Dynamical Model Forecast Guidance

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Model configuration information

In preparation of the experimental Week 3-4 temperature and precipitation outlooks, the CPC currently utilizes numerical guidance from three operational center sources. These include data from the Climate Forecast System (CFS) from NCEP, the extended 32 day bi-weekly forecasts from the European Center for Medium Range Weather Forecasts (ECMWF) and weekly extended forecasts from the Japan Meteorology Agency (JMA). The realtime forecasts are bias corrected using reforecast data available for all three systems. Table 1 and 2 summarizes some high level specifics of these three modeling systems for reference for the realtime and reforecast data respectively.

Center	Forecast Frequency	Spatial Resolution	Temporal Resolution	Realtime ensemble members per forecast
NCEP	Daily	1.0 x 1.0	6-hourly	32 (2 day lagged ensemble)
ECMWF	2x per week	0.5 x 0.5	12-hourly	51
JMA	1x per week	2.5 x 2.5	Daily	48

Table 1: Realtime model data information.

Center	Reforecast Period	Reforecast Frequency	Spatial Resolution	Temporal Resolution	Reforecast ensemble members per forecast
NCEP	1999-2011	Daily	1.0 x 1.0	6-hourly	16
ECMWF	1995-2014	Weekly	0.5 x 0.5	12-hourly	5
JMA	1991-2010	3x per month	2.5 x 2.5	Daily	5

Table 2: Reforecast model data information.

Model product information

Based on the above datasets, forecast guidance products have been developed that include 500-hPa mean height, height anomalies and standardized height anomalies, 500-hPa height forecast spread, 200-hPa mean height and anomalies, 2-m temperature anomalies and probabilities for above/below normal temperatures and precipitation anomalies, percent of normal and probabilities for above/below median precipitation.

Probabilities of above and below average are derived by counting the number of ensemble members from realtime model runs that exceed or do not exceed the model climatological mean (temperature) or median (precipitation). Height (500-hPa and 200-hPa) anomalies are calculated as the real-time model ensemble mean minus the reforecast model climatological mean. Model climatological means and medians are calculated across the calendar year from

the multi-year reforecasts and specifics vary depending on modeling system. Additional information can be provided upon request. By comparing real-time forecasts to the model reforecast-based climatologies, the forecasts are bias-corrected. However, probabilities have not been calibrated by comparison to the model skill and may not be reliable. The application of this type of calibration is currently being established with the goal of having included in realtime model forecast products by October 1, 2016.

Figure 1 illustrates some examples.
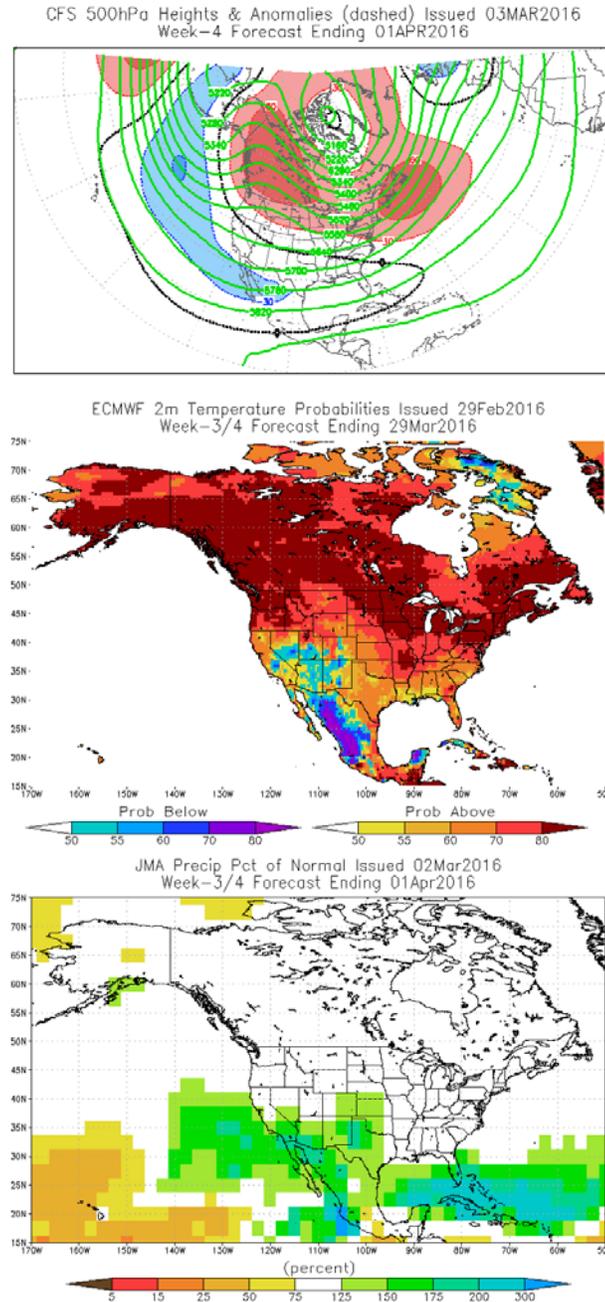
Figure 1: Example (a) 500-hPa mean height and anomalies from the CFS, (b) 2-m temperature probabilities from ECMWF and (c) percent of normal precipitation from JMA.

