

A Statistical Study on the Relationship Between Flux Emergence and CME Initiation

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In this paper we present our statistical study on the relationship between flux emergence and CME initiation. For a sample of 129 CME-source regions, longitudinal magnetic flux variations of these source regions during 12 hours before CME eruptions are studied, in order to understand the generally believed close relationship between flux emergence and CME initiation. As a comparison, long-term magnetic flux variations of 38 CME-source regions and 15 fast-emerging active regions (ARs) are also studied. Our results show that: (1) Out of the 129 CME-source regions, 70 (54%) are found to have magnetic flux increases during the 12 hours before CME eruptions and 59 (46%) are found to have magnetic flux decreases. Average value of normalized flux increase (or decrease) rates of these 129 CME-source regions, averaged over the 12 hours before CME eruptions, are found to be almost identical as those of normal ARs averaged over 111 hours, with these rates significantly smaller than the flux increase rate of those fast-emerging ARs; (2) Out of the 129 CME-source regions, 115 (89.9%) are found to have small-scale flux emergence within the region during the 12 hours before CME. The normalized flux increase rates of these small-scale regions are found to be even larger than those of fast-emerging ARs. However, about the same number (118) of source regions are found to have small-scale flux cancellation as well. These results suggest that although statistically small-scale flux emergences are usually found in CME source regions before CME eruptions, further studies are necessary to establish a unique relationship between small-scale flux emergence and CME eruption for the space weather purpose.