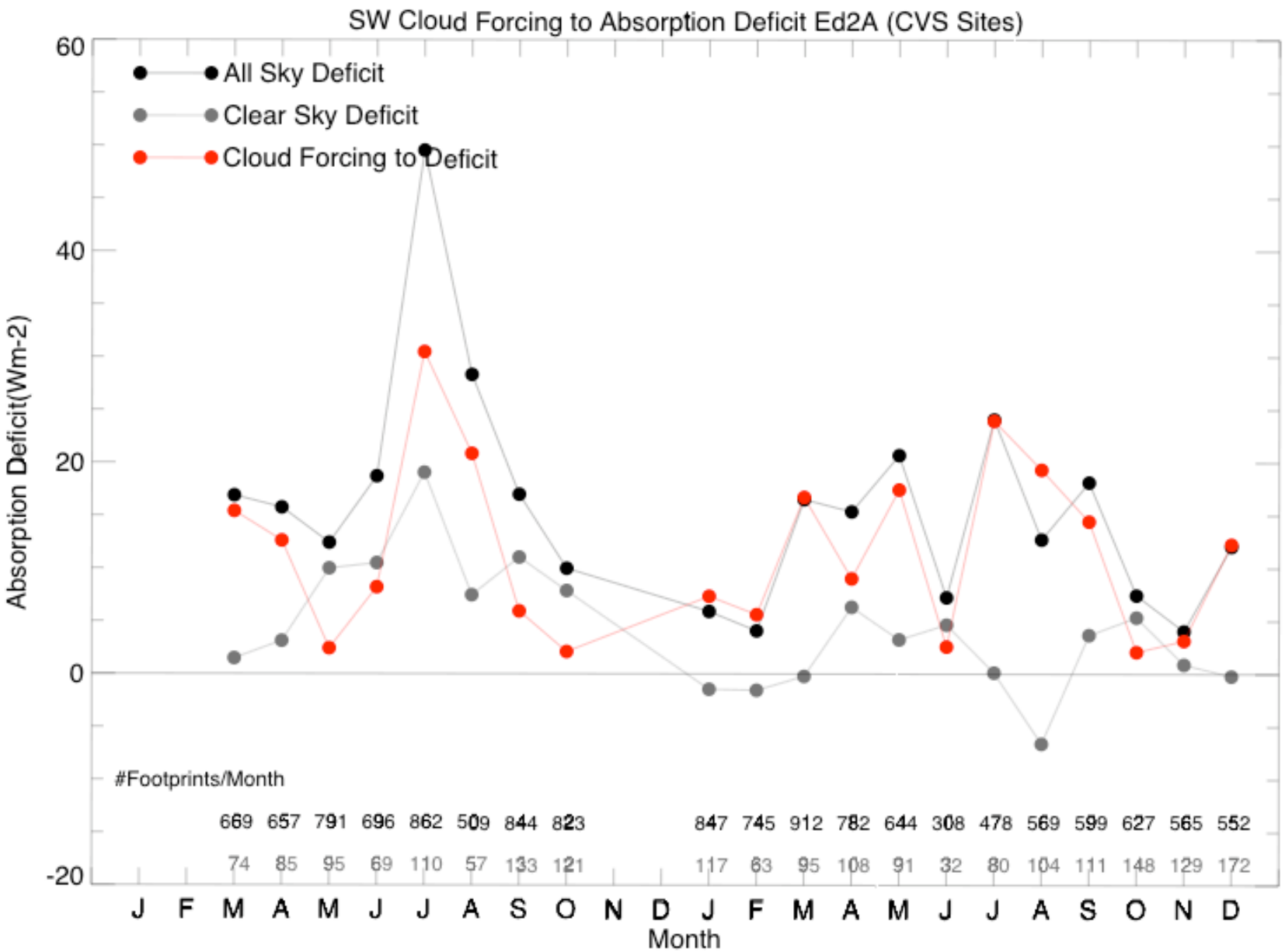
Poor person's divergence = Tu-Sd

Bias of poor person's divergence =

Tu-Sd (Untuned - Observed)


Clear SW Bias (CRS-Obs) Ed2A (CVS Sites)
SW TOA Bias
SW Sfc Bias
SW Bias, Sfc & TOA (Wm-2)
40
30
20
10
0
-10
-20
#Footprints/Month
74 85 95 69 110 57 133 121 117 63 95 108 91 32 80 104 111 148 129 172
75 85 96 68 108 50 116 114 118 56 102 108 82 31 78 100 108 139 128 169
J F M A M J J A S O N D J F M A M J J A S O N D
Month


All Sky SW Bias (CRS-Obs) Ed2A (CVS Sites)
SW TOA Bias
SW Sfc Bias
SW Bias, Sfc & TOA (Wm-2)
40
30
20
10
0
-10
-20
#Footprints/Month
644 631 757 697 856 483 791 795 799 744 822 743 737 316 477 583 576 667 562 580
669 657 791 696 862 509 844 823 847 745 912 782 644 308 478 569 599 627 565 552
J F M A M J J A S O N D J F M A M J J A S O N D
Month


