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## 2.1 Pan-WCRP Monsoon Modelling Workshop Summary

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Ken Sperber  
7<sup>th</sup> CLIVAR AAMP  
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## 2.1 Pan-WCRP Monsoon Modelling Workshop Summary

Ken Sperber led a discussion of the outcome of the Pan-WCRP Monsoon Modelling Workshop that was held at the University of California at Irvine from 15-17 June 2005. At the workshop presentations from key CLIVAR and GEWEX panels were presented to highlight the outstanding problems in modelling the Earth's monsoons. Additionally, presentations from invited experts were given to highlight important aspects of monsoon phenomena and processes, such as low-level jets, air-sea interaction, predictability, observational networks/studies, and model test beds etc. Since all persons attending the CLIVAR AAMP meeting were present for all, or most, of the monsoon workshop, a detailed description of the workshop presentations was not given. Rather, the discussion was focused on the recommendations of the workshop breakout groups and their relevance to CLIVAR AAMP.

CLIVAR AAMP endorsed the near-term workshop recommendation of investigating the diurnal cycle using a hierarchy of models a key way forward for promoting CLIVAR/GEWEX interactions. In GCM studies CLIVAR researchers have identified the diurnal cycle as a forced "mode" of variability that is poorly represented in terms of amplitude and phase, especially in the case of precipitation. Typical phase errors of 6-12 hours are noted over both land and ocean in GCMs. CLIVAR views adequate simulation of the diurnal cycle as key aspect of variability in its own right, but also because of its potential rectification on to subseasonal variability (e.g., the Madden-Julian oscillation). It is hypothesized that improvement of diurnal variability may lead to an improved representation of intraseasonal variability and improved skill of monsoon forecasts on medium-range to seasonal time scales.

GEWEX has extensive experience in fine scale modelling (RCMs and CRMs) and process studies (e.g., GCSS) that demonstrate a realistic representation of the diurnal cycle of precipitation is possible in regional climate models. Such results were presented at the Workshop and in the AAMP presentation of R. Leung. She demonstrated an excellent diurnal signal in an RCM modelling study of East Asia. AAMP members and invited experts noted the importance of correctly simulating the diurnal cycle over the Maritime continent, the Americas, and Africa. The null hypothesis is that increased horizontal resolution in global models may result in a more realistic diurnal cycle of rainfall. However, increased resolution may not be a sufficient condition to properly represent the diurnal cycle of precipitation in global models. There may be shortcomings in GCM parameterizations that have to be rectified to permit a realistic diurnal cycle. The translation of GEWEX GCSS experience in this respect will be crucial for improving global models. (*Note: Mitch Moncrieff gave an excellent presentation at the GEWEX meeting regarding improved diurnal variability in an RCM through the addition of downdrafts in the Betts-Miller convection scheme*). It is also noted that increased resolution may result in the simulation of tropical depressions and mesoscale convective systems that contribute significantly to seasonal mean rainfall over monsoon regions. The role of orographic forcing of rainfall was noted as an important component to be

evaluated. The EOS A-train satellite observations will be essential for validation purposes, but new observational campaigns may be needed in the vicinity of steep orography.

The design of experiments to improve the diurnal cycle should occur in the next 12 months through close cooperation of CLIVAR and GEWEX. The scientific basis for such experimentation (and/or the presentation of preliminary results) should occur as a targeted workshop that occurs in association with a pre-existing WCRP meeting. The prime candidate is the upcoming WCRP meeting on systematic error (I don't see this listed on the 2005 calendar on the WCRP website-when is this scheduled?). Alternative venues include the AMS hurricane/tropical meteorology conference. Alternatively, Prof. Peter Webster offered Georgia Institute of Technology as a venue.

Prof. Satomura noted that he is hosting a session on diurnal variability at the August 2005 IAMAS meeting in Beijing. As such he is suggested as the contact person to spearhead the diurnal cycle investigation across the CLIVAR/GEWEX complex.

K. Sperber was of the opinion that the adequacy of the present observing system was not sufficiently addressed at the monsoon workshop due to the workshops limited duration. For AAMP purposes, the importance of the Indian Ocean buoy system was noted as a key goal. However, the difficulty of establishing sustained observational networks in the ocean and atmosphere was noted as a limiting aspect to future progress. Prof. J. Slingo noted the drastic difference in atmospheric reanalyses over the Asian summer monsoon domain, particularly over the Indian ocean where there has been no observed data to constrain reanalyses, as evidence for an improved observational network. Prof. J. McCreary suggested that as was done for the Indian Ocean, OSSE-type experiments for an improved atmospheric network over southeast Asia may be needed. Dr. H. Cattle noted that the only way forward was to develop an implementation plan and push it through existing channels for endorsement to funding agencies. Prof. J. McCreary noted that the Indian Ocean array will be a great leap forward when completed, though TOGA-COARE type process studies may still be needed to address specific processes (such as intraseasonal oscillation onset) over and above those obtained from routine monitoring.

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