Delay analysis

Dr Rohini V S[1], Ravi chimmalgi[2]

[1]Assosciate prof,Dept of physics,Nrupatunga university, Bangalore-560001, Karnataka,India
[2]Lecturer,Dept of physics,Anmol science PU college, Davanagere, Karnataka, India

Abstract:
TSSA and CTSI shows delay or lag wrt each other[1,3,5]. Solar cycle data (21,22,23) is used in the analysis and possible correlation between **H alpha flare index and delay** is worked out .It is found that these two parameters are anti correlated with a correlation factor of 0.8 9427 . The 27day solar activity shows heighest correlation factor.

A new parameter called **delay index number** (D_I) is defined.This paramter shows two sharp peaks wrt delay event number ,during the span of solar cycle 21,22,23. The peaks fall in soalr quite period 1986 and 1996. Thus D_I acts as an indicator of quite phase (ie solar minima)of sun.The possible cause for sharp shoot up is under investigation.

Keywords: TSSA-total suncpot area,**CTSI**- composite total sunspot irradiance,D_I-delay index number

1.**Theory :**

TSSA and **CTSI** are two important parameters of solar astrophysics.TSSA is a measure of net magnetic field on surface of sun while CTSI is the net solar energy radiated out in W/m^2 .

TSSA and CTSI shows delay or lag wrt each other[1,2]. Whenever TSSA reaches maxima CTSI also shoots up.But this shooting is not simultaneous. A lag or delay is seen between TSSA and CTSI which is called as **delay(D)** measured in days.Solar maxima shows a delay of 13.5 days while minima shows 230 days.
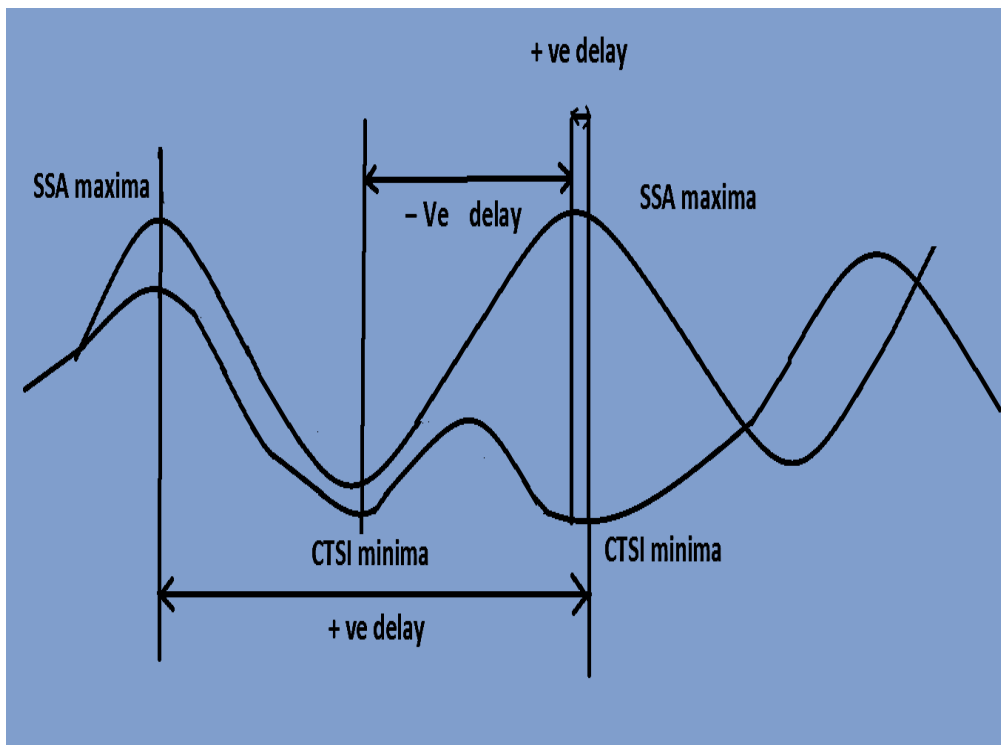

FIG 1[1]

Why both parameters cannot shoot simultaneously?.What is stopping them to go coherently?.Indeed a very curious behaviour.

