

It has also been proposed that the waves that accelerate and heat the solar wind may be generated by magnetic reconnection events in this region. A host of new observational sources of the solar atmosphere (including high resolution and high cadence photospheric vector magnetograms) are coming on line, which promise to promote real progress in the predictive qualities of these LWS coronal and heliospheric models. To realize this progress, we need to understand the implications of these new observations for the structure and dynamic behavior of the intervening chromosphere and transition region. Therefore we invite proposals with the goal of improving our ability to model this critical region with the explicit long-term goal of improving the predictive capabilities of coronal and heliospheric models, and the ionospheric/thermospheric models which depend upon solar UV emissions.

Goals and Measures of Success

The measures of success for this topic are the impact of the science advances made by the team in improving the predictive capabilities of our current models.

Types of Investigations

This group will include theoreticians, numerical modelers, and observers. Proposals which address this topic should use high resolution magnetograms directly or couple with other team models which do so. Examples of investigations which are encouraged include:

- Determine improved boundary conditions at the inner boundary of coronal models;
- Through modeling, provide a physical interpretation of UV data and images; or
- Increase understanding of the source of chromospherically generated waves which heat and accelerate the solar wind.

b. Focused science topics for Strategic Goal 2 (Sun-Climate): Solar Modulation of the galactic cosmic rays and the production of cosmogenic isotope archives of long-term solar activity, used to interpret past climate changes.

Target Description:

This topic addresses the physical processes that relate variations in solar radiative output to the variable flux of cosmic rays that produce cosmogenic isotopes. Cosmogenic isotopes (^{14}C and ^{10}Be) archived in tree-rings and ice-cores, respectively, provide unique information about levels of solar activity over many thousands of years prior to the early seventeenth century, when sunspot observations commenced. Correlations of many paleoclimate variables (e.g., ^{18}O indicators of temperature or precipitation) with the cosmogenic isotopes suggest that climate has been responding to solar forcing throughout the Holocene. Even though cosmogenic isotopes vary in response to the flux of galactic cosmic rays at Earth, and thus to modulation of the heliosphere by open magnetic flux, the correlations are typically attributed to variations in solar radiative output, which arise from changes in the closed magnetic flux that produces features in the solar atmosphere such as sunspots and faculae.

Needed for reliable interpretation of paleo Sun-climate relationships is a physics-based understanding of the relationship between radiative output and cosmogenic isotopes that takes into account the quite different processes within the entire Sun-Earth system that produce their variations.

Goals and Measures of Success:

The goal is to identify and characterize the respective solar-driven processes that simultaneously, but by distinctly different processes, modulate both solar radiative output and heliospheric structure, composition and hence the flux of galactic cosmic rays. A measure of success is a quantitative relationship between time series of solar radiative output and cosmogenic isotopes, on multiple time scales. Other measures of success include improved specification of cosmic ray transport/ attenuation in the heliosphere, and/or deposition/transport in the Earth's atmosphere as functions of solar activity.

Types of investigations:

Relevant investigations include empirical and model investigations of the organization of solar magnetic fields into closed and open flux, as a result of transport by solar differential rotation, diffusion and meridional flow. Quantitative determinations of the solar-driven heliospheric modulation of galactic cosmic rays by transport, attenuation and interactive processes are also relevant, as are investigations of other physical processes within the Sun-Earth system needed to quantitatively relate electromagnetic radiation and cosmogenic isotopes. Studies of the deposition and transport of the cosmic ray fluxes in the Earth's atmosphere are also solicited.

c. Focused science topics for Strategic Goal 3 (Near Earth Radiation): Toward combined models of acceleration, loss and transport of energetic electrons and protons in the magnetosphere

Target description:

Radiation belt electrons and protons create a hazardous environment for spacecraft operating in Earth orbit. In recent years we have significantly advanced our understanding of loss, source and transport mechanisms operating in the magnetosphere. A global understanding of the influence of the plasmasphere, plasmaspheric plumes, magnetopause location, ULF and VLF plasmawaves, and ring current particles and electric and magnetic fields is required for prediction of the dynamics of the radiation belts. Two complementary modeling approaches are used in radiation particle studies – Global MHD and particle transport. It is necessary and now possible to combine studies of various magnetospheric processes that populate the ring current, electron and proton radiation belts and to identify the important missing ingredients of both physics and measurements. This includes the critical transition region in the near-Earth (6-12R_E) magnetotail. This research is timely for preparation of the Radiation Belt Storm Probes (RBSP) and would leverage the complementary GEM focus group on “Space Radiation Climatology” and “Near-Earth magnetosphere: plasma, fields, and coupling.” As an