Historical forecast skill evaluation

It is important to document the historical forecast skill for each of the modeling systems noted above. A direct comparison of reforecast temperature and precipitation forecast skill between the three systems was not performed since the reforecast periods in which there is overlap is considerably smaller than each individual reforecast period.

Forecast skill, as measured by anomaly correlation (AC), over the reforecast period for the respective models is provided below for 500-hPa height, 2-meter temperature and total precipitation for the December-January-February (DJF) and June-July-August (JJA) seasons. The goal here is to illustrate, in general terms, the level of forecast skill for the three variables in the two main seasons for this time range. It is to help serve as an initial guide for the current state of the science for Week 3-4 dynamical model output.

Figures 2-3 illustrate these for the CFS, Figures 4-5 for ECMWF and Figures 6-7 for JMA. The observational datasets used in the analysis are described in the verification information document.
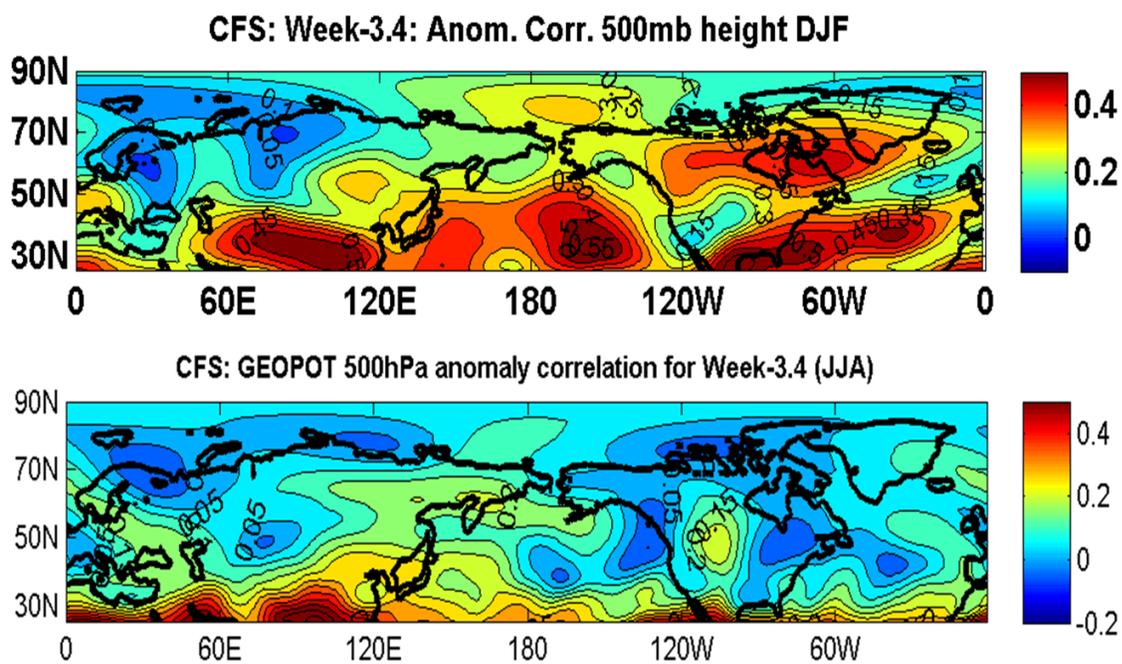

