Progress towards empirical storm-time geoelectric benchmarks

Jeffrey J. Love
jlove@usgs.gov
Geomagnetism Program
USGS Natural Hazards Mission

Co-leader of Goal 1: Benchmarks for space weather events
for the
National Science and Technology Council's
Space Weather Operations, Response, and Mitigation Task Force

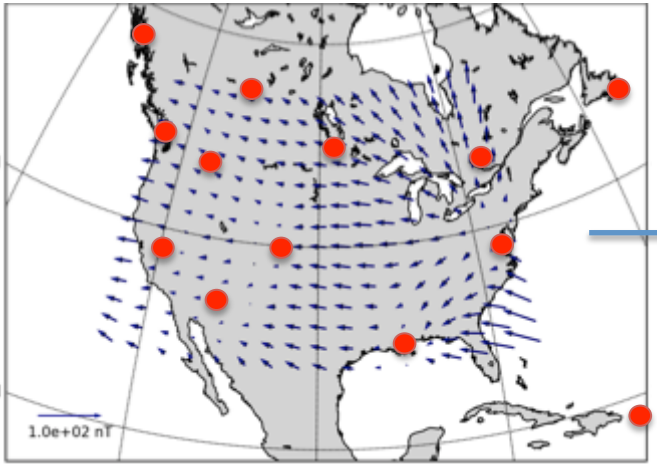
U.S. Department of the Interior
U.S. Geological Survey

Input signal time series → Convolution through a filter → Output signal time series

Geomagnetic variation →

→ Geoelectric field

Map of geomagnetic variation



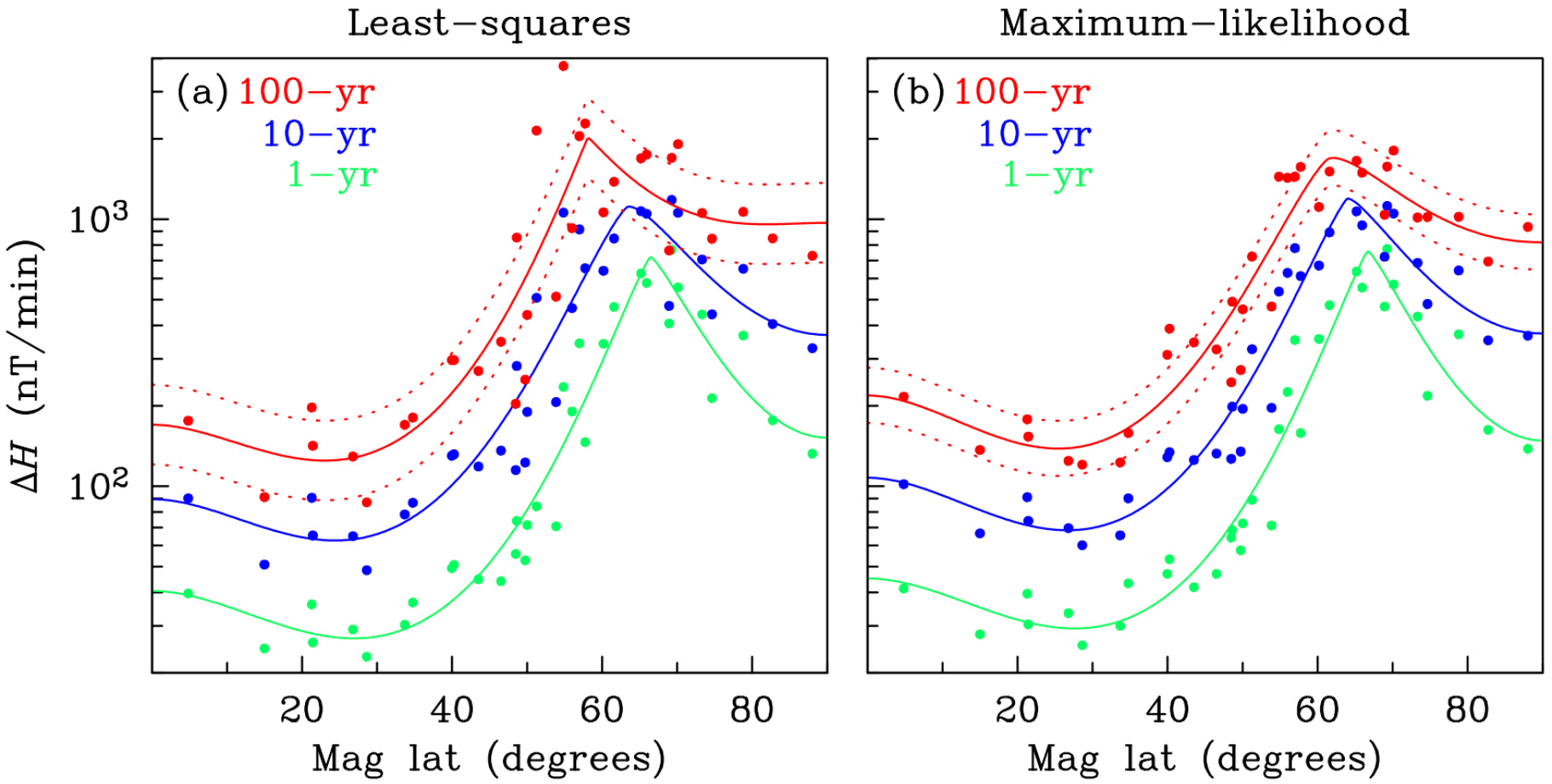
Earth conductivity model or measured impedance