SW Cloud Forcing to Absorption Deficit Ed2A (CVS Sites)
All Sky Deficit
Clear Sky Deficit
Cloud Forcing to Deficit
Absorption Deficit(Wm-2)
60
40
20
0
-20
#Footprints/Month
669 657 791 696 862 509 844 823 847 745 912 782 644 308 478 569 599 627 565 552
74 85 95 69 110 57 133 121 117 63 95 108 91 32 80 104 111 148 129 172
J F M A M J J A S O N D J F M A M J J A S O N D
Month

Terra CRS Edition 2A weighted to approximate area means for 24 hours (25 March 2000)

SW Aerosol Forcing (Wm-2)

Ed2A SW	Globe	Globe	Ocean	Ocean
		as if clear		as if clear
TOA Net	-1.1	-2.6	-2.2	-3.6
Atmophere Net	6.6	6.9	3.2	3.3
Surface Net	-7.7	-9.4	-5.4	-6.9

LW Aerosol Forcing (Wm-2)

Ed2A LW	Globe	Globe	Ocean	Ocean
		as if clear		as if clear
TOA Net	0.6	0.8	0.3	0.5
Atmophere Net	-1.3	-1.9	-0.7	-1.4
Surface Net	1.8	2.7	1.0	1.8

SW+LW Aerosol Forcing (Wm-2)

Ed2A SW+LW	Globe	Globe	Ocean	Ocean
		as if clear		as if clear
TOA Net	-0.5	-1.8	-1.9	-3.1
Atmophere Net	5.3	5.0	2.5	1.9
Surface Net	-5.9	-6.7	-4.4	-5.1

First column above shows aerosols force global TOA cooling (-0.5), atmospheric warming (5.3), and surface cooling (-5.9).

Revised SW Aerosol Forcing (Wm-2) weighted to approximate area means for 24 hr (25 March 2000)

Three changes in revision: (1) New optical properties for dust (Andrew Lacis, GISS)
(2) Aerosol vertical profile varies at each point daily
(3) Some changes to SSF input.

The revised version will be called "Edition2B". Table below does not include (3).
(3) should not be significant for these aerosol forcings, which are computed:

Revised SW	*Globe*	*Globe*	*Ocean*	*Ocean*
		as if clear		*as if clear*
TOA Net	*-2.5*	*-4.2*	*-2.5*	*-4.0*
Atmosphere Net	*4.2*	*4.3*	*2.4*	*2.5*
Surface Net	*-6.6*	*-8.4*	*-4.9*	*-6.5*

The document "CER_CRS_TerraEdition2Ajjm" describes the unrevised Edition 2A:

Ed2A SW	**Globe**	**Globe**	**Ocean**	**Ocean**
		as if clear		**as if clear**
TOA Net	**-1.1**	**-2.6**	**-2.2**	**-3.6**
Atmophere Net	**6.6**	**6.9**	**3.2**	**3.3**
Surface Net	**-7.7**	**-9.4**	**-5.4**	**-6.9**

Averages of Raw Footprints March 2000 Terra CRS Edition 2A and 2B
(Not area weighted)

Differences (%) of SSF Observations (Obs):

x = 100*[(Obs Ed2a) - (Obs Ed2b)]/[0.5*(Obs Ed2a) + 0.5*(Obs Ed2b)]

Bias (%) of Untuned SARB Calculations:

y = 100*[(Untuned Ed2a) – (Obs Ed2a)]/(Obs Ed2a)

z = 100*[(Untuned Ed2b) – (Obs Ed2b)]/(Obs Ed2b)

LW at TOA (%)

	Sea	Land	Day	Nite	Sea clear	Land clear
X = Ed2a-Ed2b	**0.1**	**0.1**	**0.1**	**0.1**	**-0.3**	**-0.1**
Y = Bias Ed2a	**-0.4**	**0.0**	**0.0**	**-0.5**	**-0.3**	**-0.5**
Z = Bias Ed2b	**-0.4**	**0.2**	**0.1**	**-0.4**	**-0.3**	**-0.4**

Averages of Raw Footprints March 2000 Terra CRS Edition 2A and 2B
(Not area weighted)

Differences (%) of SSF Observations (Obs):

X = 100*[(Obs Ed2a) - (Obs Ed2b)]/[0.5*(Obs Ed2a) + 0.5*(Obs Ed2b)]

Bias (%) of Untuned SARB Calculations:

Y = 100*[(Untuned Ed2a) – (Obs Ed2a)]/(Obs Ed2a)

Z = 100*[(Untuned Ed2b) – (Obs Ed2b)]/(Obs Ed2b)

SW at TOA (%)

