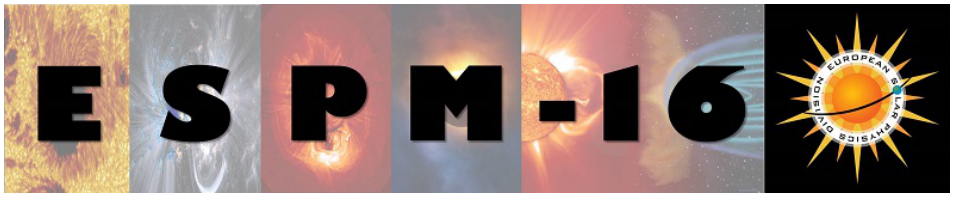

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Identifying Eruptive Active Regions with S2WARM

Wednesday 8 September 2021 11:39 (13 minutes)

One of the main goals of solar physics is the timely identification of eruptive active regions. Space missions such as Solar Orbiter or future Space Weather forecasting missions would largely benefit from the achievement of this goal. Our aim is to show how a physics based technique can provide real time indications that an active region will produce an eruption with a simple green/amber/red risk of eruption. We expand on work of Pagano et al., 2019a,b that was able to define a theoretical and operative metrics that discriminate eruptive from non-eruptive active regions by analysing the Lorentz force in a 3D dynamic reconstruction of the magnetic field configuration of active regions with magnetofrictional simulations. In this work, we finalise the metric to include the effects of magnetic flux emergence and solar flares. We therefore obtain the operative framework of the StAndrews Space Weather Active Region Monitoring (S2WARM) and we show how this can be used by space weather forecasters to derive useful information on active regions in the Sun. To do so, we apply the S2WARM technique to a time period of 45 days in 2013 when several active regions crossed the solar disk, as we individually model their magnetic field configuration evolution and benchmark S2WARM metric against observational signature of flux rope ejections and flares. We find that our technique provides correct identifications of eruptive or non-eruptive active regions in 82% of the cases and we also illustrate how to apply this technique in various space weather forecasting applications.

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