

## FEATURE ARTICLE

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## Key Points:

- American sunspot drawings from the early 19th century
- Records found in the journals of the Reverend Fisher

## Supporting Information:

- Supporting Information S1

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## Early American sunspot drawings from the “year without a summer”

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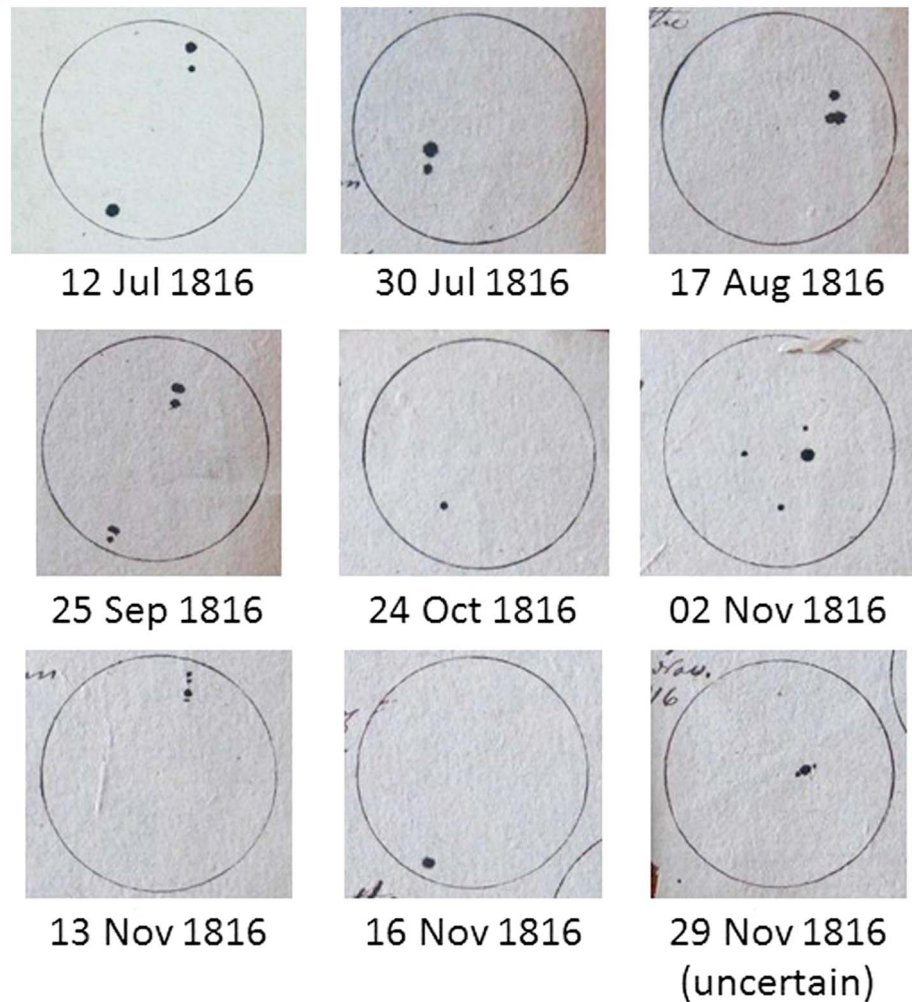
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**Abstract** A set of sunspot drawings from the early nineteenth century were discovered in the journals of the Reverend Jonathan Fisher. These drawings were made during a time when abnormally cold weather caused crops in New England to fail due to intermittent frost throughout the summer months of 1816, normally referred to as the “year without a summer.” Global changes in weather patterns were the result of the Mount Tambora volcano eruption. Since this association was unknown at the time, there was speculation that the Sun was the cause inspiring the Reverend Fisher to monitor changes in sunspots during the summer of 1816 and continuing into 1817. These sunspot drawings for the summer of 1816 overlap the solar observations of Sir William Herschel.

The year of 1816 is commonly referred to as the “year without a summer” due to the abnormally cold temperatures that persisted in the Northern Hemisphere [Klingaman and Klingaman, 2013]. Particularly hard hit by this weather anomaly were the New England states where the lower than average temperatures had a devastating impact on agriculture and, in general, the quality of life. We have now come to understand that the natural decrease in temperature toward the end of the Little Ice Age (1300–1850) was exacerbated by the April 1815 volcanic eruption of Mount Tambora in Indonesia [Fagan, 2000]. However, not knowing this connection, gentleman scientists at the time speculated that the Sun may have played a role in the extreme temperatures particularly in light of the dearth of sunspots observed during what is now referred to as the Dalton Minimum (1790–1830) [Wagner and Zorita, 2005].

