



PRediction Of Geospace Radiation Environment and Solar wind parameterS 637302

2nd Project Review Meeting
January 09-11, 2017

GFZ, Potsdam, Germany

Minutes



Attendees

Andrej Rozkov (Project Officer, REA), Simon Walker (project manager USD), Michael Balikhin (chair scientific steering committee USD), Richard Boynton (USD), Tony Arber (UW), Keith Bennett (UW), Yuri Shprits (GFZ), Mike Liemohn (UM), Vitaliy Yatsenko (NASU), Peter Wintoft (IRF), Volodya Krasnoselskikh (CNRS/LPC2E), Stepan Dubyagin (FMI), Maria Kuznetsova (SAB).

Via Skype

Zerefsan Kaymaz (external reviewer, ITU Istanbul, Turkey), Natalia Ganushkina (FMI), Vitalii Shastun (CNRS/LPC2E).

Apologies

David Jackson (SAB) Jurgen Volpp (SAB), Didier Mourenas (SAB), Robrtus von Fay-Siebenburgen (USD).

Agenda

The agenda, as previously circulated, was adopted.

Introductions

Michael Balikhin, the PROGRESS Coordinator, welcomed everyone to the meeting. Andrej Rozkov, the Project Officer, and Zerefsan Kaymaz, the external reviewer, introduced themselves to the project after which the project members introduced themselves.



Work Package Reports

General Project Overview - Simon Walker

The current status of the project and compliance to the schedule were presented. During the second reporting period

- There were no deviations from the workplan
- No ethical issues were identified
- No IPR issue were raised. It was pointed out that in the final year the Project Team needed to consider the commercialisation of products from PROGRESS. It was suggested that the Project provide a business plan that outlines the products and how they may be used both in academic circles and by industry. This should be added to the current Exploitation and Dissemination Plan (deliverable D8.2).
 - At NASA/CCMC all models are offered open source. There are rules in place for both developers and users. Models are not disclosed to users.
 - UW attaches a GPL license to the code it has generated (SWIFT).
 - A roadmap should be put in place for the demonstration of products to end users from industry and academia.
- The use of resources has not changed from that specified in the Grant Agreement.
 - UW procured a large , multiprocessor workstation for the continued development/testing of their AWESoM/SWIFT model.
 - Approval was sought from the Project Officer to attend conferences and workshops not listed in the GA.
- Deliverables
 - All deliverables have been submitted on time according to the schedule in the GA.



- Following the first Review Meeting a number of deliverables required updates. These changes were made and reports resubmitted according to the schedule set by the Project Officer and External Reviewer.
- It was pointed out that deliverable D5.3 was due in month 26 whilst the task associated with it ends on month 30. It is proposed to modify the delivery date via the current ongoing amendment.
- The current schedule for Project Milestones has been met to some degree.

MS1 100% Results available on web

MS2 60% Model results available on web

MS3 90% Models are available on request

MS5 100% Models are available on request

- Dissemination
 - There have been 9 papers published in high impact, peer reviewed journals, with a further 4 accepted, and one currently under review. Total number of project publications 22. They are listed on the Project web site.
 - There were 25 oral/poster presentations at scientific conferences, bringing the total to 55.
 - Participants were reminded to acknowledge funding from the Commission as this provides some justification for costs claimed.
 - PROGRESS will organise a summer school to present its results to young scientists. This will probably be a joint venture with another H2020 project FLARCAST. Andrej also pointed out that we may also consider 2 other Commission funded projects, HELCATS and F-CHROMA as other partners.
- Risks



- The participant from Skolkovo Institute of Science and Technoogy moved to GFZ.

This triggered two amendments.

- * Termination of Skolkovo Institute of Science and Technoogy - Completed.
- * New beneficiary GFZ - Ongoing.
- * Changes to the submission dats of some deliverables are required to match the tasks.
- * The activity of GFZ should be extended to cover the rest of the project rather than terminating in M30.

- This situation has not interupted the work schedule.

