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Homologous Coronal Mass Ejections Caused by Recurring Formation and Disruption of Current Sheet within a Sheared Magnetic Arcade

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The Sun often produces coronal mass ejections with similar structure repeatedly from the same source region, and how these homologous eruptions are initiated remains an open question. Here, by using a new magnetohydrodynamic simulation, we show that homologous solar eruptions can be efficiently produced by recurring formation and disruption of coronal current sheet as driven by continuously shearing of the same polarity inversion line within a single bipolar configuration. These eruptions are initiated by the same mechanism, in which an internal current sheet forms slowly in a gradually sheared bipolar field and reconnection of the current sheet triggers and drives the eruption. Each of the eruptions does not release all the free energy but with a large amount left in the post-flare arcade below the erupting flux rope. Thus, a new current sheet can be more easily formed by further shearing of the post-flare arcade than by shearing a potential field arcade, and this is favorable for producing the next eruption. Furthermore, it is found that the new eruption is stronger since the newly formed current sheet has a larger current density and a lower height. In addition, our results also indicate the existence of a magnetic energy threshold for a given flux distribution, and eruption occurs once this threshold is approached.