The Climate Predictability Tool

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The Climate Predictability Tool (CPT) is a software package developed by the International Research Institute for Climate and Society (IRI) designed for making seasonal climate forecasts. The software is an easy-to-use tool that runs on Windows 95+, and was developed primarily to enable forecasters at National Meteorological Services (NMSs) in Africa to produce updated forecasts for their country every month.

There are two main approaches to generating seasonal forecasts: using large-scale models of the global atmosphere, known as general circulation models (GCMs), or using a statistical approach to relate seasonal climate to changes in sea-surface temperatures, such as those associated with El Niño. In the former case, predictions are made for large-areas, and are often not very relevant for specific locations. In addition, because of the coarse scale at which the GCMs operate, the geography in the models is often distorted, and so geographical locations can be displaced. These GCM predictions therefore need to be adjusted so that they can be applied at the local level; this process is known as downscaling, and involves a statistical correction to the GCM predictions. The CPT tool is designed to perform both forms of prediction, namely downscaling of GCM output, and statistical predictions using sea-surface temperatures.

The statistical approach to making seasonal forecasts from sea-surface temperatures has been used for a number of years now at many NMSs. Since the late 1990s, these statistical forecasts have been combined to produce a consensus forecast, representing a patchwork of nationally-based forecasts for subcontinental areas, in meetings known as climate outlook forums (COFs). While such forums have been very successful in building the capacity to produce seasonal climate forecasts, a number of problems emerged. The CPT tool was designed in response to these problems, and, specifically, was developed to address the following issues:

a. *Slow production time*: the time taken to construct the statistical forecasts at the COFs was requiring long and expensive pre-forum workshops. By using CPT, forecasts can be produced in just a few hours. The quick production time makes it possible to hold shorter, and thus cheaper, pre-forum workshops, and provides more time at these workshops for advanced training. It also makes it viable for forecasters to produce updated forecasts on a monthly basis.

b. *Artificial skill*: an important step in producing a reliable seasonal forecast is to obtain a realistic estimate of how good the model predictions are. The quality of these predictions is known as skill, and it is quite easy to overestimate the skill of a model, i.e., to get the impression that the predictions are better than they really are. CPT performs rigorous tests for estimating skill levels, and adjusts the forecasts accordingly.

c. *Dependence on one model*: it has been demonstrated extensively that the best seasonal forecasts are produced by generating a number of predictions and then combining these, perhaps by simply taking the average of the predictions. In the past, however, there has been a strong reliance on the prediction from a single model, simply because the effort invested in constructing the statistical model tended to encourage an over-confidence in the prediction from this model. Inputs from other sources (most notably the GCM predictions) were largely down-played because of the lack of a sense of ownership of these additional products. By making it much easier to generate a set of predictions by using CPT, the official forecasts from the National Meteorological Services and from the COFs now consider

a broader range of inputs than was possible in the early years of seasonal climate forecasting efforts.

d. *Unreliable probabilitiies*: seasonal climate forecasts are expressed probabilistically because of the large uncertainties involved in forecasting the next few months. However, most forecasting methodologies do not explicitly indicate the uncertainty in the prediction, and so this uncertainty has to be estimated. The simplest and most intuitive ways of estimating forecast uncertainty are unfortunately not very reliable, given the small sample sizes typical of most seasonal climate forecasting systems. A more reliable system has been implemented in CPT.

e. *Forecast format*: seasonal forecasts are typically presented as the probability that the seasonal rainfall total, for example, will fall within pre-defined ranges. These ranges are most commonly set as the upper and lower terciles (third of the data) of the historical rainfall totals. This format tends to be very unpopular with users of the forecasts, partly because the forecast is too abstract (it is not clear how much rainfall is meant by the upper and lower terciles), and partly because the forecast is too unspecific (the upper and lower terciles are often not very interesting thresholds). Within CPT there are options that provide considerable flexibility to tailor forecasts for specific user requirements, including options to redefine the ranges. Forecasts can be produced in a variety of formats, and detailed information is provided so that the forecast can be communicated to the end users in easy-to-understand terms.

The software has been introduced to most of the COFs and is now used fairly extensively. It is being used increasingly in other areas, including South America and South-East Asia.

The software is available free of charge from the IRI's web page:
http://iri.columbia.edu/outreach/software/
Although not required, users are encouraged to register so that they receive notifications of software updates. Enhancements to the software can be requested from the web page, or by sending e-mail to cpt@iri.columbia.edu.