Existing NASA Satellite-Derived Surface Insolation Products

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This paper reviews three NASA surface insolation data sets that are now available free of cost to the public from the NASA Distributed Active Archive System (DAAC). All three data sets cover the entire globe using a 280-km grid system. Two are science data sets, and one is formulated for commercial applications in the Solar Energy industry. The first science data set is the Version 1.1 World Climate Research Program's Surface Radiation Budget data for the period from March, 1985 through December, 1988. The second science Surface Radiation Budget data set contains both insolation and longwave radiation products for the period between July 1983 and June 1991. The third data set is commercially oriented and was developed at the request of the DOE National Renewable Energy Laboratory. Accuracies and limitations of these satellite products will be discussed on a region-by-region basis.

Existing activities to improve NASA's commercial application data sets will also be presented.

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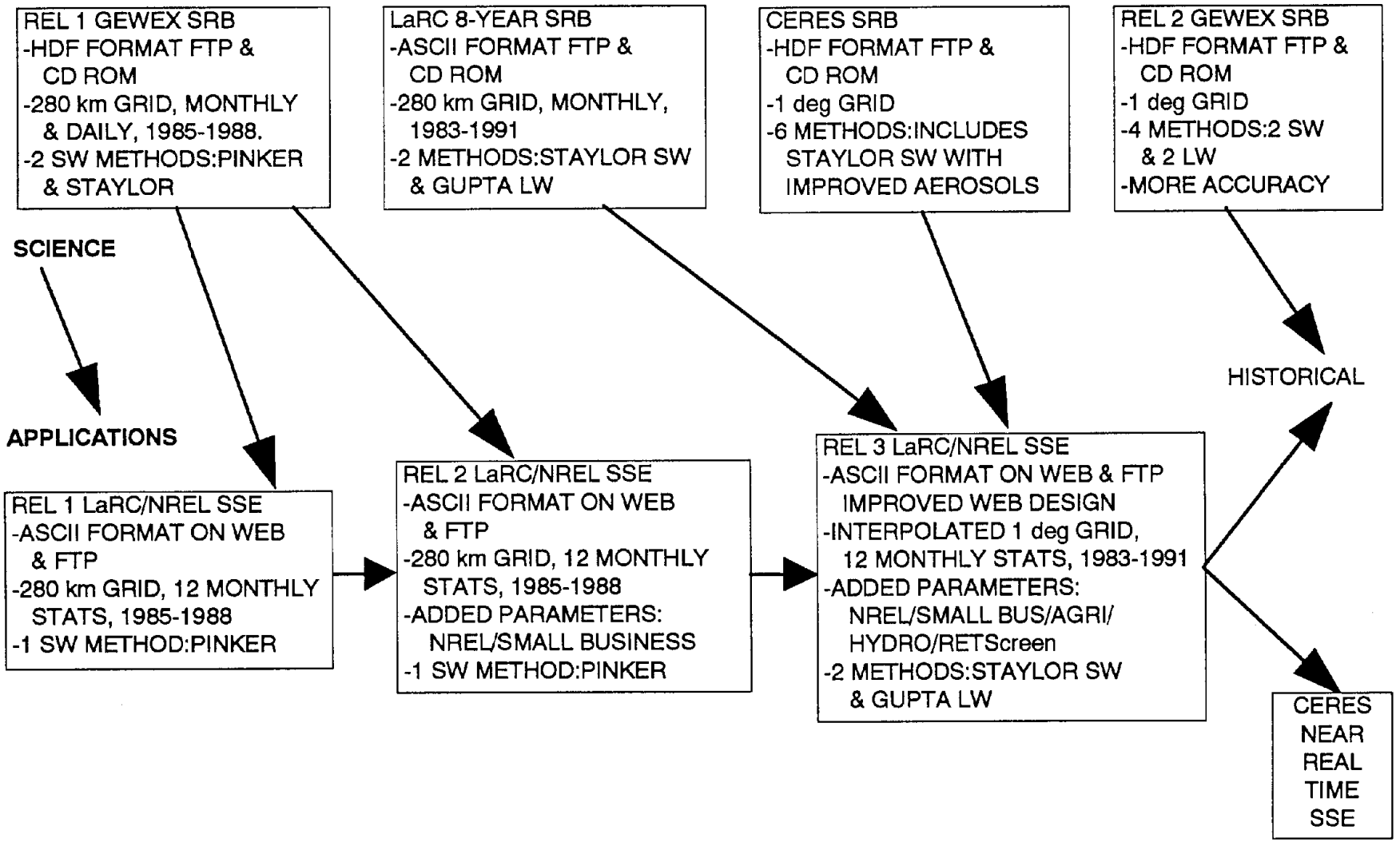
NASA "OFFICIAL" SRB ACTIVITIES