2.Analysis:

In an attempt to solve this puzzle, first the vissible wavelength region **H alpha** is choosen.The solar activity in this region is indicated by **H alpha index (I).**

The 27day averaged solar cycle(21,22,23) data is used in the analysis and possible correlation between H alpha index and delay is worked out .**Delay(D)** and **flare index(I)** are anti correlated ,connected via power law according to **graph5 & graph 6.**

$$D = 35138\ I^{-0.905}$$
correlation factor = -0.894269633
For H alpha flares;yearly average

$$D = 75.282\ I^{-0.7}$$
lation factor = -0.641762374Corre

For all category of flares;yearly average

Correlation factor for H alpha flares is more compared to all category of flares.Thus Delay events are much correlated to H alpha emission

A new parameter called **delay index number** (D_I) is defined.This paramter shows two sharp peaks in **graph4** .The possible cause for these sharp peak is under investigation.
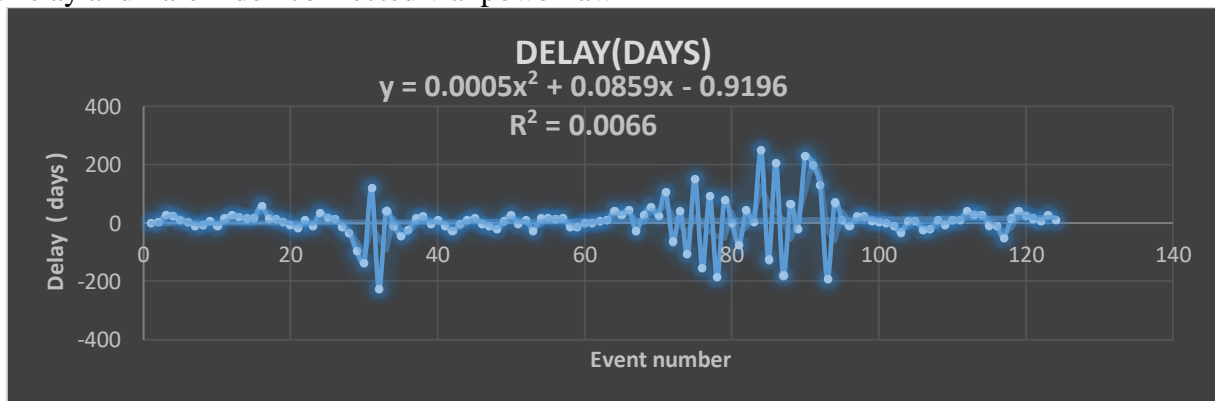
Graph1 indicates sun is not quite during solar minimas identified by event numbers 20 to 40, 65 to 95 etc.With reference to **graph2, graph3** event numbers are identified as quite sun period for solar cycle 21,22,23
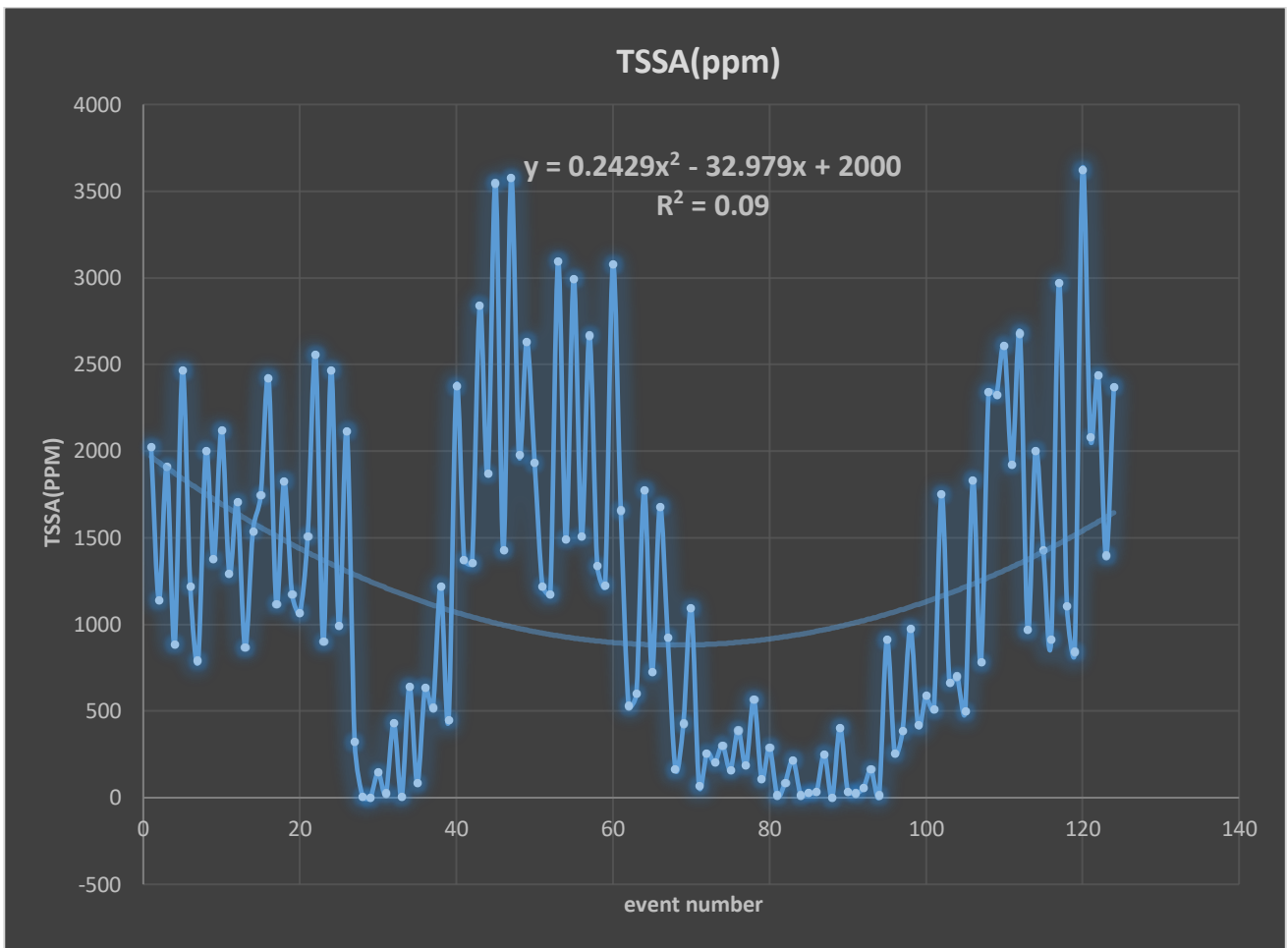
3.Author's note:

There is no conflict of interest regarding publication of this article.Author confirms that this paper is free from plagiarism
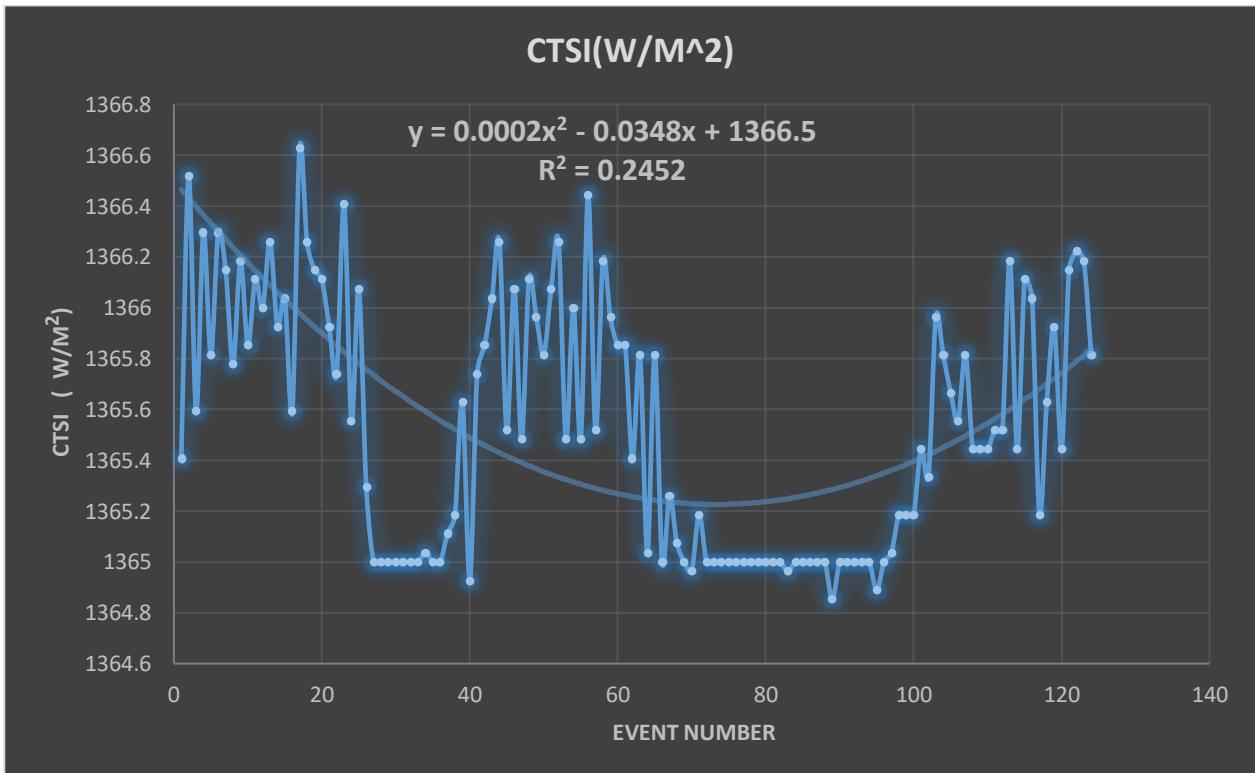
4.Conclusions:

