1. This document contains community input received, and lists additional focused science topics that were discussed in the TR&T SC panel.

1.1 Additional Focus Science Topics

- Develop the capability to simulate transients on global heliospheric scales to understand and predict the short and long-term variability of GCRs
- Investigate persistent, significant modifications of the middle and low latitude thermosphere/ionosphere system during the recovery phase of intense geomagnetic storms
- Given a solar energetic particle event, predict the distribution of these particles throughout the magnetosphere
- Quantify the relative importance of different fundamental processes responsible for electron acceleration in the inner magnetosphere
- Determine the flows in the solar interior, and their effect on flux transport mechanisms and on predicting the solar cycle.
- Investigate the processes (and associated uncertainties) by which ice-core records of various kinds indicate past variations in solar activity distinctly from conditions in geospace and the Earth's climate
- Quantify the differences between the solar irradiance at times of minima in the solar cycle and extended periods of low solar activity such as the Maunder and Spoerer Minima
- Through verification and validation, investigate the reliability and specify the warning times provided by energetic particle precursors and solar wind/IMF models for predictions of hazardous solar wind disturbances

1.2 Letter to the Community

On behalf of the NASA LWS TR&T Steering Committee (TSC) I would like to invite recommendations for 2006 focused science topics.

Since the TR&T program, and LWS as a whole, are required to produce science with a demonstrable impact on society, the TR&T is a directed program with well-conceived "targets" that are defined and updated on a regular and systematic basis. The TSC is in the process of selecting the most important and timely scientific targets for the 2006 ROSES competition. At the end of the process the TSC will recommend about 10 focused science topics to the LWS Program Scientist, who will select approximately 5 or 6 for the 2006 ROSES.

The TSC has compiled a preliminary list of suggested focused science topics and it is seeking feedback and additional suggestions from the space physics community. Please send your sour suggestions and comments to Tamas Gombosi, Chair of the LWS TR&T Steering Committee (tamas@umich.edu). If you suggest an additional focused science topics, please include a short title, a one paragraph description, and a sentence about the expected expertise of the focus group members.

The preliminary list of suggested focused science topics is the following:

1. Determine the flows in the solar interior, and their effect on flux transport mechanisms and on predicting the solar cycle.

Anticipated team: people working on measuring large scale flows, e.g. meridional flows, determining effective diffusivities for flux transport models, developing capability for modeling flux transport globally in 3D.

2. Predict the emergence of solar active region flux and the resulting effects on the global structure of the solar corona and solar wind.

Anticipated team: helioseismologists, solar interior MHD modelers, solar coronal and heliospheric modelers, and experts on data assimilation.

3. Understand the role of dynamic coronal and heliospheric magnetic field structure in accelerating and releasing energetic particles.

Anticipated team: global magnetic field theorists, particle acceleration experts, coronal observers, in-situ measurement experts.

4. Determine the conditions leading to eruptive flares and fast CME onset.

Anticipated team: vector magnetogram experts, coronal and chromospheric observers, coronal modelers, experts on in-situ observations of ICMEs

5. Determine the mechanisms through which solar forcing affects regional and global climate, making use of existing climatological data, atmospheric models and known variations in the total and spectral radiative outputs of the Sun.

Anticipated team: solar physicists, atmospheric chemists, global circulation and climate modelers, and physical oceanographers.

6. Investigate the reliability of ice-core records of nitrate deposition as indicators of extreme solar energetic particle events, the mechanisms by which these are generated and deposited, and the application of these data as proxy indicators of past solar activity and conditions in geospace.

Anticipated team: glaciologists; atmospheric physicists, and chemists, and solar physicists.

7. Quantify the differences between the expected solar irradiance at times of minima in the solar cycle and at times of extended Grand Maxima.

Anticipated team: solar dynamo modelers and solar physicists involved in the study of solar variability and solar irradiance.

8. Understand how flares accelerate particles near the Sun (I.e., through shocks and/or reconnection) and how they contribute to large SEP events.

Anticipated team: solar and in-situ observers and modelers to test flare acceleration mechanisms and their contributions to SEPs

9. Understand the production and evolution of suprathermal seed populations as an intrinsic part of evolving space plasmas.

