PRediction Of Geospace Radiation Environment and Solar wind parameterS 637302

1st Project Review Meeting
January 12-13, 2016

University of Sheffield, Sheffield, UK

Minutes

Attachments

Presentation of V. Yatsenko.

Attendees

Andreij Rozkov (project officer, REA, Belgium), Zerefsan Kaymaz (external reviewer, ITU Istanbul, Turkey), Robertus von Fay-Siebenburgen (coordinator USD), Simon Walker (project manager USD), Michael Balikhin (chair scientific steering committee USD), Richard Boynton (USD), Hua-Liang Wei (USD), Natalia Ganushkina (FMI), Tony Arber (UW), Yuri Shprits (UW), Mike Liemohn (UM), Bart van der Holst (UM), Vitaliy Yatsenko (NASU), Peter Wintoft (IRF), Magnus Wik (IRF), Dave Pitchford (SAB), David Jackson (SAB), Carlos Armeins (EC JRC), Carol Heathcote (PA to M. Balikhin).

Apologies

Volodya Krasnoselskikh (LPC2E), Vitalii Shastun(LPC2E), Eamonn Daley (SAB), Jurgen Volpp (SAB), Didier Mourenas (SAB), Maria Kuznetsova (SAB).

Agenda

The agenda, as previously circulated, was adopted.

Introductions

Robertus von Fay-Siebenburgen, the PROGRESS Coordinator, welcomed everyone to the meeting. Andreij Rozkov, the Project Officer, and Zerefsan Kaymaz, the external reviewer, introduced themselves to the project after which the project members introduced themselves.

Although Volodya Krasnoselskikh (LPC2E) could not attend the meeting in person he managed to participate via Skype.

Work Package Reports

WP 1: Management - Simon Walker

The current status of the project and compliance to the schedule were presented. Two discrepancies with the schedule (risk situations) were noted (see later). The current management structure of the project was shown, highlighting the change of Project Officer, together with the composition of the Scientific Steering Committee and Stakeholder Advisory Board (SAB). Since the last meeting a new member of the SAB, Eamonn Daly (ESA/ESTEC) has been recruited. The project meetings that have taken place during the 1st Reporting Period have followed the schedule outlined in the DoA.

It was noted that all deliverables except one had been submitted as defined in the schedule. All deliverables are available from the EC participant portal or the Project Only section of the web site. Since most deliverables are for public access a new page will be added to the web site to allow enable their public dissemination. Those deliverables which include a journal manuscript will be kept private until the paper is accepted for publication.

Two risk situations occurred during the first reporting period, both of which were anticipated within the DoA. The first was the current delay to D3.3 (reasons for this were outlined in the discussion of WP3). The second involves the movement of the participant from SkolTech to the University of Warwick. This resulted in a request from SkolTech to terminate their involvement in the project. An amendment to the DoA for this is currently being prepared. Neither of these situations is expected to delay the overall project schedule.

The procedure to generate the 1st Periodic Report was outlined. The technical section consists of two parts. The first is completed on line whilst the second consists of a narrative outlining the scientific progress toward the project goals and is currently being prepared. The financial section is completed on line.

WP 2: Propagation of the solar wind from the Sun to L1 - Bart van der Holst and Tony Arber

Propagation of the solar wind from the surface of the sun to L1 will be performed using two coupled codes, AWSoM and SWIFT.

AWSoM models the transfer of energy within the solar atmosphere from 1-25 R_{sun} using GONG magneto grams as the input data source. The numerical background to the AWSoM was presented. In order to solve the full 3D model most of the computational resources are required in the region 1-1.15 R_{sun} with an estimated 25,000 cores required for real time operation. It has, however, been possible to reduce this by setting the lower boundary used by AWSoM to 1.15 R_{sun} and to use 1D thread solution to a potential field source surface model between 1-1.15 R_{sun}, resulting in real time operations with only 120 cores. This code has been validated by comparison with observations from Solar Dynamics Orbiter and the Stereo A and B satellites.