- Feedback

- Following the first review meeting feedback was received from our external reviewer. All points raised were answered. Deliverables were updates baed on the Reviewers comments.
- No specific points were received from the members of the Stakeholder committee who were present at the meeting. Comments raised were answered in minutes of Stakeholder meeting.

- Work package highlights were presented.

WP 2: Propagation of the solar wind from the Sun to L1 - Tony Arber

A summary of the work performed in the last year were presented. It is now possible to run AWESoM in real time. Results of the AWESoM analysis of GONG magnetograms were further analysed using the spectral code CHIANTI to yield solar images that are comparable with those from SDO. The steady state results from the PROGRESS AWESoM/SWIFT model were shown to be comparable with measurements at L1. The time dependent results currently do not show as good a correlation with measurements. It was suggested that this may be simply due to an input error since the steady state results are reasonable.



Currently NASA/CCMC runs the WSA-ENLIL coupled model. Questions were posed regarding the operation of the standard version of WSA. The team were informed that WSA uses solar magnetograms as input and does not include any feedback from measurements at L1.

The current version of AWESoM/SWIFT imports hourly magnetograms. SWMF (NASA) uses continuous magnetograms created by smoothing consecutive inputs. This may help to smooth model outputs.

The 'poor' quality of parameters at L1 should be compared with output from the WSA-ENLIL model.

It was mentioned that the Project should aim for a closer integration between WP 2 and the other WP. Once the WP 2 model produces acceptable results a list of requirements will be drawn up to define what parameters are required by the other WP and the format for data transfer. The first results should be expected some time in April.

It was suggested that the project team write a review paper to describe the aims and objectives of PROGRESS.

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

The objectives of WP 3 and tasks performed in the 2nd Reporting Period were presented.

IRF has setup a REST data server to provide access to real-time measurements of the solar wind parameters.

Models for the geomagnetic indices Kp and Dst were developed and by participants at IRF, USFD, and SRI. The results of these models formed the basis for deliverable D3.4. Examples of the output from Kp models were presented. There are four Kp models from USFD, with forecast horizons on 3, 6, 12, and 24 hours. These models can forecast the occurrence of moderate storms but with a delayed onset. Larger storms may be missed due to the lack of statistics. Models from



IRF show a good correlation with measurements, often identifying the onset precisely. Since the model output is unconstrained, values greater than 9 may appear.

New IRF models for Dst show improved forecasts in comparison with earlier models, especially for larger values.

The development of models for AE are ongoing and will be reported later in the project. The normal time resolution of the AE index is 1 minute. It is impossible to forecast this time resolution based on measurements at L1 due to difficulties in the propagation of solar wind parameters from L1 to the magnetopause. Forecasting should therefore target onsets of AE activity. An alternate scheme, based on pattern recognition may be a possible alternative to neural network modeling.

The results of models from SRI were presented at the meeting. However, they do not appear in the deliverable. The external reviewer commented on this, saying that this beneficiary appeared disconnected from the project as a whole. There is a greater need for SRI to integrate their results with those of the rest of the project.

WP 4: Statistical wave models and quasi-linear diffusion coefficients - Volodya Krasnoselskikh

The calculation of a new set of statistical wave models for the modes chorus, equatorial magnetosonic, and hiss is based on earlier tasks within WP4 to identify the parameters that are most influential to the amplitude of the wave emissions. Using the two most influential parameters the wave amplitude, together with the location of observation has been used to model the variation of wave amplitude as a function of the two input solar wind/geomagnetic index parameters. The large errors probably result from the fact that the ERR analysis used to identify the input parameters could only explain a small fraction of the total variance of the input signals. The complete set of results may be found in D4.4 and the models are currently available on request.



