US CLIVAR: SUBSEASONAL VARIABILITY WORKING GROUP PERSPECTUS

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I. Background

A. Motivation

The variability on subseasonal time scales is rich with well known phenomena such as blocking, the Pacific/North American pattern (PNA), Arctic / North Atlantic Oscillation (AO / NAO), and the Madden-Julian Oscillation (MJO). Individually and together, these phenomena have influence on global scales and interact with phenomena at both shorter time scales (e.g., mid-latitude weather, tropical cyclones) as well as longer time scales (e.g., ENSO, monsoons). However in most cases of these phenomena, the important mechanisms involved, their mutual interactions, their predictability, and the ability of current models to simulate them are still in question. Improvements made in predicting these time scales are in many ways an important step in making further progress in weather and climate simulation/prediction. For weather, these time scales offer the hope for extending (at least occasionally) the range of useful forecasts of weather and/or weather statistics, while for the seasonal and longer-term climate prediction problem they are a key component of the atmospheric "noise" that is a limiting factor in the climate prediction problem.

B. Timing

The timing is ideal as well as critical for forming a Subseasonal Working Group (SSWG) now. To begin with there is a substantial base of recent and current activity to build upon. In April of 2002, NASA[1] sponsored a broadly based workshop on the problem of subseasonal (2wk-2mo) prediction. In June of 2003, this was followed up by a second workshop[2], sponsored by the NASA, NSF and NOAA components of US CLIVAR. The latter was focused on issues related to the MJO and tropical-extratropical interactions as they relate to the subseasonal simulation and prediction problem. The tangible outcomes of these meetings included: 1) the development of a recommended framework for a set of multi-year ensembles of subseasonal predictions that can be analyzed in regards to their representations of subseasonal variability, predictability and forecast skill, 2) an assessment of the present status of GCM representations of the MJO and recommendations for future steps for improvement, and 3) an implementation plan for an Experimental MJO Prediction Program. The occurrence of these two workshops described above, along with their large and enthusiastic attendance, the tangible nature of their outcomes, and their calls for continued follow-on activities exemplify the considerable scientific interest, as well as the growing programmatic level of activity, in the subseasonal component of weather-climate interactions. In regards to the latter, this includes a wide-range of activities within the Climate Dynamics, Large-Scale Dynamic Meteorology and CPT Programs of NSF, the CLIVAR-, CPPA- and ARC-related programs of NOAA, and the MAP and NEWS programs within NASA. In addition, there are considerable institutional and programmatic activities in the area of subseasonal variability occurring within the EMC, CPC and CDC components of NOAA as well as with the AMIP family of projects, GEWEX, NAME, the proposed Thorpex, and the International CLIVAR Monsoon Panel. *To date, all these activities have yet to have a comprehensive guiding influence that would be able to best exploit the complementary nature and deliverables of these activities.* In addition to the above, there are a number of new resources and investments that could yield significant return in the area of subseasonal variability. These include relatively new and promising model development efforts

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[1] Schubert, S., R. Dole, H. v. d. Dool, M. Suarez, and D. Waliser, 2002: Proceedings from a workshop on "Prospects for improved forecasts of weather and short-term climate variability on subseasonal (2 week to 2 month) time scales", 16-18 April 2002, Mitchellville, MD, NASA/TM 2002-104606, vol. 23, 171 pp.

[2] Waliser, D., S. Schubert, A. Kumar, K. Weickmann, and R. Dole, 2003: Proceedings from a workshop on "Modeling, Simulation and Forecasting of Subseasonal Variability", 4-5 June 2003, University of Maryland, College Park, Maryland, NASA/CP 2003-104606, vol. 25, pp. 62.

(including relevant hindcast data sets) at GMAO/GSFC/NASA, GFDL/NOAA, and EMC/NCEP/NOAA, as well as useful integrations with the Multi-Model Framework (MMF; e.g., super-parameterization) approach. In addition, there is a wealth of altogether new satellite data resources becoming available from NASA's A-Train (e.g., AQUA, AURA, CloudSat, CALIPSO) whose sampling and products are ideally suited for subseasonal research.