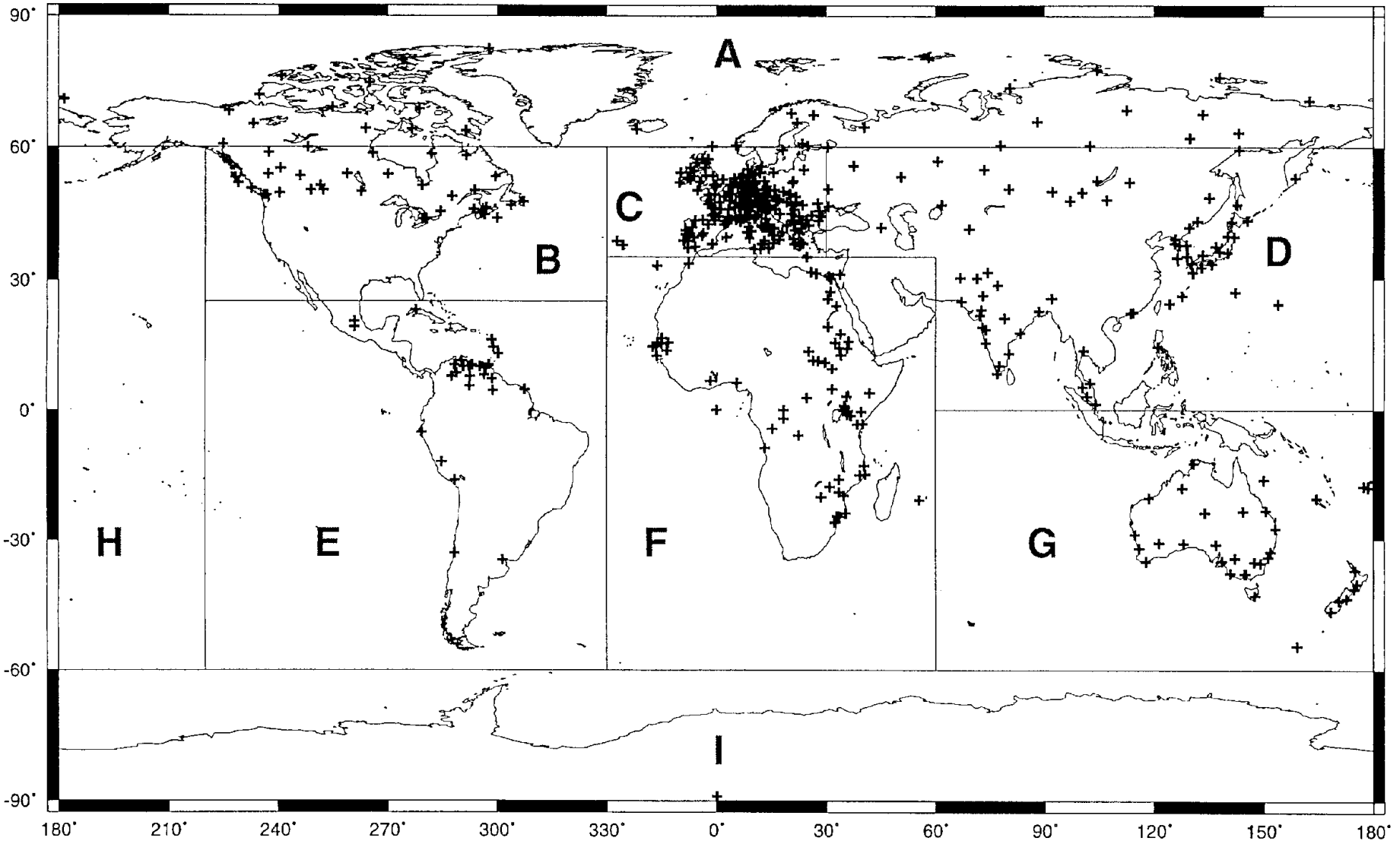


"OFFICIAL" = APPROVED FOR RELEASE THROUGH EOS DAAC SITES.

SSE WEB SITE PARAMETERS

(STATISTICS FOR 12 MONTHS)

RELEASE 1	RELEASE 2	RELEASE 3
-SW INSOLATION: AVG, MAX,MIN MULTI-DAY MAXS MULTI-DAY MINS -3-HR DIURNAL: SOLAR ELEVATION SW INSOLATION CLOUD % & OPT DEPTH -AVERAGE: AEROSOL OPT DEPTH COL WATER VAPOR AIR TEMP CLOUD % & OPT DEPTH	-IMPROVED TERMINOLOGY -SOLAR AZIMUTH -BACK-UP SYS DESIGN INFO -SURPLUS OUTPUT INFO	-LW IRRADIANCE -WINDS -PRECIPITATION -PAR IRRADIANCE -VARIOUS TEMP PARAMETERS -SPECIFIC HUMIDITY -RELATIVE HUMIDITY ?? -PRESSURE -SURF ALBEDO



1986 sites

Presentation: Existing NASA Satellite-Derived Surface Insolation Products
By Charles H. Whitlock and Roberta C. DiPasquale

COMPARISON OF PINKER AND STAYLOR RESULTS OVER GLOBE

VER 1.1 WCRP/SRB FOR OCTOBER 1986

	PINKER MTD		STAYLOR MTD	
REGION	BIAS %	RMS %	BIAS %	RMS %
A	2.6	20	-1.1	21
B	3.1	14	-0.6	15