1. Delay index shows two sharp peaks which fall in solar quite/minima period .This imples quite sun is very active , not very quite as it is assumed.
2.H alpha flare index much correlated with delay
3.Delay and flare index are anti correlated.
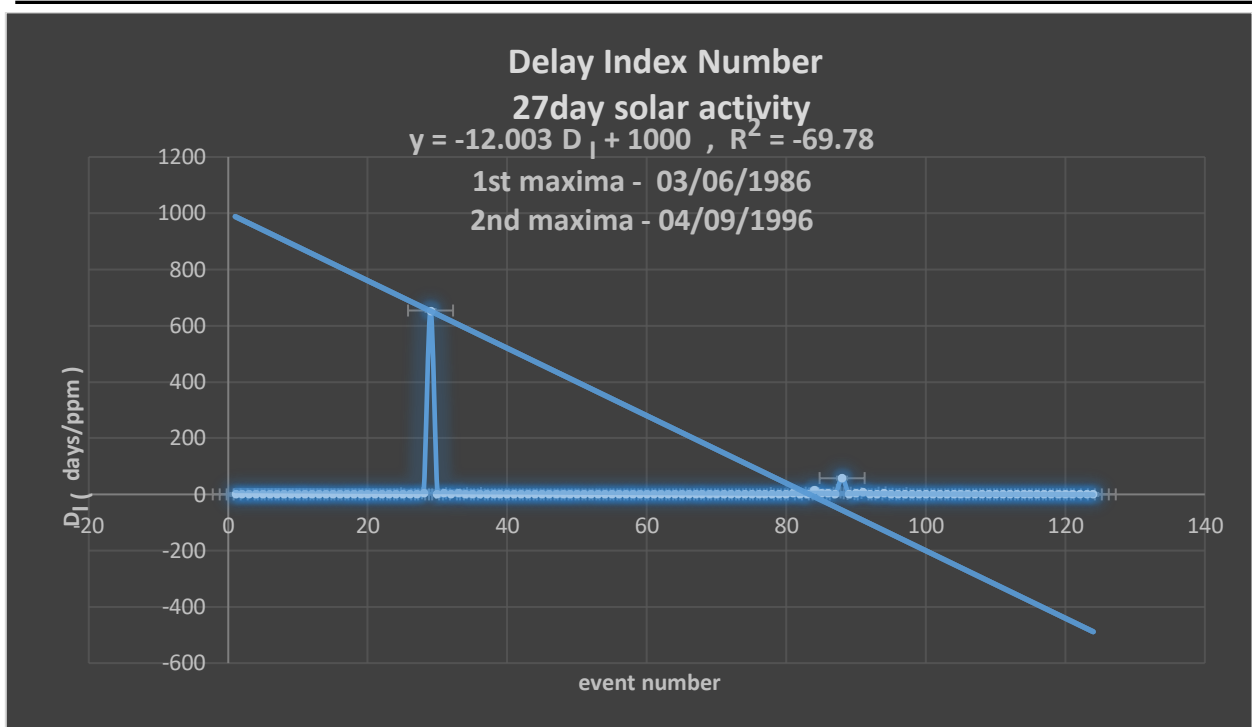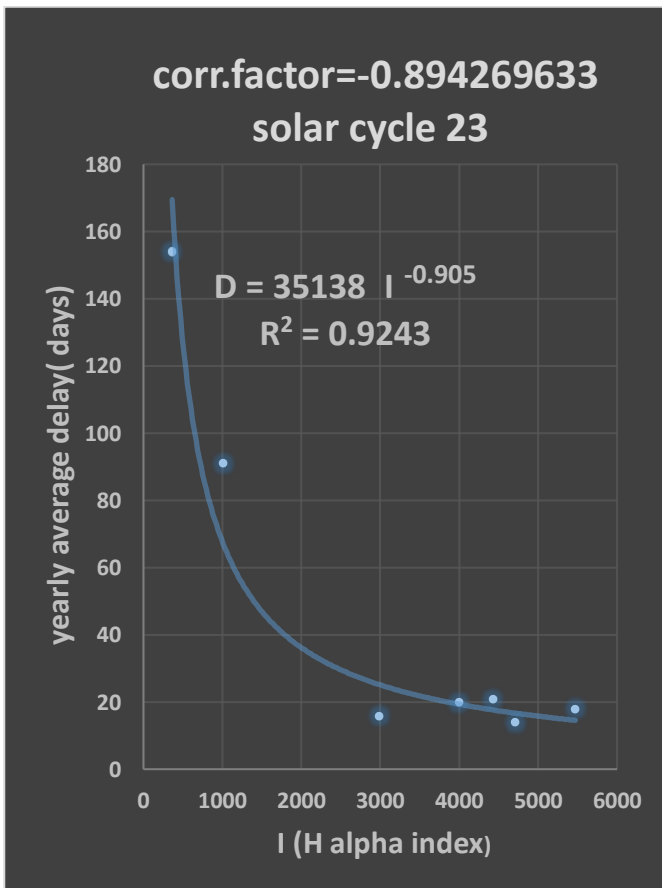4..Delay and flare index connected via power law