Anticipated team: in-situ solar wind and suprathermal observers and modelers to investigate how evolving seed populations (including composition) are linked to the solar wind and fed into acceleration at embedded shocks.

10. Investigate the reliability and specify the warning times provided by energetic particle precursors for predictions of hazardous solar wind disturbances.

Anticipated team: solar observers specifying when disturbances are released, in-situ observers predicting arrival times based on precursors, and magnetospheric observers to determine geo-effectiveness. Energetic particle models are used to understand the underlying physics behind precursor success and reliability.

11. Develop the capability to simulate space weather on global heliospheric scales to understand and predict the short and long-term variability of GCRs.

Anticipated team: in-situ observers and modelers to understand the physics behind GCR modulation on various temporal scales.

12. Quantify the relative importance of different fundamental processes responsible for electron acceleration in the inner magnetosphere.

Anticipated team: solar wind observers, energetic particle observers and modelers, turbulence modelers, global MHD modelers, hybrid and kinetic modelers, data analysis experts.

13. Determine the location of magnetic reconnection and the rate of energy transfer from the solar wind into the magnetosphere/ionosphere system as a function of solar wind conditions.

Anticipated team: experts on magnetopause processes, ionospheric convection, local plasma and global image data, MHD/hybrid/kinetic modelers.

14. Determine the relative abundance of solar wind and ionospheric plasma throughout the inner and outer magnetosphere.

Anticipated team: experts on magnetopause processes, ionospheric convection, local plasma and global image data, MHD/hybrid/kinetic modelers.

15. Given a solar energetic particle event, predict the distribution of these particles throughout the magnetosphere. How do the different energies and species penetrate throughout the magnetosphere?

Anticipated team: solar wind observers, energetic particle observers and modelers, global MHD modelers, hybrid and kinetic modelers, data analysis experts.

16. Investigate the mechanisms leading to large electron density gradients at mid and low latitudes in response to geomagnetic disturbances.

Anticipated team: satellite and ground-based observers, modelers including coupled model developers (thermosphere-ionosphere-plasmasphere-magnetosphere).

17. Investigate the long-term impact of storm-time enhanced high-latitude energy deposition on the thermosphere and ionosphere.

Anticipated team: satellite and ground-based observers, data assimilation experts, and first-principle coupled thermosphere-ionosphere modelers.

18. Investigate mid- and low latitude auroras and their aeronomical effects.

Anticipated team: people with multi-satellite data sets (radiation belt, ionosphere), ground-based observers, theorists and modelers.

19. Investigate the effects of lower atmosphere forcing on the electrodynamics and the formation of irregularities in the quiet time ionosphere and thermosphere.

Anticipated team: satellite and ground-based observers, coupled lower-upper atmospheric modelers, and modelers of plasma instabilities.

20. Extreme Solar Events: Impact on Space Environment, Space Weather.

Anticipated team: global MHD modelers, data analysts, SEP theorists and observers, theorists.

21. Understand the strong storm-time response of the magnetosphere-ionosphere coupling at high latitudes.

Anticipated team: global MHD modelers, observers, and theorists to understand and test modes of the magnetosphere1s strong storm-time response to large solar wind drivers.

22. Feedback loop of Magnetosphere-Ionosphere-Magnetosphere Coupling.

Anticipated team: modelers of the MI system, modelers of the subsequent ionospheric response. Provide observations of the ionosphere and magnetosphere during intense storms when this feedback is most pronounced (probably soon after storm commencement).

Please send me your feedback by December 16, 2005.

Tamas Gombosi

Chair, NASA LWS TR&T Steering Committee

1.3 Community Response

Dear Tamas

I suggest a focused science topic for the 2006 meeting as below:

"Role of IMF in the prediction of Geomagnetic storms"

Anticipated team: Researchers working on space weather, solar wind, magnetopshere, geomagnetic fields and the simulation of interactive solar terrestrial processes.

Dear Dr. Gambosi:

Following your article in the SolarNews (Dec 2, 2005), please consider the following focused topic amongst your 2006 LWS TR&T FOCUSED SCIENCE TOPICS.

Coupled chromospheric and coronal eruptive phenomena related to sequential chromospheric brightenings (SCBs).

