AIACC Project AF07

Progress report : July 2003

Development of Regional Climate Change Scenarios for Sub-Saharan Africa

1. Summary

Meetings in Cape Town and Hartebeespoort dam have gone a long way to emphasizing research priorities for the coming period. The GCM climate change data has been made available and analysed. The results indicate that each GCM suffers from biases that vary in time and space. Further work is required to fully understand the implied uncertainty for future climate projections. Results from RCM experiments suggest that both vegetation and soil moisture play a significant role in modulating the climate over the continent. A 10 year climatology (1985-1995) of MM5 has been completed for southern Africa.

Disk space and backup facilities are a problem at other host institutions in Africa, particularly in Senegal and Zambia. We have had one disk failure in Senegal that may result in the loss of data. The Zimbabwean participant has left his host institute and currently there are no model simulations being undertaken there. Two participants have met in Italy and undertaken collaborative research using RegCM3.

A methodology has been proposed to translate the GCM projections of future climate change into projections useful for impacts researchers. A CD of these ‘guided perturbations’ has been prepared for general release, and a journal article is in press.

All CDs prepared as part of the project are now served over the internet by LAS/DODS servers based in Cape Town, and have also been sent to other Africa project groups. Copies are being sent to AIACC in Washington for further duplication and dissemination.

2. Description of tasks and outputs produced

The main focal points of the last six months have been meetings in Cape Town and Hartebeespoort Dam, South Africa, the development of support material for other groups, continued assessment of GCM products, and development of downscaling through the RCM and empirical techniques. The Cape Town meeting included a PRECIS training workshop with participants from other AIACC projects and institutes, as well as international collaborators (Mark New, Martin Stendel).

Alongside the PRECIS workshop, participants in AF07 met to discuss project activities and results. An evaluation of the GCM data was presented by the project post-doc (Mark Tadross) and the project PI (Bruce Hewitson) presented an analysis of GCM data at space and time scales at which the data is used to force an RCM. It is apparent from these analyses that significant time/space biases exist in all three GCM
datasets. There were also presentations on the effect of desiccating soil moisture in the RCM (Mark New) and an overview of the ECHAM model (Martin Stendel).

The discussions with project participants were fruitful (see attached report for discussions on technical details). In particular it was apparent that the Senegalese participant (Abdoulaye Sarr) had performed multiple runs with MM5, in the process testing a number of configurations and parameterisations. This is the most comprehensive set of runs over west Africa yet achieved in this project. However it was noted that disk space was now very limited and impeding further work, a situation also noted by the Zambian participant (Suman Jain). The Zimbabwean participant (Brad Garanga) regrettfully informed us that the person assigned to running the model in Zimbabwe had left his job and another division at Zimbabwe Meteorological services had appropriated that the computer used for simulations. This means that there are currently no personnel/equipment to perform simulations in Zimbabwe. The Ghanian participant (Joseph Intsiful) is currently finishing his PhD research on testing aspects of the land-surface scheme and its applicability over west Africa. He expressed a preference to continue his research as part of a post-doctoral exchange at the University of Cape Town. The Nigerian participant (Ernest Afiesimama) was unable to make the workshop due to his UNFCCC commitments in Nigeria. However Bill Gutowski met him as part of a RegCM workshop in Italy and he is moving forward with his simulations, though power cuts in Nigeria are a problem. At the same workshop Abdoulaye Sarr and Joseph Intsiful undertook a sensitivity test of the impact of land use change on precipitation/temperature over west Africa using RegCM3.

The meeting in Cape Town was followed by the all-Africa AIACC project meeting at Hartebeespoort Dam, South Africa. This meeting involved discussions on a variety of disciplines and proved very beneficial for the exchange of ideas and knowledge. It was recognized at this meeting that a simple method was required to produce climate change predictions at scales appropriate for impact studies. Bruce Hewitson proposed a solution combining GCM and observed station data that has been accepted for publication. It was also apparent at the meeting that there is a need for an evaluation of GCM biases and how they may affect RCMs nested within the GCM fields. This led to a proposed collaboration with project AF20 that has similar interests and a joint paper is currently in draft.

Since the Africa-wide meeting we have received updated GCM fields for HadCM3. These data were created using an updated version of HadAM3H, with improved physics and parameterisations. The ‘conditional perturbation’ method of applying the GCM climate change data to observations has been applied to the Africa Station data and a CD prepared for dissemination. A Distributed Oceanographic Server (DODS) has been installed to serve data in a similar manner to the LAS server. The Africa Station data CD and DDC GCM data are now served by both LAS/DODS.

The downscaling activities continue, and the initial long term runs with the RCM to establish a baseline model climate has been completed. Baseline climates for the RCM driven by the GCM control runs are being prepared. Empirical downscaling was put on hold while the guided perturbations were prepared for dissemination to other projects. The empirical downscaling methodology is now back on track, and initial downscaled products will be completed shortly.
3. Difficulties encountered and lessons learnt

Internet access still remains a problem for some participants. Perhaps more importantly (though related) is a shortage of disk space and backup facilities. Abdoulaye Sarr has reported a failed disk, the data on which was not backed-up. As mentioned previously this data comprised the most comprehensive experimental runs over west Africa. As yet we do not know if the data has been irrevocably lost. A simple backup (say CD-Writer) would enable key files to be archived.

It has also become apparent that Suman and Abdoulaye, who have performed the most model runs at their host institutions, are short of disk space to archive data. With these two problems in mind we have applied for additional funding to install two large disks (one removable) at all sites. This will increase data capacity and allow one disk to be used to transport data when traveling. In turn this circumvents some of the problems associated with archiving when internet access is restricted. We have also applied for funding for CD-Writers to be installed at each site, to enable the backup of key files.

The above difficulties were anticipated in the last project report.

4. Interaction with national communications under the UNFCCC

5. Tasks to be performed in the next eight-month period

- Continued validation of GCMs and quantification of their errors. This seeks to understand the characteristics of the different GCMs in the context of forcing a regional model with this data, and the implications for uncertainty of the climate projections.
- Development and dissemination of GCM results to other AIACC projects.
- Empirical downscaling of GCM data.
- Long and short term MM5 nested runs in both NCEP and climate change simulations.
- Pursuit of ERA data in the light of ERA/NCEP discrepancies over Africa.
- Visit by Suman Jain to Cape Town.
- Visit by post-doc to west African sites.
- Journal paper submission. A number of pertinent papers are in preparation.

6. Anticipated difficulties in the next eight-month period

- Disk space for most participants.
- Communicating results to the home base in Cape Town for synthesis.
• Backup of data to an external storage device is not currently possible and a disk failure will mean loss of data. In this light it remains to be seen the implications of the disk failure in Senegal.
• Power failures in Nigeria.

7. Draft or final papers or other outputs produced by the project

• EOS paper on guided perturbations, in press - CD distributed
• Discussion paper on downscaling – submitted to BAMS
• Conditional interpolation procedure – submitted to J. Climate.
• GCM evaluation - draft
• RCM baseline climate - draft