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The indicators of photspheric magnetic activity

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Abstract: The total sunspot area (**TSSA**),complex total solar irradiance(**CTSI)** are two important parameters in solar astrophycics studies. These two paramters are correlated with each other. 27day solar activity shows heighest correlation[1] between them. Also TSSA and CTSI shows delay / lag w r t each other which is identified as **delay (D).** Three solar cycles (21,22,23) data is investigated for this **delay phenomena[1].** The 27day averaged data for TSSA,CTSI confirms existance of delay between TSSA,CTSI. Also the investigation shows that TSSA and D are exponentialy related. Two new constants **K_R,R_h (** called **ROHINI constants) & C** correction factor for TSSA are identified ,which play a very important role in solar astrophysics.

Keywords: SSA, TSSA, CTSI, Delay, SSN, ROHINI constants

1. INTRODUCTION:

TSSA,CTSI,D plays a very important role in solar astrophysics. Always a phase lag is found between TSSA & CTSI. The lag is identified as delay[1] which is measured in days. Delay varies from-230 to +230 days during solar minimas,13.5 days at solar maxima[1].

The parameter delay hints at various important aspects like quantization of sunspot area wrt differential rotation ,CME and Hα flares[5] etc. Hence an analytical approch is utilised to investigate solar data for probable relation between delay and total sunspot area which confirms their exponential dependency . It also identifies new constants **K_R ,R_h** ,delay index number **D I .**

2. THEORY:

27day averaged three solar cycle(21,22,23) data is analysed and delayed events are identified[1].The following trend is observed between **ln(TSSA), Abs(delay)** according to fig2

$$\ln(TSSA) = \quad 0.0174 ABS(DELAY) + 7.0854....(1)$$

which implies

$$TSSA = \exp(0.0174\, ABS(DELAY) + 7.0854)....(2)$$

Let **ABS(delay) =D,TSSA=A then,**

$$A = \exp(\quad 0.0174\, D + 7.0854)....(3)$$

Thus sunspot area can be corrected by estimating actual area using equations (3)

$$A = \exp(\quad 0.0174\, D)\exp(7.0854)$$

$$= 1194.4009 \exp(\quad 0.0174\, D)$$

Thus

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$$A = (K_R)\exp(R)...(4)$$

where $K_R = 1194.4009$, $R = (0.0174D)$ days

$for D = 1 days, R = R_h = 0.0174 days$

Where **K_R, R_h** are the constants reffered as **ROHINI constatnts** named after the author (Dr Rohini v s) whose first mention & identification starts from this paper.
If **A_E**, **A_T** experimental and theoretical values, then correction factor **' C '** for sunspot area is

$$C = (A_T \sim A_E) \quad ...(5)$$

Such that

$$A_E = A_T \sim C .....(6)$$

$$P = (A_E/A_T)100 .....(7)$$

Where P is %error.Thus P surves as the quality factor for the astronomical experimental data obtained by various solar observatories.

$$D_I \text{ (delay index number)} = D/A \text{ per ppm} .....(8)$$

serves as an important parameter which predicts delay offered by magnetised solar plasma. It clearly indicates that **sunspots can not grow to any dimension**[5], their size is determined by the activity under differential rotation.The 25 to 31 day solar activity predicts different sunspot area maxima values[1].

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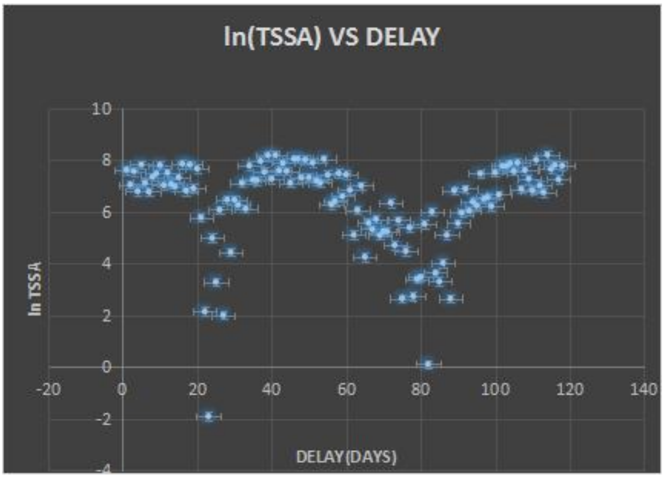

fig1: variation of ln(TSSA) with delay

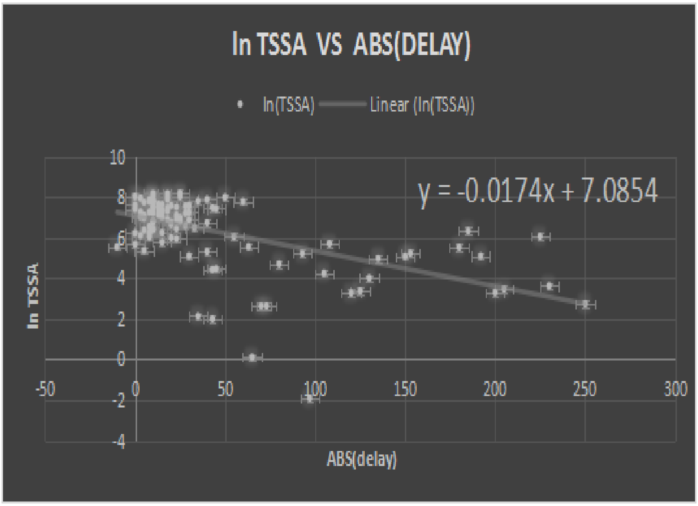

fig 2: variation of ln(TSSA) with ABS(delay)

3.CONCLUSIONS:

Thus estimation of delay serves as an important tool in estimating errors in the solar astronomical experimental data,. It corrects existing data and also gives scope for better understanding existing solar theories with this correction.
The exponential relation eqn(4) helps in predicting solar cyle period, triger and end of cycle,quite sun period etc, also explains growth and decay of sunspots on a fixed time scale .

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