Figure 2: Anomaly correlation for mean Week 3-4 500-hPa height for (top) Dec-Jan-Feb and (bottom) Jun-Jul-Aug from the NCEP CFS.
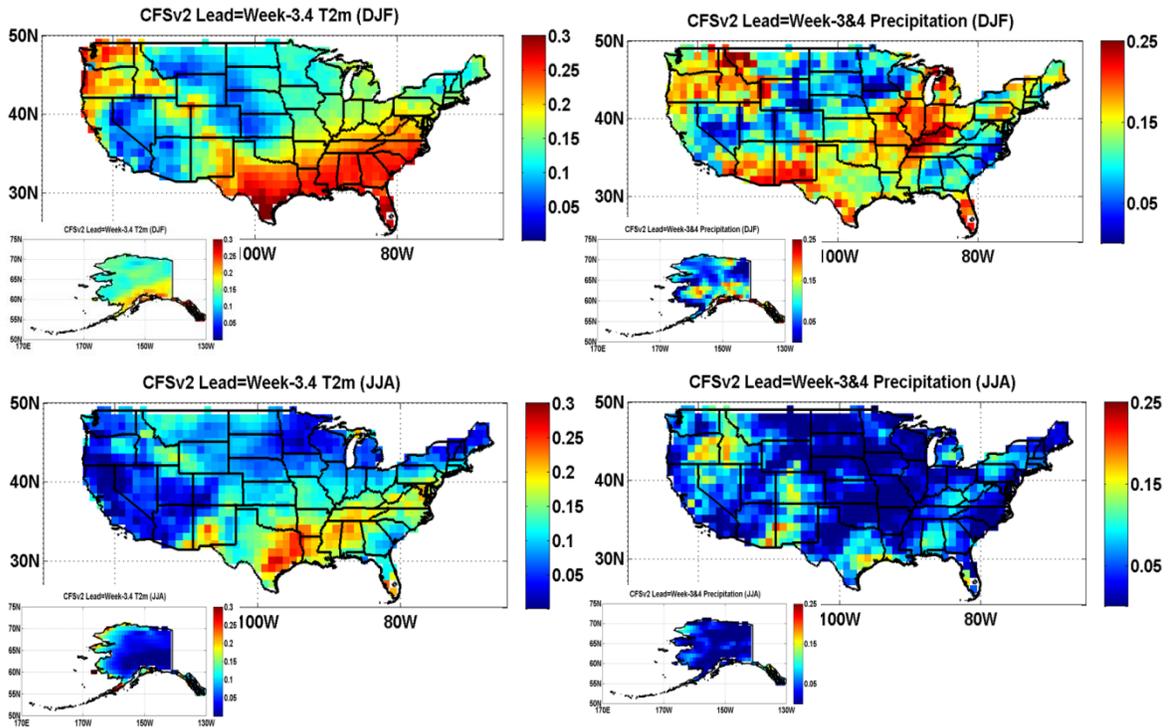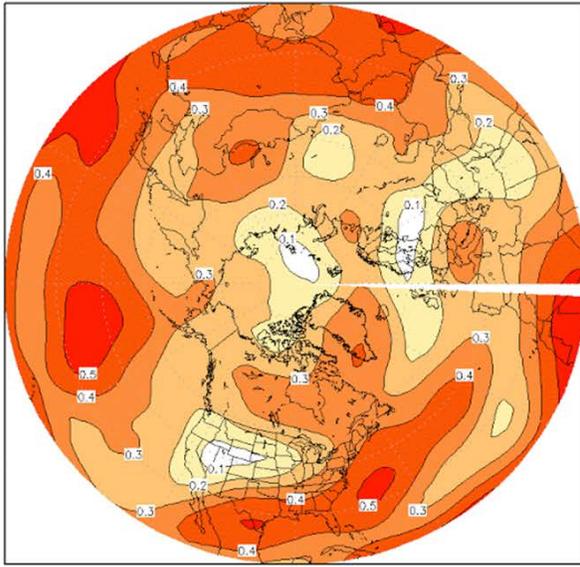
Figure 3: Anomaly correlation for mean Week 3-4 temperature (left) for (top) Dec-Jan-Feb and (bottom) Jun-Jul-Aug and Week 3-4 precipitation (right) for (top) Dec-Jan-Feb and (bottom) Jun-Jul-Aug for the NCEP CFS.
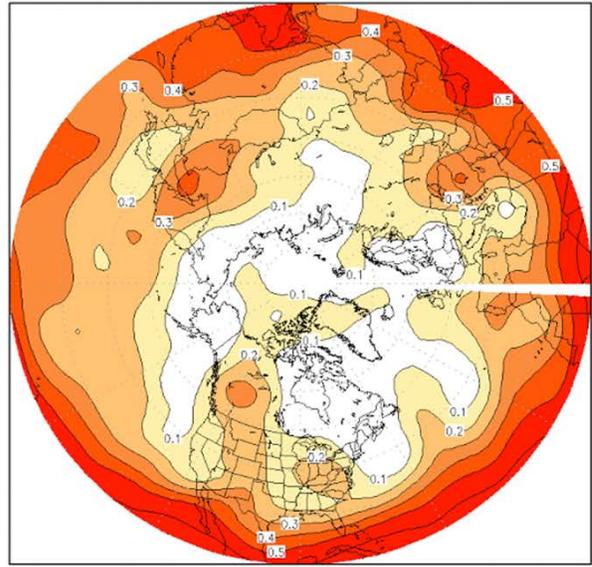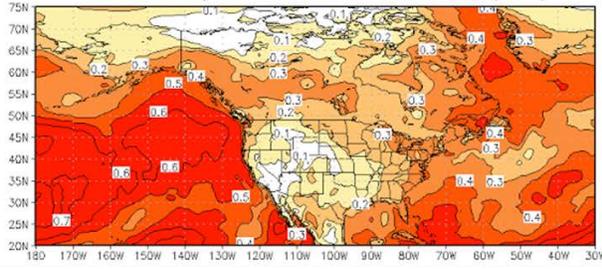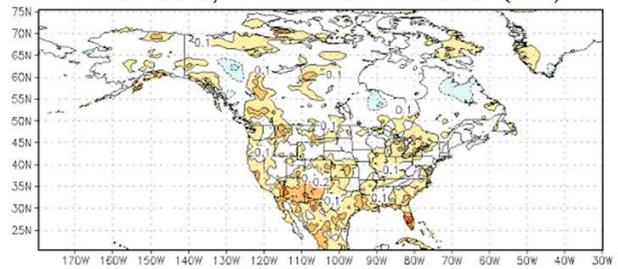
Figure 4: Anomaly correlation for mean Week 3-4 500-hPa height for (left) Dec-Jan-Feb and (bottom) Jun-Jul-Aug for ECMWF.

