

The University of Colorado Space Weather Technology, Research, and Education Center (TREC): Enhancing the research-to-operations (R2O) and operations-to-research (O2R) cycle in space weather forecasting

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Abstract: The CU Boulder Space Weather Technology, Research, and Education Center (Space Weather TREC) was initiated in late 2017 as a Chancellor's Office "Grand Challenge" to establish a focal point at CU for the various space weather related programs on campus. TREC will be a national center of excellence in cross-disciplinary research, technological innovation and education, enabling federal agencies, academia, commercial partners, and industry to collaboratively address the nation's evolving space weather forecasting, mitigation and response needs and to enhance the knowledge transfer from the research community to the operational community (R2O), and vice-versa (O2R).

Major CU partners of TREC include the Laboratory for Atmospheric and Space Physics (LASP), the Cooperative Institute for Research in Environmental Sciences (CIRES), and the Aerospace and Engineering Sciences (AES), Astrophysics and Planetary Sciences (APS), and Atmospheric and Oceanic Science (ATOC) departments. In addition, the National Solar Observatory (now located on the CU campus), the High Altitude Observatory, and several commercial partners in Boulder and beyond are partnering with TREC to address both research and operational space weather opportunities. NOAA's Space Weather Prediction Center, the Nation's civil space weather forecasting authority, is also located in close proximity to TREC in Boulder.

TREC is composed of the Research Enterprise which focuses on applied research to develop new tools and mission concepts for space weather forecasting; the Models, Applications, and Data Technology (MADTech) Enterprise which is developing a "space weather data portal" aggregation system as well as an Operational Testbed system for verification and validation purposes; and the Education Enterprise which is developing graduate and professional certificate programs in the CU system and leading the Boulder Space Weather Summer School.

The Research Enterprise is currently focusing on the Grand Challenge goal of producing a new full-physics model of satellite drag for use by satellite operators during geomagnetic storm conditions. In addition we are developing real-time radiation belt "nowcasting" and solar polar-orbiting constellation mission concepts. Future topics may include Deep Learning systems for solar eruption forecasting, auroral imaging CubeSat constellations, and inclusion of EMP physics

in "whole atmosphere" space weather forecasting models. TREC is just spinning up its capabilities and we are actively looking for opportunities to collaborate in our current and/or future areas of focus.