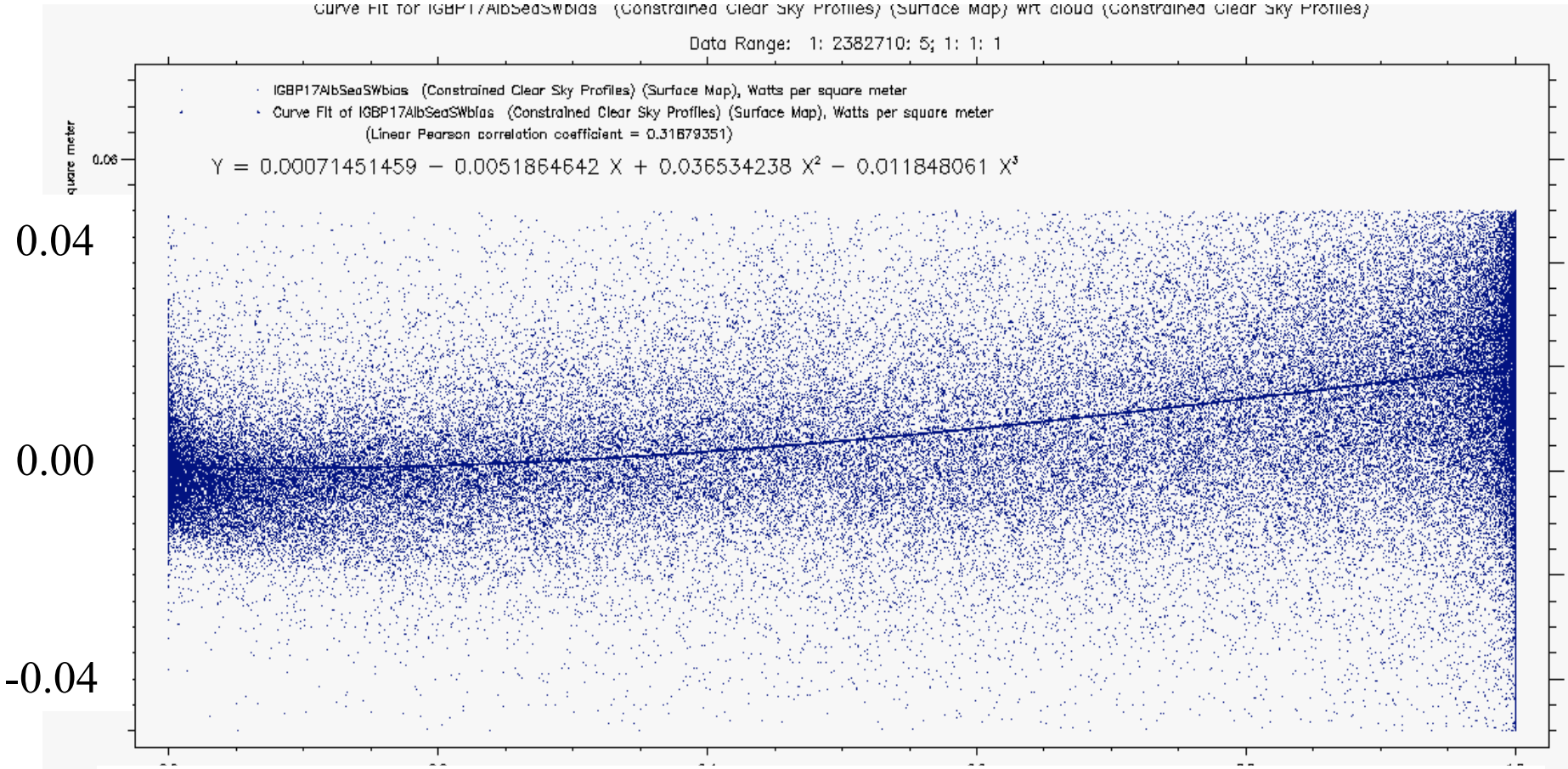
	Sea	Land	Day	Nite	Sea clear	Land clear
X = Ed2a-Ed2b	**0.4**	**0.6**	**0.5**		**0.5**	**-0.1**
Y = Bias Ed2a	**4.1**	**0.0**	**2.4**		**1.1**	**1.5**
Z = Bias Ed2b	**4.8**	**1.2**	**3.3**		**3.8**	**-0.3**