Based on: 1) the level of interest, research and programmatic activity in the US, 2) the development and availability of a number of new/improved modeling and observational resources applicable to the subseasonal problem, 3) the need/call for coordinated subseasonal follow-on activities (e.g., workshops, experimentation, use of new observation systems/data), 4) the cross-cutting and global nature of a number of subseasonal phenomena (e.g., MJO, AO, PNA), 5) the fact that these phenomena are the main link between weather and seasonal-to-interannual climate variations, 6) and the importance of having this component of variability represented in our weather and climate models, *the time for establishing an SSWG is ideal and critical*.

II. Objectives

A. Guidelines and Specific Tasks

1. Develop and coordinate model experiments and inter-comparisons designed to assess and improve our model representations of the most important components of subseasonal variability in regards to their influence on, and linkages between, climate and weather. Organize activities for model evaluation through systematic comparison with in-situ, satellite, and assimilated global observations in order to identify and alleviate model deficiencies. *Specific target for the two-year time frame is the MJO phenomena. In this regard, we will develop and utilize a systematic approach to model evaluation and possible improvement for the MJO, including a set of metrics for model diagnostics and assessment and use these metrics to develop an inventory of how well current models simulate the MJO. Emphasis will be placed on utilizing new data resources and comprehensive strategies as a means of improving our model representations and physical understanding.*
2. Develop and coordinate model and multi-model ensemble predictions of subseasonal variations to estimate the expected predictability as well as model prediction skill of subseasonal variability. Identify key scientific questions regarding predictability and prediction skill of subseasonal variations, including documenting the signal to noise ratio on subseasonal time scales, and characterizing the importance of initial conditions, boundary conditions, land surface processes (i.e. soil moisture), ocean coupling, and modulation by lower-frequency variability. *Specific target for the two-year time frame is the MJO phenomena.*
3. Determine optimal course of action with respect to the development, dissemination and analysis of experimental forecasts of subseasonal variability. *Here the focus will be to facilitate the translation of MJO prediction techniques/resources that are both available and skillful into a useful venue, including its impacts on medium-range forecasting. In conjunction with item 2), identify systematic MJO forecast errors and work to identify the most likely sources of these forecast errors and their remedy.*
4. Coordinate SS activities between the International CLIVAR Monsoon Panel, GEWEX, CPPA, NAME, AMIP-related activities, NOAA operational/research centers, the proposed Thorpex program, etc. Where additional modeling, analysis or observational resources are needed, provide plans for implementation to USCLIVAR, GEWEX, and the IAG.

NOTE: In regards to items 1 and 2 (i.e. hindcast activities related to modeling, prediction and predictability) there are a number of available or pledged activities that will contribute to these objectives. NCEP already has a very relevant hindcast data set for examining subseasonal variability with their Coupled Forecast System (CFS). NASA has funded subseasonal modeling

and analysis activities (via Schurbert et al.) that will provide for a hindcast data set from GEOS5 will also contribute to these activities in early/mid 2006. B. Wang/U. Hawaii are conducting relevant modeling hindcast studies with a coupled ECHAM5 model that will also contribute to these objectives. In regards to item 3 (i.e. actual forecasting), the Experimental MJO Prediction Project (http://www.cdc.noaa.gov/MJO/index.html) presently receives a number of empirical forecasts as well as numerical forecasts from the NCEP Global Forecast System (GFS) ensemble, the Climate Diagnostics Center (CDC) experimental ensemble product, and the Australian coupled POAMA forecast model, with additional pledges from ECMWF and KMA. There are *many* other model data sets already available to examine simulation capabilities of the MJO and other subseasonal variability (e.g., IPCC, AMIP, CMIP, individual climate simulations from a given model center). The above list of modeling resources provides the means to undertake many of the proposed activities.

