

WORLD METEOROLOGICAL ORGANIZATION

CBS ET/ILRF/Doc. 3(1)

COMMISSION FOR BASIC SYSTEMS

(V.XI.2001)

EXPERT TEAM MEETING ON INFRASTRUCTURE
FOR LONG-RANGE FORECASTING

ITEMS: 3 and 5

GENEVA, SWITZERLAND, 12-16 NOVEMBER 2001

ENGLISH ONLY

**INPUT TO ICTT ON CC, ON THE ESTABLISHMENT OF APPROPRIATE OPERATIONAL
INFRASTRUCTURE FOR THE PRODUCTION AND EXCHANGE OF LRF**

(Submitted by Dr V. Kousky, NOAA/NWS, USA)

Summary and purpose of document

This document examines the dynamic climate forecast process used at NCEP, which consists of predicting the tropical Pacific SSTs (using an oceanic GCM) and then through the predicted SSTs, as surface boundary conditions to force an atmospheric GCM.

Action proposed

The Team is invited to make its recommendations taking into account the proposals submitted in this document.

1. INTRODUCTION

A great deal of understanding has been gained concerning the processes responsible for interannual to decadal climate variability. The most important phenomenon affecting interannual variability over many regions of the world is the El Niño/ Southern Oscillation (ENSO) cycle, which links changes in sea surface temperatures (SSTs) in the tropical Pacific to changes in surface temperature, atmospheric circulation and precipitation over many regions of the world. Since both El Niño (anomalously warm tropical Pacific SSTs) and La Niña (anomalously cold tropical Pacific SSTs) last for several months, the ENSO cycle provides the basis for making skillful seasonal forecasts of temperature and precipitation for certain regions, with lead times up to 3 seasons.

The dynamical climate forecast process used at NCEP consists of first predicting the tropical Pacific SSTs using an oceanic GCM and then using the predicted SSTs as surface boundary conditions to force an atmospheric GCM. This two-tiered approach is necessary, due to inadequacies in physical parameterizations that preclude the use of a fully coupled forecast system. NCEP also has access to atmospheric model forecasts made at other institutions (e.g., the IRI and Scripps Institution of Oceanography).

In addition to the dynamical SST forecasts, NCEP also utilizes statistical techniques to predict SSTs, and the impacts that they might have on temperature and precipitation over the United States.

2. OPERATIONAL INFRASTRUCTURE FOR THE PRODUCTION OF LRF AT NCEP

Probability predictions of surface temperature and total precipitation, for the conterminous U.S.A, Alaska and Hawaii, are derived from a combination of several objective forecast tools. These tools include the Canonical Correlation Analysis (CCA), Optimal Climate Normals (OCN) and the Coupled Model Forecasts (CMF). Any method used in producing the Climate Outlook is required to be accompanied by sufficiently thorough skill records, in order that the forecasts can be objectively combined with other forecasts via multiple linear regression. All of the forecast tools are displayed in the same format.

The observed distributions of seasonal mean temperature and total precipitation during 1971-2000 are divided into three equally likely categories – BELOW, NORMAL, and ABOVE, for temperature, and BELOW, MODERATE, and ABOVE, for precipitation. The average likelihood, or climatological probability, of these categories is 1/3, 1/3, and 1/3, respectively. For simplicity we designate this category as “CL”, which signifies “Climatological probabilities.” For regions where there is expected skill in forecasting a tilt in the odds toward either the BELOW or ABOVE categories, isolines are drawn that depict the percent increase in probability with respect to the climatological probability (33.3%) of the occurrence.

Probability predictions of seasonal mean SST and SST anomalies in the tropical Pacific are produced by objectively combining forecasts made using both statistical and dynamical techniques. The resulting consolidated SST forecast then serves as the basis for making composites, based on historical temperature and precipitation data. These composites are then used subjectively to adjust the final U.S seasonal temperature and precipitation probability outlooks.

3. REQUIREMENTS FOR THE PRODUCTION AND EXCHANGE OF LRF PRODUCTS

The skill of long-range empirical outlooks has always been modest. This is because the predictions are derived from distributions which necessarily acknowledge a large number of possible outcomes, while the observed single event against which the outlook is verified includes the noise created by unpredictable (on monthly and seasonal timescales) synoptic disturbances. According to some estimates of potential predictability, the noise is generally larger than the signal in middle latitudes.

Therefore, it is imperative that climate outlook products be accompanied by skill information. This, in turn, requires that the procedures used in preparing long-lead climate outlooks be carefully formulated, taking into account the known skill of the predictive tools. Thus, each climate outlook and each predictive tool should be accompanied by a skill map. Ideally, forecast products should be displayed in a common format and the measure of skill should be the same in each case. This would facilitate intercomparisons and objective combinations of the tools and products to arrive at consensus outlooks.

4. EXPERIMENTAL EXCHANGE OF LONG-RANGE FORECASTS AND REPORT OF RESULTS

Each LRF, as well as all tools, should be verified and all verification scores should be readily available to the users. The verification techniques should be the same for all tools and outlooks, in order to facilitate intercomparisons and evaluations, as well as to provide the basis for preparing consensus outlooks. Time series displays of skill should be available for each outlook and each forecast tool. Regular assessments (seasonal) summarizing the verification statistics should be made available in a timely fashion to the user community.
