



COMPOSITE OF PLAGE AREAS OVER THE ENTIRE 2011 CENTURY

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Total solar irradiance

TSI: spectrally integrated solar radiative flux at 1 AU





Ca II K as proxy to magnetic field





Chatzistergos et al., 2019a

Available plage area series



Results vary due to the use of:

Different archives

- **Different data sample**
- Different normalisation area
- Unaccounted disc ellipticity
- Different segmentation methods

Kuriyan et al., 1982 Foukal 1996 Worden et al., 1998 Preminger et al., 2001 Ermolli et al., 2009a Ermolli et al., 2009b Tlatov et al., 2009 Chatterjee et al., 2016 Priyal et al., 2017 Singh et al., 2018 NSGD

Our corrections and calibration

Automatic process to:

- Determine solar disc radius
- Identify QS CLV and artefacts
- Relate QS CLV from historical data to QS CLV from modern data to construct CC
- Calibrate images and compensate for limb-darkening





Method's accuracy

Added randomly with different severities on 2000 Rome/PSPT images



Relative differences between original and calibrated contrast images as a function of time.

Relative difference in disc fractions between original and calibrated contrast images as a function of time.



No dependence of error on activity



Chatzistergos et al., 2018

Plage coverage over the 20th century



Chatzistergos et al., 2019b

Archives' inconsistencies



Chatzistergos et al., 2019b

Relations between archives



Chatzistergos et al., 2019b

Plage coverage over the 20th century



Chatzistergos et al., 2019b

The composite is available at: <u>http://www2.mps.mpg.de/projects/sun-climate/data.html</u> <u>http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=J/A+A/625/A69</u>

Summary

- Historical Ca II K can provide valuable information on solar surface magnetism, needed by irradiance/climate studies
- We developed a process to photometrically calibrate and segment historical Ca II K SHGs
 - Relatively small errors estimated from synthetic images
 - No need for adapting segmentation parameters
- Derived plage areas depend on employed bandwidth
 > We produced the first plage area composite spanning the entire 20th century from 9 Ca II K archives

Thank You!