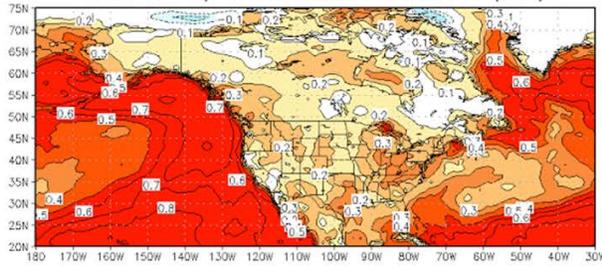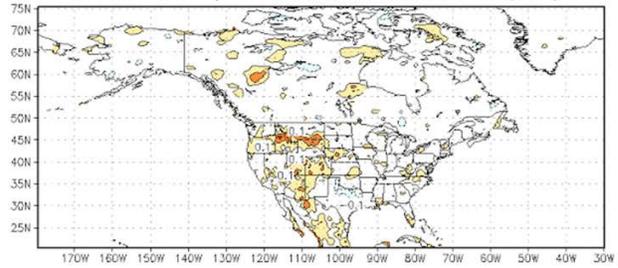Figure 5: Anomaly correlation for mean Week 3-4 temperature (left) for (top) Dec-Jan-Feb and (bottom) Jun-Jul-Aug and Week 3-4 precipitation (right) for (top) Dec-Jan-Feb and (bottom) Jun-Jul-Aug for ECMWF.
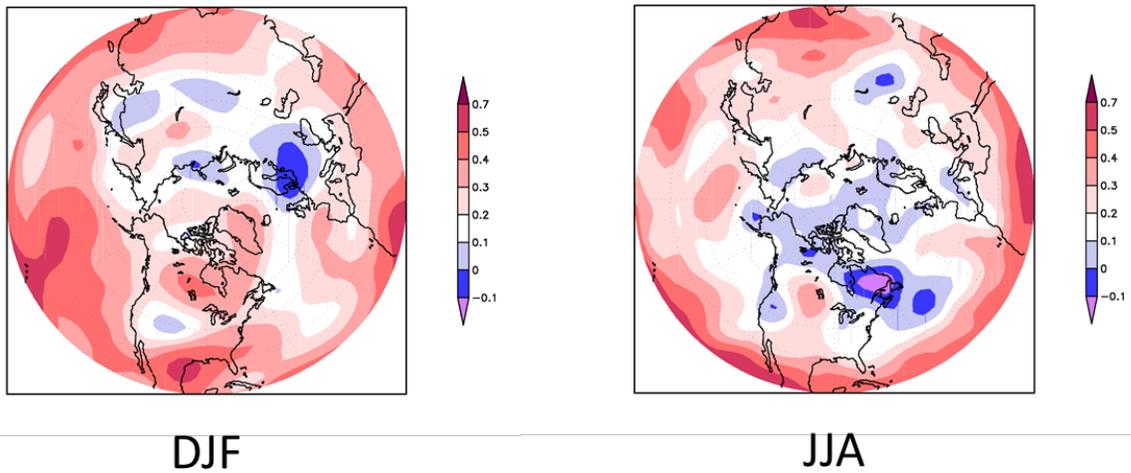
DJF   JJA

