

ENVK2-CT1999-00022: Predictability and Variability of Monsoons and the Agricultural and Hydrological Impacts of Climate Change (PROMISE)

Month 30 Report

COORDINATION

WP4000: Development of the PROMISE data archive

A new software system - DODS (Distributed Oceanographic Data System) has been installed and merged with the existing GrADS technology. Tests show the new system to be stable and secure. Two new datasets have been added to the archive using the software: a greenhouse gas experiment and a sulphate aerosol experiment (see <http://o3k.cineca.it:9095/dods>). Output from a regional model simulation of the impact of climate change on the Indian Monsoon will be added soon (**CINECA**).

Staffing problems and major changes in the architecture of the archive have caused difficulties with WP4000. These problems have now been overcome, but unfortunately the delays have affected other areas of the project - particularly WP3100. Nevertheless, we anticipate that the data archive will be fully operational by the end of the project.

WP5000: Collaboration with research institutions in monsoon-affected countries

An 8-page brochure outlining the achievements of PROMISE has been circulated widely amongst the scientific and end-user communities (**UREADMY**). PROMISE research has been presented at a UK-DEFRA (Department of the Environment, Food and Rural Affairs) meeting in China. The planned series of visits to key scientists in the international agricultural research centres of the CGIAR has been completed. The programme of PROMISE-sponsored visits has led to plans for a major collaboration with CIAT in Columbia (**UREADMY/UREADAG**).

WP 6000: Project coordination

The PROMISE web site (<http://ugamp.nerc.ac.uk/promise>) continues to be the main tool for administering and publicizing the project. Plans for the final PROMISE conference are well advanced. Sponsorship from ITCP, START/CLIMAG and WCRP will enable approximately forty delegates from developing countries to attend. Several leading researchers have agreed to give keynote talks. There has been wide interest from both the meteorological and impacts research community in coming to the meeting. Further details are available at: <http://ugamp.nerc.ac.uk/promise/research/conference2003> . (**ICTP/UREADMY**)

RESEARCH

WP1000: Natural variability of monsoon climates

The intraseasonal variability of the West African monsoon has been characterised using statistical techniques. A dynamic scenario has been proposed to explain the observation that the onset of the monsoon is associated with an abrupt shift in the ITCZ (**LMD**).

A novel method of extracting seasonal signals from climate data has been developed using X11 - a type of statistical analysis previously applied to economic data (**UREADMY**).

The CNRM coupled model's simulation of interannual variability in the Indian summer monsoon, equatorial Pacific and the ENSO-monsoon teleconnection has been assessed using the set of statistical procedures shortly to be made available through the PROMISE web site (**CNRM**).

The simulation of the mean monsoon and its interannual variability by a development version of the Met Office model (HadGAM1) has been compared to the standard model (HadAM3). The analysis has raised important questions about ability of atmosphere-only models to simulate the monsoon in situations where ocean-atmosphere feedback is paramount. (**Met Office**)

Overall progress of WP1000 has been satisfactory, although delays in the ERA-40 and the DEMETER projects have caused deviations from the original work plan. No problems with achieving D1001, D1002 and D1003 are foreseen.

WP1100: Seasonal predictability of monsoon climates

The dependence of the Indian summer monsoon on interannual variations in tropical and Indian Ocean SST has been investigated using an AMIP-type simulation of ECHAM4 in the period 1979-1993, time-slice experiments and analysis of observational data (**DMI**).

Progress in this work package has been hampered by delays in the DEMETER project and ERA-40 and staffing changes at DMI. Despite these problems, it is expected that all of the WP1100 deliverables will be achieved.

WP1200: Sensitivity of monsoon variability/predictability to SST forcing

The simulation of the response of East African rainfall to Indian Ocean SST in atmosphere only and coupled GCMs has been investigated using control integrations of ECHAM4 and the SINTEX coupled models (**UREADMY**).

ECHAM4 has also been used to investigate the influence of Atlantic Ocean SST and El Nino on precipitation in Northeast Brazil. (**MPI**).

Analysis of the response of the Asian summer monsoon to the 1994 Indian Ocean dipole in HadGAM1 revealed that, although the local response was realistic, the model failed to reproduce the anomalies in the Asian monsoon (see also WP1000) (**Met Office**)

Staffing changes at the Met Office meant that, as reported earlier, the study of Caribbean rainfall was terminated at the end of year 1. Apart from that, progress on WP1200 has been satisfactory.

WP1300: Impact of land surface processes on tropical climate variability

A sensitivity study using the ARPEGE AGCM has been used to investigate the role of soil moisture in controlling the variability in boreal summer climate (**MF**).

AGCM simulations, forced by SST and vegetation anomalies have been used to study the relative importance of the land-surface and SST in controlling the seasonal cycle in West African rainfall (**UB**).

Integrations of the Met Office unified model using annual mean and seasonally varying leaf area index (LAI) have been used to investigate the response of meteorological fields, such as surface temperature, latent heat flux and precipitation, to LAI (**UREADMY**).

No problems are anticipated in achieving deliverable D1302. The Eurasian snow-depth experiments were to be carried out at ICTP and therefore D1301 probably will not be achieved.

WP2000: Climate change scenarios

A 150-year coupled scenario integration using SRES-B2 forcing has been used to study the evolution of the Asian monsoon (**CNRM**).

Time-slice experiments have been used to investigate extreme precipitation events during the Asian summer monsoon and changes in the hydrological cycle in the Indian region (**DMI**).

Progress on this work page has been satisfactory. It should be noted, however, that the poor simulation of the mean monsoon in many GCMs makes it difficult to reliably predict future monsoon strength. This problem will affect D2001 (Documentation of the impacts of anthropogenic climate change on the characteristics of monsoon climates).

WP2100: Impact of land use changes on future monsoon climates

Time-slice experiments have been used to investigate the combined effects of "realistic" land-cover change and greenhouse warming in Africa (**MF**).

Scenarios for land-use change from 1960-2030 in Central Africa have been collated and adapted for use in MOSES - the land surface scheme of the Hadley Centre GCM (**CEH**).

Man-made and natural irrigation have been incorporated into the LMD hydrological scheme. The parametrization has been found to agree well with observations (**LMD**).

Overall progress in WP2100 has been satisfactory and no problems in achieving the deliverables are anticipated.

WP3000: Ground hydrology and water resources for monsoon climates

The GWAVA model for water resources in West Africa has been developed and tested using observational data. The grid-based modelling is underway (**CEH**).

The irrigation scheme described in WP2100 has been incorporated into ORCHIDEE (the land-surface scheme for the ARPEGE model). (**LMD**).

Despite delays caused by staffing changes at CEH, it is expected that all the WP3000 deliverables will be achieved.

WP3100: Seasonal prediction of crop yields and assessment of climate change impacts on crop productivity

Tests of the large-scale crop model described in previous reports indicate a good agreement with observations, with the best results in areas where the correlation between crop yield and rainfall is high (**UREADMY/UREADAG**).

Calibration and validation of the SARRAH crop model has been completed for millet. A study comparing farmers' criteria for sowing with regional scale meteorological measures of monsoon onset has been carried out in collaboration with LMD (**CIRAD**).

Coupled climate-vegetation simulations of the Met Office AGCM showed that the net primary productivity (NPP) was improved by increased carbon dioxide concentration, but that this effect was counteracted by the radiative impact of greenhouse gas related climate change (**Met Office**).

Although progress in WP3100 has generally been satisfactory, delays in the provision of climate scenarios (see WP4000) and in historical climate and crop yield data at AGRHYMET mean that D3103 may not be fully achieved by the end of the project.