Prominence Eruptions and their association with CMEs during solar cycle 24

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Solar prominences are highly dense magnetized plasma structures, which are cooler than the background corona. When these structures lose their equilibrium, they can either erupt partially/fully or can fall back onto the surface of the Sun. When the eruption is successful, the prominences become the interior core of coronal mass ejections (CMEs). A classical structure of the CME contains a leading edge followed by a dark cavity and then the prominence material as its core structure. Here, we present a statistical study of solar prominence eruptions (PEs) and the associated CMEs observed during solar cycle 24 (May 2010 – December 2019). For this study, we use data from the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO) together with the Large Angle and Spectrometric Coronagraph (LASCO) onboard the Solar and Heliospheric Observatory (SOHO) spacecraft. We analyse a total of 1225 (67% radial, 32% transverse, and 1% failed) PEs. The average heights of all, radial, and transverse PEs are 1.31, 1.36, and 1.21 $R_\odot$, respectively, and their average speeds are ~ 38, 53, and 9 km s^{-1}, respectively. For the association of PEs and CMEs, we set a confidence level (CL) from 0 to 3: 0 for no association and 3 for clear association. We found that, 662 (54 %) are associated with CMEs out of which 69 % CMEs shows clear bright core structures for CLs 1–3 and 78 % for CL3. The average speed of these PEs, associated CME cores, and CME leading edges are 62, 390, and 525 km s^{-1}, respectively. From the morphological and height-time analysis of PEs and CME cores, our study reveals that the prominence and CME core are the same material at different heights. The temporal and spatial relationship between PEs and CMEs is solar cycle dependent. The temporal offset is large during solar maxima and small during minima. In the case of spatial relationship, it is found that during solar minima, the central position angle (CPA) of CMEs is closer to the equator than that of the PEs due to a strong polar field during solar minima.