FOR COMPLETION BY WORK PACKAGE LEADERS

6-month progress report

Period: 1 September 2004 to 28 February 2005

WP4.2, prepared by Silvio Gualdi (INGV) on 1 March 2005

Status of milestones and deliverables due in this period:

Number	Date due	Description	Status
none	-	-	-

Forecast status of milestones and deliverables due in next 6 months:

Number	Date due	Description	Forecast Status
none	-	-	-

Summary of achievements this period:

Work has been undertaken by all partners for WP4.2 to be completed on time. To this aim, a preliminary assessment of the influence of the tropical sea-surface temperature (SST) on the extra-tropical, low-frequency variability modes has been performed. Specifically, the effects of the Indian Ocean SST trend on the low-frequency extra-tropical atmospheric variability (decadal variability of both the Northern Hemisphere and Southern Hemisphere annular modes) have been assessed by CERFACS, using AGCM simulations forced with prescribed SSTs. Also, an analysis of the causes of North Pacific and North Atlantic variability and its interaction with the tropical oceans has been initiated by IfM-Kiel, using an existing 2000-year coupled simulation and partially coupled run experiments. Preliminary results indicate some evident effect of the Indian Ocean SST variability on the low-frequency variability over both the extra-tropical northern Pacific and Atlantic.

ICTP has implemented an intermediate-complexity coupled model to investigate the statistical significance of inter-decadal variations and trends in teleconnection between tropical oceans and extra-tropical variability. The model has been set up and tested in two configurations. The first configuration, with full coupling in the Indian Ocean and prescribed SST elsewhere, is being used in ensemble mode to investigate the relationship between ENSO and the Indian Ocean Dipole, and the respective teleconnection patterns. In the second configuration, the coupling domain covers the Indo-Pacific Ocean from 30S to 60N; here, the AGCM may use either the full SST or the SST anomaly generated by the ocean model. Using simulations performed with an atmospheric-only and a fully coupled ocean-atmosphere model, INGV has initiated an analysis of the impact of interactive SSTs on the simulation of the Indian Summer monsoon (ISM) and its variability. The preliminary results indicate that the coupled model produces a more realistic relationship between the ISM activity and the SST anomalies over the tropical Pacific.

Some progress has been made in the study of the factors that influence El Nino in coupled models. Preliminary results from an analysis of El Nino in simulations for

the IPCC FAR performed by the UREADMM have shown that the strength of the seasonal cycle in the coupling between SSTs and surface winds over the tropical Pacific affects the strength of El Nino. The study also suggests that no model captures El Nino very realistically, emphasising the importance of understanding important aspects of modelling El Nino as proposed in RT4. Furthermore, a recent research carried on by UREADMM with a flux-corrected version of HadCM3 has shown that the mean state in the tropical Pacific is important for El Nino. In particular the shape of the Warm Pool and westerly wind activity can significantly affect the amplitude and periodicity of El Nino. INGV has made progress in assessing the effects of the model resolution on the simulation of the El Nino variability. In particular, it has been shown that a number of features of the simulated El Nino are substantially improved when the resolution of the atmospheric component of the coupled model is significantly increased (from T30 to T106). Still, the mechanisms through which this improvement occurs are not fully understood and require further investigation.

The production of a global soil moisture and snow mass climatology over the period 1986-1995 has been initiated in the framework of the Global Soil Wetness Project. This project provides a global 3-hourly atmospheric forcing that is used to drive the ISBA land surface model of CNRM. The resulting land surface climatologies are currently being validated against available observations (in situ measurements of river discharge, satellite measurements of snow cover), before starting the ensembles of seasonal hindcasts with GSWP versus interactive boundary conditions of soil moisture.

CNRM has also analysed the evolution of Arctic sea ice using CNRM's IPCC AR4 data. The results indicate that the modelled depletion of sea ice during the second half of the 20th century is close to observations, in terms of magnitude, but it is also consistent with the recently observed decrease of the amount of multiyear ice. This allowed to carry out preliminary work about the behaviour of the Arctic sea ice cover, and to get insight about how it may be affected by climate change during the 21th century.

The analysis of the effects of the 11-year solar cycle on the atmosphere has been initiated by the MPIMET using simulations performed with the HAMMONIA GCM. This model was already been shown to be successful in simulating the solar variability influence on the mesosphere and thermosphere. Preliminary results show that the model is able to reproduce also the main basic features of the changes observed in the wintertime stratospheric jet, especially in the Northern Hemisphere.

NERSC has started the analysis of the ocean heat uptake in a 300-year control integration performed with the Bergen Climate Model (BCM), focusing on high latitude sinking, subduction at mid latitudes and mixing at low latitudes.

Finally, a proposed design for the coordinated experiments in RT4 has been developed by UREADMM and was discussed at the RT4/RT5 meeting Paris in February. The initial set of experiments will address, in particular, the factors that influence the ratio of land versus ocean warming under climate change. This ratio is very uncertain and affects many of the important impacts of climate change.

Summary of anticipated future problems and solutions (if any):

During 2005, CNRM should perform two ensembles of boreal summer hindcasts, with interactive and GSWP boundary conditions of soil moisture respectively. The timing of these experiments will however depend on CNRM ability to validate the GSWP climatology over the next few months. Beyond 2005, other ensembles of seasonal hindcasts should also focus on the impact of snow mass boundary conditions on the boreal winter and/or spring climate variability.

Access to external computer resources will be needed by ICTP for the production of large ensembles of coupled simulations.

Due to funding problems, MPIMET is not sure about when they can start a series of new simulations with higher resolution of the spectral solar irradiance and with a higher vertical model resolution (necessary for simulating the QBO, which is supposed to be important in the solar response of the stratosphere). A subsequent analysis of the solar influence on modes of climate variability can also not be scheduled, yet.

Any issues to be raised with, or advertised to, other WPs/RTs:

CERFACS raises the problem of the availability of the PCMDI IPCC database to ENSEMBLES members, in order to carry out statistical analyses on a wider range of coupled models simulations.

The boreal summer hindcast experiments performed by CNRM will be coordinated with those that are planned in RT4.4, where the focus will be however on land surface initial conditions rather than boundary conditions.