SARB calculation over clear ocean (ice free) uses no broadband CERES input

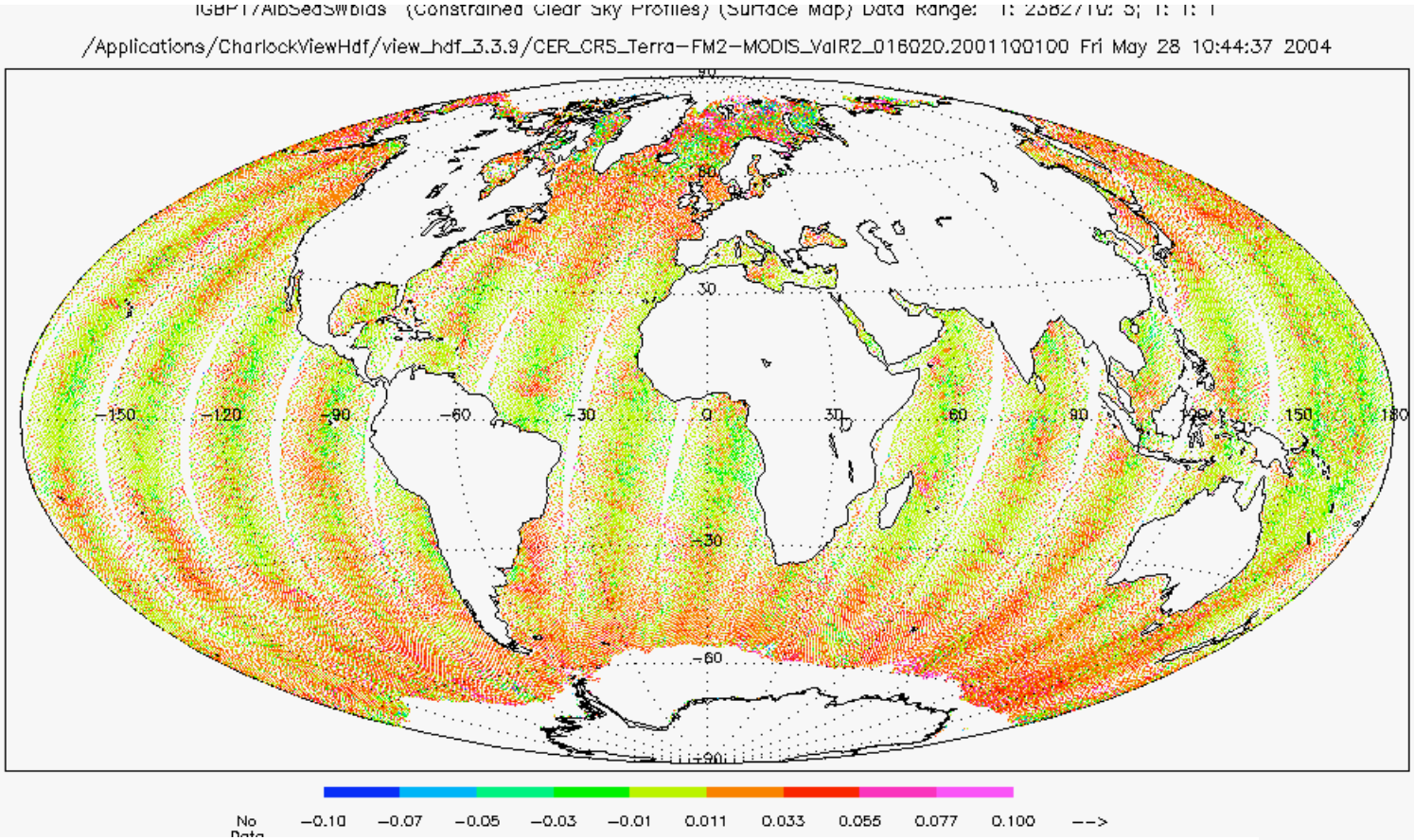
Illustration of a persistent problem: SARB TOA albedo is too high over cloudy ocean

[Untuned TOA albedo - Observed TOA albedo] vs [Cloud fraction]

for IGBP=17 (ocean) 1 Oct 2001 CRS Ed2a

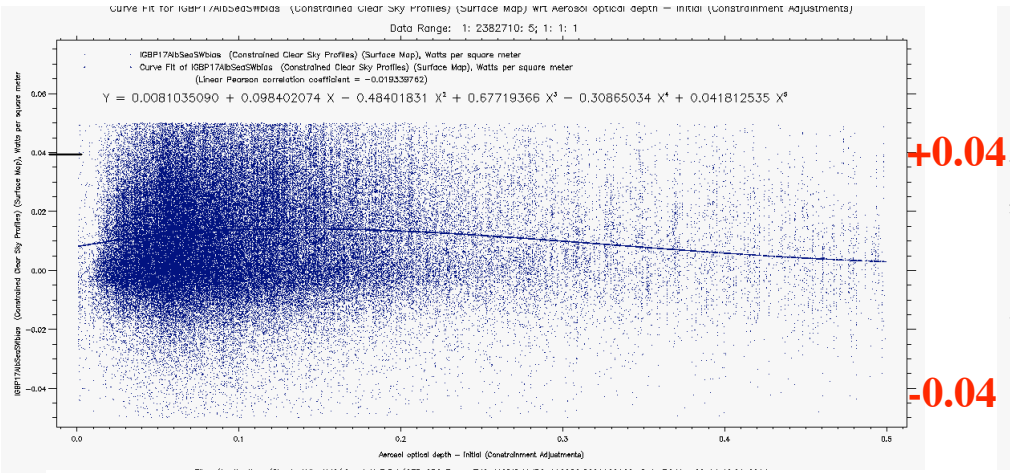


(Untuned Albedo - Observed) at TOA 1 Oct 2001 IGBP type 17 (ocean)



-0.10 TOA albedo bias 0.10

All sky TOA Albedo Bias vs. AOT (0.0 to 0.5)

