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Multi-Spacecraft Observations and Modeling of Interplanetary CMEs and CIRs in 2009 and 2010

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Since the late 2009, the sunspot number, CME occurrence rate, solar wind speed and temperature, IMF, and other parameters have been increasing, indicating the rise of solar cycle 24. Using the observations of STEREO A/B and Wind/ACE near 1 AU, we investigate the variability of large-scale solar wind structures in this rising phase, including the occurrence of interplanetary CMEs, CIRs, and interplanetary shocks. Using the STEREO support at the Community Coordinated Modeling Center (CCMC) of NASA, we assess the predication capability of the WSA-ENLIL model on the general solar wind and magnetic sectors. Besides the statistical work, we also focus on an active interval of 1-3 August 2010, when a few CMEs occurred, and the maximum IMF of over 30 nT was observed at STEREO B. We compare the structures encountered by STEREO A/B, Wind, as well as Venus Express, and use the Grad-Shafranov model to reconstruct the magnetic flux ropes, and further compare them with the coronal and remote heliospheric observations of the CMEs. The observations are compared with the ENLIL cone model results to study the evolution of CMEs. The geomagnetic responses of the events are investigated too.