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Poster
The largest geomagnetic storm in two decades occurred in 2024 May with a minimum Dst of ?412 nT. We examine its solar and interplanetary origins by combining multipoint imaging and in situ observations. The source active region, NOAA AR 13664, exhibited extraordinary activity and produced successive halo eruptions, which were responsible for two complex ejecta observed at the Earth. In situ measurements from STEREO A, which was 12°.6 apart, allow us to compare the “geo-effectiveness” at the Earth and STEREO A. We obtain key findings concerning the formation of solar superstorms and how mesoscale variations of coronal mass ejections affect geo- effectiveness: (1) the 2024 May storm supports the hypothesis that solar superstorms are “perfect storms” in nature, i.e., a combination of circumstances resulting in an event of an unusual magnitude; (2) the first complex ejecta, which caused the geomagnetic superstorm, shows considerable differences in the magnetic field and associated “geo-effectiveness” between the Earth and STEREO A, despite a mesoscale separation; and (3) two contrasting cases of complex ejecta are found in terms of the geo-effectiveness at the Earth, which is largely due to different magnetic field configurations within the same active region. Implications for future measurements at sub-L1 will also be discussed.

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