Modelling Paths of the Moon’s Shadow on the Surface of the Earth During Total Solar Eclipses

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Solar eclipses are exciting but short-lived events that rarely occur in populated areas. The astronomy enthusiast might therefore be interested in knowing where they must go to observe some given eclipse the longest. In this project I devise a computationally simple way of finding that place. The method works by modelling how Moon’s shadow moves across the Earth and considering its speed relative to the surface. This model is centred around a few orientation parameters that relate the position of the Moon to the Earth and change depending on the particular eclipse. As the shadow travels eastwards very quickly, the time under occultation for a stationary observer is generally largest around the equator, where there is a greater influence from the Earth’s rotation in the observer’s velocity. In those cases, one can expect four to six minutes of occultation depending on the eclipse’s parameters. The exploration provides a possibly new perspective on solar eclipses and a way of calculating their duration for arbitrary points on the Earth, with much potential for more extensive development.