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Major Geomagnetic Storms in Solar Cycle 24 and Challenges in Forecasting Geomagnetic Storms

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Solar Cycle 24 has produced 11 major geomagnetic storms (where Dstmin < -100 nT) with three in 2011, six in 2012 and two in 2013 (as of 15 January 2014). Detailed analysis of each event will be given in terms of its solar driver(s): CME, coronal hole high speed solar wind stream (HSS), multiple CMEs or interactions between CME and HSS. While some of these storms are associated with a fast and wide CME, the several cases involving slow or common CMEs and interactions with HSS are particularly interesting. These events pose great challenges for accurate space weather forecasting, since operationally the slower or average CMEs tend to receive less attention and are sometimes overlooked altogether. In addition, cases (e.g., the CME associated with the X1.2 flare on 7 January 2014) where seemingly potent/geoeffective CMEs (fast and wide) result in yet weak geomagnetic disturbances will be presented. What has been done at CCMC/SWRC (http://ccmc.gsfc.nasa.gov and http://swrc.gsfc.nasa.gov) and multitude of challenges in geomagnetic storm forecasting will be discussed.