A new class of large-scale solar chromospheric eruptive activity,sequential chromospheric brightenings (SCBs), have been reported by Balasubramaniam et al. 2005, ApJ 630, 1160.

SCBs are chromospheric network points (outside of active regions) that sequentially brighten over a narrow path of chromospheric network points. SCBs appear as single or multiple trains of brightenings, the underlying magnetic poles of each train having the same (negative or positive) polarity. SCBs are associated with the following phenomena: Solar flares, filament eruptions, CMEs, disappearing transeqatorial loops, Moreton waves, and EIT blast waves.

Since that initial work on SCBs we have furthered our understanding of them by both, a statistical survey of these events, as well as a detailed understanding of individual events. SCBs and filament eruptions occur in tandem, every time, while their association with CMEs is 71% of the time, from this limited survey of about 3-year data. When associated with CMEs, SCBs occur well in advance about 30 minutes prior. Our understanding of SCBs was primarily revealed by the USAF/NSO ISOON Chromospheric H-alpha full-disk chromospheric data, coupled with data from SOHO/LASCO, SOHO/MDI, GOES and TRACE missions. ISOON provides unpreceedented and consistent, 1-minute cadence, chromospheric full-disk data with a spectral band-pass of 0.1 Angstroms, with a pixelation of 1.1 arcseconds.

Should you be at the AGU next week, and are interested, we have two more posters on them:

(1). 1340 SH13A-0282 MCC Level 1 Case Study of A Sequential Chromospheric Brightening (SCB) Associated with May 6, 2005 event. K S Balasubramaniam, A A Pevtsov, R A Hock

(2). 1340 SH13A-0281 MCC Level 1 ISOON H-alpha Survey of Sequential Chromospheric Brightenings R Hock, K S Balasubramaniam, A A Pevtsov

Given the potential for SCBs to be statistical precursors of CMEs, and its implication for space weather, I ask that it be a focused sub-topic under your item 4 "Determine the conditions leading to eruptive flares and fast CME onset."

The expected expertise of such a focus group to explore these events are chromospheric and coronal observational astronomers, vector magnetography experts and MHD modelers.

Dear Tamas,

Thank you for the opportunity to input recommendations for 2006 LWS TR&T Focused Science Topics and other feedback and additional suggestions from the community. Let me begin by briefly stating my experience with LWS and NASA funding in general. I have been fortunate to have received continuous NASA funding as a PI since my very first proposal submitted in 1992, and I am currently PI on both a Sun-Solar System Connections SR&T as well as a LWS TR&T project which started earlier this year. On the other side of things, I have served on approximately half a dozen NASA SR&T, GI, or LWS review panels, and have returned numerous write-in proposal reviews each year during this time.

Rather than make specific suggestions for focused topics, I'd like to take this opportunity to express a more general, but serious concern on the detrimental impact to the peer-review system which the use of these focused topics seems to be having. In short, it is my opinion that the imposition of strict and sizable funding quotas to the focused topics results in the selection of highly ranked and highly relevant proposals being unnecessarily declined. This unfortunate result is a direct consequence of proposals being submitted to the more oversubscribed and competitive categories available to those topics not covered by the focused areas. It is important to remember LWS proposals, even more so than previous SR&T and GI proposals, are judged on both scientific merit and relevance to specific science goals and NASA missions. The use of funding quotas frequently thwarts the review panels own recommendations for funding LWS-relevant and critical science and therefore weakens the peer-review system which forms the basis for science funding.

I believe that the community, through representative members such yourselves, can and should help to identify critical and timely research topics for NASA and other agencies to aid their funding decisions. I would like to make it clear that I see considerable merit in the identification of focused areas. These focused topics can provide a flexible and timely augmentation of a base set of science and mission goals as identified in the AO, to be used by the panel and outside reviewers to judge the relevance of a proposal to NASA missions. However, these missions, including SDO (the flagship LWS mission), will require a considerable range of data analysis, theory and modeling efforts to fully maximize their utility to the community. A selection and funding mechanism in which all submitted proposals receive an equal opportunity to be ranked on scientific merit and relevance side-by-side without arbitrary funding quotas would thus optimally serve the community and the NASA missions, as well as preserve the foundations of the peer-review system.

