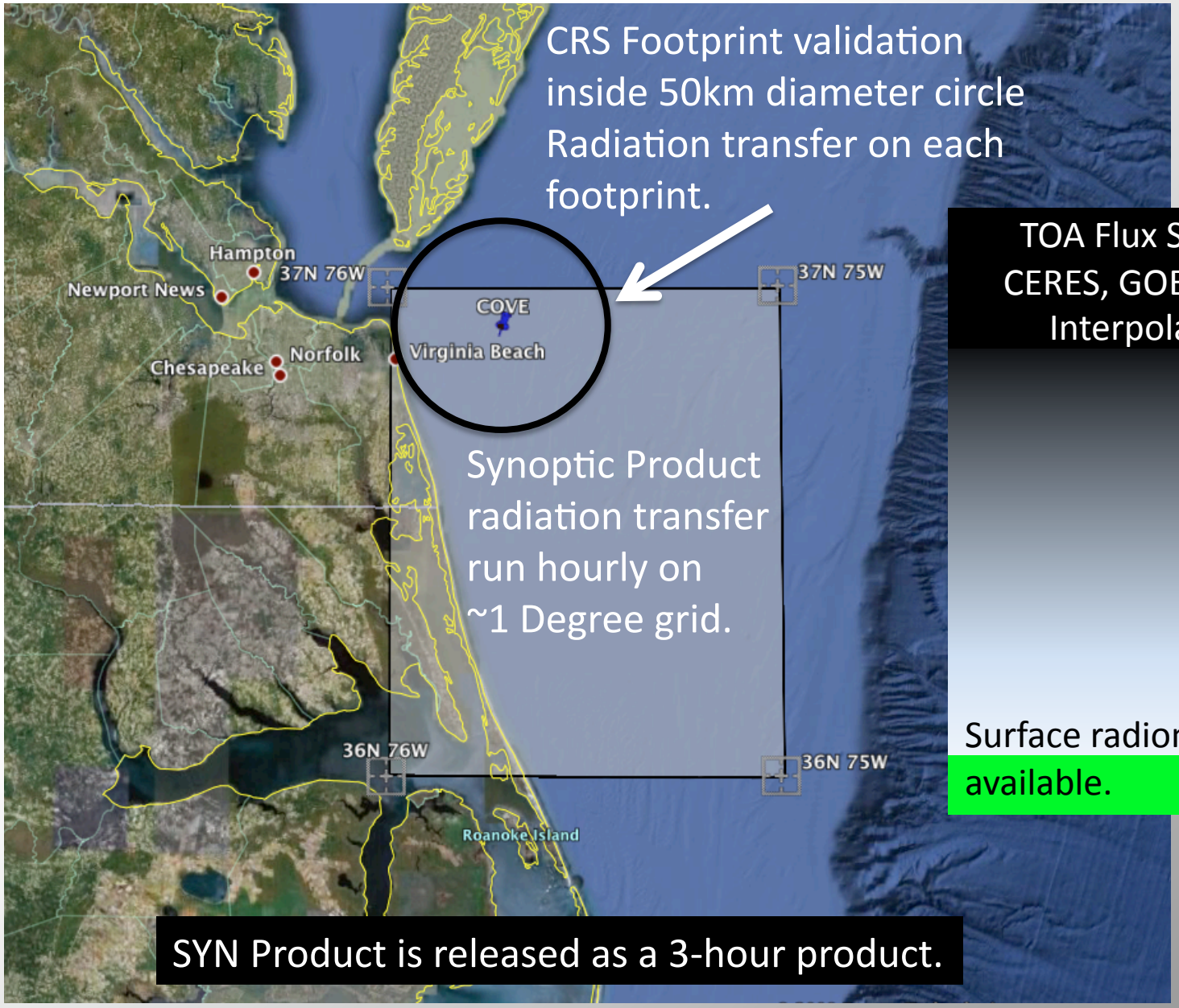
CERES "SYN" Synoptic Product Validation



CRS Footprint validation inside 50km diameter circle Radiation transfer on each footprint.

