SUNDASH: MONITORING AND ANALYZING SOLAR ACTIVITY

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ABSTRACT

1. INTRODUCTION

The goal of this dashboard is to monitor and analyze historical and trending sunspot activity. A high number of sunspots indicates high solar activity. It is helpful to monitor this solar activity, because it may result in aurora displays or interfere with satellite communications and power systems. Sunspot activity typically occurs over an 11 year cycle with some variation.

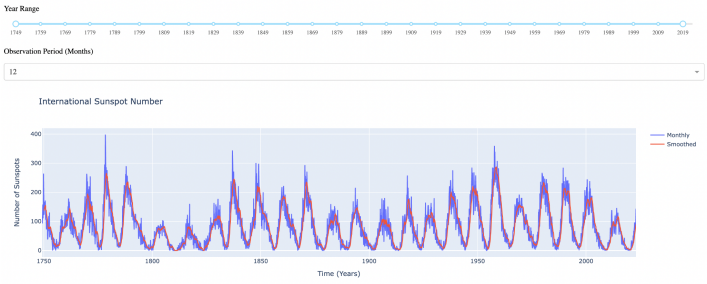
2. DATA SOURCES

The data used to analyze sunspot activity in this dashboard comes from the Sunspot Index and Long-term Solar Observations (SILSO), an activity of the Solar Influences Data analysis Center (SIDC) provided by the Royal Observatory of Belgium. Specifically, the dataset used contained the monthly mean total sunspot number going back to the year 1749 up to 2023.

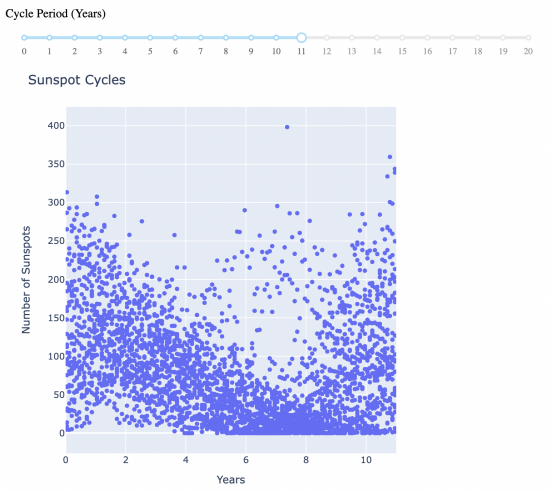
Additionally, images provided by NASA's Solar and Heliospheric Observatory (SOHO) were used in order to display real-time images of the sun with different imaging filters. Inspiration was drawn from a dashboard created by an employee at SOHO.

3. METHODS

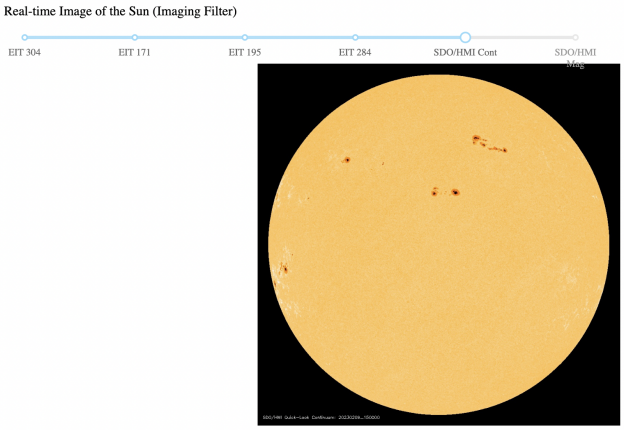
This dashboard was built in Python, using the Dash package. The Plotly package was used to create the visualizations and the Pandas package was used to load and extract the data. The dashboard consists of three visualizations. The first is a line graph of international sunspot numbers over the years. It plots the monthly average sunspots as well as a smoothed line showing the average values over a period of months. A range slider controls the range of years displayed and a dropdown controls the period of months. The dropdown allows the user to select from 1 up to 24 months as the period over which to smooth the data.



The second visualization is a scatter plot displaying the variability of the sunspot cycle. In order to create this, the data from each fractional year had its modulus taken. This resulted in a number that is relatively its own position in an 11 year cycle. The default graph is shown over that 11 year cycle, but a slider is used to tune this cycle to the user's interest. The slider ranges from 0 to 20 years, and as the range gets further from 11, the variability of the graph increases.



The third visualization is a slideshow of multiple real-time images of the sun. The user can control which imaging filter to display with a slider.



5. CONCLUSION

With this dashboard, users can participate in an interactive experience in analyzing and monitoring sunspot activity. In both the line chart and the scatter plot, the 11 year cycle can be clearly seen. The ability to experiment with a range of years will provide valuable insights to anyone interested in learning more about sunspot activity.

REFERENCES

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