I'd like to thank you and the other members of the Steering Committee for the time you have all devoted to serving the community in this regard.

Dear Tamas,

In the 22 LWS topics solar energetic particle events are very well covered, but it is important to not leave out the physical mechanisms that are ultimately responsible for the solar cycle and the solar activity phenomena. In my opinion, #4 and #2 are extremely important and should not be dropped. #5 and #7 are also important and could be merged in one single topic.

Dear Tamas,

Here's a suggestion regarding the notice you just sent out re: "2006 LWS TR&T Focused Science Topics":

Title: Validation/Verification of Various Heliospheric Models.

Heliospheric model validations with identical/similar, physically-representative, initialization conditions to mimic mutually-chosen solar events. Verification, again with the different model comparisons, of solar wind plasma and IMF correlation coefficients and timing of specific structure arrivals (e.g., shock metrics) at one or more in situ spacecraft locations.

Anticipated team: published global solar wind modelers, solar wind/IMF forecasters, and computational experts.

Note that a "demonstrable impact on society with well-conceived 'targets' [i.e., correlation coefficients, prediction efficiencies, and metrics] that are defined and updated on a regular and systematic basis" is very much outlined above. Your consideration is appreciated.

Hi Tamas,

This is in response to your request for input. I am very interested on those dealing with the solar irradiance focus areas, that is #5 and #7.

My interest is especially on #5 and I work on studying the solar physics mechanisms that cause spectral irradiance changes. I am also very interested on the mechanisms by which the spectral irradiance affects the Earth's atmosphere.

However, I am also very interested in the mechanisms by which the Sun produces its particle output that affects the magnetosphere but I find too specific descriptions of the solar corona and solar interior processes that sound to me as people bias on their research and not a true research topic. My interest is in prominences, what they are, their eruptions and relationship with the chromospheric and coronal plasma around as well as with the photospheric plasma. I believe this is very relevant to understanding, observing, and predicting the solar output that affects the Earth, other planets, and eventually space travel. Some will say this is not covered by the too detailed topics you listed so far, but I would say it is essential to several of them. Many of the topics in your list are important on the observed phenomena, but not just a few cover all important things.

This brings the issue of a ton of very specific and detailed items and I don't think the areas should be so narrow in an AO since this would mean they just point to few individuals. I understand that many such small groups want to be covered but they should not drive the AO to just cover them. An AO should narrow down things from the top main goals and be general enough that various points of view in regard to relevance to those goals are covered, so that there is a good chance of making progress towards the goals.

Sorry if it sounds complicated but I see too many too detailed topics that seem to be individual theories rather than topics.

Tamas,

Since LWS is directed towards science with a demonstrable impact on society, at least some of the 2006 targeted-research topics should address problem areas where the demonstrable impact should involve real and immediate problems.

My comments on the current list of suggestions (as a ground-based M-I observer) is that many of the suggested areas have a solar-physics flavor, and seem to address general-knowledge topics. Writing up those in a way to focus on their societal-applications aspects would be in keeping with the LWS directives.

Topic #16. Investigate the mechanisms leading to large electron density gradients at mid and low latitudes in response to geomagnetic disturbances, is aimed at a real and immediate need of the FAA WAAS system, and is highly appropriate for inclusion in the 2006 ROSES list.

Topic #19 introduces the important issue of lower-atmosphere forcing, but could be broadened to include both quiet and disturbed conditions. Thermospheric effects and pre-conditioning may well impact the growth and severity of storms.

An additional topic would be determining the role of ionospheric ions (thermal ions) on the development of storms. [redistribution of the ionosphere and plasmasphere and the appearance/injection of these ions into the magnetotail during storms can influence sotrm development and perhaps severity.]

I'll look forward to seeing the 2006 list - thanks for the chance to comment.

Dear Tamas

Here's my input on the selection of 2006 LWS TR&T Focused Topics.

I think that we are entering an era where helioseismology can play an important role in the understanding and prediction of space weather. I am currently aware of three lines of investigation that have great potential to provide predictors of activity, or the equally important lack of activity. These are holographic imaging of solar farside activity; time-distance observations of subsurface active regions before they are visible on the surface; and ring-diagram analysis of flows with strong vorticity below strongly flaring active regions. All of these areas have demonstrated strong correlations with surface activity, but all need further work in the area of statstical significance, false alarm proabability and determination of danger thresholds.

