

Space Weather Roadmaps

21 /11/2014, 16:30 to 18:00, meeting room Reine Elisabeth, Palais des Congrès, Liège, Belgium

Set up of the splinter

The Space Weather roadmaps splinter session was conceived in the way splinter sessions are supposed to be conceived, namely with the strong emphasis on discussion. No presentations were planned. The about 25 participants got the following preliminary information.

“Open discussions on long term plans in international Space Weather (SW) research and operational services. We foresee to address e.g. questions like

What topics in SW research (in theory, models and observations) should be emphasized to get leaps forward in SW services?

How to enhance knowledge exchange between SW service providers and users?

How to attack the problems in data dissemination (data access and standardization issues)?

How to support international coordination to ensure continuity of some key S/C missions and to get new missions?

How to support the research-to-operations transition of SW codes?

The floor will be open for oral presentations (10-15 min) on completed, on-going or planned SW roadmap projects to support the discussions.

Best regards,

Stefaan Poedts and Kirsti Kauristie”

Discussion

The mentioned questions were projected on the big screen and served as a lead for the discussion.

Terry Onsager opened the discussion by remarking that the COSPAR roadmap is a roadmap for science, which is different from a roadmap for operational services. Do we need different roadmaps?

Kirsti Kauristie (KK) replied that indeed, we need different roadmaps for different purposes, because although they are indeed partly overlapping, they are at the same time very different. For example, the L5 missions mentioned in the COSPAR roadmap is overlapping with a services roadmap.

It was remarked that when different roadmaps are being developed, it will be important to show the relationship between the different roadmaps, like the 'science' roadmap of COSPAR LWS, the SWWT roadmap, the SSA Architectural roadmap, the WMO recommendations (which are strictly for observations), etc. We indeed need some international coordination among all these initiatives and, in fact, the roadmaps will evolve with time anyway.

However, Terry Onsager noticed, there is no document saying something like: if you want to improve services in the next 5 years, this is what you need to do.

Kirstie replied that the COSPAR LWS roadmap indeed contains mainly general recommendations, though it also contains some more specific recommendations. Moreover, it also contains priorities. However, these are mainly for missions and science, and thus not for services. How are we to use the resources we have today in the best way, provided we can maintain them?

Alexi Glover mentioned that in SSA there are two approaches. There is first the top-down approach, which has led to the architectural design study, and then there is also the bottom-up approach which is precisely to review what the current capabilities are and what gaps there are and what is needed to fill these gaps. As a matter of fact, the latter was one of the main goals of the SN-1 study. This is associated with the questionnaire that was sent around in which each SW team could list its assets and services. The SWWT has access to this SN-1 data base but cannot use the search engine, but during the SWWT Steering Board meeting last Wednesday, an Action item was put on Alexi Glover to make this possible in the near future.

Masha Kuznetsova remarked that, despite the fact that there are a lot of roadmaps, none of them is world-wide. They are all limited to a continent or even to a single country. This indeed poses quite a challenge. There is some competition involved and also some politics. Stefaan Poedts remarked that, moreover, there is an issue with security: e.g. the USAF and other military forces have developed a lot of assets but do not really feel a need to share them, even though some of these assets would be also very useful for civil purposes. Nevertheless, closer international collaboration is absolutely necessary and models and services need to be compared in detail. Apart from modelling there is also coordination and openness necessary for ground-based and space-based observations. Masha Kuznetsova mentioned that CCMC was from the beginning designed to be international and it is very open and ready to collaborate with everybody that wants to. Stefaan Poedts added that in Europe, the ESA "Virtual Space Weather Modelling Centre (VSWMC) – Phase 1" study and prototype development just finished. The

recommendation given to ESA is also to make the VSWMC in the next Phase not only larger but very open so that modelers can take advantage of it and contribute to it from all over the world.

