

## Does the Sun vary and how do we know?

- The Sun's output has remained nearly constant for tens of millennia.
- It does vary by a small fraction of a percent, due to fluctuating magnetic activity that causes solar flares and dark sunspots.
- Sunspots are relatively easy to observe, and astronomers have been doing so for hundreds of years. In the plot below, the yellow lines shows actual observations of sunspots.
- To understand the variability of the Sun over much longer time frames, scientists use isotopic measurements, for example in tree rings, which are sensitive to the Sun's magnetic activity.
- The blue data is reconstructed from the tree ring analysis, dating back more than 11,000 yrs.
- In the overlap period (insert), it agrees with direct observations.