WP 5: Low energy electron models - Stepan Dubyagin, Natalia Ganushkina

The loss of electrons from the radiation belts is an important process that needs to be quantified in order to improve modeling results of the radiation belt electron fluxes. To improve the IMPTAM model, values of the electron lifetimes, currently used within VERB, have been incorporated into IMPTAM. These values modify the electron loss rate due to chorus emissions output and hiss inside the plasmapause. These new values update those currently used based on results from Chen (2005) that over simplify the problem. The new values, derived from the results of Orlova and Shprits (2014) and Orlova et al., (2014, 2016), enable IMPTAM to more accurately reproduce storm time fluxes at geostationalry orbit and compare well with measurement from Van Allen Probes.

WP 6: Forecast of the radiation belt environment - Simon Walker and Yuri Shprits

The current status of the VERB-NRMAX coupled model was presented. This model uses electron fluxes from the Sheffield NARMAX models that calculate the electron flux at GEO (L=6.6) as the basis of an estimate of the boundary electron flux at L*=7 that is one of the input parameters required by the VERB model. The second input parameter required by VERB is Kp. This parameter is now retrieved from GFZ Potsdam, the institute that computes the official Kp values. Forecasts of Kp are currently taken from the Wing model at NOAA. This will eventually be replaced by values resulting from models produced as part of PROGRESS WP3. Initial results for a large geomagnetic storm were presented and look quite favourable. The model is currently being tested and validated.

The VERB code has been extended to include data assimilation. This helps to constrain the output from VERB, enabling more realistic forecasts of the high energy electron flux populations. These VERB results were compared with measurements from the Van Allen Probes MagEIS (relativistic energies) and REPT (ultra-relativistic energies) instruments. While MagEIS data



were reproduced well, there were still problems replicating the REPT data sets. Following the analysis of one particular geomagnetic storm it was possible to analyse relativistic and ultra-relativistic particles separately. Results showed that particle loss as a result of the interaction with EMIC waves was an important process that had so far been overlooked. The inclusion of EMIC waves enabled VERB to reproduce both the MagEIS and REPT data sets. This work resulted in a publication in the prestigious journal Nature Communications. As a result, this work received much media coverage.

WP 7: Fusion of forecast tools - Simon Walker

WP 7 began in June 2016 and is aimed at merging the results of the various scientific work packages to form a coherent view and forecast of the radiation belt electron fluxes. The first results from PROGRESS have already been added to the PROGRESS web site. These results include

- Forecasts of the Kp and Dst geomagnetic indices from IRF (WP 3).
- Forecasts of electron fluxes at geostationary orbit generated by the Sheffield NARMAX models (WP 6)
- A comparison of IMPTAM low energy flux predictions for GEO with measurements from the GOES 13 satellite.
- A comparison of VERB high energy electron flux predictions with measurements from the Van Allen Probes MagEIS and GOES electron sensors.

Other current developments include access to the statistical wave models generated in WP 4, and a panel showing current values of Kp, Dst, and various solar wind parameters.



Summary of Project Officer/External Reviewer

Zerefsan Kaymaz and Andreij Rozkov then gave the project their impressions on the Project's achievements. Overall, they reported that everything seemed fine with the Project. However, the following points need to be addressed.

- None of the deliverable contained results from the partners at SRI. As a result, the role of SRI within the Project is unclear. The role of SRI needs to be more prominent.
- The Exploitation and Dissemination plan (deliverable 8.2) should include an overview of a business plan for the Project, outlining the transfer of results and models to external users from both commercial and academic communities.
- The Project needs to expand its dissemination activities beyond the academic community to include potential Stakeholders and also the public.
- The current amendment should be retracted and expanded to include the change of deliverable dates and to extend the participation of GFZ further than month 30.
- Stakeholder feedback should be sought for WP 7 to ensure that the products resulting from PROGRESS meet the demand of potential users.
- The Project Officer wished to be kept informed regarding the organisation of the summer school.

Within the next month the project should receive detailed reports from the external reviewer and project officer. The date of the final Review Meeting should be set as soon as possible to enable maximum attendance. It was proposed to have the meeting at the University of Michigan. However, Andrej has since reported that it would be extremely difficult to justify such a visit.