Vishal
Upendran
BAERI/LMSAL
Raman Mukundan , University of New Hampshire, Department of Physics and Astronomy,
Sahiti Yerramilli, Carnegie Mellon University, School of Computer Science
Michael Heyns, Imperial College London, Department of Physics
Banafsheh Ferdousi, University of New Hampshire, Main campus,
Panagiotis Tigas, University of Oxford, Oxford Applied and Theoretical Machine Learning Group
Teo Bloch, Univeristy of Reading, U.K.
Angelos Vourlidas, The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Rd, Laurel, MD
Evangelos Paouris, [1] George Mason University, 4400 University Dr, Fairfax, VA 22030, USA and [2] The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Rd, Laurel, MD
Siddha Ganju, Nvidia Corporation, Santa Clara,
Mark Cheung, CSIRO, Space & Astronomy Epping, NSW Australia,
Asti Bhatt, SRI International, Menlo Park, CA, USA,
Ryan McGranaghan, ASTRA LLC, Louisville, CO, USA
Yarin Gal, University of Oxford, Oxford Applied and Theoretical Machine Learning Group

Oral

To safeguard critical infrastructure against space weather hazards such as geomagnetically induced currents, we need to develop operational forecasting tools. These tools need to (i) be computationally fast and inexpensive, (ii) resolve signatures over a range of length and time scales, and (iii) be actionable - including forecast uncertainties and an appropriate lead time to enable informed decision making. To address this need for a lightweight, multiscale, ground magnetic perturbation forecasting tool, the Deep leArninG Geomagnetic pErtuRbation (DAGGER) pipeline was created in 2020 during the Frontier Development Lab (FDL) research sprint. The core of the pipeline leverages spherical harmonic basis functions to forecast magnetic perturbations at both global and local scales.

This year, The FDL-X program has focused on elevating DAGGER's technical readiness and integrating it across other FDL forecasting and data product modules. We present two components of this workflow: SHEATH and DAGGER++. SHEATH is a solar wind forecaster which ingests full-disc SDOML v2 data to forecast solar wind and IMF properties at L1, while DAGGER++ is an upgrade on the original DAGGER model. SHEATH increases the forecast horizon of the entire pipeline to several days, while DAGGER++ provides high-fidelity forecasts by incorporating magnetosphere-ionosphere contextual data. The whole pipeline now quantifies uncertainty in forecasts and enables DAGGER to facilitate real-time deployment and integration with Sun-side and Earth-side modules.

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