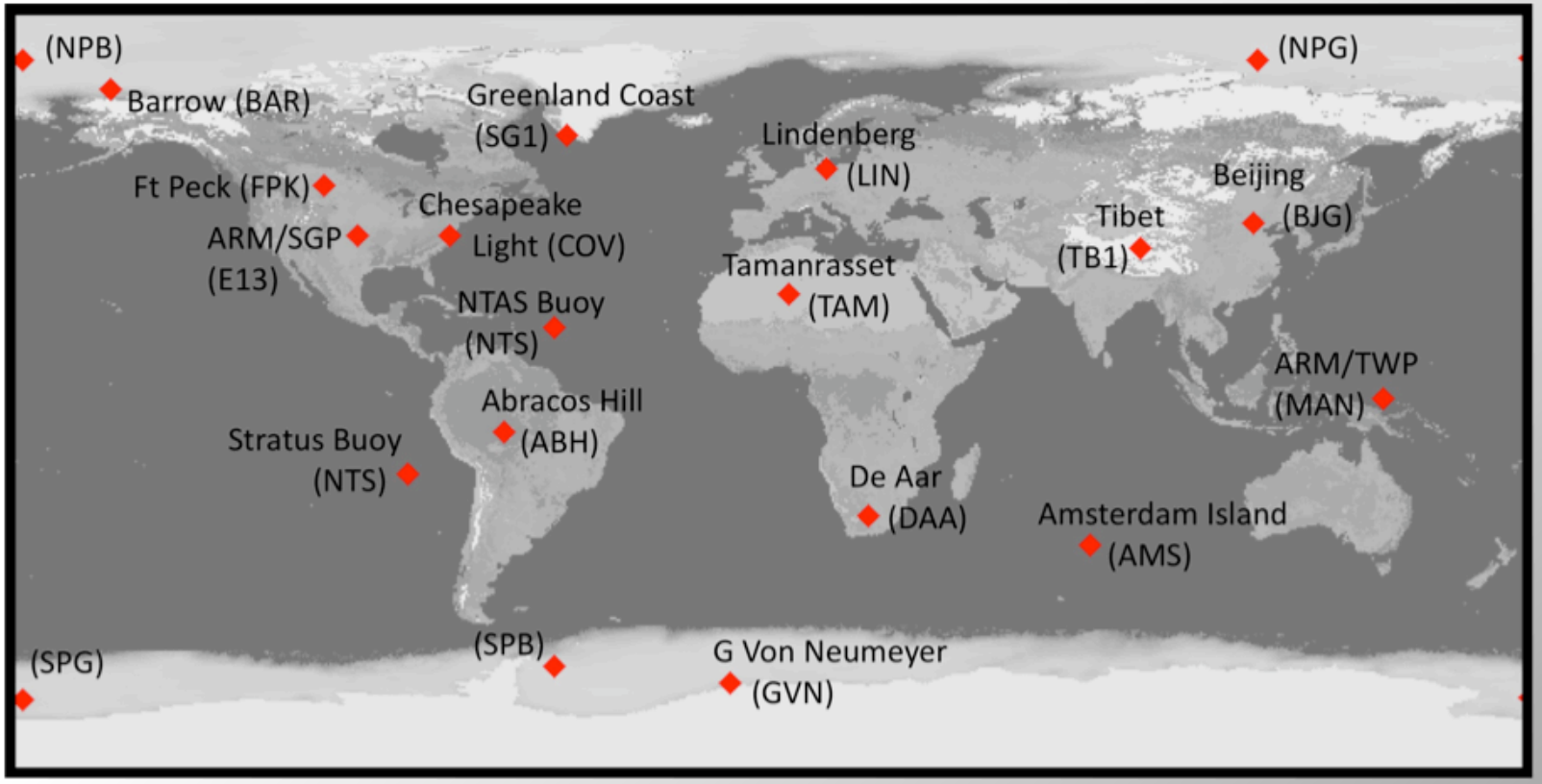
Synoptic Product radiation transfer run hourly on ~1 Degree grid.

TOA Flux Source CERES, GOES NBB, Interpolated

Surface radiometery if available.

SYN Product is released as a 3-hour product.

SYN(I) Validation
Surface Grid Box Locations



- Chosen 20 out of possible 180.
- 11 have surface downwelling observations.
- Use a special hourly validation product SYNI.
- Have ~5 years from Terra & ~3 years from Aqua.

