WEEK.2 FORECAST SKILL CHARACTERISTICS AND FLOW REGIME ASSOCIATION

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Hindcast experiments, each out to 30 days, for five recent winters (DJF in 1997/98 to 2001/02) conducted at the National Centers for Environmental Prediction are analyzed for the performance of its global forecast system (GFS). The skill of week.2 forecast (Day 8 to 14) in 500-mb geopotential height over the North Pacific North America (NPNA) sector (150E-60W & 25-75N); the North Atlantic (NA) sector (60W-0E & 25-75N) and the Eurasia sector (0-150E & 25-75N) are investigated. Various types of flow regime are identified by a cluster analysis technique. The skill level of Week.2 forecasts is found to be related to the type of flow regime.

A simple clustering technique is adopted to identify and the most frequently occurring pattern:

1. Correlation coefficient matrix is calculated for all 7day mean of observation of Z500 during verification period (5 DJF winters, 450 maps).
2. Map that has the highest number of correlation coefficient with value greater than or equal to a threshold of 0.5 is identified as seed I for the most frequently populated seed.
3. All of seed I cases (those maps correlated with seed I at or above the threshold level 0.5) are removed. From the remaining maps, the one that has the highest number of correlation coefficients greater than or equal to the threshold value 0.5 is identified as seed II for the second most frequently populated seed.
4. All seed I and II cases are removed, and a Seed III is chosen as 2nd and 3rd step.
5. Above procedure is repeated until all seeds that contain at least 35 maps (7days/year) are identified.
6. Subsequent averaging of all members in a cluster formed the composite flow regimes

Before the most prominent flow regimes are presented, the week.2 forecast serial correlations, for the last 5 DJFs, are contrasted with 7-day-mean atmospheric variability. As shown in Fig. 1, the North Pacific region, where large standard deviation (std dev) is observed, is expected to have week.2 AC skill score close to 0.7. On the other hand, the North Atlantic region is not expected to have high week.2 AC skill score, although that region has large std dev. It is also seen that the continental U.S. sector does not have high week.2 AC skill score except the southeast region.

Fig. 2 shows the four most frequently occurring flow regime patterns for the NPNA sector. Over this sector, as shown in Fig. 3, an average anomaly correlation skill level reaches 0.72 for an association with Rossby Wave-train (RWT) flow regime type, while it is only 0.46 for an association with positive phase of PNA flow.

Figure 4 shows the four most frequently occurring flow patters. Over this sector, as shown in Fig. 5, an average AC skill score of 0.54 is associated with a negative NAO flow regime, while 0.43 with a positive NAO flow regime.

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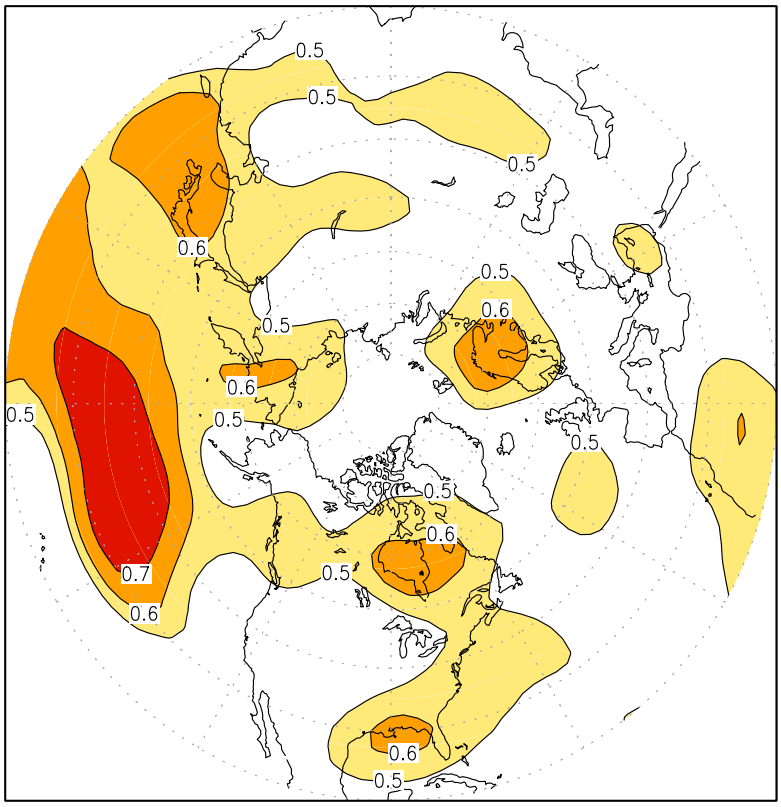
Another important aspect of characteristics is the occurrence frequency of each type of flow regime. While the RWT develops 14% of the time, the positive PNA develops only 9% of the time. And, while a negative NAO flow regime develops 24% of the time, a positive NAO flow regime develops only 17% of the time. A model systematic-bias correction in the tropics is found to be essential (not shown here), while it is not as critical for the extratropical latitudes.