C	5.8	15	2.6	14
D	9.6	16	7.5	15
E	6.6	18	2.7	18
F	2.1	12	1.1	12
G	4	10	0.9	9
AVERAGE =	4.8	15.0	1.9	14.9

NOTE: GROUND SITE DATA COURTESY NREL AND WRDC IN ST PETERSBURG.

PRESENT ACCURACY OF RELEASE 1 & 2 SSE INSOLATION VALUES

~RMS FOR FLAT & LOW-MOUNTAIN CELLS

REGION	JAN	APRIL	JULY	OCT
EAST & WEST EUROPE	10%(+)	5%(+)	10%(+)	10%(+)
CENTRAL ASIA	15%(-)	10%(-)	10%(-)	10%(-)
CENTRAL NORTH AMERICA	5%	10%	10%	10%
CENTRAL AFRICA	30%(+)	15%	40%(+)	10%(+)
ASWAN DESERT	8%(-)	8%(-)	8%(-)	8%(-)
CONGO RAINFOREST	30%(+)	8%(-)	20%(+)	10%
AMAZON RAINFOREST	20%(+)	20%(+)	20%(+)	20%(+)
GUIANA HIGHLANDS OF SOUTH AMERICA	30%	20%(+)	25%(+)	10%(+)
KOUMAC, NEW CALEDONIA	10%	10%(-)	10%(-)	5%(-)
FIJI	15%(+)	15%(+)	15%(+)	15%(+)
KWAJALEIN	5%(-)	5%(-)	5%(-)	5%(-)
BERMUDA	5%(-)	5%(-)	5%(-)	5%(-)
WEST PACIFIC ASIA COASTAL CITIES	8%	35%(+)	25%(+)	10%(+)
SOUTH POLE	20%(-)	NA	NA	NA
ANTARCTIC COASTAL ICE SHELF	20%(-)	NA	NA	NA