Terra SYNI Data Product

Tuned Model Statistics for 20 Grid Boxes

Nov 2000 through Oct 2005

20 Sites	Obs	Bias			RMS			correlation			N
Quantity	Mean	Hourly	Daily	Mnthly	Hourly	Daily	Mnthly	Hourly	Daily	Mnthly	(Hrly)
SW TOA UP	103	-1	-1	-1	13	7	4	0.99	1.00	1.00	873198
LW TOA Up	226	-1	-1	-1	11	7	4	0.98	0.98	0.99	874105
SW Surface Down	183	2	2	4	65	28	19	0.97	0.96	0.98	403186
LW Surface Down	318	-1	-1	-1	23	17	10	0.96	0.98	0.99	407521
TOA Albedo	40.4	-0.9	-1.1	-1.1	5.6	4.4	3.3	0.95	0.97	0.98	466750
Surface Transmiss.	53.5	0.3	0.6	0.5	12.3	7.2	3.6	0.82	0.91	0.93	177562

(Fluxes in W/m^2; Albedo and transmission in %)

(All Bias' are Model – Observation)

Aqua SYNI Data Product

Tuned Model Statistics for 20 Grid Boxes
Jul 2002 through Oct 2005

20 Sites	Obs Mean	Bias			RMS			correlation			N (Hrly)
Quantity		Hourly	Daily	Mnthly	Hourly	Daily	Mnthly	Hourly	Daily	Mnthly	
SW TOA UP	102	-1	-1	-1	14	7	5	1.00	0.99	1.00	564876
LW TOA Up	226	0	0	0	11	7	3	0.98	0.99	1.00	565521
SW Surface Down	180	2	3	5	62	27	20	0.97	0.96	0.98	245999
LW Surface Down	320	-1	-1	-1	23	16	10	0.96	0.98	0.99	246528
TOA Albedo	40.2	-1.0	-1.2	-1.1	5.6	4.2	3.1	0.95	0.97	0.98	303449
Surface Transmiss.	53.3	0.3	0.6	0.5	12.0	7.0	3.3	0.83	0.91	0.93	107846

(Fluxes in W/m^2; Albedo and transmission in %)
(All Bias' are Model – Observation)

Effect of Tuning TOA, on the Surface

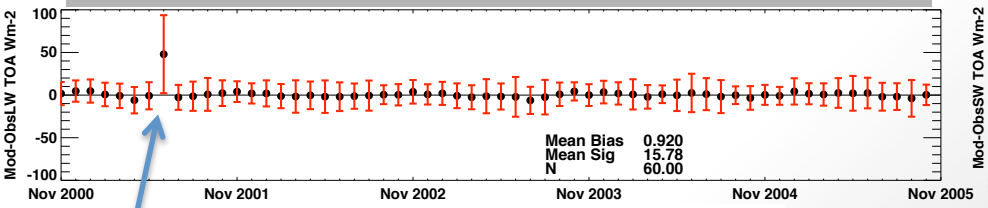
Similar to CRS, radiation transfer model is run once.
Results are compared to observations at TOA;
input parameters are adjusted by the 'tuning' algorithm.
Surface flux down is left to itself.

Terra Data Product 20 Sites	Bias		RMS		Correlation (r)	
	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned
LW TOA UP	-1	-1	13	11	0.96	0.97
SW TOA Up	-1	-1	20	13	0.99	0.99
LW Surface Down	-1	-1	23	23	0.96	0.96
SW Surface Down	1	2	65	65	0.97	0.97

Aqua Data Product 20 Sites	Bias		RMS		Correlation (r)	
	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned
LW TOA UP	0	0	12	10	0.96	0.98
SW TOA Up	-1	-1	21	14	0.99	1.00
LW Surface Down	-1	-1	23	23	0.96	0.96
SW Surface Down	2	2	62	62	0.97	0.97

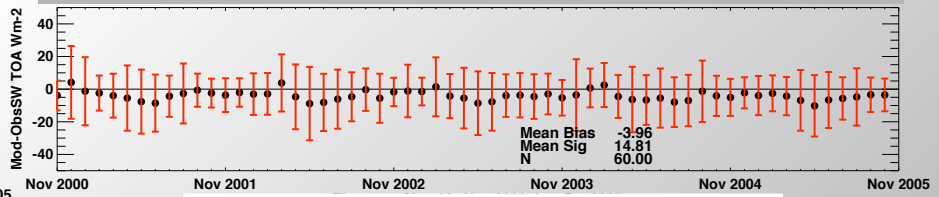
E13: Monthly Mean Bias +/- 1 Std Deviation

TOA LW Bias (Model – Observation) W/m^2



Month (Nov 2000 through Oct 2005)