I thus urge that you consider the following choices of topics for the TR&T process:

1. Determine the flows in the solar interior, and their effect on flux transport mechanisms and on predicting the solar cycle.

Anticipated team: people working on measuring large scale flows, e.g. meridional flows, determining effective diffusivities for flux transport models, developing capability for modeling flux transport globally in 3D.

2. Predict the emergence of solar active region flux and the resulting effects on the global structure of the solar corona and solar wind.

Anticipated team: helioseismologists, solar interior MHD modelers, solar coronal and heliospheric modelers, and experts on data assimilation.

4. Determine the conditions leading to eruptive flares and fast CME onset.

Anticipated team: vector magnetogram experts, coronal and chromospheric observers, coronal modelers, experts on in-situ observations of ICMEs.

Note that Topics 1 and 4 as currently outlined do not include helioseismologists as anticipated team members, but there may well be helioseismoligists submitting proposals for these topics.

Let me know if you want any more input. Thanks for serving the community in this capacity!

Dear Tamas,

I would like to vote for topic 5 (Determine the mechanisms through which solar forcing affects regional and global climate). This topic was left out of the last LWS target list and should be included this time. It has a significant impact on our understanding of long-term climate change and is therefore of basic interest to society.

Dear Dr. Gombosi,

I am writing to suggest the following ideas for the Focused Science Topic. I hope that you'll find this thrust of relevance and value to the frontiers of solar-terrestrial physics.

Focused Science Topic:

Data Assimilation from the Photosphere through the Corona

Anticipated Team: MHD Modelers; Tomographic Modelers; Observers with experience with EUV/X-ray imagers, White-Light Corongraphs and Vector Magnetographs

With unprecedented observational capability coming on-line in the next decade, the time has come for an empirically-driven model of the solar atmosphere from the photosphere through the corona. The goal of this Focused Science Topic is to create a time-dependent global model of this region that is consistent with all ground-based and space-based observations as well as MHD theory. This class of models will make use of multi-spacecraft EUV, X-ray and white-light corona observations as well as full-disk vector magnetograms. While the latest tomographic and computational electromagnetics methods can use these data sets to specify the 3D distributions of density, temperature and (nonlinear, force-free) magnetic fields, they must be merged with a MHD computation engine to determine velocities and resolve dynamics on time-scales relevant to many space weather events.

Dear Dr. Gombosi,

Just a quick note on your message in the SPA Newsletter. First of all, congrats on getting community input into the system. Well done.

My quick read is that there are a good number of excellent topics in space plasma physics, with solar and B-merging being perhaps a bit too dominant. Since the number of actual space weather effects that occur below ~1000 km exceeds those above (where, of course, most of the drivers are), there might be some consideration of more ionosphere-thermosphere-mesosphere studies. Some ITM examples might be:

*** The local time dependence of thermospheric winds driven by auroral heating is perhaps the most poorly understood dynamical effect during large geomagnetic storms. (relevance: ionospheric storms and thermospheric drag).

*** "Coupling from Below" is the noise of pure solar-terrestrial-coupling, but upper atmospheric variability (for radio communications and satellite drag) from sources below the thermosphere during the course of a month compares with that from solar-magnetospheric sources.

*** The intrusion of equatorial ionosphere processes into midlatitudes competes with auroral to midlatitude coupling, but the extent and "matching point (probably near L = 1.3-2.0)" are poorly known (relevance ionospheric storms and plasma structuring).

Dear Tamas

I am writing in response to your message in the recent issue of the SPD Solar Mail regarding the list of proposed Focused Science Topics for the coming year's LWS TR&T Program.

I wish to strongly support both Topic Number 1 and Topic Number 2 from your list in Solar Mail

I was extremely unhappy to learn that helioseismology had been completely excluded from the list of Focused Science Topics in the LWS Amendment to the 2005 ROSES. This complete absence of any helioseismic topics meant that my 2005 LWS renewal proposal had to be submitted to the Independent Investigations component of this year's competition, which restricts that renewal proposal to competition for only 15 per cent of the total funding that will be available for this year's proposals.

