Real-Time CME Forecasting Using HMI Active-Region Magnetograms and Flare History

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We have recently developed a method of predicting an active region's probability of producing a CME, an X-class Flare, an M-class Flare, or a Solar Energetic Particle Event from a free-energy proxy measured from SOHO/MDI line-of-sight magnetograms. This year we have added three major improvements to our forecast tool: 1) Transition from MDI magnetogram to SDO/HMI magnetogram allowing us near-real-time forecasts, 2) Automation of acquisition and measurement of HMI magnetograms giving us near-real-time forecasts (no older than 2 hours), and 3) Determination of how to improve forecast by using the active region's previous flare history in combination with its free-energy proxy. HMI was turned on in May 2010 and MDI was turned off in April 2011. Using the overlap period, we have calibrated HMI to yield what MDI would measure. This is important since the value of the free-energy proxy used for our forecast is resolution dependent, and the forecasts are made from results of a 1996-2004 database of MDI observations. With near-real-time magnetograms from HMI, near-real-time forecasts are now possible. We have augmented the code so that it continually acquires and measures new magnetograms as they become available online, and updates the whole-sun forecast from the coming day. The next planned improvement is to use an active region's previous flare history, in conjunction with its free-energy proxy, to forecast the active region's event rate. It has long been known that active regions that have produced flares in the past are likely to produce flares in the future, and that active regions that are nonpotential (have large free-energy) are more likely to produce flares in the future. This year we have determined that persistence of flaring is not just a reflection of an active region's free energy. In other words, after controlling for free energy, we have found that active regions that have flared recently are more likely to flare in the future. Consequently, flare and CME forecasts are significantly improved by using separate f