Analyzing Solar UV Intensity data at highest resolution ever with SUNRISE balloon borne Observatory

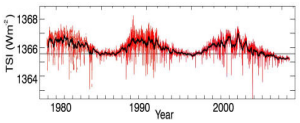
Piyush Agrawal [1, 2], Michael Knölker [2], Jesse Lord [2, 3], Alice Lecinski [2]

Indian School of Mines [1], India High Altitude Observatory [2], NCAR University of Colorado [3], Boulder

and the SUNRISE team

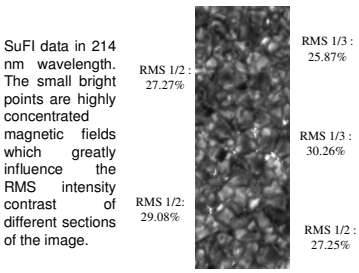
Introduction

• The Solar irradiance variation with solar cycle as observed for the last three solar cycles is approximately 0.1%. The irradiance variation in the UV and EUV, however, is large.



• This is thought to be largely due to temporal variations in the number density of small bright magnetic structures called faculae and plage, but there may also be a contribution due to changes in the thermal structure of the non-magnetized plasma as well.

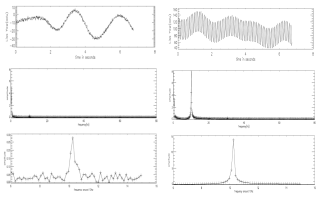
• The project aims to relate this solar irradiance variation with small areal concentrations of magnetic field i.e. how much the intensity fluctuate due to the variable presence of small patches of magnetic field.



RMS Intensity Contrast : 28.19%

The 10 Hz Signal

• The SUNRISE data are of variable quality due to several sources of pointing 'noise' in frequency ranges between 1 and 150 HZ. We used a clearly identifiable 10 Hz signal in the pointing data was to identify observing moments of minimal vibration.

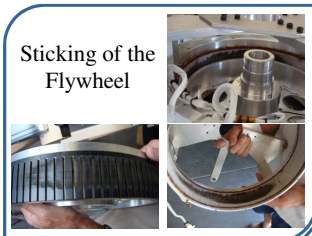


Liss Yaw with Low amplitude of 10Hz signal Liss Yaw with High amplitude of 10Hz signal

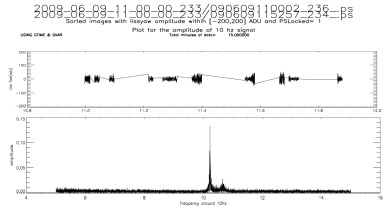
• It appears that the sticking of azimuthal drive is a source of amplification for the 10 Hz ……..... but its complicated.

• Another reason may be the repeated excitation and reinforcement between the Liss Yaw and Flywheel. The Liss Sensor being at the very end of the telescope, cause the telescope to wag "like the tail of a dog", which is not damped, having a characteristic Eigen frequency of 10 Hz.

Sticking of the Flywheel



Result : I



• The plot shows a LISS Yaw vs. time distribution for good data subsets and the corresponding FFT(Fast Fourier Transformation). The bad data subsets were withdrawn either because of two reasons :

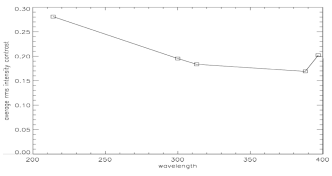
1. Liss Yaw signal being out of the range: [-200,200] ADU
2. "PSLocked" being not equal to 1

• We went back to the observational data to find whether these data sets were indeed of better quality

SUNRISE BALLOON BORNE OBSERVATORY

Result : II

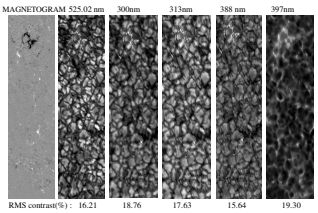
• The good data subsets, thus obtained in Result I where then analyzed to calculate the rms intensity contrast in the 5 SUFI wavelengths, so as to relate to solar irradiance variations.



Average rms intensity contrast vs wavelength

NOTE: RMS Intensity Contrast for 525.02 nm wavelength is 16.21 %

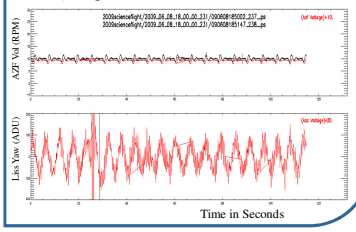
RMS Intensity Contrasts

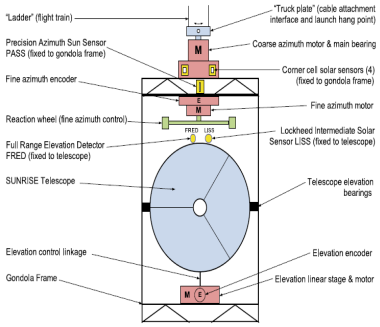


• The figure shows the IMaX magnetogram and corresponding SuFI data with their rms intensity contrasts. The image resolution is 0.01 arcseconds. The high magnetic flux concentration at the very top of the magnetogram imparts a significant rise in the intensity contrasts.

Methods

• Engineering data consists of pointing characteristics throughout the flight. Coding was done on the IDL platform. Pointing system assumes pointing to be good whenever the LISS Yaw signal is within [-200, 200] ADU.





Different Pointers and Sensors onboard Sunrise

To be done:

• With the tools developed, we will look into other frequencies and investigate their relationship to the 10 Hz signal

• So far we concentrated on June 9 data, application of the analysis tools to the other data will follow

• Having identified the best data we will return to the science data

• Then the rms contrast variation with varying magnetic flux content will be studied using all data suitable

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- Thanks Everyone