

# To Rain or Not to Rain: Correlating GOES Flare Class and Coronal Rain Statistics

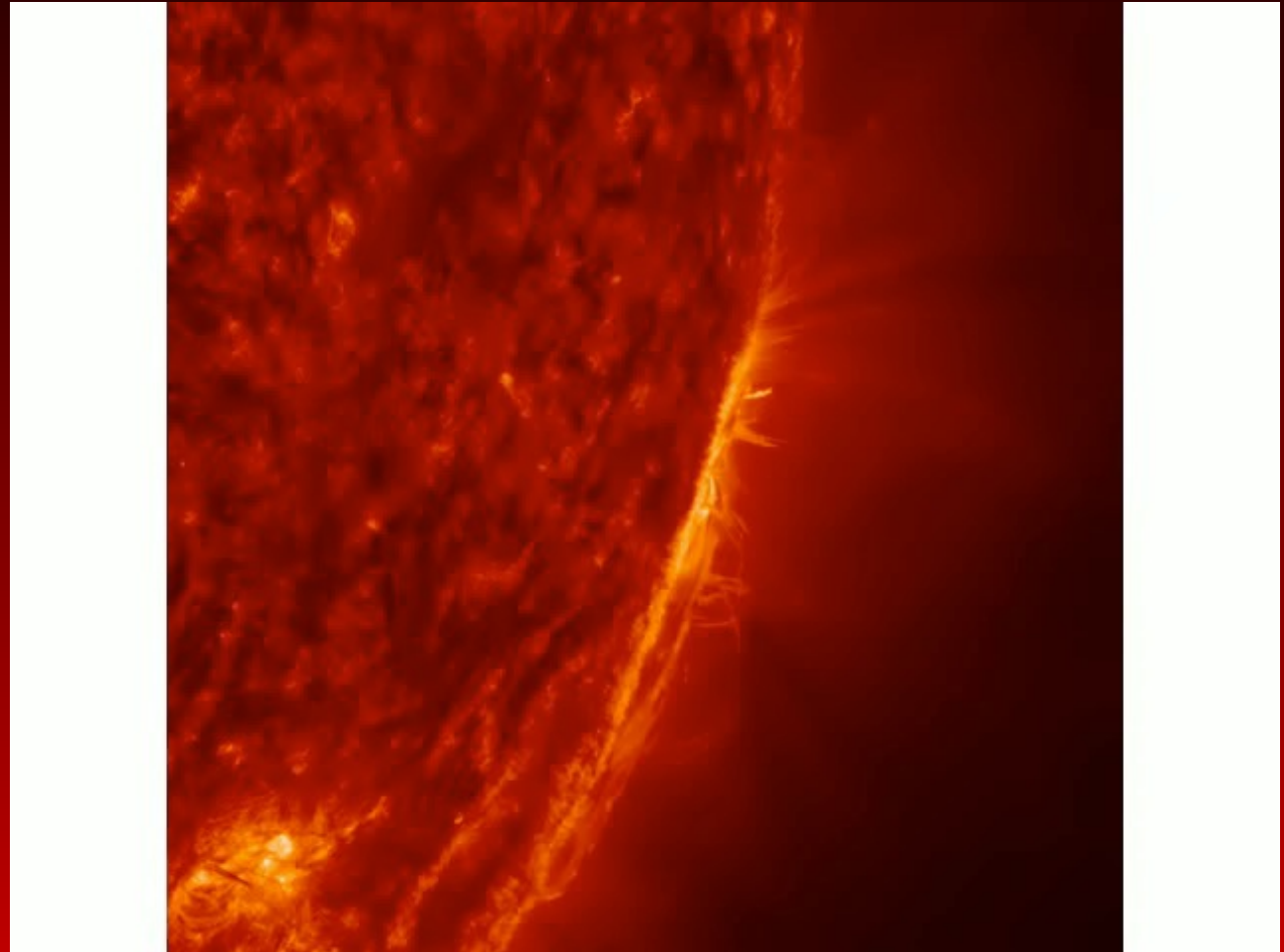
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# How does it rain on the Sun?