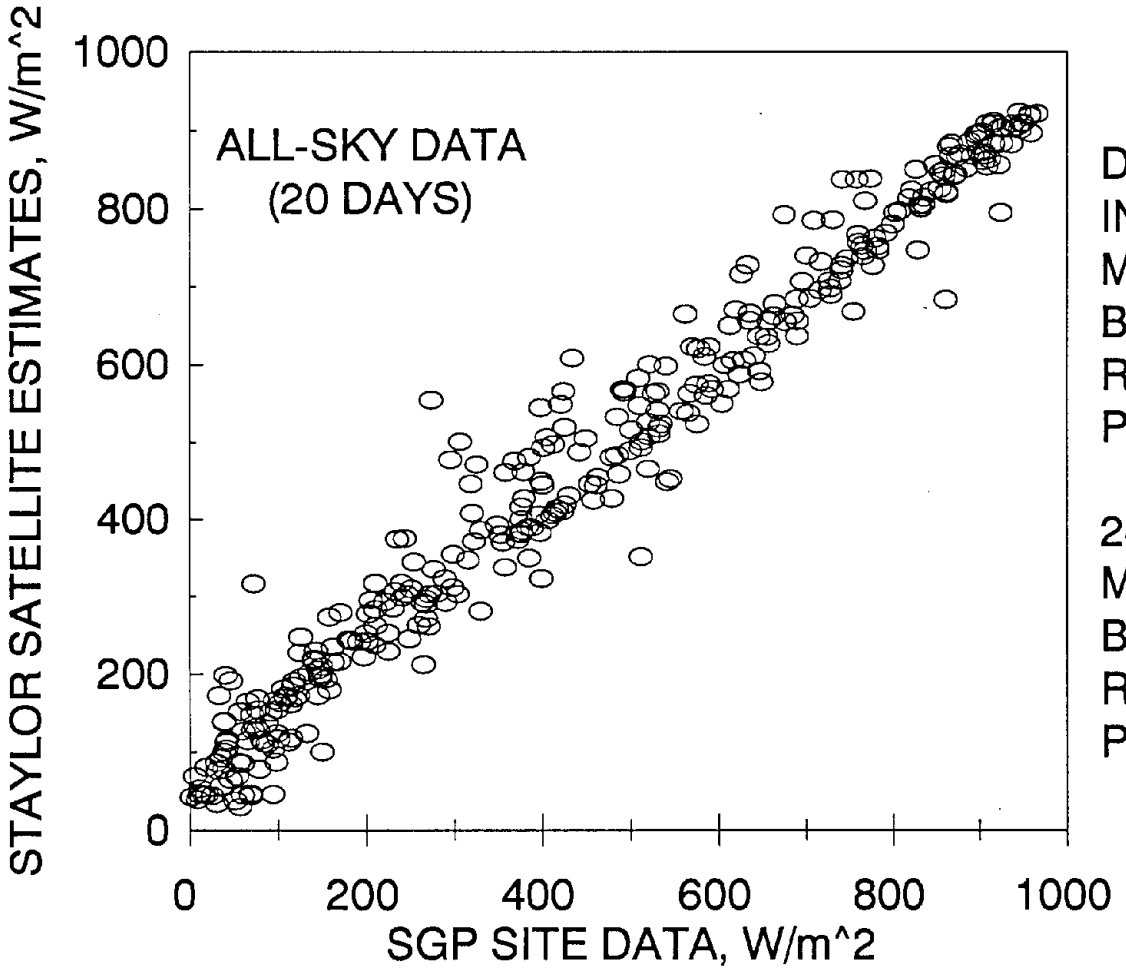
(+) INDICATES SATELLITE BIASED HIGHER THAN GROUND SITE DATA.
(-) INDICATES GROUND SITE > SATELLITE.
GROUND SITE DATA COURTESY SWISS FEDERAL INSTITUTE OF TECHNOLOGY IN ZURICH

SUMMARY:

1. **VALUES ARE ERRATIC AT COASTLINES NEAR MOUNTAINS.**
2. **LARGE (+) VALUES ARE CAUSED BY HIGH POLLUTION IN AEROSOLS.**
3. **LARGE (-) VALUES OVER BARE SNOW & ICE ARE CAUSED BY SATELLITE OPTICS.**

STAYLOR VS SGP ARM DATA FOR APRIL 1994

NOAA 1/2 HR DATA AVERAGED +/- 15 MIN



DAYLIGHT
INSTANTANEOUS:
MEAN = 421 W/m^2
BIAS = +4.6%
RMS = 16.5%
POINTS = 346

24-HR DAILY:
MEAN = 161 W/m^2
BIAS = +4.6%
RMS = 7.9%
POINTS = 20

PROBABLE BEST ACCURACY USING OPERATIONAL SATELLITES:

BIAS < 5%

STD ERR (W/O BIAS) = 5%

EFFECT OF TUNING STAYLOR AEROSOLS ON ALL-SKY VALUES

12 MONTHS OF GEBA[1] DATA IN 1986 W/O COASTS OR HIGH MOUNTAINS

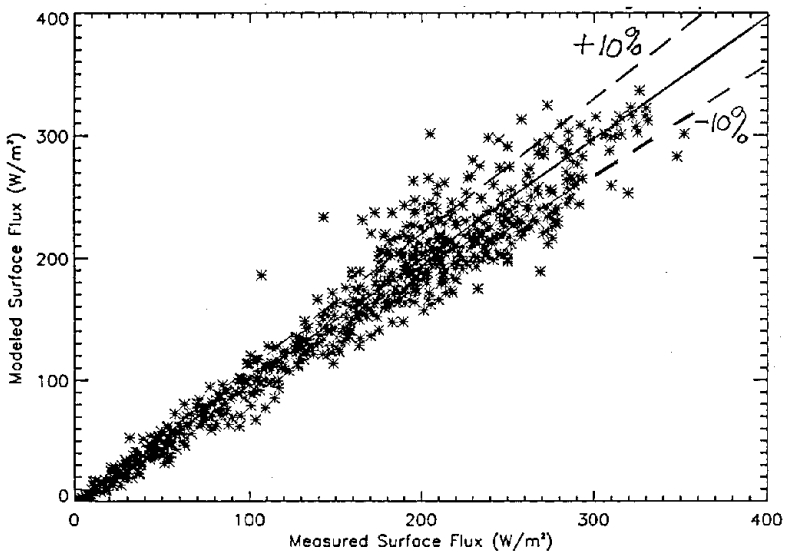
(A) WITHOUT TUNING

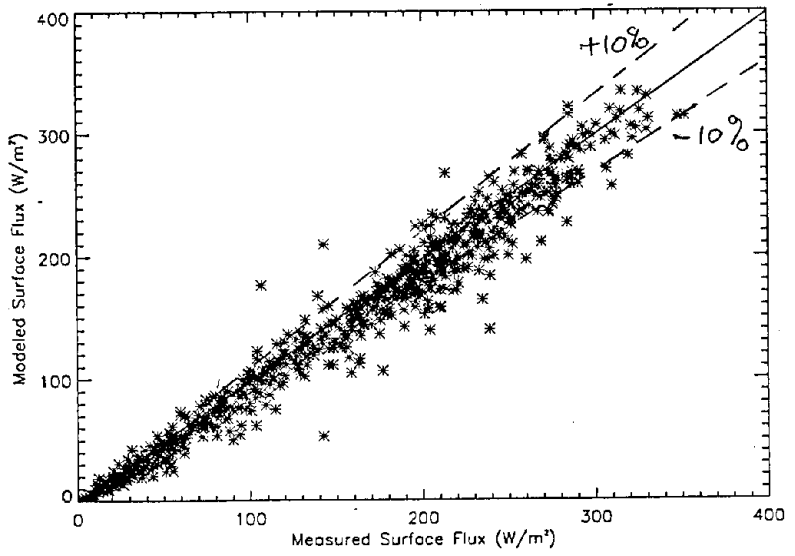
BIAS = -3.2%
RMS = 13.4%
POINTS = 781

(SATELLITE - GROUND SITE)

(B) WITH TUNING

BIAS = -6.7%
RMS = 12%
POINTS = 779





AEROSOL TUNING REMOVES LARGE POLLUTION ERRORS !