Propagation from 25 R_{sun} to L1 will be performed by SWIFT, a new code based on the widely used Lare3D MHD model. The original Lare3D code has been expanded to use either a cartesian, polar, or cylindrical grid to aid testing and validation. The scheme uses a Lagrangian grid which makes it easier to add new physics. Modules of include effects of shock viscosity and a two temperature plasma have been tested against the widely used Odin code and will soon be integrated within the man SWIFT code.

WP 3: Forecast of the evolution of geomagnetic indices - Peter Wintoft

The objectives of WP 3 and tasks performed in the 1st Reporting Period were presented. Two reports, have been successfully delivered. The first provides a summary of currently existing models for the geomagnetic indices Dst, Kp, and AE, together with their limitations. The second describes the creation of a database of parameters that are required by such models.

The third deliverable, D3.3, will report on the evaluation and verification of s subset of the

models reported in D3.1. There was a short discussion on the best evaluate and verify the models as well as the choice of events to use for this process. However, due to local institutional constraints, the work for this deliverable has not been carried out (the original delivery date was September 2015). This has meant that fewer resources than were expected have been used during the 1st Reporting Period. These resources will now be used to complete the task and deliver the expected report in early 2016. The Project Officer stressed the importance of submitting a report and also mentioned that the report may be updated later during the project if needed. It is not expected that this long delay will have a detrimental effect on the the rest of this WP and the Project as a whole.

WP 4: Statistical wave models and quasi-linear diffusion coefficients - Michael Balikhin, Yuri Shprits

The objective of WP 4 is to generate a new set of statistical wave models that take into account variations in the solar wind and the history of the Earth's geomagnetic environment. These wave models are used to create sets of diffusion tenses that characterise the interaction between plasma waves and particles such as electrons. Using software developed at LPC2E the distribution of occurrence of the Chorus, Hiss, and Equatorial Magnetosonic waves were determined. This distribution was used to determine a set of grid cells, each containing of the order or 1000 data points, that will form the basis of the spatio-temporal modelling activity using the Error Reduction Ratio (ERR) analysis method. The wave data sets used in this analysis were compiled into a se of databases, based on observation satellite, and wave mode. Only Cluster and THEMIS datasets can be used since that have been cross calibrated. Other potential data sets to use include those from the satellites Polar, CRRES, Akebono, and Dynamics Explorer. However, these data sets currently lack the cross calibration and so are not directly comparable.

The results of the ERR analysis show which of the input parameters are best correlated with the wave amplitudes and also the lag time of the measurements. The low value for the sum of the contributions of all parameters in the analysis indicates that there is no causal relation ship

between the wave amplitude and solar wind parameters.

A comparison of the various loss processes has been carried out, resulting in a set of new models to describe these processes. These model results show significant changes to the distribution of low energy electrons, and so have been implemented within IMPTAM, the low energy electron model used within PROGRESS.

WP 5: Low energy electron models - Natalia Ganushkina and Yuri Shprits

WP 5 models the low energy ($<$ 200 keV) electrons within the radiation belts. These are important as they lead to the surface charging of satellites. They also play a key role in the generation of Chorus waves. IMPTAM, the model used within PROGRESS, currently runs on-line in real time (imp tam.fmi.fi). Inputs used include solar wind parameters and IMF from the ACE satellite, Kp and Dst from WDC Kyoto, and Kyoto AE index (data not public) and the results are compared with the geostationary GOES 13 MAGED electron measurements.

A new model for the IMPTAM boundary conditions has been produced. Originally this saws based on the Tsygenenko and Mukai model for particle temperatures which assumes a ratio $T_e/T_i \sim 0.2$. However, analysis of THEMIS data has shown new results in this area and resulted in a set of more realistic boundary condition models for use as inputs to IMPTAM.

The VERB high energy electron flux model has been extended to include lower energy electrons. This extension has meant adding new physics modules to the code as wells modifying the computational grid in oder to capture the dynamics of these particles. Model results are verified using measurements from the Van Allen Probes, NOAA POSE, and IMPTAM.

