Technical and instruction guide Information report on climate prediction by the International Research Institute for Climate and Society.

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The prediction results are from the climate prediction forecasts done by the International Research Institute (IRI) Seasonal Climate forecasts: IRI Climate foresting summary

Accessed from: http://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/

Climate forecasting is primarily made up of two tiers. The first tier deals with the predictions of Sea Surface Temperature (SST) for all the global oceans. SST predictions form the drivers of atmospheric climate predictions. The second tier is the Atmospheric Global Circulation Model (AGCM). The AGCM uses the set of predicted SST values to predict atmospheric climate (i.e. Temperature and precipitation) for at most 3 months to come. Figure 1 Illustrates the SST and AGCM components and also shows that the SST predictions use a combination of statistical and dynamical models to forecast sea surface temperature.

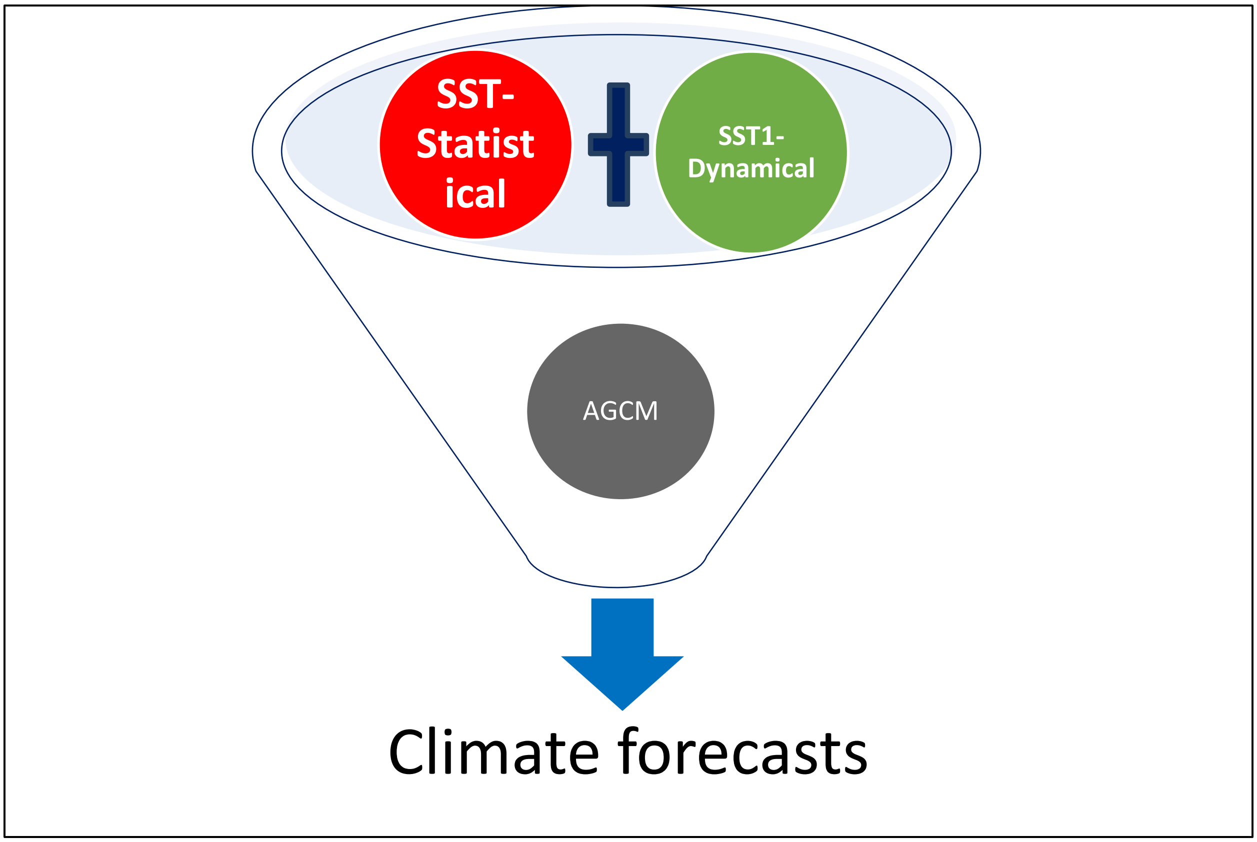

Figure1: major components of IRI climate forecasts: SSTs and AGCM

1. Sea-Surface Temperature Predictions

The precise details of the method of deriving the SST predictions have evolved over the years, but they use both persisted SST anomalies and evolving SST predictions based on a combination of dynamical and statistical models (Barnston et al., 2003). Some of these methods include (but are not limited to) the National Centers for Environmental Prediction (NCEP) coupled ocean–atmosphere dynamical model for predictions of the tropical Pacific SST (Ji et al. 1998), separate canonical correlation analysis (CCA) predictions for the tropical Atlantic and Indian Oceans, and damped persistence for the extra-tropical oceans with 3 months e-folding time. These predictions were smoothly blended at their geographical interfaces.

2. Atmospheric Global circulation models (AGCM) for Climate prediction