Enhancing knowledge exchange between SW service providers and users

Terry Onsager remarked that the most important thing is to create a model that produces information that is immediately useful for a user. Stefaan Poedts (SP) replied that indeed, the advanced academic models are funded by science faculties and services is not their main goal. These teams do not even get funding for providing services, they have to develop and advance science. SP used the metaphor of Formula 1 car racing. The advanced scientific models can be seen as the equivalent of the Formula 1 circuit in car industry. The extreme competitive circumstances and the limitations posed on the teams forces them to further develop the technology. But many of these new technologies lead to spin-offs for the civil car industry, like servo steering, turbo motors, four-wheel driving, etc. SP also mentioned that in engineering there is a research domain called "Reduced modeling" which is trying to reduce the complexity and resolve redundancies of large-scale dynamical systems, while preserving the overall system behavior. Such techniques are required in order to prepare the complex scientific models for using them in services and predictions.

SP remarked that during the EU FP-7 program there were a lot of projects that developed SW assets and models. But these were mostly separate efforts. What we really need is coordination, someone or some instance with a vision and a global plan. The individual projects should be steered and all contribute small or larger pieces of the bigger puzzle. Without such a global view and without coordination, the money spent on the projects and the efforts delivered are not lasting very long because after the project is finished and the funding source dried up, the assets are becoming outdated very soon and become useless. This way, nothing is lasting for longer than 3-4 years.

It was remarked that this bigger picture is precisely what the roadmap should provide. SP agreed but remarked that the EU is supposed to take this up and to follow it up, i.e. coordinate the calls and projects to develop some long(er) lasting infrastructure.

Topics in SW research

Kirsti Kauristie remarked that one big problem is the magnetic structure of a ICME, which was mentioned as very needed in the COSPAR roadmap. Then one has to ask what is needed for solving this puzzle and the roadmap mentions e.g. the L5 mission. But again, this road then has to be followed with some consistency...

Another question, that has been addressed in the WMO, is how many magnetometers we need and where they should be placed. This should be studied and quantified with our models and once the results are known, one can prioritize where the data is needed. This is important given the limited resources. The question how many magnetometers are needed depends also on the end users, on their needs and request. Of course, one cannot put a magnetometer every 200 km. It is remarked that it is necessary to identify where a forecast can 'drive' an action, e.g. switch off an instrument to protect it during an SEP event. In other words, it is necessary to identify where the forecast can make a difference, but this is quite a difficult and complex task. Such efforts have been made, however.

It was remarked that one also needs to quantify the needs, because for instance, in some cases one needs a certain accuracy and if it cannot be delivered, there is no need to bother anyway. So the user community and the service providers need to communicate more to each other. But how to enhance this 'knowledge exchange'? This is the job of the service providers. They need to discuss with their customers. However, these discussions are partly confidential. So maybe the service providers need to communicate more with the modelers and discuss with them the requirements of their users. Daniel Heynderickx remarked that this is what happened to a certain extent in the SPACECAST project where the users were brought into the project from the start, with some success. But there need to be moderators for the discussion because there are communication problems with terminology, for instance. It is a learning process, which leads us to the next topic.

Training and education

Space Weather is mentioned in many programs and there are many summer and winter schools but these are mostly academic. Jesse Andries mentions the SW school for engineers that was organized for the second time this year and was focusing on HF communication, ionospheric transition and GNSS effects. Next year it will be organized again and this time it will focus on GICs.

Masha Kuznetsova mentioned her educational activities at CCMC with summer internships involving students in SW forecasting which is a great experience for them for any career path they will choose later.

Kirsti Kauristie mentioned that an example where training and education is needed is data assimilation. How to infuse data in models in a proper way? Some research groups are already good in that and we can learn from them, and also from colleagues from meteorology. Again some coordination is needed to spread this knowledge. This is a good recommendation for a roadmap, actually, that this effort is needed. There is research on how to do this and this research should be funded.

The discussion came to an end around 17h35.