The Reverend Jonathan Fisher (1768–1847) was a Congregational minister who spent the bulk of his adult life serving the tiny coastal hamlet of Blue Hill in northern Maine [Murphy, 2010]. He was a Harvard-educated pastor who, as an “Enlightened Christian,” was able to reconcile his religious beliefs with scientific knowledge [Cathey, 2015]. Fisher made valuable contributions to the practical and intellectual developments of the eastern frontier of Maine in the early nineteenth century [Chase, 1948]. In 1816 he experienced this dire summer and made continual reference to the cold weather in his personal journals. As he was a highly educated man, it is probable that Fisher was aware of the speculated association of the cooler temperatures with sunspots [Daily National Intelligencer, 1816]. During the summer of 1816 and into 1817 Fisher included in his journals sketches of “spots on the rising Sun” made perhaps using the camera obscura that still exists in the home he built in 1814. Figure 1 is a composite of the full set of solar drawings made by Fisher during the summer and fall of 1816.

The sunspot drawings of Jonathan Fisher, motivated by the anomalous weather conditions in 1816, were made during the interval between the extensive records of Staudach (1731–1996) and Schwabe (1789–1875) [Vaquero and Vazquez, 2009]. However, the sunspot drawings of Fisher were not the first set of drawings from the Americas. Professor John Winthrop (1714–1779) from Harvard University included in his journal a pair of sunspot drawings for 20 and 22 April 1739 around the time, in retrospect, of the local solar maximum [Kilgour, 1938]. Jose Antonio Alzate (1737–1799), in Mexico, was another solar observer who produced sunspot drawings before Fisher [Vaquero et al., 2007]. A contemporary of Fisher was Sir William Herschel (1738–1822), from Cambridge England, who made solar observations from 1779 to 1818 although his most active years were between 1799 and 1806 [Hoyt and Schatten, 1992a]. During the summer of 1816 Herschel made solar observations for 13 July, 19 July, 20 July, 22 July, and 3 August [Hoyt and Schatten, 1992b]. Fisher produced sunspot drawings on 12 July, 30 July, and 17 August which nicely overlap the solar observations of Herschel. In particular, on 13 July Herschel noted the presence of three “pretty considerable” sunspots, two of which were presumably near the west limb and one of which was closer to the eastern limb. These sunspots correlate favorably with