[1]GEBA COURTESY SWISS FEDERAL INSTITUTE OF TECHNOLOGY IN ZURICH

EFFECT OF INTERPOLATING STAYLOR 280km TO 1-DEG GRID

12 MONTHS OF WRDC[1] DATA IN 1986 WITH COASTS & HIGH MOUNTAINS

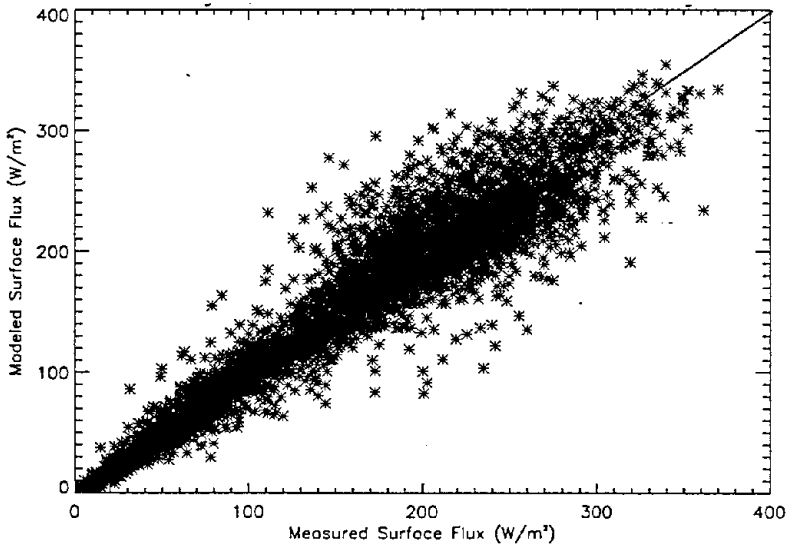
(A) ORIGINAL 280 km

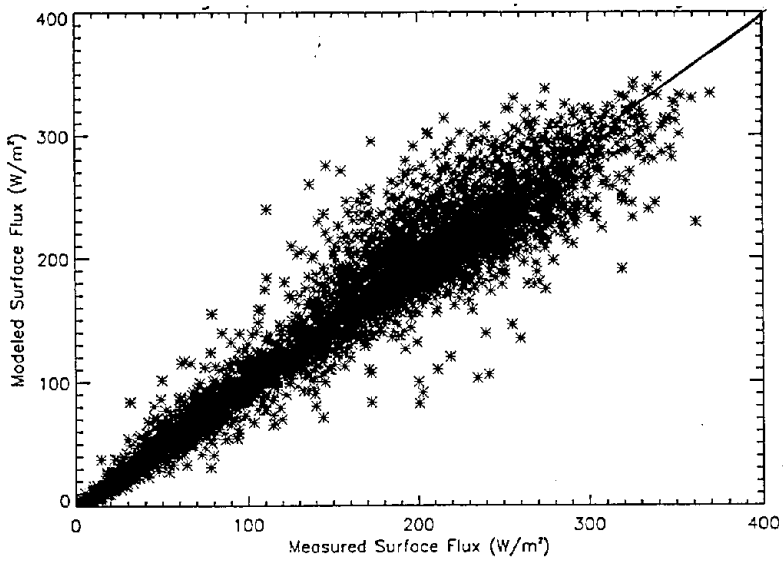
BIAS = -0.6%
RMS = 14.9%
POINTS = 3542
OUTLIERS > ±25% = 2.6%

(SATELLITE - GROUND SITE)

(B) INTERPOLATED 1°

BIAS = -1.7%
RMS = 15.0%
POINTS = 4923
OUTLIERS > ±25% = 2.1%





ACCURACY STATISTICS UNAFFECTED BY GRID INTERPOLATION!

[1]WRDC COURTESY NREL & WORLD RADIATION DATA CENTER IN ST. PETERSBURG.