I fully understand that members of the 2005 LWS TR&T Steering Committee felt that helioseismology had received far too much funding with the selection of the HMI for SDO and that this was a way of "leveling the playing field" for their interests in Solar Physics, but changing the rules after existing LWS grants were funded and projects initiated which could logically be expected to last longer than a single three-year funding cycle does not appear to me to allow for judicious continuation of existing LWS research programs. This just does not seem to be either a fair or an effective way to facilitate continuity in the U.S. scientific base. Once again, I am writing to encourage the 2006 LWS TR&T Steering Committee to include both Focused Science Topics 1 and 2 in this year's LWS Amendment to the ROSES 2006. Both of those suggested Topics are superbly stated and they are both essential to our improvement in our overall ability of forecasting solar activity in the future. It is not sufficient to have an LWS Program which effectively begins at one or two radii above the solar surface.

Thank you for soliciting discussion of the suggested Focused Science Topics prior to your Committee's deliberations. I appreciate the openness which you email announcement suggests and I thank you for this opportunity to bring the potential consequences to my research group of last year's Topic selection to your attention.

Dear Tamas,

Here's some quick feedback concerning topics relating to the ionosphere/thermosphere. I would prioritize the draft list of topics as follows, with the top priority coming first in my list.

19. Investigate the effects of lower atmosphere forcing on the electrodynamics and the formation of irregularities in the quiet time ionosphere and thermosphere.

Anticipated team: satellite and ground-based observers, coupled lower-upper atmospheric modelers, and modelers of plasma instabilities.

16. Investigate the mechanisms leading to large electron density gradients at mid and low latitudes in response to geomagnetic disturbances.

Anticipated team: satellite and ground-based observers, modelers including coupled model developers (thermosphere-ionosphere-plasmasphere-magnetosphere).

21. Understand the strong storm-time response of the magnetosphere-ionosphere coupling at high latitudes.

Anticipated team: global MHD modelers, observers, and theorists to understand and test modes of the magnetosphere1s strong storm-time response to large solar wind drivers.

17. Investigate the long-term impact of storm-time enhanced high-latitude energy deposition on the thermosphere and ionosphere.

Anticipated team: satellite and ground-based observers, data assimilation experts, and first-principle coupled thermosphere-ionosphere modelers.

22. Feedback loop of Magnetosphere-Ionosphere-Magnetosphere Coupling.

Anticipated team: modelers of the MI system, modelers of the subsequent ionospheric response. Provide observations of the ionosphere and magnetosphere during intense storms when this feedback is most pronounced (probably soon after storm commencement).

18. Investigate mid- and low latitude auroras and their aeronomical effects.

Anticipated team: people with multi-satellite data sets (radiation belt, ionosphere), ground-based observers, theorists and modelers.

Dear Tamas,

In preparing for the next-generation of solar space-weather instrumentation (Solar-B, STEREO, SDO) and their science goals, I have identified two major stumbling blocks that I feel deserve special attention from the TR&T program.

1) Develop methods to routinely measure magnetic free energy in active regions. Among the highest priorities in the study of the explosive and eruptive drivers of space weather is the determination of the available energy for the event. The measurement of that quantity is ideally based on vector-magnetic measurements combined with coronal field models. The measurements are subject to significant uncertainties, they are usually made below the force-free domain, models cannot at present incorporate coronal observations to guide or validate the model process, and the codes require far too much computational resources or expert intervention to be useful for the research community at large and for the user community in particular. A concerted effort should be started to develop a measurement tool that can be applied routinely so that the research can focus on using the free energy rather than on determining what it is.

Focus group members: MHD and NLFF field modelers, vector magnetography experts, coronal observers and modelers.

2) Improve the readiness of X-ray/EUV spectral codes to aid in spectral irradiance modeling. Spectral irradiance in the X-ray and EUV domain is measured by a variety of instruments with incomplete coverage in time and wavelength domain. Ideally, a subset of spectroscopic signatures can be used to compute the full spectral irradiance, but that requires appropriate, validated spectroscopic models. Problems that we currently face include uncertainties in ionization and excitation balances, in line strengths, in abundances, and even in the significant incompleteness of line lists. A joint effort of spectroscopists and user groups should be able to significantly reduce the current uncertainties that may exceed a factor of two even for broad-band signals.

