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Poster
Accurately predicting the horizontal component of the ground magnetic field perturbation (dBH), as a proxy for Geomagnetically Induced Currents (GICs), is crucial for estimating the impact of geomagnetic storms and remains a topic under active investigation. The current state-of-the-practice Geospace model is computationally expensive for fine-grid global simulations, while existing machine learning methods consistently tend to underestimate dBH. Additionally, these models either lack uncertainty quantification (UQ) or provide UQ that lacks calibration. In this work, as part of the NextGen SWMF project funded by NSF, we develop a data-driven, grid-free global model using deep Gaussian process (DGP), a Bayesian non-parametric approach that forecasts the maximum dBH in 20-minute temporal bins for the full surface of Earth with calibrated uncertainty. The model uses solar wind measurements and the Dst index as input, and it is trained based on ground magnetometer station data provided by SuperMAG over the period 2003-2013 to estimate the spatial-temporal correlation of dBH on the full surface of Earth. The model's predictions are evaluated based on the Heidke skill score (HSS) for a total of 23 storms with a SYM-H index < -50 nT in 2015. The results demonstrate that our model outperforms the state-of-the-art model, with predictions exhibiting high accuracy in mid-latitudes and high-latitude regions in the northern hemisphere.

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