TOA SW Bias (Model – Observation) W/m^2

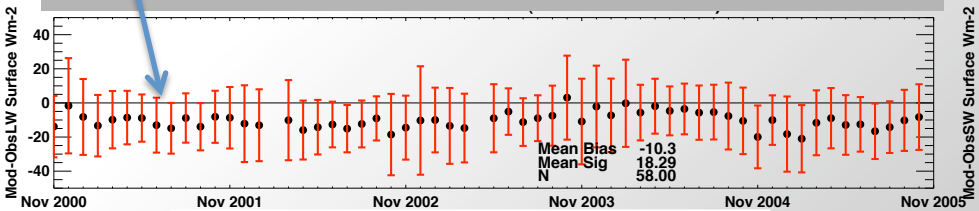


Month (Nov 2000 through Oct 2005)

Effect of missing MODIS data in Jun 2000 in LW TOA Up results. Not noticeable in TOA SW Bias, nor in LW or SW down.

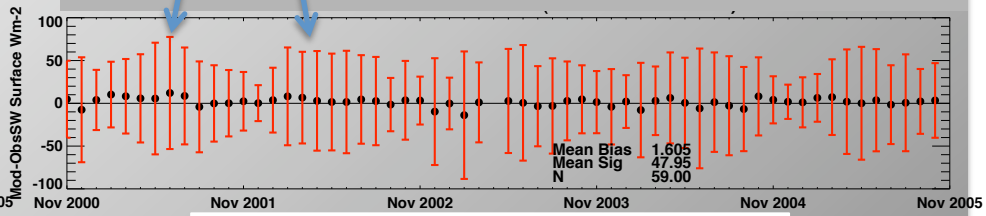
See some annual signal in the variance of SW down, less so in SW up at TOA

Surface LW Down Bias (Model – Obs) W/m^2



Month (Nov 2000 through Oct 2005)

Surface SW Down Bias (Model – Obs) W/m^2



Month (Nov 2000 through Oct 2005)

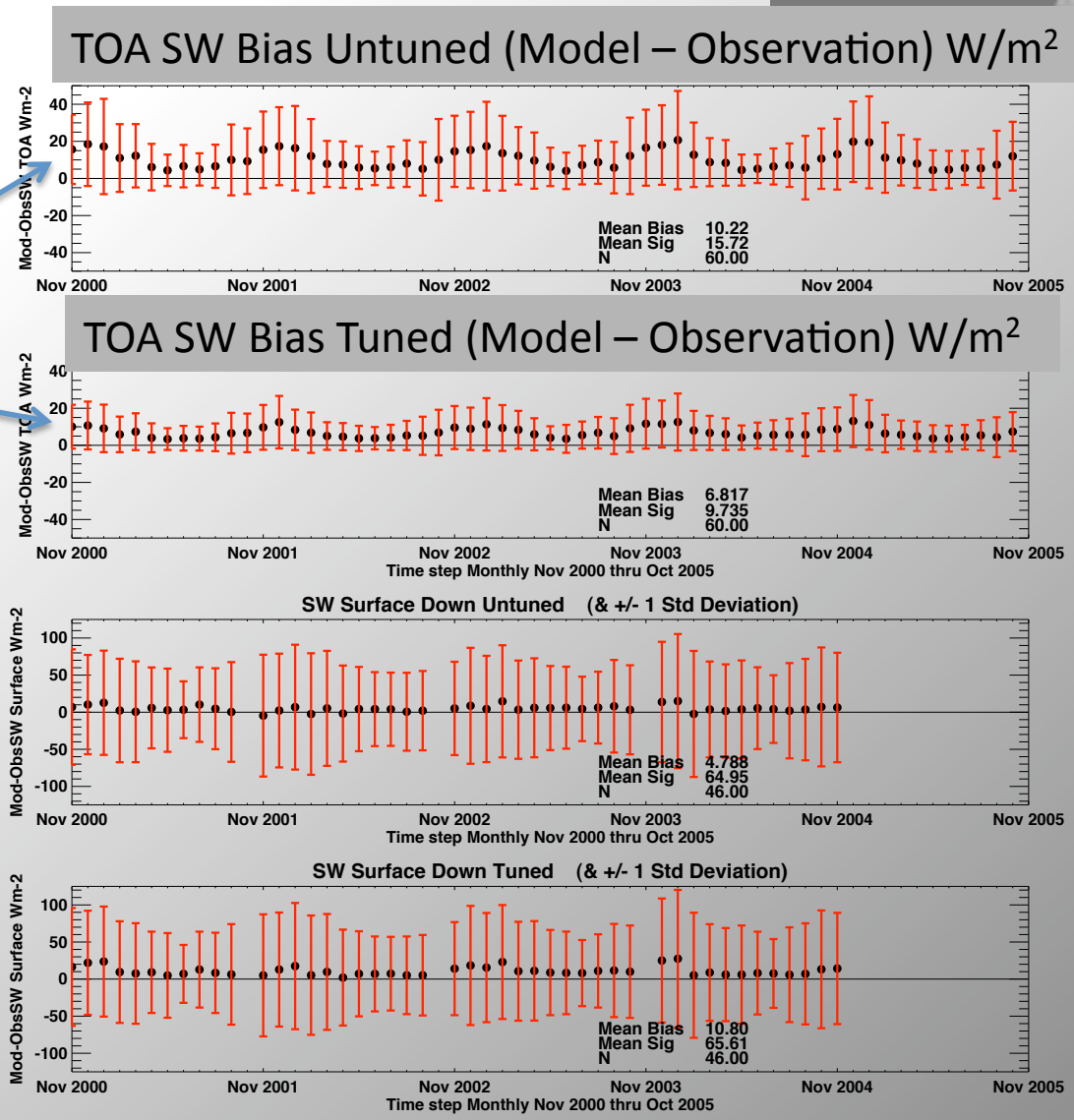
Stratus Buoy: Monthly Mean Bias +/- 1 Std Deviation

