CEDAR community statement on GDC

The Coupling, Energetics, and Dynamics of Atmospheric Regions (CEDAR) community strongly endorses NASA's Geospace Dynamics Constellation (GDC) mission since it will provide tremendous value for fundamental space physics research and space weather science. GDC was recommended as a top-priority mission by the 2013 Decadal Survey of Solar and Space Physics, and remains ***a top-priority mission now***.

CEDAR's mission is to understand the fundamental properties of the space-atmosphere interaction region, which remains vastly under-sampled. GDC's science instruments will provide a completely new view of the ionosphere-thermosphere (IT) system, as they will simultaneously measure, for the first time on a global basis, the physical properties of the IT. GDC will observe the solar wind and magnetospheric energy inputs that are a primary and as yet unpredictable cause of IT variations on a wide range of spatial and temporal scales. At the same time GDC will observe how these fundamental drivers cause significant impact on IT and redistribution of mass, momentum, and energy. In addition, GDC will provide the first ever view of the full range of spatiotemporal scales of the IT variability, from meso-scale all the way to the global scale. The GDC mission *plays a vital role in the future of the CEDAR science* as it provides observations critically needed for major advances in geospace research.

The unprecedented comprehensive data set from GDC will revolutionize our transition from scientific research in space weather to future predictive tools and operational models. The IT system occupies a crucial region where space weather impacts our technological society. The lack of critically important data hinders our scientific understanding of space weather causes and consequences in the IT system, our ability to predict these consequences, and our assessment and future development of space weather models.

The GDC mission, currently scheduled for launch by the end of this decade, represents a dramatic improvement in the observational coverage needed to *advance our understanding of space physics and the science of space weather*, and to *drive critically needed validation of our operational models* as well as to *form the basis for next-generation models of space weather* in the IT system. GDC's database represents a *two-orders-of-magnitude increase* in volume and systematic coverage compared to previous missions. GDC's unique multipoint measurement scheme, which will sample the space environment at twelve local times around the globe every ninety minutes, is a tremendous leap in our ability to observe and understand what is happening in the IT system, and to track the causes and consequences that drive space weather.

GDC will additionally serve as a *pathfinder* for future operational missions. Uniquely, GDC's constellation is designed to evolve over time, allowing us to assess the relative utility of a range of measurement configurations in improving space weather predictive capability. GDC's comprehensive instrument suite will also provide measurements of all the critical parameters of both neutrals and plasma and allow us to optimize the system architecture for future observational missions to routinely provide characterization of IT dynamics.

Finally, GDC's *real-time space weather data stream*, transmitted to operational agencies at low latency, will allow us to *dramatically improve our nowcasting capability* of the current operational products. These data will also be directly assimilable into next-generation operational models, providing real-time and improving forecasts of the IT space weather environment that are important for communication, navigation, and satellite systems.

In short, the CEDAR research community is very excited about the GDC mission as a critical source of space physics data. We are looking forward to leveraging available CEDAR research infrastructure to maximize the value and impact of GDC's science and real-time space weather for the Nation.

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