Continuous and Cleaned Data Streams

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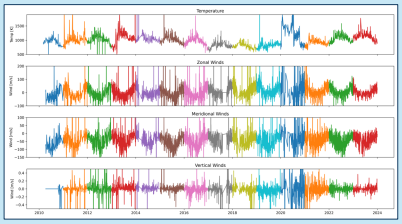
Computational Physics Incorporated (CPI)

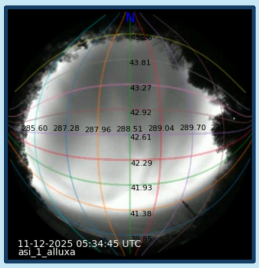
MEASURE

CPI operates 4 Fabry Perot Interferometers (FPIs) longitudinally from Maine to southern Brazil, strategically located at Easton, ME, Millstone Hill, MA, Santarém, Brazil, and Cachoeira Paulista, Brazil. Each of these sites provides zonal, meridional, and vertical winds and temperatures at two upper atmosphere altitudes, with 1.5- to 3-minute sampling and uncertainties <0.5km/s.



13 years of continuous data from the FPI in Millstone Hill, MA.

Neutral Winds



A calibrated image from an All-Sky Imager (ASI) in Massachusetts.

CPI provides geographically calibrated all-sky images of the night sky from two locations to measure airglow and detect auroral phenomena. After image capture, an algorithm will automatically correct for the distortion of the lens and calibrate the image.

Auroral Boundaries

Locations of magnetometers in CPI's Magstar array.

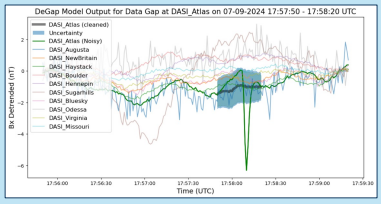
The MagStar array, CPI's premiere magnetometer network with 13 stations across CONUS, measures variations in the surface magnetic field and produces derives regional electric fields. Data are measured at <0.1 microTesla with a 1 Hz sampling rate and real-time data processing. The robust instrumentation and data stream offer operational capabilities for needs including GIC monitoring and space weather forecast data assimilation.

Magnetic Fields

PROCESS

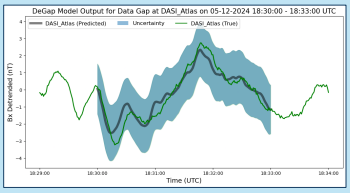
Our proprietary Deep Gaussian Processing (DeGaP) algorithm uses machine learning from spatio-temporal sensor networks for data cleaning and gap-filling.

Identify Anomalies → **Remove Bad Data** → **Fill in Gaps**



Magnetometer data from 11 sites with anomaly detection at Atlas magnetometer station and gap-filling demonstration.

Demonstration of the DeGaP algorithm (in grey) on magnetometer data with contamination from a car (green). The blue is the uncertainty of the correction and data from other magnetometers in the network is also shown.



Simulated data gap and gap-filling, compared to real data.

We simulated a data gap in the magnetometer data between 18:30 and 18:33 UTC. The black and green line shows the predicted and the real magnetic field data respectively along with uncertainty.

About CPI

Computational Physics Inc. (CPI) is an employee-owned government contracting company with over 40 years of experience in space weather research and development. Our customers include **NASA**, **NOAA**, **NSF**, the **Naval Research Laboratory** and the **US Naval Observatory.** CPI produces operational ground-based space weather instrumentation and data streams and supports end-to-end development including science and engineering requirements,, hardware production and integration, software development and data processing, calibration, validation, and data hardening, and operational integration.

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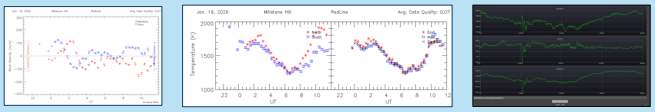
Acknowledgements

The Brazilian Space Agency (INPE) owns and hosts the FPIs in Brazil in an operational collaboration with CPI. The Millstone Hill Radar Facility is operated in Cooperative Agreement with NSF, and that facility hosts a CPI magnetometer and CPI optical instruments. The Francis Malcolm Science Center in Easton Maine hosts the CPI FPIs there in cooperation with the Boston University Center for Space Physics.

PROVIDE

Current: *Free access to real-time and archival data*



Future: *Operational data-as-a-service subscription*

Tier	Who It's For
Evaluation	Program managers, researchers, and developers evaluating CPI data for mission fit. 30-day access, 500 API calls/day, 3 stations, documentation and sample data sets. No commitment required.
Research & Planning	Research institutions, planning organizations, and analysts who need high-quality geomagnetic observations. Full 1 Hz QC'd data, selected regions, contaminant flags, weekly space weather digest, 10K API calls/day.
Operations	Power utilities, pipeline operators, and critical infrastructure stakeholders who need actionable intelligence for compliance or operational decision-making. Full MagStar array, real-time E-field modeling, GIC hazard indices, storm alerts (SMS/email), streaming endpoints, 50K API calls/day, IAGA-2002/JSON/CSV export.
Enterprise	Government agencies and large enterprises requiring SLA guarantees, redistribution rights, and integration support. Dedicated endpoints alert redistribution, custom configurations, full historical archive, 10 hrs/yr bundled consulting, negotiable API limits.