Over oceans model has significant Bias (10 W/m^2) in SW at TOA.

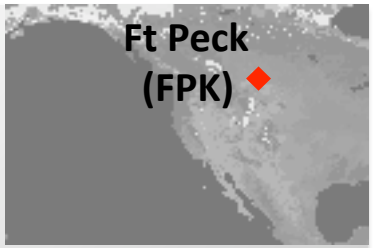
Tuning can remove some of that bias. (7 W/m^2) and reduce scatter.

At that level tuning does affect surface insolation. (Untuned bias of 5W/m2 goes to tuned bias of 11 W/m2.)

At least at this ocean location the error is strongly seasonal.



Inter-satellite comparisons



Longwave Flux Bias (RMS) W/m^2

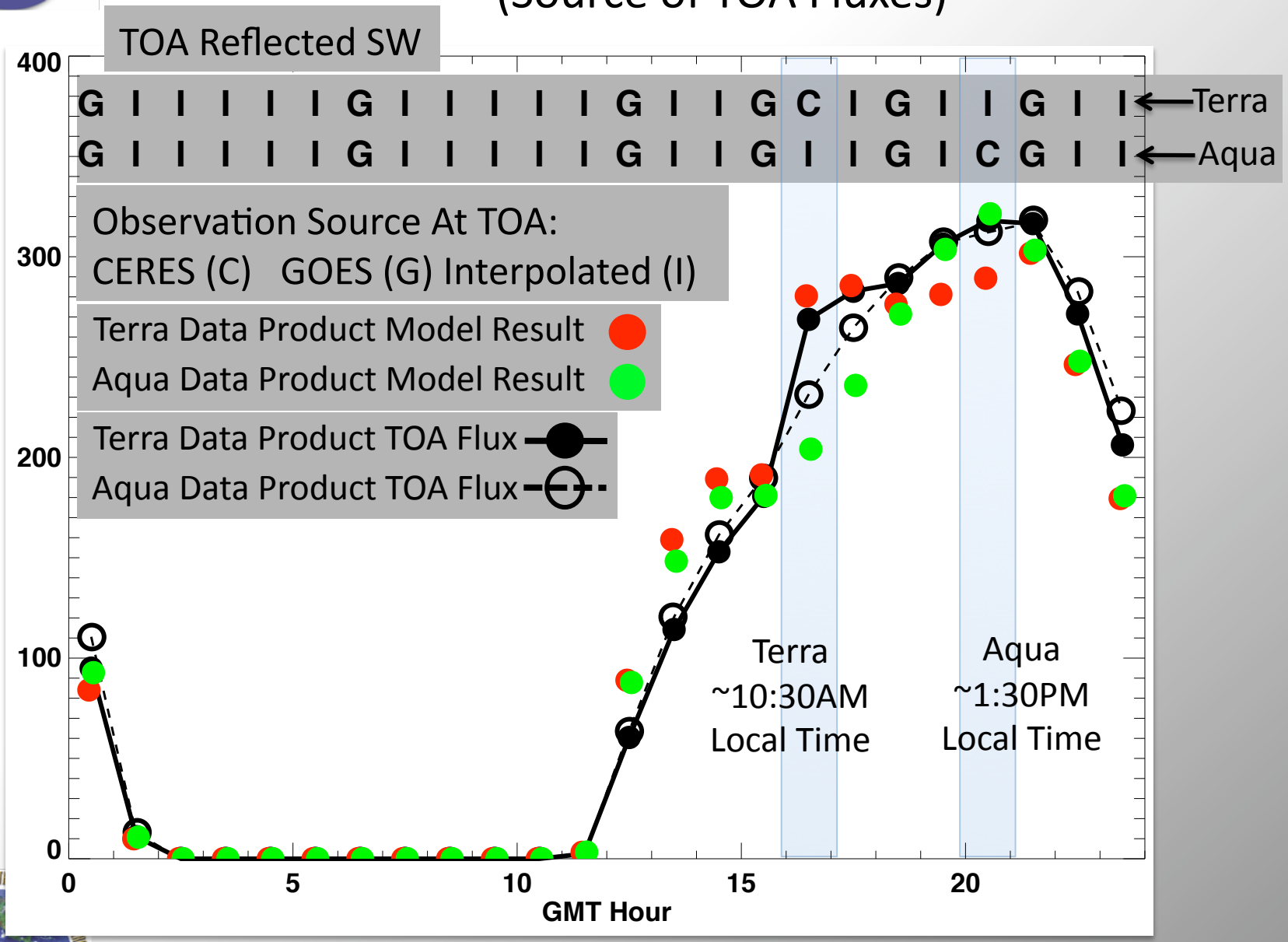
Fort Peck, MT		Hourly		Daily		Monthly	
Quantity (Untuned)	Obs Mean	Terra	Aqua	Terra	Aqua	Terra	Aqua
LW TOA Up	223	-1(13)	-1(13)	-1(8)	-1(8)	-1(4)	-1(4)
LW Surface Down	283	-3(28)	-5(26)	-3(18)	-5(17)	-3(9)	-5(10)

