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Latitude dependency of the geomagnetic secular variation S parameter: A mathematical artifact

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Secular variation, the change in the Earth's magnetic field through time, reflects the energy state of the geodynamo. Secular variation is commonly quantified by paleomagnetists as the standard deviation of the angular distances of the virtual geomagnetic poles to their mean pole, known as the S value. This parameter has long been thought to exhibit latitude dependence [S(λ)], whose origin is widely attributed to a combination of time-varying dipole and non-dipole components. The slope and magnitude of S(λ) are taken as a basis to understand the geomagnetic field and its evolution. Here we show that S(λ) stems from a mathematical aberration of the conversion from directions to poles, hence directional populations better quantify local estimates of paleosecular variation.