Map of geoelectric variation

E

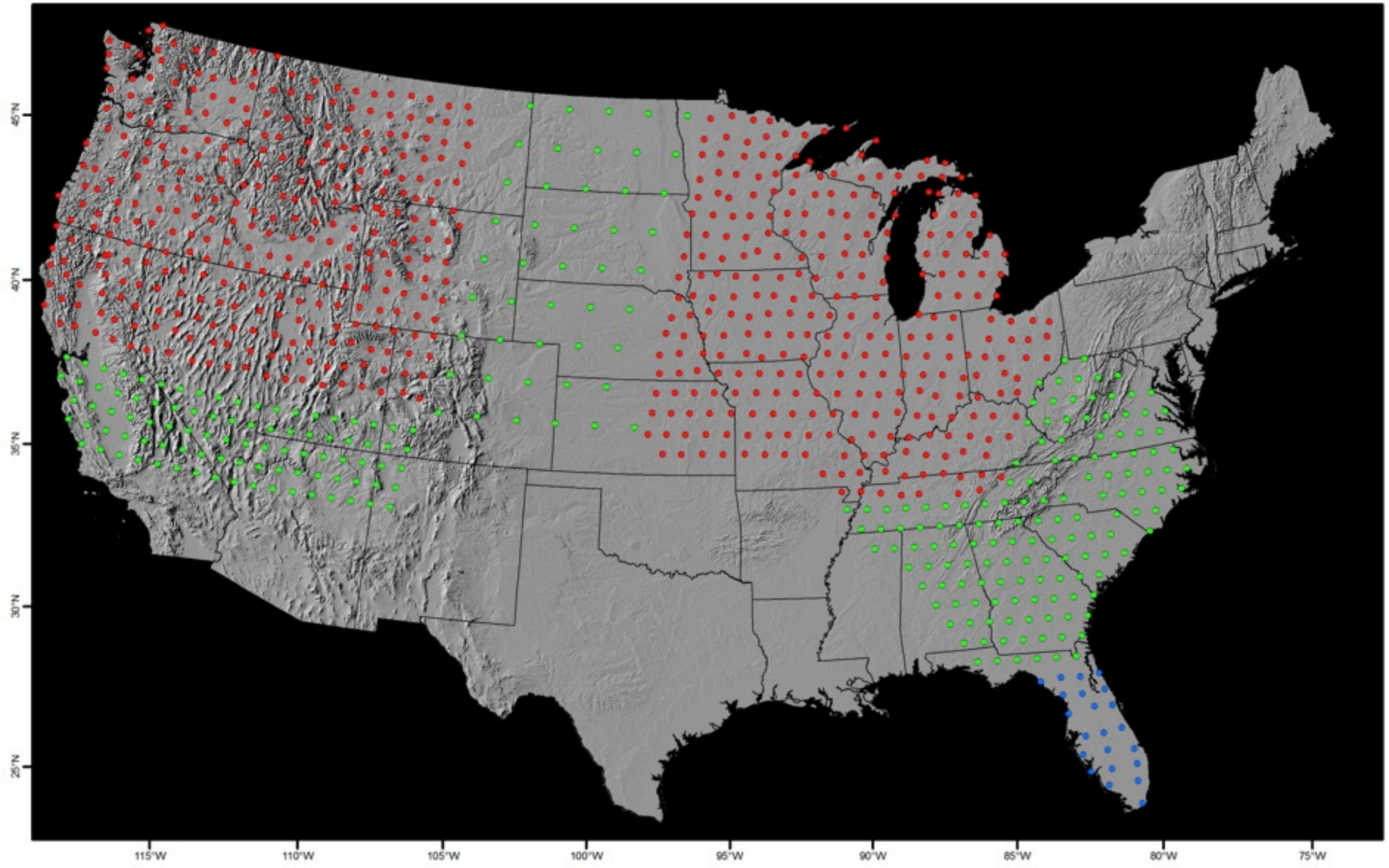
Love, J. J., Rigler, E. J., Pulkkinen, A., Balch, C. C., 2014.
Magnetic storms and induction hazards, Eos, Trans. AGU, 95(48), 445-446, doi10.1002/2014EO480001.