Shortwave Flux Bias (RMS) W/m^2

Fort Peck, MT		Hourly		Daily		Monthly	
Quantity (Untuned)	Obs Mean	Terra	Aqua	Terra	Aqua	Terra	Aqua
SW TOA Up	102	0(19)	0(18)	0(9)	0(8)	0(5)	0(4)
SW Surface Down	164	0(53)	1(53)	0(20)	1(19)	1(8)	1(7)

Terra & Aqua Data Products

(Source of TOA Fluxes)



Inter-satellite comparisons TOA

Longwave Up at TOA W/m^2 (Untuned)

LW TOA Up (Hourly) 14 Sites	~Time	Observed Mean	Bias	RMS	N
Terra Model-Terra CERES obs.	~10:30AM	249	-4	12	7545
Terra Model-Terra G/i obs.	~1:30PM	252	-7	17	7544
Terra G/i-Aqua CERES obs.	~1:30PM	247	6	16	7548
Terra Model-Aqua CERES obs.	~1:30PM	247	-1	15	7544

Shortwave Flux Up at TOA W/m^2 (Untuned)

SW TOA Up (Hourly) 14 Sites	~Time	Observed Mean	Bias	RMS	N
Terra Model-Terra CERES obs.	~10:30AM	261	6	25	7545
Terra Model-Terra G/i obs.	~1:30PM	262	0	30	7544
Terra G/i-Aqua CERES obs.	~1:30PM	260	2	43	7548
Terra Model-Aqua CERES obs.	~1:30PM	260	2	46	7544

Inter-satellite comparisons: Surface

Longwave Down at Surface W/m^2 (Untuned)

LW Sfc Down (Hourly) 14 Sites	~Time	Observed Mean	Bias	RMS	N
Terra Model-CAVE obs.	~10:30AM	343	-5	19	4061
Aqua Model-CAVE obs.	~10:30AM	343	-4	21	4063
Aqua Model-CAVE obs.	~1:30PM	349	-4	20	4058
Terra Model-CAVE obs.	~1:30PM	349	-5	22	4058

Shortwave Down at Surface W/m^2 (Untuned)

SW Sfc Dn (Hourly) 14 Sites	~Time	Observed Mean	Bias	RMS	N
Terra Model-CAVE obs.	~10:30AM	590	12	104	4064
Aqua Model-CAVE obs.	~10:30AM	590	12	115	4066
Aqua Model-CAVE obs.	~1:30PM	585	10	122	4074
Terra Model-CAVE obs.	~1:30PM	585	19	133	4074