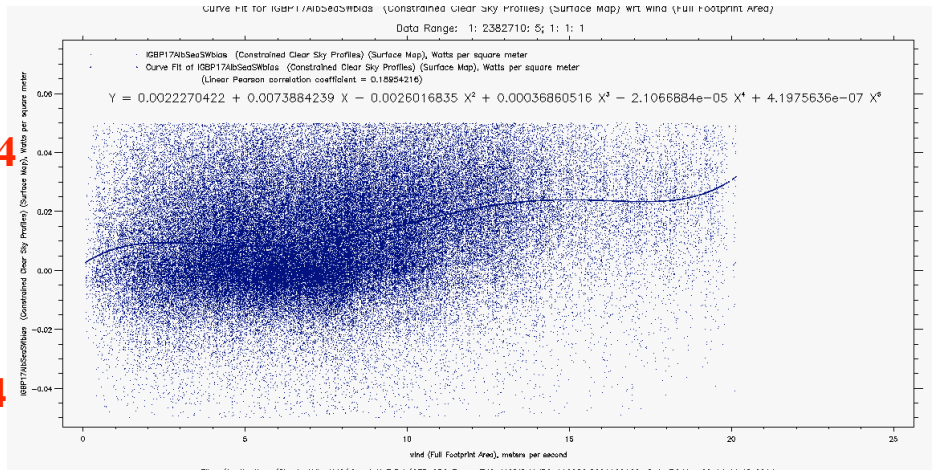


+0.04

-0.04

0.0 AOT 0.5

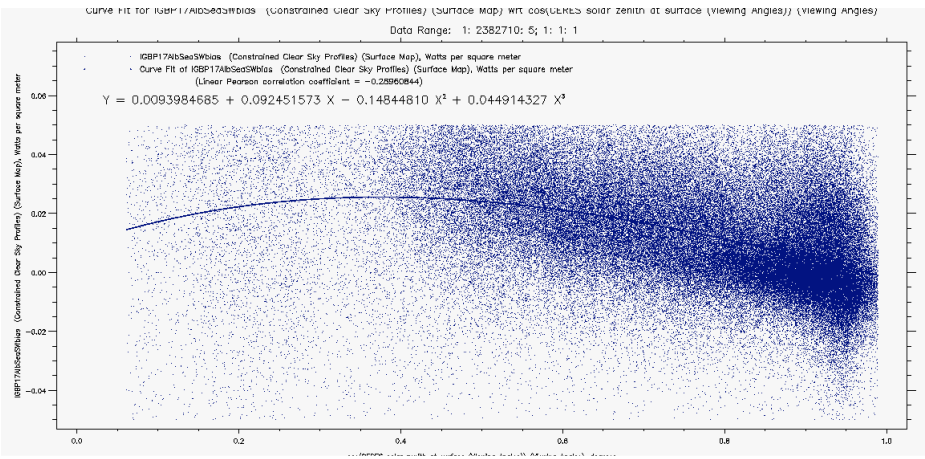
All sky TOA Albedo Bias vs. Wind Speed (0 to 25 m/s)



0 Wind (m/s) 25

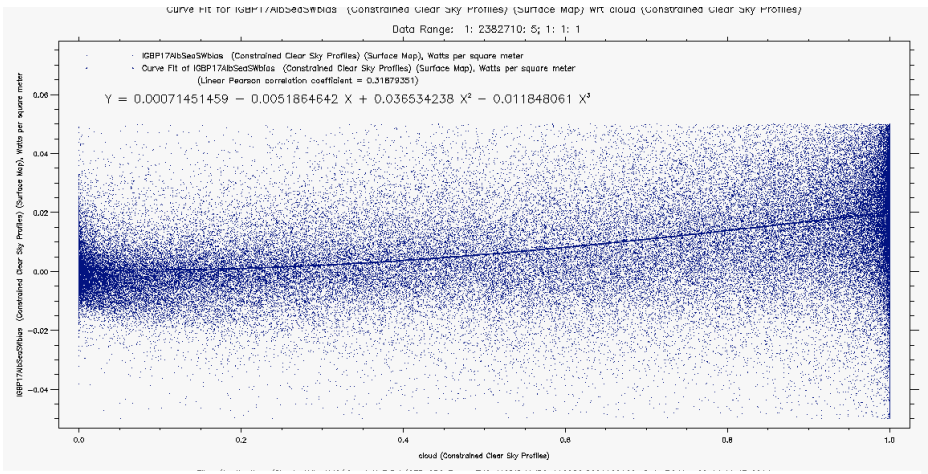
All plots on page use same vertical scale: +0.04 to -0.04

All sky TOA Albedo Bias vs. cosSZA



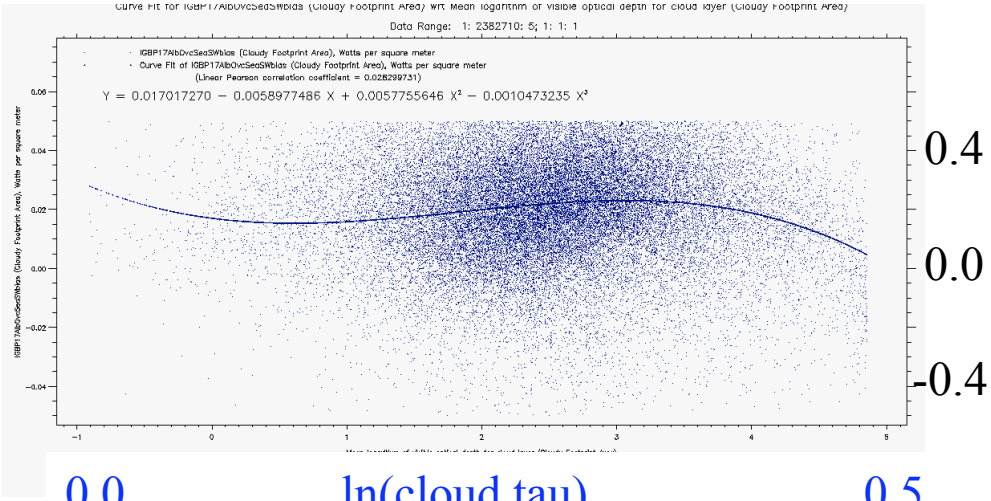
0.0 cosSZA 1.0

All sky TOA Ocean albedo Bias vs. Cloud Fraction



0.0 Cloud Fraction 1.0

Overcast TOA Albedo Bias vs. ln(tau)