B. Proposed/Tentative Timeline

In addition to monthly telecons, we propose the following:

March 2006:	First SSWG Meeting
April 2006:	Deliver Prospectus on (refined) Proposed Activities and Goals
May 2006:	Special Session at AGU on Intraseasonal Variability
August 2006:	First SSWG Workshop
September 2006:	Deliver Workshop Summary Report
March 2007:	Second SSWG Meeting
April 2007:	Deliver Report on Accomplishments to-date and a Prospectus on (further refined) Proposed Activities and Goals
May 2007:	Special Session at AGU on Intraseasonal Variability
August 2007:	Second SSWG Workshop – Coordinated with GEWEX or Int. CLIVAR Monsoon Panel
September 2007:	Deliver Workshop Summary Report
November 2007:	Third SSWG Meeting
December 2007:	Deliver Report on Accomplishments to-date and Recommendations for Future Activities and Goals

C. Anticipated Outcomes and Benefits to US CLIVAR

At present, US CLIVAR – through its NSF, NOAA and NASA sponsors - is investing considerable resources into areas relevant to the SS problem, yet no accounting of these resources in terms of overlap, leveraging and gaps is being made in a systematic manner, particularly in light of a number of international/other relevant programmatic efforts (e.g., Int. CLIVAR, GEWEX, Thorpex). The formation of an SSWG would alleviate this shortcoming, and thus substantially increase the return on investment for these resources. In doing so, greater gains will be made in representing the fundamental forms of weather and climate variability in our model simulations and predictions. Most tangible in this regard is the expected increase in understanding and possibly predictive skill of variability between the more traditional areas of weather and SI prediction.

III. Publication and Outreach

Workshop reports – hardcopy, pdf, and web
SS result of the month on web
Highlight recent/new journal articles on web
One article to US CLIVAR Variations newsletter
One article to International CLIVAR exchanges newsletter.
One article to GEWEX NEWS newsletter
Final report.

IV. Reporting Plan

Based on the US CLIVAR Summit and the Panel Terms of Reference, we see the greatest relevance of the SSWG to the PSMI and PPAI panels. Thus, we propose to report our progress to, as well as seek support through, both of these panels. In addition, we propose to report progress at the annual US CLIVAR executive/summit meeting. To the extent possible, we will also provide reports to the International CLIVAR Monsoon Panel and to relevant entities within GEWEX in order to convey progress as well as to entrain partnership and engagement.

V. Thoughts on Leadership and Membership

Duane Waliser – co-chair - Modeling, diagnostics, prediction, predictability, focus on tropics.
Siegfried Schubert – co-chair - Modeling, diagnostics, predictability, focus on extra-tropics, scale-interactions and data assimilation connections.
Klaus Weickmann – Observations, tropical-extratropical interactions, modulation of weather and impact on medium-to-extended range forecasts.
Ken Sperber – Modeling experimentation and diagnostics, monsoon interaction, International CLIVAR Monsoon Panel connection.
George Kiladis / Chidong Zhang – Observations and diagnostics studies.
Wayne Higgins/H. van den Dool – NCEP/operational prediction connection, extreme events.
Bin Wang/Adam Sobel –Theoretical considerations.
Steve Woolnough/Julia Slingo/Pete Inness (all U. Reading)/ Harry Hendon (Aust) - Other multi-faceted MJO expertise.
Mitch Moncrief Mesoscale modeling/physics and Thorpex connection.
GEWEX Connection: Inquiries have been made with R. Lawford who has expressed interest in cross-fertilizing. Naming possibilities depends in part on support structure for this person and degree of international interest. S.Woolnough participates in the GEWEX Cloud System Study.

We recognize the need for *considerable* interaction with modelers, both from a expertise sense but also in regards to modeling-center participation. Whether such participants would all be members or routinely invited to activities is an important consideration.

Eric Maloney - MJO modeling, parameterization and some connection to NCAR model.
Myong-In Lee - MJO modeling, parameterization and connections to GEOS.
Leo Donner Convective and cloud parameterization and connections to GFDL.
Guang Zhang - Convection parameterization and connections to NCAR.

Ben Kirtman - Coupled modeling and connection to SI modeling and prediction.
Randy Koster - Soil moisture and land-atmosphere interactions.
Ragu Murtugudde - Ocean modeling and interactions.

VI. Resources

The following activities and items would necessitate resources from USCLIVAR:

3 Working Group Meetings for 2 days each. Travel Support for Working Group along with 2-3 Invited Guests,

2 Workshops for 2.5 days each for approximately 40-60 attendees. Travel Support for Working Group along with 3-4 Invited Guests, along with typical meeting room rental costs, incidental food, audio/visual, etc.

VII. Proposed Period of WG

January 1, 2006 to December 31, 2007