AGCMs deal with the prediction of the atmospheric response to the present and predicted SST patterns. In this second tier of the IRI prediction system, several AGCMs are forced by the set of predicted SSTs. The initial states of the AGCMs are not based on observed atmospheric or land surface conditions but are taken from ongoing updates to long AGCM simulations forced by observed SSTs (Barnston et al., 2003, Barnston et al., 2010). The earliest predicted period begins 3–4 weeks after the time of the forecast integrations, use of observed atmospheric initial conditions is not considered critical. However, the lack of observed land surface initial conditions (soil moisture, snow cover) may slightly degrade the forecasts because their effects can continue for longer than one month. The initial conditions used, differing among ensemble members, are characteristic of the respective model, region, and time of year, and the probability distribution of possible atmospheric states is spanned across members, constrained to be consistent only with the prescribed SST boundary conditions.

The process of bringing together the AGCM predictions into a final forecast was automated using two multi-model ensembling methods were used: a Bayesian method and a canonical variate method (Mason and Mimmack 2002; Rajagopalan et al. 2002; Robertson et al. 2004). The two forecast results were averaged and in both methods, individual model weighting varies by grid point and forecast target season, governed by the models' historical skills over an approximately 50-yr period when forced by observed SST fields (Barnston et al. 2003).

3. Data and verification methods

To calibrate and verify the model forecasts, consistent datasets of observed global temperature and precipitation are required. For temperature, the 28 gridded global Climate Anomaly Monitoring System (CAMS)dataset from National Oceanic and Atmospheric Administration (NOAA) (Ropelewski et al. 1985) is used. For precipitation, the Climate Prediction Center (CPC) Merged Analysis of Precipitation (CMAP; Xie and Arkin 1997) for data from 1979 onward and the data from the Climate Research Unit (CRU) of the University of East Anglia for1961–78(Newetal.2000; Mitchell and Jones, 2005) are used. Below is a list of some of the verification methods that are used to assess the reliability of the results (Barnston et al. 2010).

- Ranked Probability Skill Score (RPSS)
- Likelihood Skill Score (LSS)
- Generalized Relative Operating Characteristics GROC