Focus group members: laboratory and astrophysical spectroscopists, members of instrument teams, ionospheric/thermospheric modelers

Dear Tamas,

I have read with interest your preliminary list of 22 focused science topics for the LWS work.

They look fairly comprehensive to me. However, I would like to draw one point to your attention:

Items 4 and 8 you are treating separately. Howver, it is my opinion that energetic particles (and by that I include all non-thermal particles, not just the relativistic ones) are a crucial ingredient to the eruption of big flares and fast CMEs. They are NOT simply the by-product of either the flare or the CME, although both may contribute to the acceleration of the particles we observe at 1 AU. Thus I would suggest that you consider either merging 4 and 8, or adding an additional topic to reflect the point I make above; eg "Non-thermal particle production prior to CME and major flare eruption."

It is not appropriate to draw such a neat separation between the flare and CME eruptions on the one hand, and energetic particle acceleration on the other.....although the MHD theorists who are attacking the eruptive problems would certainly not want to have to start considering non thermal particles! However, sooner or later the community will "have to bite the bullet".

Dear Tamas,

I was encouraged by Chris St. Cyr to send you my input for the next TR&T AO items, even if it is after the deadline.

Independently from what we talked about at AGU, I think that research on the following topic would enhance sun-climate studies:

"Improvement of the total solar irradiance composite - independent analysis of the 3-decade long total irradiance data".

Justification:

The most important environmental problems facing humanity today is to understand and predict global change (both natural and man-induced) as well as the rapid changes in our space environment. The critical issue is: What are the relative impacts of natural and anthropogenic influences on changes in the Earth's atmosphere?

The main problem is that the time period of interest far exceeds the lifespan of any single total irradiance monitoring experiment, thus composite irradiance time series must be compiled from data of several irradiance experiments.

The largest obstacle to compile such a composite is the 2-year gap between the ACRIM I and ACRIM II experiments. Currently three composites have been compiled. While the ACRIM composite (Willson) and the IRBM composite (Dewitte and Crommelynck) use the Nimbus-7/ERB data as published by the original teams, the PMOD composite (Frohlich) use the significantly modified Nimbus-7/ERB data as well as the ERBS data to bridge the gap between the ACRIM I and II experiments. We note that the PMOD composite is also calibrated with models of total irradiance developed from the Photometric sunspot index and the Mg c/w ratio using multiple regression models.

The ACRIM composite shows about an 0.04% increase of TSI between the minima of cycle 21 and cycle 22 (similar to the IRBM composite), the PMOD composite shows no difference between the minimum and maximum levels of TSI over the last three decades. To clarify the existence of a secular trend in TSI is important for climate studies, especially because of the results are different depending on what composites are used in climate models.

The situation is further complicated since at the declining portion of cycle 23, TSI has already reached the level of the last minimum while other indices (sunspot number, CaK, Mg c/w ratio) are still not in their minimum. This new result (presented by Pap and Floyd at the AGU 2005 Fall meeting, paper in preparation) also indicates that the currently used proxies (He line equivalent width at 1083 nm and the Mg c/w) cannot account for the measured changes in total irradiance during cycle 23.

Research to do:

To reprocess the TSI data, especially the Nimbus-7/ERB data and the ERBS data and apply a tool to each data which is based on the same principle. We note that the Nimbus-7/ERB data have been processed by Doug Hoyt, but in that process changes in the beta angle, among other things were not taken into account. The ERBS data are principally not processed, those are engineering data adjusted to 1 AU.

Therefore, a careful analysis of various data sets, starting with the raw data is necessary to rule out the existence of any secular trends in the 3 decade long TSI data. The apparent differences between various indices used as TSI proxies and measured TSI data also show that proxy models should not be used when creating a composite. This effort would require collaborative research between the various teams, i.e, ACRIM, Nimbus, ERBS. Calls for such an effort had been already made at various science meetings (SORCE, AGU and Solar Variability meeting at Rome).

Related to this topic, it would be very essential to develop an effort to document instrument performances and data analysis processes of the various experiments in peer-reviewed journals. A careful and independent assesment of the various TSI data and their composites would provide very important information to colleagues in the climate community.

