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The response of a planet to solar eruptive events such as solar flares and coronal mass ejections (CMEs) depends on the characteristics of the local heliospheric conditions and the plasma environment of the planet in question. With a tenuous atmosphere and localized crustal magnetic fields, Mars at ~1.5 AU is only weakly shielded by its induced magnetosphere from space weather activity. Venus, an unmagnetized planet at ~0.7 AU, has an induced magnetosphere but also a thick atmosphere that is constantly being eroded due to interaction with the solar wind flow. Closest to the Sun at ~0.3 AU is Mercury, which possesses a global but weak magnetic field that shields its thin exosphere, has a highly dynamic magnetosphere that can respond strongly to CME impacts.

An overview will be presented that highlights the important results that have helped to advance our understanding of the various processes experienced by Mars, Venus, and Mercury during space weather events of Solar Cycles 23 and 24. Observations of these processes are based on in situ measurements and remote-sensing observations from MAVEN, Mars Express, Mars Science Laboratory, Venus Express, MESSENGER, and the Venus flyby observations from PSP, in combination with advanced modeling techniques. Comparing the impacts and effects of space weather activity at these planets provides a wide range of scenarios that can serve to enhance our understanding of space weather impacts and effects at Earth.
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