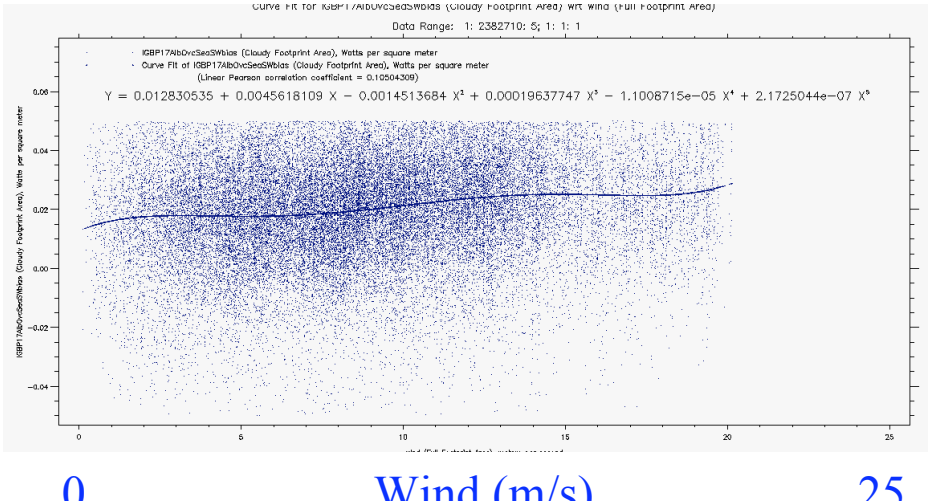
0.4

0.0

-0.4

0.0 ln(cloud tau) 0.5

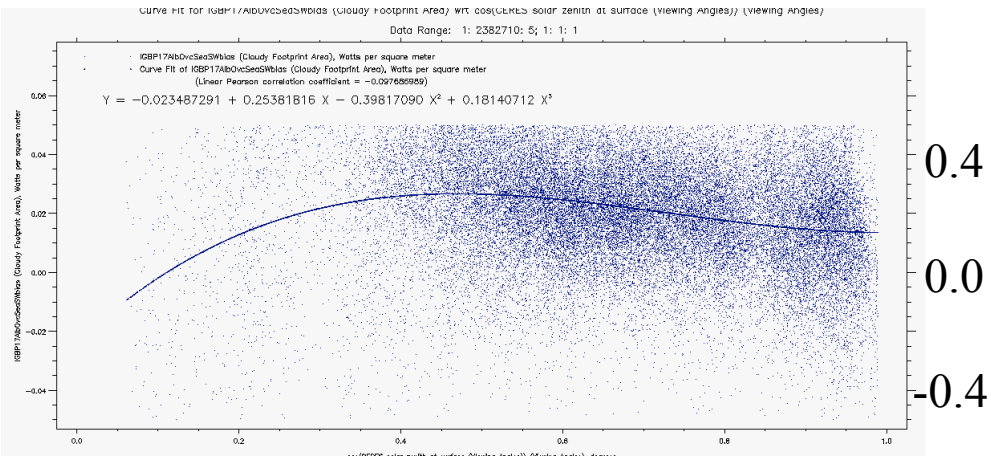
Overcast TOA Albedo Bias vs. Wind Speed (0 to 25mm/s)



