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Predicting lognormal distributions of geomagnetic field time derivatives

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Nearly two decades of auroral zone magnetometer observations are used to develop statistical predictions of geomagnetic field time derivatives.
Distributions of differences between successive 5-second vector field measurements are approximately lognormal, motivating a parametrization in terms of the first and second log-moments which are nearly uncorrelated and exhibit very different properties. Log-mean ranges over several orders of magnitude, with typicall autocorrelation time scales longer than 30 minutes. Log-variance correlation time is usually less than 5 minutes, with small amplitude noise-like fluctuations. Both log-moments depend on local time and magnetic latitude, but these factors predict less than 10% of observed variance. Simple combinations of solar wind parameters can be used to predict nearly 50% of log-mean but almost none of log-variance.
Including information about recent local activity significantly improves log-mean predictability to 70% but only accounts for 10% of log-variance.

Empirical models for these two parameters provide lognormal distribution forecasts which can be used to obtain point and range estimates of upcoming geomagnetic activity.
Prediction accuracy is highest during the day and lowest before midnight.
Hourly predictions of typical (median) and disturbed (90th percentile) events are unbiased, with roughly 90\% of cases falling between half and twice the predicted value.
Extreme (99th percentile) event magnitudes are consistently lower than predicted, by about 20%, possibly due to deviations from lognormality in the tail of the distribution.

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