Sunspot number and area from Observatory of Madrid (1876-1986)

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ABSTRACT

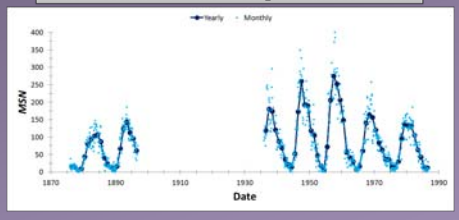
The solar program of the Observatory of Madrid, Spain, began in 1876. During ten solar cycles, observations to determine the number and area of sunspots were performed in this institution. This solar program was finished in 1986. Data of sunspot number and area were published in several journals. Four different stages (with different observers and instruments) of this solar program have been detected from the metadata. In this work, we recover the published data and analyze the daily series of sunspot number and area.

MADRID OBSERVATORY

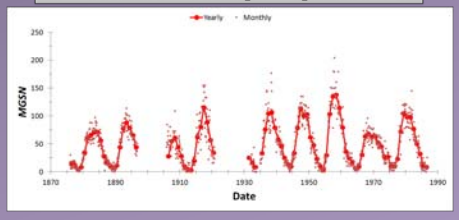


AVAILABLE DATA

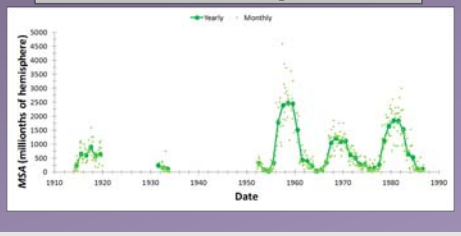
MSN ≡ Madrid Sunspot Number

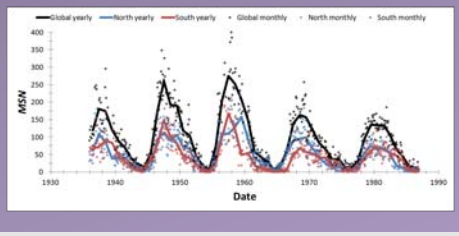


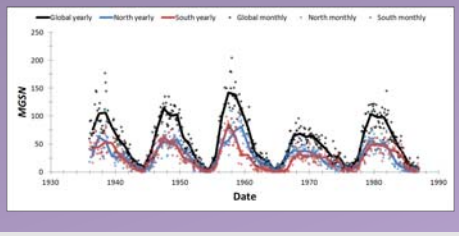
MGSN ≡ Madrid Group Sunspot Number



MSA ≡ Madrid Sunspot Area

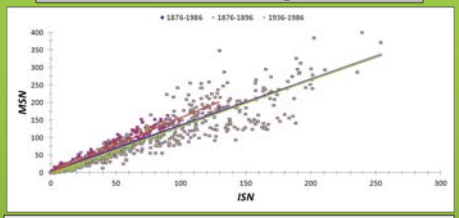






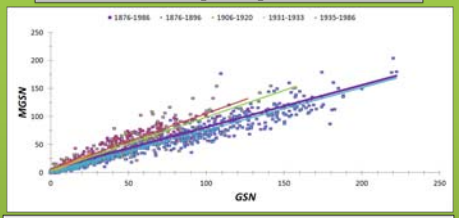
ANALYSIS

ISN ≡ International Sunspot Number



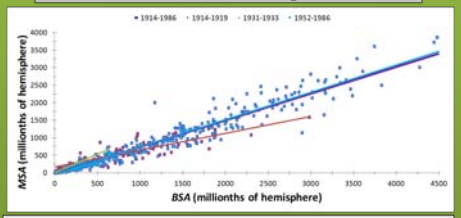
$MSN = (1.31 \pm 0.02)ISN + (2.7 \pm 1.5)$
$r = 0.924$

GSN ≡ Group Sunspot Number

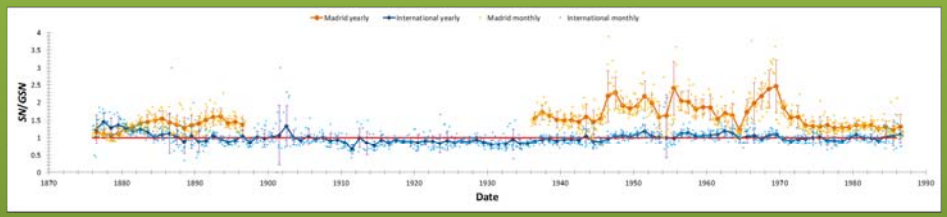


$MGSN = (0.75 \pm 0.01)GSN + (6.4 \pm 0.7)$
$r = 0.931$

BSA ≡ Balmaceda Sunspot Area



$MSA = (0.76 \pm 0.01)BSA + (-34 \pm 13)$
$r = 0.965$



CONCLUSIONS

- We have recovered daily Sunspot Number and Group Sunspot Number data for the periods 1876-96 and 1935-86 and monthly Group Sunspot Number data for the periods 1906-20 and 1931-33 from Madrid Observatory.
- We have recovered daily Sunspot Area data for the periods 1914-19 and 1952-86 and monthly data for the period 1931-33 from Madrid Observatory.
- Our analysis of the solar indices from Madrid Observatory shows the reliability of the recovered records.
- The spots/groups ratio has been evaluated by the *MSN*/*MGSN* ratio. We found two abrupt changes in this ratio around 1946 and 1973.

ACKNOWLEDGEMENTS

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