0 Wind (m/s) 25

All plots on page use same vertical scale: +0.04 to -0.04

Overcast TOA Albedo Bias vs. cosSZA



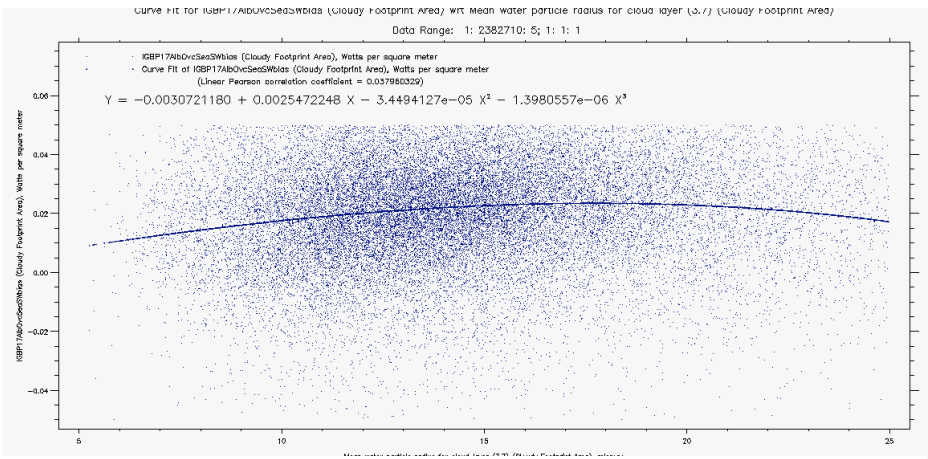
0.4

0.0

-0.4

0.0 cosSZA 1.0

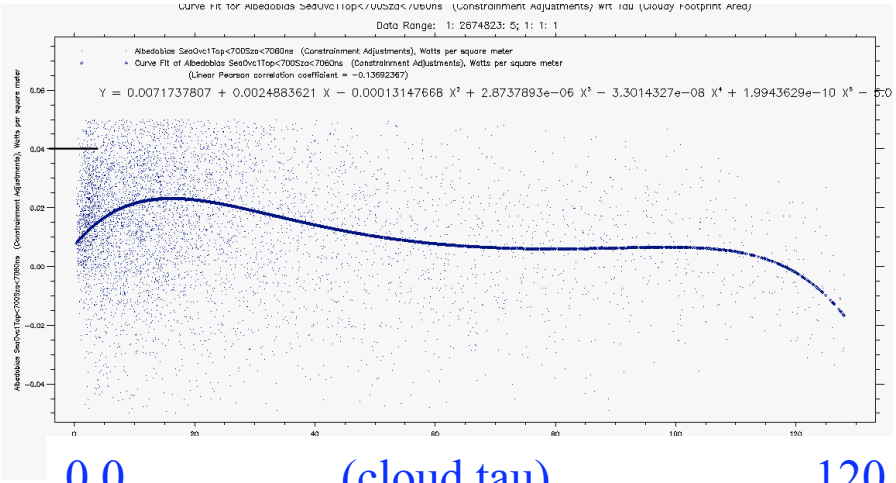
Overcast TOA Albedo vs. Water Cloud Radius



5 Droplet radius (micron) 25

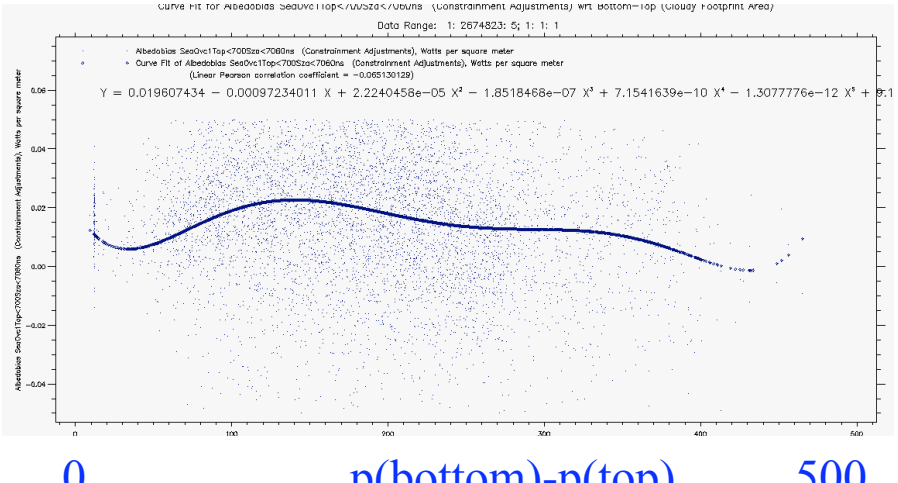
Cloud Top Pressure < 700 mb

Albedo bias (numbers -0.04 to + 0.04)
VS Optical Depth (numbers 0 to 120)



0.0 (cloud tau) 120

Albedo bias (numbers -0.04 to + 0.04)
VS Bottom-Top in mb (numbers 0 to 500 mb)