DELAY(DAYS)
$y = 0.0005x^2 + 0.0859x - 0.9196$
$R^2 = 0.0066$

Graph[1]

Graph 2[1]

Graph 3[1]

Delay Index Number
27day solar activity
$y = -12.003\ D_I + 1000\ ,\ R^2 = -69.78$
1st maxima - 03/06/1986
2nd maxima - 04/09/1996

Graph 4[1]

corr.factor=-0.894269633
solar cycle 23

$D = 35138\ I^{-0.905}$
$R^2 = 0.9243$

Graph 5

H alpha index (I)	Delay(D) (yrly avg)	year
363	154	1996
1008	91	1997
2992	16	1998
4706	14	1999
5471	18	2000
4421	21	2001
3997	20	2002
table1		

year	I (flare index) (yearly average)	D(delay in days , yearly average)
1986	1.13	105
1987	2.66	27
1988	8.14	15
1989	17.39	10
1990	12.20	16
1991	15.16	15
1992	7.74	22
1993	4.23	36
1994	1.58	109
1995	0.86	41
1996	0.42	154
1997	1.01	91
1998	4.00	16
1999	6.39	14
2000	7.61	18
2001	6.80	21
2002	4.56	20

Table 2
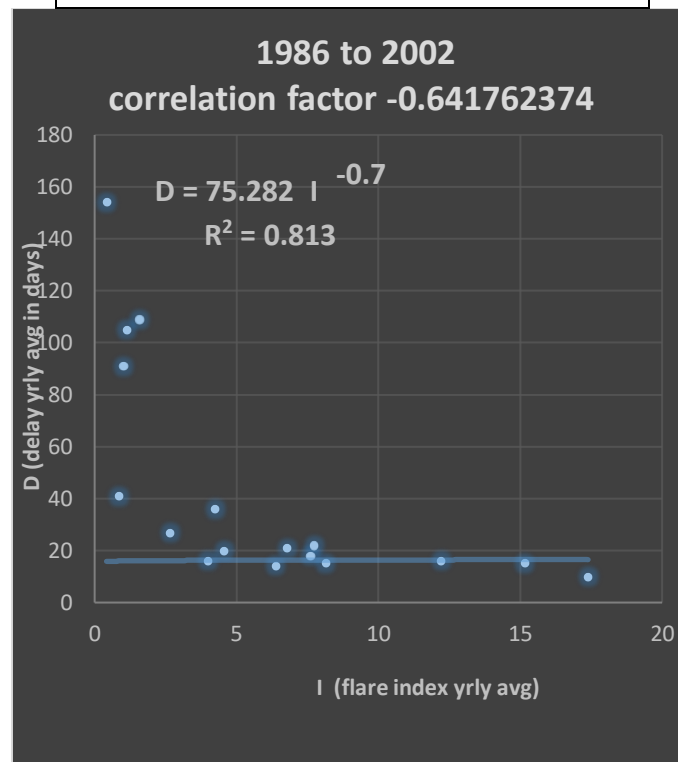
Graph6

5.Reference:

1. Studies on variations in solar total andspectralirradiance,thesis,DR ROHINI V S ,BUB, july2013

2. Solar dynamo model-IJSR-DR ROHINI V S,vol 3,issue 7, july 2014,Paper ID: 020141060

3. Solar irradiance modelling-IJSR-DR ROHINI V S ,vol3,issue 8,aug 2014,Paper ID 02015448

4. 3rd asia- pacific solar physics meeting APSPM 2015,3-5 nov 2015,Seoul national university,seoul,Rep.of Korea,"session-solar interior and dynamo-SD05- the new solar dynamo model-DR ROHINI V S "

5.1–8 ̊A coronal background X-ray emission and the assosciated indicators of photospheric magnetic activity -K. B. Ramesh[1] and V. S. Rohini[1,2] -The Astrophysical Journal, 686: L41–L44, 2008 October 10 ,2008. The American Astronomical Society ,U.S.A