Figure 6: Anomaly correlation for mean Week 3-4 500-hPa height for (left) Dec-Jan-Feb and (bottom) Jun-Jul-Aug for JMA.

Temperature DJF   Precipitation DJF

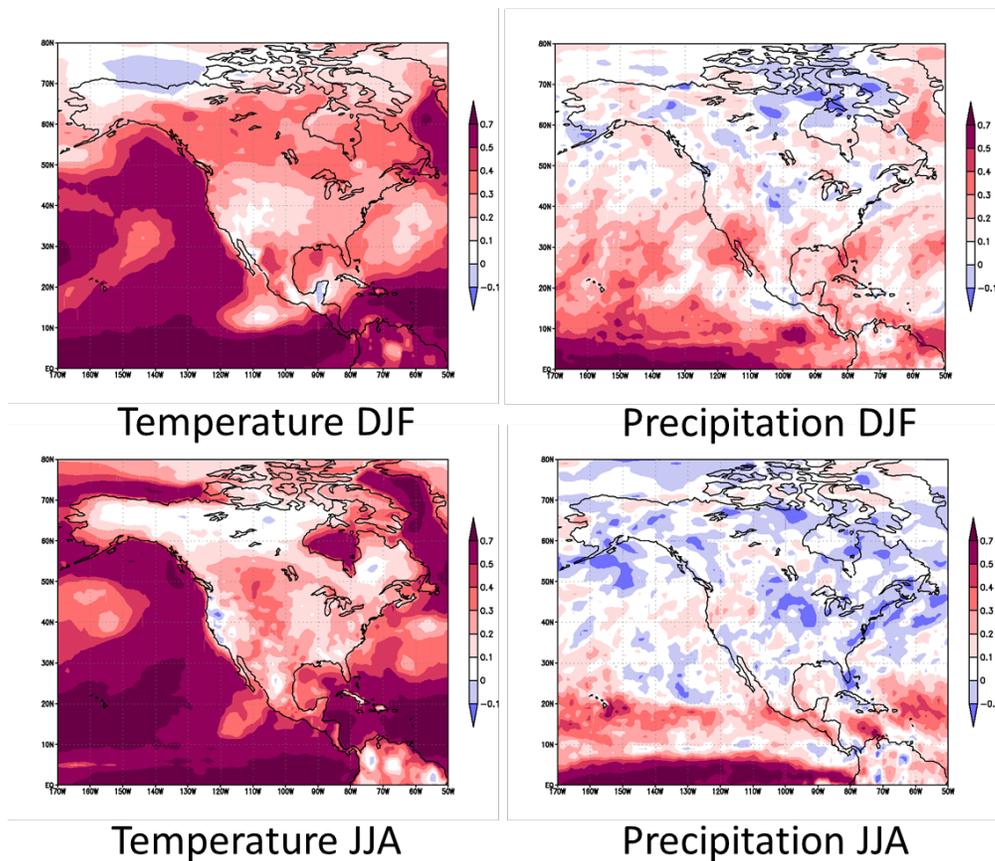Temperature JJA   Precipitation JJA

Figure 7: Anomaly correlation for mean Week 3-4 temperature (left) for (top) Dec-Jan-Feb and (bottom) Jun-Jul-Aug and Week 3-4 precipitation (right) for (top) Dec-Jan-Feb and (bottom) Jun-Jul-Aug for JMA.