4. How to interpret the IRI Forecast maps

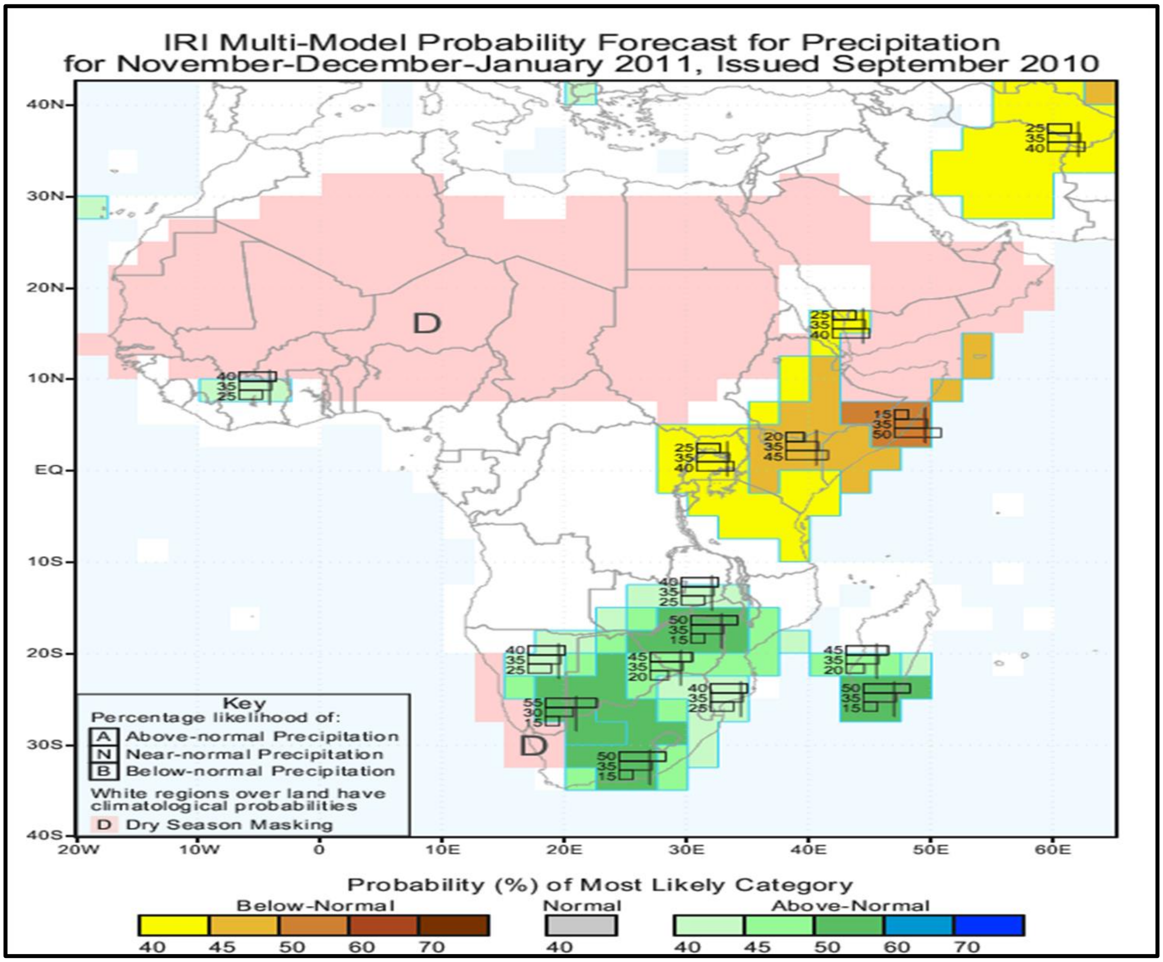

Figure 2: Africa Precipitation Forecast map for Issue date September 2010 for Oct-Nov-Dec target season issued by the IRI for climate and society

Figure 2 above covers the Oct-Nov-Dec target season (IRI, 2016). The Map shows tercile probabilities of precipitation. Tercile probabilities are the forecast probabilities that the precipitation will be in the lower 33.3% of the climatological distribution (cold or dry), the middle 33.3% (near normal temperature or precipitation), or the upper 33.3% (warm or wet). The color shading indicates the probability of the most dominant tercile, that is, the tercile having the highest forecast probability. The color bar alongside the map defines these dominant tercile probability levels. The upper side of the color bar shows the colors used for increasingly strong probabilities when the dominant tercile is the above-normal tercile, while the lower side shows likewise for the below-normal tercile. The gray color indicates an enhanced probability for the near-normal tercile (nearly always limited to 40%). The white part indicates the climatology forecast (33.3% for each tercile), in which case no tercile is dominant. Numbers and their associated histograms show the probabilities of the three terciles. In areas with lots of spatial detail, there may not be sufficient room on the map, to allow histograms for each region. In those cases, some idea of the probabilities may be gained from the color alone. Areas that are marked by "D" represent regions for which less than 3cm of precipitation typically occurs over the season. For example, in the case of much of southern Somalia in October-December 2010, there is a 15% probability that the precipitation will be in the wettest third of the years, a 35% chance it will be in the near-normal third of the years, and a 50% chance that the precipitation will be in the driest third of the years.

More information on the IRI forecasts can be found on the International research institute for climate and society website: http://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/

5. References

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