PRediction Of Geospace Radiation Environment and Solar wind parameterS

Work Package 1
Management

Deliverable 1.1
Minutes of the First Stakeholder Meeting

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1.0	2016-02-10	SNW	Initial draft

Contents

Summary

As part of its management structure project, PROGRESS has set up a Stakeholder Advisory Board (SAB) to oversee the project activities from an industrial/commercial perspective. The SAB is tasked to provide feedback to the project as to how PROGRESS may tailor its activities to provide assets that could be employed within the fields of satellite manufacturing and operations that will lead to an enhancement in the operational planning/provision of services and also the forecast of the Space Weather environment.

This deliverable provides a summary of the proceedings of the 1^{st} meeting between the SAB and the project, and outlines areas that PROGRESS can actively fulfil.

1 Introduction

This document forms Deliverable D1.1 of the Horizon 2020 funded project PROGRESS.

In order to obtain commercially/industrially related feedback on its activities the project PROGRESS set up a Stakeholder Advisory Board (SAB). The SAB is tasked to provide feedback to the project as to how PROGRESS may tailor its activities to provide assets that could be employed within the fields of satellite manufacturing and operations that will lead to an enhancement in the operational planning/provision of services and also the forecast of the Space Weather environment.

The initial composition of the SAB, as described at the project Kick-off Meeting (held in Brussels, 2015-01-12) was as follows:

- Project Coordinator/Manager
- Dave Pitchford - SES
- David Jackson - UK Met Office
- Maria Kuznetsova - NASA Coordinated Community Modeling Centre
- Jeurgen Volpp - ESA European Space Operations Centre
- Didier Mourenas - CEA

Dave Pitchford was appointed as Chair of the SAB.

Within the lifetime of the project it was foreseen that new members would be invited to join the SAB. During the first year we were able to add Eamonn Daly (ESA European Space Technology Centre) to this list of members.

The first official meeting of the SAB took place in Sheffield on 2016-01-13 in conjunction with the project 1^{st} Review Meeting, and 2^{nd} Project Meeting. The minutes of this meeting form Deliverable D1.1 and are appended to this document.

2 Conclusions

From the discussions during the meeting it emerged that PROGRESS can provide several products of use to members on the SAB in their commercial roles. These are detailed in the minutes of the meeting.

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1st Stakeholder Advisory Board
January 13, 2016

University of Sheffield, Sheffield, UK

Minutes

Attendees

Andreij Rozkov (project officer, REA, Belgium), Zerefsan Kaymaz (external reviewer, ITU Istanbul, Turkey), Simon Walker (project manager USFD), Michael Balikhin (chair scientific steering committee USFD), Richard Boynton (USFD), Hua-Liang Wei (USFD), 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).

Apologies

Eamonn Daley (SAB), Jurgen Volpp (SAB), Didier Mourenas (SAB), Maria Kuznetsova (SAB).

Agenda

The agenda, as previously circulated, was adopted.

Summary of Meeting

The two members of the Stakeholder Advisory Board present at the meeting introduced themselves and gave a brief overview of their roles within their respective organisations.

Dave Pitchford

Dave works for SES, a satellite operations company based in Luxembourg dealing primarily with communications satellites situated at Geosynchronous orbit. The company is also responsible for the build and launch phases for new satellites.

The current trend for orbital insertion is to use plasma thrusters as opposed to chemical rockets. This change means that satellites may take ∼200 days to reach orbit rather than ∼10 days with rocket motors which results in the satellite spending considerable longer crossing the radiation belts before reaching their desired orbit. The fluxes of electrons within the radiation belts, and hence the radiation dose experienced by a satellite, are usually estimated from AE-8, an average model for the radiation belt electron fluxes. Results from AE-8 are also used by satellite manufacturers to define the radiation tolerances of satellite components and subsystems. Typical radiation specifications for a satellite manufacture may be ∼25 times the AE-8 predictions. However, it was shown that the actual flux levels may surpass this limit. The electron flux models resulting from PROGRESS should provide an improved method for estimating the radiation belt electron environment.

A second issue related to satellite operation is that of charging. Two types of charging occur,

surface charging due to large fluxes of lower energy electrons, and internal charging caused by fluxes of high energy particles and resulting in electrostatic discharges within the satellite body. Internal electrostatic discharges have been linked with the occurrence higher than normal electron fluxes related to high speed streams in the solar wind and typically seen during the declining phase of the solar cycle. The current declination phase has seen high energy fluxes above levels used in the design of satellites, resulting in an increase in the number of operational anomalies observed.

The objectives of PROGRESS include several products that are of interest. These are:-

- An increase in the lead time for solar wind parameter forecasts at L1 (WP 2)
- Accurate forecasts of the geomagnetic indices Kp, Dst, and AE (WP 3) based on outputs from WP 2.
- Accurate models for the forecast of fluxes of high and low energy electrons at GEO (WP 6) based on outputs from WP 2.
- Realistic forecasts of the energetic electron environment throughout the radiation belt region (WP 5, 6 with inputs from WP 4) based on outputs from WP 2, 3, 6.

David Jackson

David Jackson works at the UK Met Office Space Weather Operations Centre (MOSWOC) that oversees the forecasting of space weather hazards. Within the UK, the government has recognised in importance of Space Weather, classifying it as having a moderate impact and medium to high likelihood within the UK National Risk Register. The Met Office Space Weather Operations Centre specialises in the migration of research applications into its operational environment, and runs 24/7 providing alerts and advice to government organisations and others.

The Met Office runs a number of specialised models such as WSA-ENLIL to forecast solar wind conditions, REFM to provide a 3 day forecast of energetic elections at GEO, D-RAP to predict conditions in the D-region, and Bernese/MIDAS for TEC predictions. Their approach

is to implement existing models with the goal of having a system that models from the Sun to the Earth. Currently, however there are gaps within the modelling system, related to the magnetosphere and radiation belts, two of the areas that are focal points within PROGRESS.

As a member of the UK Space Agency led Sol-Terra project (in conjunction with STFC and RHEA) MOSWOC has been instrumental in the definition of requirements for an end to end system for the operational forecasting of space weather hazards.

Within the framework of PROGRESS we will produce:-

- models that accurately characterise the nature of the electron environment within the radiation belt region (WP 5, 6)
- specific models for GEO (WP 6)
- solar wind parameters at L1 (WP 2)

Once the results from these models have been validated and IPR issues regarding the provenance and ownership of these models have been addressed, the Scientific Steering Committee would consider the distribution of models to interested third parties (as addressed in the PROGRESS Grant Agreement)

Eamonn Daly

Although not present, Eamonn Daly (ESA/ESTEC) provided some comments on the proposed work plan of PROGRESS.

- Need to be able to assess the accuracy and reliability of forecasts
- Statistical wave models - what makes the PROGRESS models unique
- Coupling of VERB and NARMAX methodologies - quantification of model performance
- 'Fusion' of forecasts - need to take care of the interfaces early in the project.

All of these points have been taken onboard by the participants of PROGRESS. In particular:-

- a great deal of work is being done to ensure the validity of the results from models from WP 2, 4, 5, 6. WP 3 also includes a specific task to investigate validation and verification methods for models of the evolution of geomagnetic indices
- the PROGRESS statistical wave models are unique in that they also include both input from solar wind parameters and the recent geomagnetic history of the magnetosphere
- in the light of the last comment above for the work related to the fusion of forecasts we are now beginning to discuss the various interfaces and data sharing protocols required by this work package ahead of its official start date.