Notes on the CCMC Workshop International Session

The CCMC workshop session on international collaboration was quite well attended and attracted some excellent talks, which will be posted online. The subsequent discussion was very useful and identified several opportunities for practical collaborations between the participating groups. It was stressed that the objective of further internationalising the CCMC was not to create any kind of bureaucratic new institution, but simply to build on activities which were already going on at grass-roots level, to make them as effective as possible and to encourage more such collaborations, in order to further the aims of the CCMC and its international partners.

Specific ideas were as follows:

CCMC Community Building

Community building in this sense means increasing the number of international institutions working with CCMC and using its models and services, thereby creating a more distributed space weather service community. It is clear that this is already happening to a significant extent. For example, operational space weather services in Korea and Denmark are already using CCMC products along with their own data and several countries would welcome a closer collaboration with CCMC in principle (including UK, South Africa and Russia). Certain organisations have quite well-defined needs - for example, ESA might be interested in using CCMC resources to predict space weather conditions at Venus, to support Venus Express operations. Tools like NASA's Integrated Space Weather Analysis system (ISWA) might be useful as an initial focus, providing a platform which could be improved and extended through collaboration. It was also noted that the models and services used by CCMC were ultimately derived from the science community, so that there was always a key requirement to maintain a close linkage between the international science community, which was developing and testing the models, and the communities that were using them for predictions and operations.

Joint metrics and model validation

For agencies which are developing an operational space weather programme (ESA is an example) there is a clear need to take common international steps toward the verification and validation of models. This is an area in which it is essential to have commonly agreed metrics to be used for model validation, and the development of such metrics is an area in which CCMC and ESA (for example) could work together. ESA's requirement is not so much to find the "best model" (since several models will be offered in parallel) as to have an agreed and quantitative way of understanding how its models perform under specific conditions. This knowledge, in turn, can drive improvements in models.

Common modelling challenges

CCMC had already defined a set of modelling challenges (http://ccmc.gsfc.nasa.gov/challenges) which were intended to be community-wide and thus had clear potential for internationalisation. Collaboration in this area should be encouraged, wherever international partners had appropriate capabilities.

Collaborative model development

Extending from the above, there seemed to be considerable scope for the joint development of new models and tools, including "plug-in patches" which could (for example) supply parameterised inputs to models. The presentation by the Linkoping group showed that excellent work was already underway in the development of common visualisation tools; this was an area where there are many exciting possibilities to be explored.

New models and services

It was clear that there were a number of space weather models and services which were being used in the international community, without yet being linked into the CCMC. Prime examples would be in the ESA remit, not only the set of European models to be used operationally in the forthcoming SSA system, but also those being developed in ESA's Virtual Space Weather Modelling Centre. CCMC had suggested a concept in which such models would continue to be developed and hosted at their originating institutes, but could be made available to the community via the CCMC, to be run via web services. Another possible idea was to explore the potential for linking tmodels from different places together (e.g. using CCMC's Kameleon tool). There certainly seemed to be scope here to be explored for collaboration and the UK, for one, expressed interest to explore a web service mode of operation for its operational GPS TEC model, MIDAS, developed by the University of Bath.

Because some countries and communities would have particular requirements from their space weather services, it would inevitably be the case that certain countries evolved specific value-added products beyond the normal range produced by CCMC. Where this was the case, it might be useful to share such products with the whole international community, as long as they were clearly documented and their provenance was well described.

International data sources

There was clearly great potential to increase the amount of data, both real-time and historic, available to the CCMC, either for assimilation into models or for comparison with model outputs. Likewise, there was potential to increase the dissemination of model outputs for use by the international community. The CCMC Kameleon tool might have an important role to play here - certainly for making the outputs of different models intelligible to a wider international community but also potentially for helping to manage diverse data resources.

Tools like the CCMC DONKI database and the CME scoreboard were recognised to have already established themselves as significant resources for international collaboration and there was scope for them to be used by a still wider community. Creating a larger community of users to submit and compare scoreboard entries and to "feed the DONKI" would potentially have wider benefits e.g. in model validation.

Joint educational activities

Many countries would like to increase their expertise in space weather and already existing initiatives such as the "CCMC Boot Camps" would be good ways to achieve this. One way of doing this would be to encourage wider international participation in the "Boot Camps" which were held in the US. There could also be scope for activities such as "International Boot Camps" in locations other than the US, open to students from around the world. It was suggested that another approach might be for specific countries to take the "Boot Camp" model and apply it in their own national educational context.

Personnel exchanges already seemed to have been very effective in ensuring that experience at CCMC is disseminated and used effectively elsewhere. For example, the experience gained by key personnel during visits to CCMC had played a key role in enabling the establishment of operational space weather services in Denmark and Korea, among others. These exchanges could happen at any level - indeed some of the most important future benefits might be realised from exchanges of students between CCMC and comparable activities elsewhere.

A number of countries had already developed wider educational activities, for example in relation to schools and colleges. Sharing of best practice in this area was recognised to be very valuable, since it would enable more such schemes to be established internationally, potentially widening the pool of future expertise.

Frameworks for co-ordination

There was quite a vigorous discussion about the best way to take CCMC-related collaborations forward. On one hand, there was some feeling that there were already too many different international space weather initiatives and that little would be gained by adding a new one, when what was really needed was a "root and branch" reform of the whole area of international space weather collaboration. Other people thought that this was too ambitious a goal and that there would be a place for an international initiative related to the CCMC, which would be distinctive from, but complementary to, existing initiatives in this area.

It was emphasised that, as stated above, the idea would not be to build a new bureaucratic mechanism for collaboration, but rather to arrange CCMC-related collaborations through the frameworks which already existed. COSPAR could be one possibility through which a collaboration could be organised. Other examples might be the UN International Space Weather Initiative (which had funding at the level of $50k-$100k per annum), the SCOSTEP VARSITI project, which funded visiting scholars, speakers and workshops and had more of a focus on developing countries, or NASA;s International Living With a Star (ILWS) programme. The use of such international fora, beyond CCMC, would also have other benefits - for example collaborating in the framework of international programmes could also help promote collaborations between organisations other than CCMC - for example establishing a tighter co-ordination in Europe, where collaboration could still be improved.

Some of these programmes were already undertaking significant initiatives in international space weather collaboration. For example the ISWI initiative had promoted the Callisto system for detecting radio bursts, which might provide useful information for CCMC speed determination, in

the absence of a coronagraph. Other examples of international initiatives relating to space weather included the UN Committee on the Peaceful Uses of Space and the World Meteorological Organisation's recent attempts to specify an observing network for space weather monitoring. The fact that there were so many different potential fora for collaboration was, in some ways, seen as a problem as well as an opportunity, because it only emphasised how many such international space weather initiatives currently existed and how loosely co-ordinated they were.

One response to the plethora of international initiatives might be to say that none of them was completely appropriate and that it might be better for CCMC to put its own machinery in place to promote international collaboration - .e.g. by establishing a small steering committee and a chair with the responsibility for promoting international CCMC-related collaborations. An advantage of this approach would be to keep the oversight of the international collaborations close to the CCMC project and to ensure that there would be appropriate oversight and accountability of the various activities.

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April 9th 2014