Fig. 1
Week.2 fcst serial correlations (5 DJFs)



Std Dev of 7D-mean Verifications

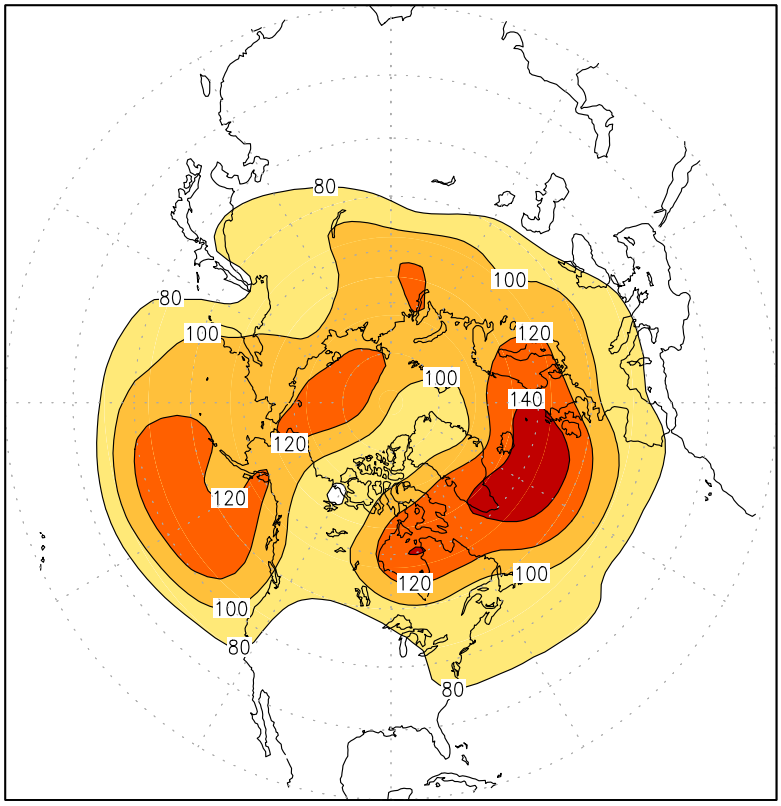
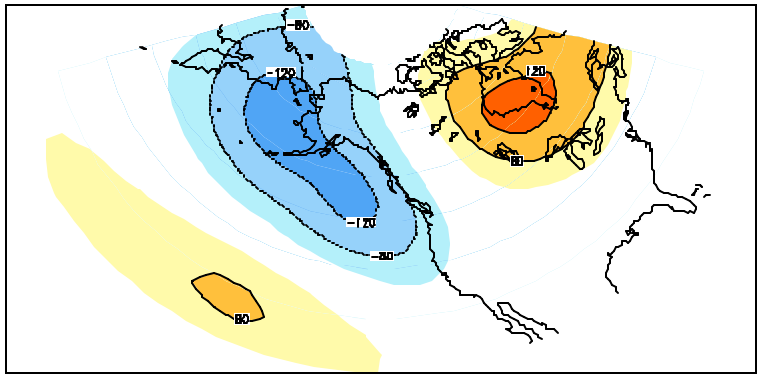


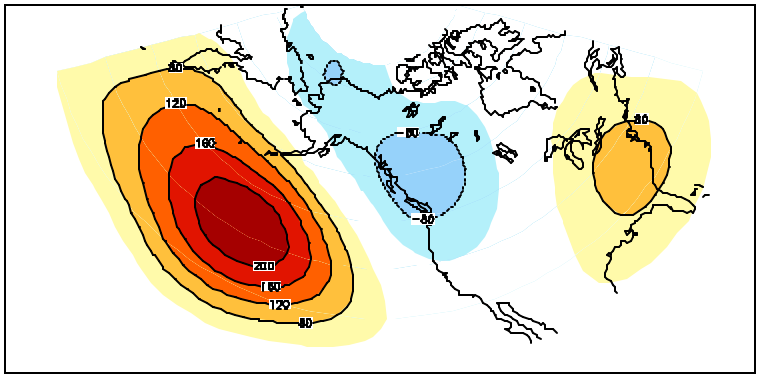
Fig. 2
Flow Regimes in NP(150E-60W, 25-75N)

Regime: 1 (NP:150E-60W,25-75N)