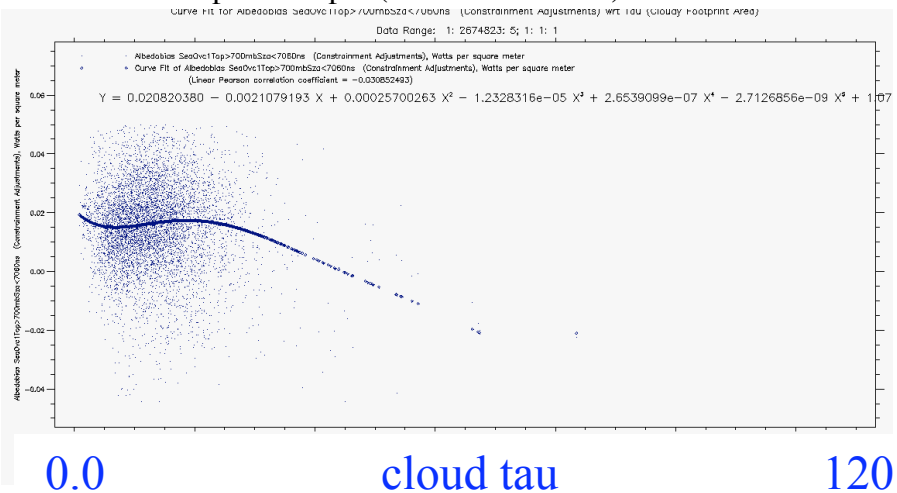


0.4
0.0
-0.4

0 p(bottom)-p(top) 500

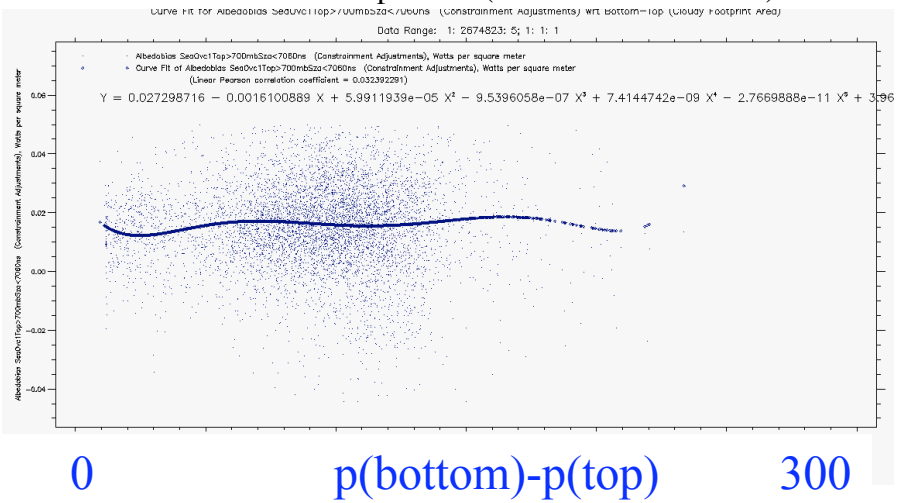
Cloud Top Pressure > 700 mb

Albedo bias (numbers -0.04 to + 0.04)
VS Optical Depth (numbers 0 to 120)



0.0 cloud tau 120

Albedo bias (numbers -0.04 to + 0.04)
VS Bottom-Top in mb (numbers 0 to 300 mb)

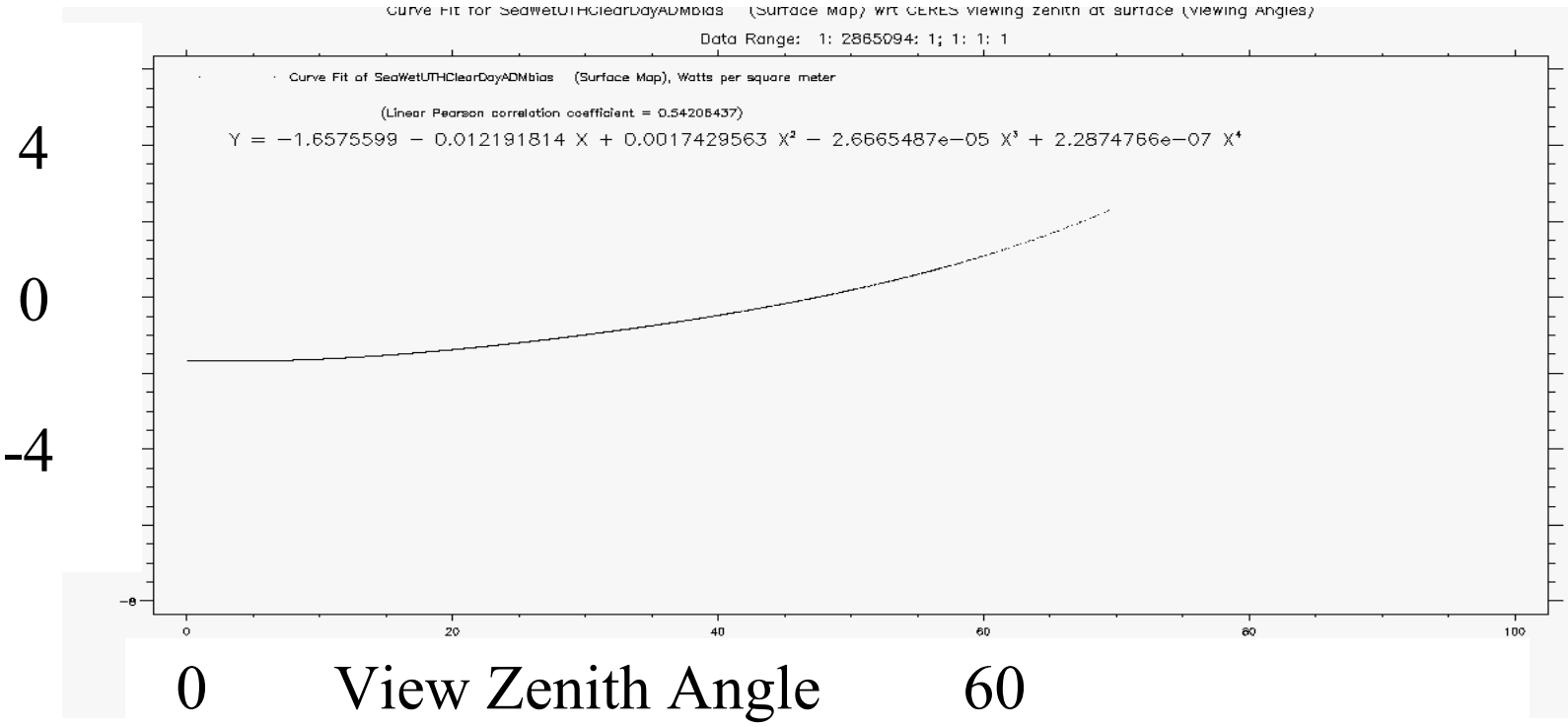


0.4
0.0
-0.4

0 p(bottom)-p(top) 300

(OLR error as corrected for bias in computed LW radiance) vs VZA

Clear Day Ocean UTH>50-100% (there were a few >100%)



Does this suggest undetected cirrus?