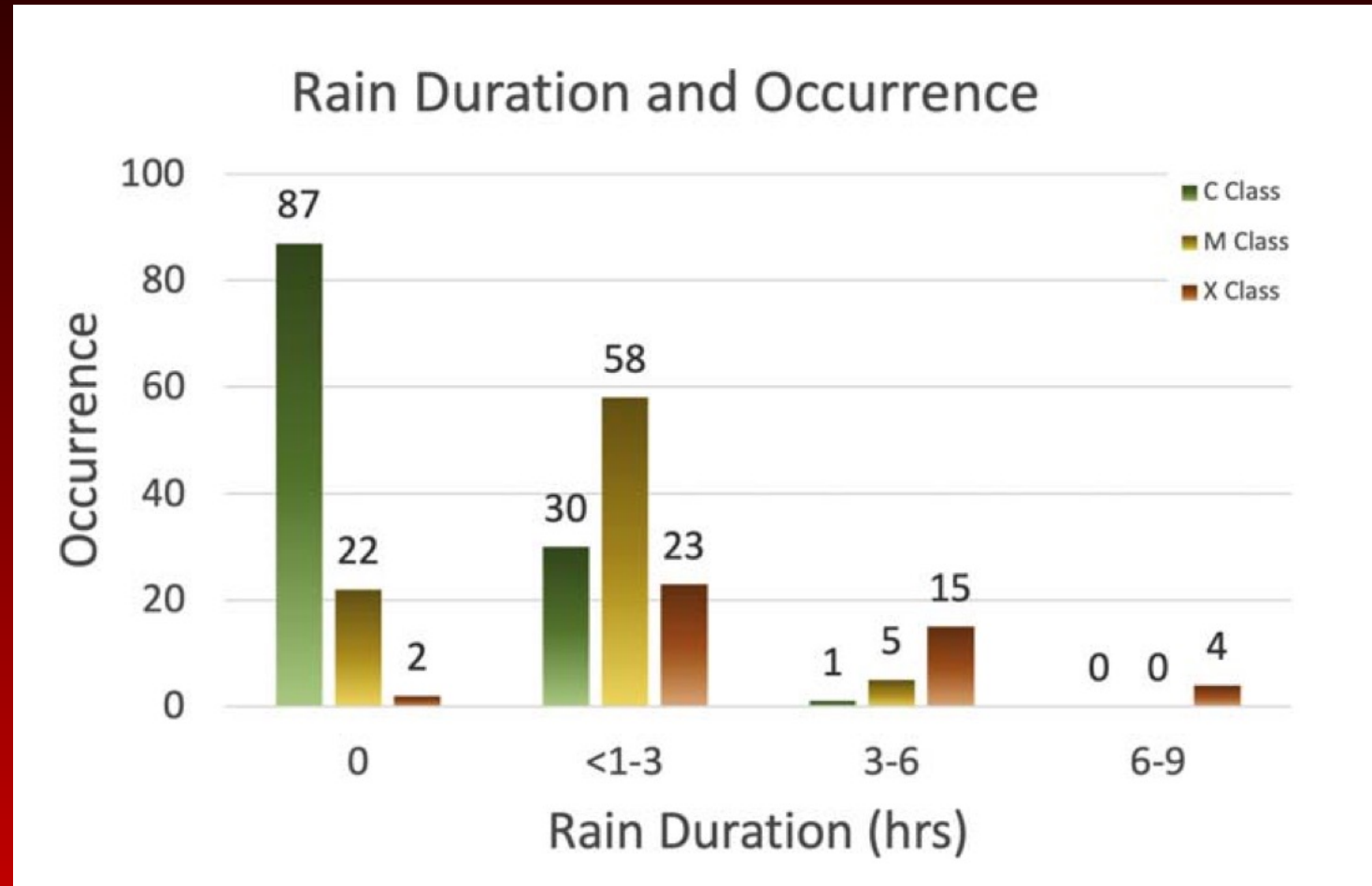
- Magnetic reconnection resulting in a solar flare forms newly reconnected magnetic loops
- Plasma outlines the post-flare magnetic field loops and plasma rain “drops” fall back down to the photosphere
- This eye-catching event referred to as “post-flare coronal rain”



