NREL's SOLPOS program for estimating Pyranometer Readings :- *Lab Report* 🔬

Data was given in the format:

<year> <month> <day> <hour> <minute> <latitude> <longitude> <reading>

This was then fed into NREL's SOLPOS program, https://www.nrel.gov/grid/solar-resource/solpos.html , and a CSV produced.

As the program only produces valid output for years 1950-2050, data was cleaned for invalid outputs.

Data was then fed into PSPP (an SPSS-like alternative) and Linear Regression performed.

The following fields correspond to the following variables:

year – The actual year.
month The actual month.
day – The actual day of the month.
daynum – The computed day of the year (1-365)
amass – The computed relative optical airmass
ampress – The computed pressure-corrected airmass
azim – The computed solar azimuth angle
cosinc – The computed cosine of solar incidence angle on panel
elevref – The computed solar elevation angle, degrees from horizon, refracted
etr – The computed extraterrestrial (top-of-atmosphere) W/sq m global horizontal solar irradiance
etrn – The computed extraterrestrial (top-of-atmosphere) W/sq m direct normal solar irradiance
etrtilt – The computed extraterrestrial (top-of-atmosphere) W/sq m global irradiance on a tilted surface
prime – The computed factor that normalizes Kt, Kn, etc.
sbcf – The computed shadow-band correction factor
sretr – The computed sunrise time, minutes from midnight, local, WITHOUT refraction
ssetr – The computed sunset time, minutes from midnight, local, WITHOUT refraction
unprime – The computed factor that denormalizes Kt', Kn' etc.
zenref – The computed solar zenith angle, deg. from zenith, refracted
amass_angle_[0-9] – The computed relative optical airmass for externally set refracted zenith angles 1-10.
reading – The actual reading from a pyranometer.

Here is the output from PSPP:

```
REGRESSION

REGRESSION
      /VARIABLES= year month day daynum retval amass ampress azim cosinc elevref etr etrn et
amass_angle_1 amass_angle_2 amass_angle_3 amass_angle_4 amass_angle_5 amass_angle_6 a
      /DEPENDENT= reading
      /METHOD=ENTER
      /STATISTICS=COEFF R ANOVA.
```

Model Summary (reading)

R	R Square	Adjusted R Square	Std. Error of the Estimate
.32	.10	.10	1770.65

ANOVA (reading)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	10742418765814.39	29	370428233303.94	118151.88	.000
Residual	96233234716866.31	30694576	3135186.97		
Total	106975653482680.70	30694605			

Coefficients (reading)

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	-431338777240.61	NaN	.00	NaN	NaN
year	1.30	.03	.01	51.04	.000
month	214.81	15.92	.39	13.49	.000
day	6.64	.52	.03	12.67	.000
daynum	-6.99	.52	-.39	-13.36	.000
retval	.00	.00	.00	NaN	NaN
amass	987841.52	3083.94	5421.90	320.32	.000
ampress	-994676.96	3105.20	-5422.47	-320.33	.000
azim	7.38	.01	.33	738.38	.000
cosinc	900.92	2.05	.30	439.57	.000
elevref	784.44	NaN	8.43	NaN	NaN
etr	10.50	.02	1.99	457.76	.000
etrn	.35	.00	.13	89.17	.000
etrtilt	.07	.00	.02	53.51	.000
prime	-4006.25	19.78	-.95	-202.53	.000
sbcf	2406.19	31.61	.07	76.13	.000
sretr	-2.33	.01	-.13	-174.57	.000
ssetr	1.44	.01	.08	158.17	.000
unprime	-13511.29	49.83	-2.15	-271.13	.000
zenref	925.24	NaN	9.94	NaN	NaN
amass_angle_0	-1288.12	NaN	.00	NaN	NaN
amass_angle_1	-6997.38	1268.57	NaN	-5.52	.000
amass_angle_2	-7548.17	NaN	NaN	NaN	NaN
amass_angle_3	47006.18	NaN	NaN	NaN	NaN
amass_angle_4	58738.85	NaN	.00	NaN	NaN
amass_angle_5	-66663.97	NaN	NaN	NaN	NaN
amass_angle_6	30383.48	NaN	.00	NaN	NaN
amass_angle_7	-21968.55	2567.07	.00	-8.56	.000
amass_angle_8	-77104.17	NaN	.00	NaN	NaN
amass_angle_9	431338778737.20	NaN	.00	NaN	NaN