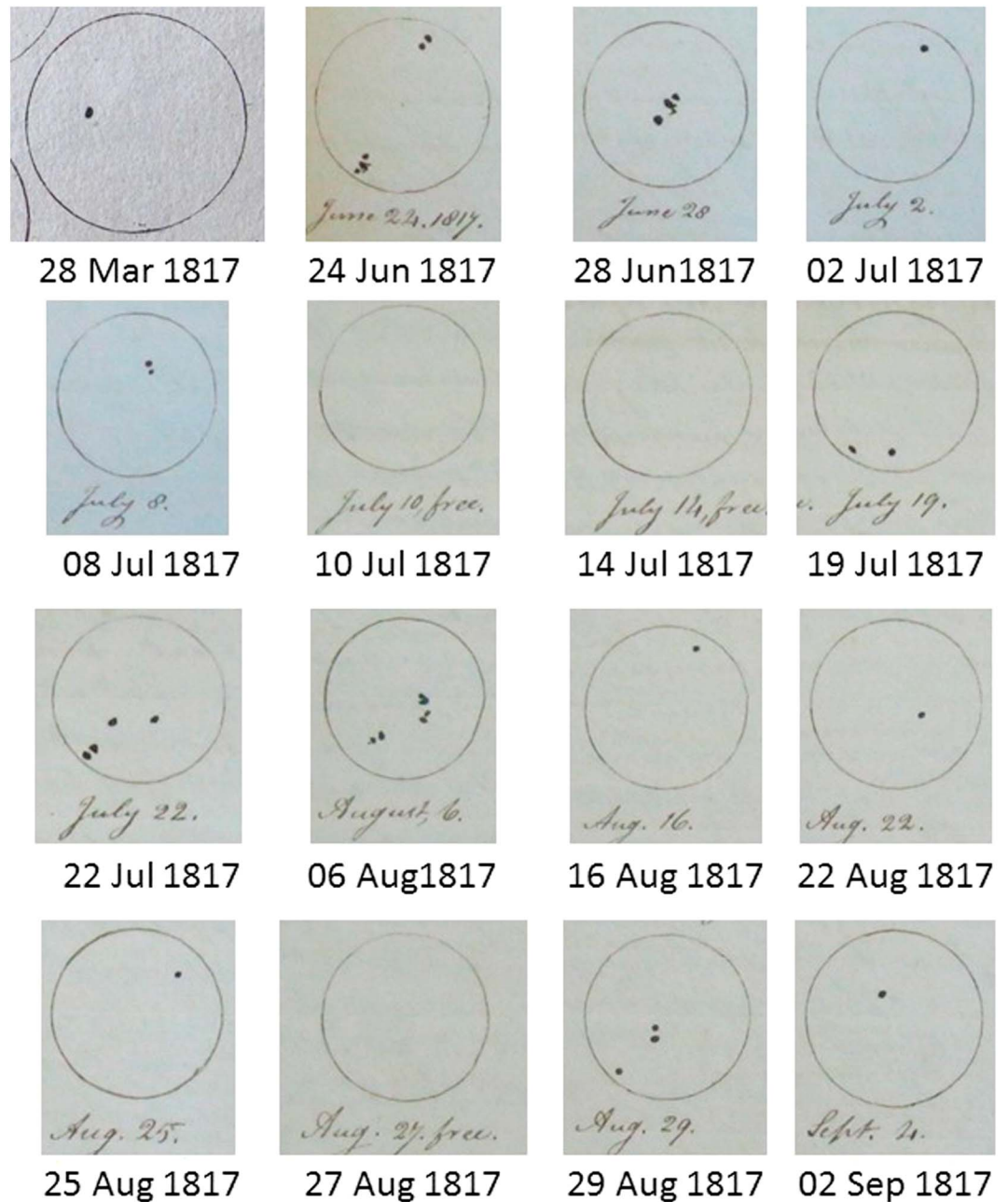


**Figure 1.** Sunspot drawings by Jonathan Fisher (1816).

the sunspots apparent in the Fisher drawing of 12 July. For the remainder of the month Herschel tracked the progress of sunspots across the visible Sun. On 3 August Herschel observed two “not large” sunspots which may be compared to the sunspots depicted in Fisher’s drawing for 30 July. While the association between the sunspot drawings of Fisher in Maine and the solar observations of Herschel at Cambridge (England) may not be surprising, it is nevertheless interesting given the time period and separation of the observers.

In 1817 Fisher continued to produce periodic sunspot drawings as the temperatures in New England returned to more seasonable levels. The full set of Fisher drawings for 1817 is provided in Figure 2. This same year Fisher speculated on the nature of the Sun as “a vast body of combustible matter, somewhat perhaps, like that which produces the lava from the burning mountains and that the surface of the Sun is as a vast oven of melted lava; that like terrestrial ignited substances, it diffuses light and heat in proportion to its size.” He also suggested that the spots on the Sun might “consist of fragments broken by the operation of fire from parts of the Sun below the surface” and that the fragments “might diminish the intensity of heat at the surface but when they become inflamed, might increase it.” How interesting that Fisher mistakenly suggested that volcanic action on the Sun might be the cause of the anomalously cold temperatures in New England, whereas, in fact, it was a volcano on Earth that was the true cause.

The Reverend Jonathan Fisher died in Blue Hill Maine in 1847. For the better part of 200 years his journals remained tucked away in the attic of his home that was passed down through the generations until the Jonathan Fisher House Society took an interest in preserving his home and records. Observing sunspots



**Figure 2.** Sunspot drawings by Jonathan Fisher (1817).

during the year without a summer was only a small piece of Fisher’s legacy as a pioneer minister, farmer, entrepreneur, and artist on Maine’s eastern frontier. For the space weather community the existence of these early sunspot drawings, while interesting, may also prove useful by contributing to a recalibration of the historical sunspot number [Clette *et al.*, 2016].

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