Credit: NASA/SDO

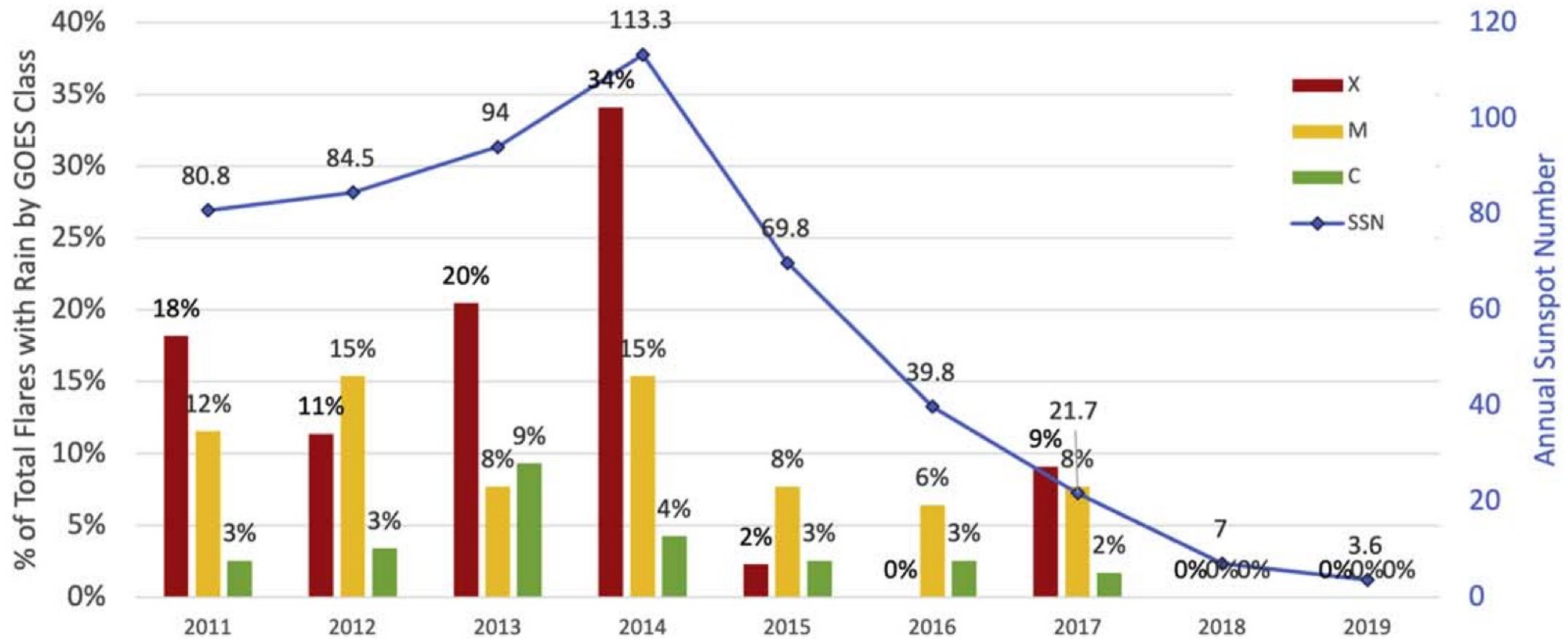
# No statistics recorded before on post-flare rain!

- 240 flares analyzed evenly through Solar Cycle 24 (2011-2019)
  - 49 X-class, 74 M-class, and 117 C-class
- **Direct energy correlation between flare energy and rain duration**



# Solar Cycle Activity Predictions

Rain Occurrence as Percent of All Detected Flares By GOES Class and Year



# Implications

- Post-flare rain is present for the majority of M and X-class flares but frequency is reduced significantly in C-Class flares
- X and M-class flares could be a useful tracker of the solar cycle
- Post-flare rain duration can act as a proxy for flare energy release
- Post-flare arcades can persist for days after a flare, transitioning from post-flare rain to common quiescent active region rain

# Summary

- Paper recently published in The Astrophysical Journal:  
<https://iopscience.iop.org/article/10.3847/1538-4357/ac94d7>
- Correlation between flare energy and rain duration
- Plan to extend post-flare coronal rain analysis to future solar cycles for refined solar activity prediction
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