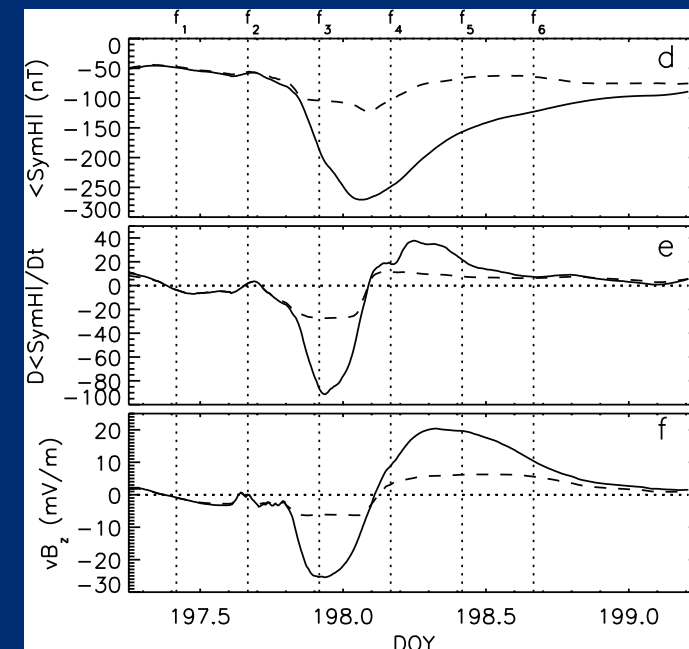
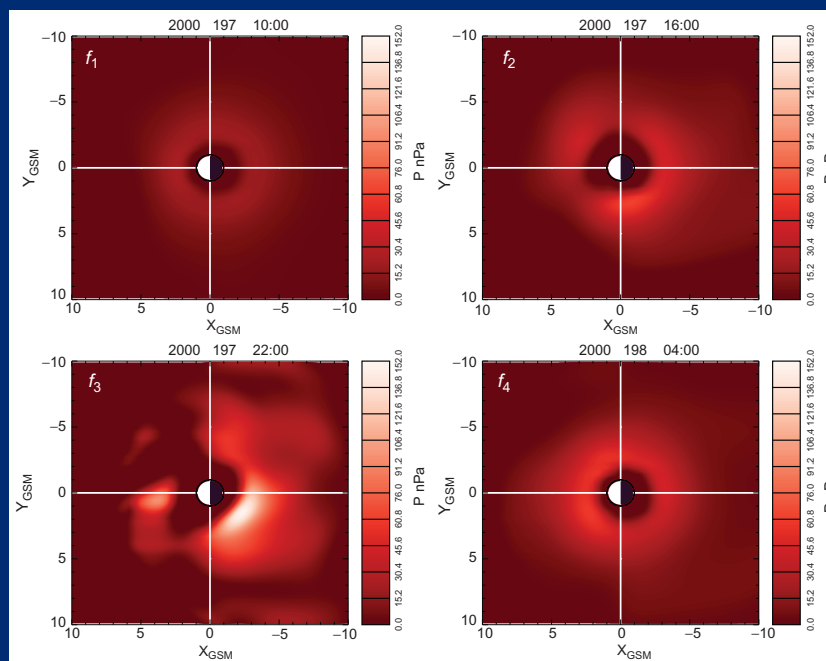


# Empirical Modeling of Extreme Space Weather Events: Storm-Time Geomagnetic Field, Electric Current, and Plasma Pressure

- Mining more than two decades of geomagnetic field data (1995-2016) using the nearest neighbor method enables reconstruction of the magnetic field and electric currents for the strongest geomagnetic storms.
- Application of quasi-static force balance for isotropic plasmas makes it possible to recover the corresponding storm-time pressure distributions.
- Statistical analysis of the nearest neighbor bins suggests that for strong storms the reconstructed currents and plasma pressure should be further adjusted because the nearest neighbor distributions are skewed toward weaker events.

## Bastille Day Geomagnetic Storm Near-Earth Plasma Pressure



Global parameters of the magnetosphere state and solar wind input used in the data mining procedure: average index  $\langle \text{Sym}H \rangle$ , its time derivative and the solar wind electric field  $vB_z$ . Dashed lines show the corresponding parameters averaged over their nearest neighbors.

**Application of modern data-mining and machine-learning techniques to the largest spaceborne magnetometer database enables reconstruction of the magnetic field, current and plasma pressure distributions for strong geomagnetic storms**