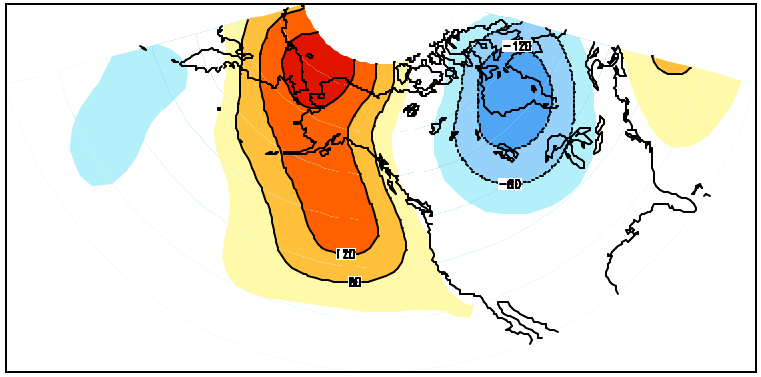
135 maps

Regime: 2 (NP:150E-60W,25-75N)



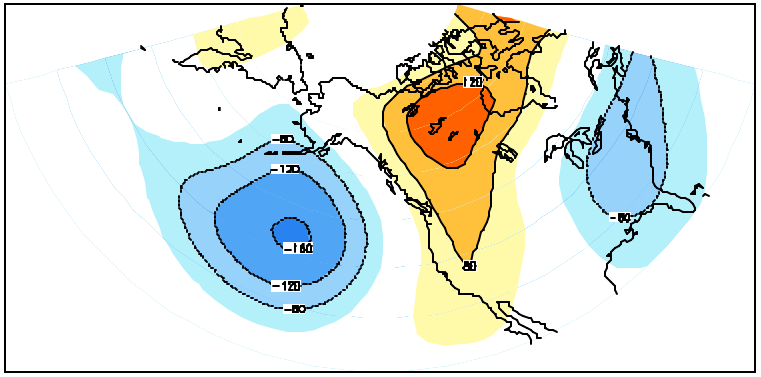
61 maps

Regime: 3 (NP:150E-60W,25-75N)



40 maps

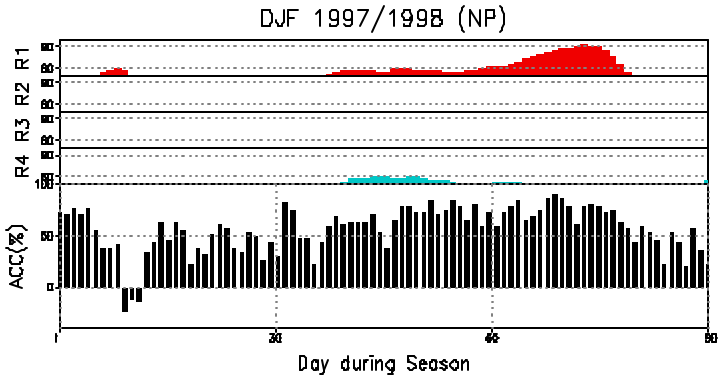
Regime: 4 (NP:150E-60W,25-75N)