Dear Tamas,

In polling the steering committee of the COSPAR session on the Radiation Environment of the Inner Heliosphere for topics for invited speakers, the top three topics (out of 9 suggestions) were the following:

- Long term variations in solar particle activity
- Forecasting SPE event onset/evolutions
- Improved radiation environment models.

Obviously the long-term variations involve the ice core work.

I would suggest the following changes to your list of anticipated team: solar-terrestrial physicists, solar physicists, auroral physicists, atmospheric physicists, and chemists.

In the list of suggested topics you circulated, I did not see anything directly related to solar proton event forecasting. The AF is still using a program developed 30 years ago; the NOAA program is not quite as old. They both have about the same level of confidence although the way they are used and their output makes direct comparison different. There are other methods out there, but nothing that has been implemented in an operational mode or even tested with a large amount of historical data which makes me suspicious of what is available (and the usefulness of those newer methods). It may be that there is really nothing that can predict what NASA would need (with a minimal false alarm rate). This is a tall order as you know.

I am also advocating one more item for consideration, and this is the solar proton prediction problem that seems to have been stagmented with respect to research advances over the past ten years. There is a lot of "hype" about MHD models "doing everything"; however, I have not seen anything better than what was done ten-fifteen years ago.

Dear Tamas and Lika,

Please consider the attached Focused Science Topic for the upcoming LWS TR&T solicitation. Several people/groups are working on this general problem, and I feel progress would benefit greatly if there were more coordination. It's also a very timely topic in light of the upcoming missions, especially SDO and Solar-B, since the new data will be highly applicable.

Solar Origins of Soft X-ray and EUV Radiation

Target Description: The variable soft X-ray and EUV radiation from the Sun plays a dominant role in controlling the thermodynamics, chemistry, and ionization state of the terrestrial upper atmosphere. As such, it has major space weather impacts on radio signal propagation and satellite drag, and affects communication, navigation, surveillance, and collision avoidance of space assets with space debris. Progress in nowcasting and forecasting the solar spectrum depends critically on our ability to construct realistic, physics-based models of the corona. Coronal heating is a crucial ingredient of these models, since (1) it is the source of the radiation energy and (2) its detailed properties determine the spectrum of the radiation and therefore where in the terrestrial atmosphere the energy is absorbed. Focused Science Topics A and B in the ROSS-2004 solicitation dealt with the response of the terrestrial atmosphere to solar radiative forcing. This new topic completes the Sun-Earth connection by addressing the solar origins of the driver radiation.

Goals and Measures of Success: The goals of this Focused Science Topic are to understand how the X-ray and EUV spectrum from the Sun is produced and, in particular, to understand coronal heating as the fundamental cause of the radiation. The prime measure of success for this work would be a substantial improvement in our ability to reproduce multi-spectral observations of active regions and the global corona using physics-based models.

Types of Investigations: It is expected that the focus team will include, but certainly not be limited to, the following types of investigations:

1. Theoretical modeling of active regions and the global corona that is based on either a parameterized

description of coronal heating or a first-principles treatment.

2. Theoretical or observational investigations of the dependence of coronal heating on key physical parameters, such as magnetic topology, field strength, loop length, and photospheric velocity patterns.

3. Observational or theoretical studies of the relationship between active region evolution and changes in the radiation spectrum.

Dave and Tamas,

I'm not a fan of the topic disappearing and reappearing, especially if it's on a 3 year cadence--I could get stuck forever out of synch with a good topic.

I should be more clear about my suggestion: there should be a few new topics each year and a few carry-overs from the previous year, with a topic given a lifespan not to exceed 3 years (or, maybe 4 at the outside). There would presumably be up to 3 times as many focused science topics active at any one time as there are now.

A simpler solution might be to allow the "independent investigations" part to include focused science topics from the previous 2 years, and to call these out in the AO. Perhaps something like this, "Those wishing to propose toward a focused science topic from the previous two AOs may do so under the independent investigations line. However, if selected, such proposals will be attached to the corresponding focused science team."

The current system assumes that either (1) all scientists will respond to the AO, even those who are in the middle of a grant from a previous year, or (2) it doesn't matter which scientists work the focused topics, NASA will get equally good results regardless. I don't think either alternative is true.