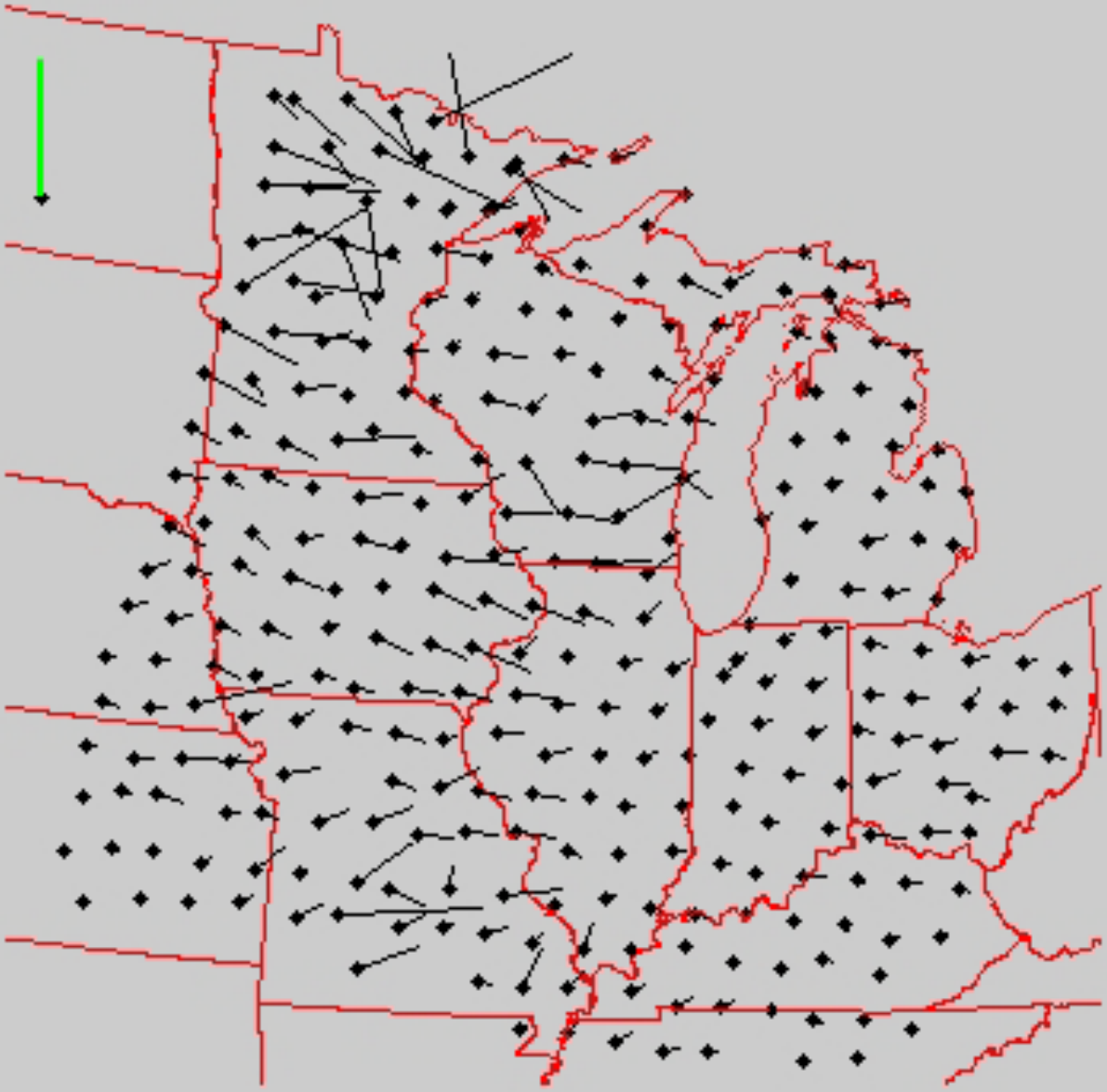
Statistics of delta-H vs latitude



Love, J. J., Coïsson, P. & Pulkkinen, A., 2016. Global statistical maps of extreme-event magnetic observatory 1-min first differences in horizontal intensity ΔH, Geophys. Res. Lett., under review.

NSF EarthScope MT survey by 2018 with recent USGS work in Florida.





Bedrosian, P. A. & Love, J. J., 2015. Mapping geoelectric fields during magnetic storms: Synthetic analysis of empirical United States impedances, Geophys. Res. Lett., 42(23), 10,160-10,170, doi:10.1002/2015GL066636.

Conclusions

- Induced geoelectric fields show substantial geographically distributed differences in amplitude, direction, and phase.
- Across the north-midwestern United States, a plausible but intense magnetic storm having 500 nT amplitude at 100 seconds would induce geoelectric fields with a geographic average amplitude of 2.71V/km, but a representative range of 0.15 V/km to 16.77 V/km.
- Combining maps of Earth impedance with probability maps of extreme-event geomagnetic activity should allow us to develop probability maps of extreme-event geoelectric fields.