



The umbra-penumbra area ratio of sunspots during the Maunder minimum

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We studied the umbra–penumbra ratio of sunspots in the period 1660–1709 (during the Maunder Minimum, a period of very low solar activity around 1645–1715) comparing our results with this ratio in other epochs. In total, we have analyzed 196 sunspot drawings including 48 different sunspots. The value of the umbra–penumbra ratio obtained in this work is equal to 0.26 ± 0.01 . Moreover, from the frequency distribution of this parameter, the maximum value of the ratio lies between 0.20 and 0.25. Our results are similar to values found for other epochs in the 19th and 20th century. In several cases, the value of this ratio varies remarkably when sunspots are close to the solar limb. We have also compared the value of the umbra–penumbra ratio for the same sunspot observed by different observers. Moreover, we compared the values of this ratio obtained for the sunspot observed in 1676 (October and November) appeared in three different historical documentary sources. We found similar values. We conclude that the early sunspot drawings are suitable for this kind of analysis.