WP 6: Forecast of the radiation belt environment - Richard Boynton and Yuri Shprits

The NARMAX ERR methodology used in WP 6 and 4 was explained in detail. A set of models for the daily averaged fluxes of electrons at energies in the range 30-500keV were created to

complement those at higher energies that have been running successfully wind 2012. The results of these models were presented. It was pointed out that the models perform best for high energy electrons (800keV and 2Mev) since at these energies the electrons take two or more days to build up whilst at lower energies the fluxes may significantly change in a few hours.

An on the fly comparison of the PROGRESS predictions with those given by the SPACECAST showed that the PROGRESS results were much closer to the measured data values.

It was pointed out that these models are quick to run, typically about 5 minutes including all the transfer of ACE and GOES input data sets and so realtime implementation is possible.

A quick overview of VERB (Versatile Electron Radiation Belt) model, a numerical simulation model was presented. The use of data assimilation techniques within such codes has the potential of vastly improving their accuracy. Examples were shown of the improvements that data assimilation enables, including a re-evaluation of a magnetic storm in March 1991 to confirm the existence of a fourth radiation belt during this period.

WP 7: Fusion of forecast tools - Simon Walker

It was noted that this WP was scheduled to begin in month 18 (June 2016).

WP 8: Dissemination - Simon Walker

The main dissemination paths of the project were outlined. It was pointed out that these mainly target a scientific audience and more efforts should be made to increase the number of public dissemination activities.

Currently, the project has 7 papers published in peer reviewed journals, PDF's of which are available from the project web site, and links to the journal publishers should be added.

There are 37 conference presentations with inputs from PROGRESS related personnel listed in

the web site. It was pointed out that the presentations should also be included on the web site as evidence of the dissemination activities.

A list of conferences attended by project personnel was given. The Project Officer reminded participants that permission from the EC should be sought to attend conferences outside the EU that are not mentioned in the DoA.

A brief overview of the project web site was given. Statistics of usage should be kept.

Summary of Project Officer/External Reviewer

Zerefsan Kaymaz and Andreij Rozkov then gave the project their impressions on the Project's achievements as well as a list of points that the project should address in future.

It was mentioned that PROGRESS was a strong, timely project with a strong team of scientists behind it. There appears to be no negative items. In particular, the following points were raised:-

- During the meeting there was no presentation from the beneficiary NASU. A report will be attached to the minutes.
- The deliverable D3.3 (due in M9) is delayed to deliver by the responsible partner INSTITUTET FOR RYMDFYSIK because as it was explained INSTITUTET FOR RYMDFYSIK had to devote their manpower to another project that was in a critical phase. This explanation cannot be accepted by PO as the reason not to fulfil the contractual obligations in PROGRESS project. The coordinator explained that the delay will not generate the snow-ball delay in the implementation of the work in the 2nd period. It was agreed that deliverable should be submitted in "Draft" version at the moment, and as "Final" by the end of February (end of 60 days after reporting period).
- For travel outside the EU that was not foreseen in the proposal the Project Officer has

to be informed. Permission for this travel will usually be granted provided there are no ethical issues involved.

- Any travel funded by PROGRESS should be associated with some form of 'material output' as evidence that it occurred. Examples of material output include conference presentations, meeting minutes, etc. All conference presentation have to include an acknowledgement to PROGRESS. A suggestion for such an acknowledgement may be found on the project web site.

- Collaborations with other, currently funded EU space weather related projects is strongly encouraged, for example FLARECAST.

- There should be monthly project related telecons to keep the various teams better informed regarding the project status. There should be a telecom with the Project Officer every six months, initiated by the Project team.

- Commercial aspects of the Project should be be given greater visibility, and should be clearly outlined in the minutes of the SAB meetings.

- For dissemination items there should be more quantitative indicators included. Such items should include the type and size of audience addressed, or the circulation of meeting minutes.

- The financial submissions for the 1st Periodic report should be completed by the end of February.

- Technical issues, based on the report of the external reviewer, will be made available to the Project within one month of the review meeting.