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Evolution of the critical torus instability height and CME likelihood in solar active regions

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Aims: Working towards improved space weather predictions, we aim to quantify how the critical height at which the torus instability drives coronal mass ejections (CMEs) varies over time in a sample of solar active regions.

Methods: We model the coronal magnetic fields of 43 active regions and quantify the critical height at their central polarity inversion lines throughout their observed lifetimes. We then compare these heights to the changing magnetic flux at the photospheric boundary and identify CMEs in these regions.

Results: We find higher rates of CMEs per unit time during phases when the critical height is falling rather than rising, and when magnetic flux is increasing rather than decreasing. Furthermore, we support and extend the results of previous studies by demonstrating that the critical height in active regions is generally proportional to the separation of their magnetic polarities through time.