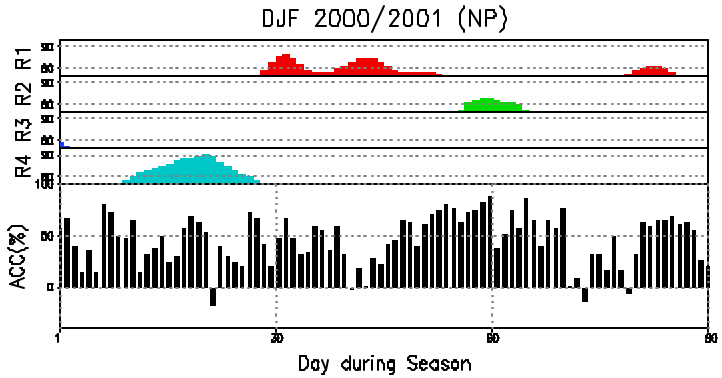


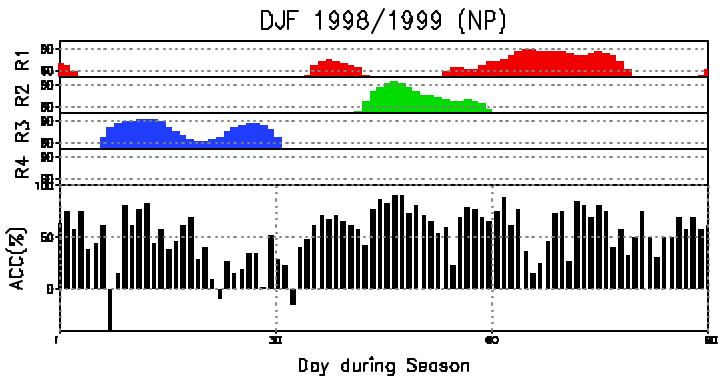
39 maps

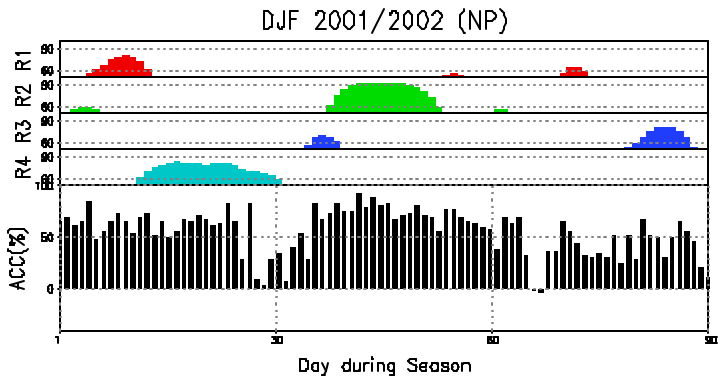
Fig. 3

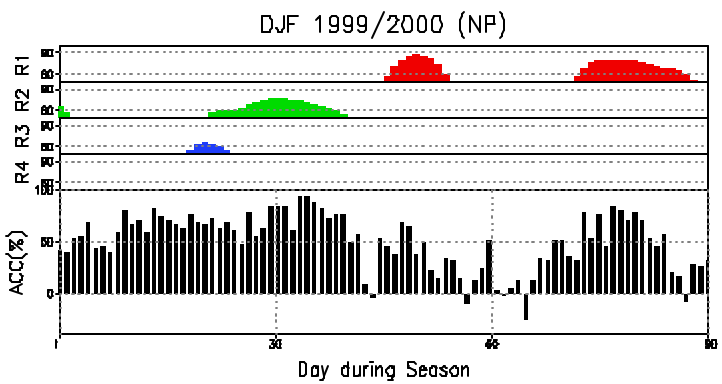
Week2 Forecast Skill for the Flow Regimes in NP











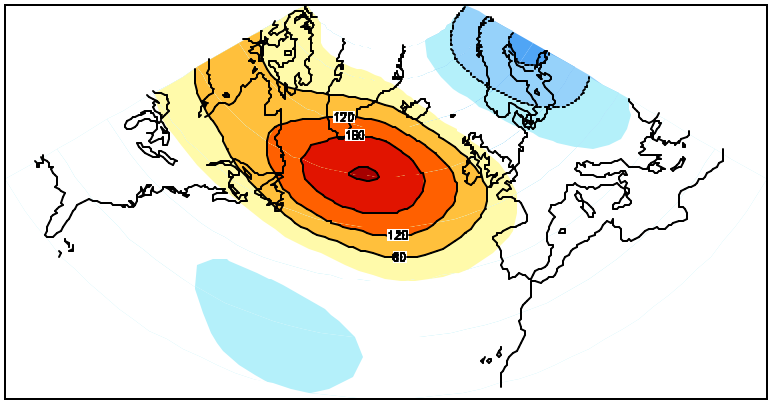
Average skill score (ACC) of regimes:

- R1~58
- R2~72
- R3~45
- R4~46

Fig. 4

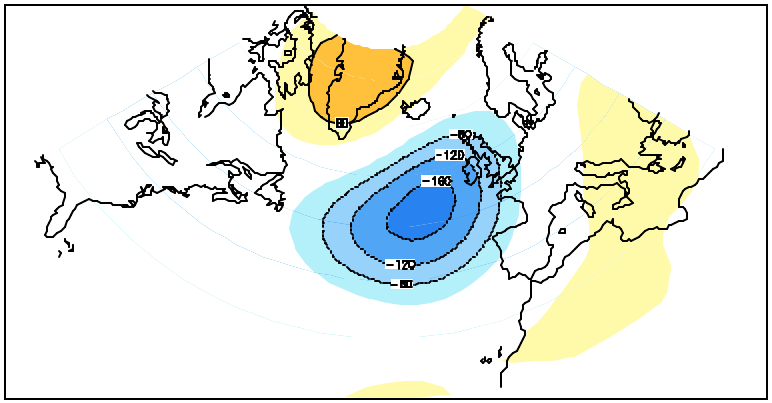
Flow Regimes in NA(60W-0, 25-75N)

Regime: 1 (NA:60W−0,25−75N)



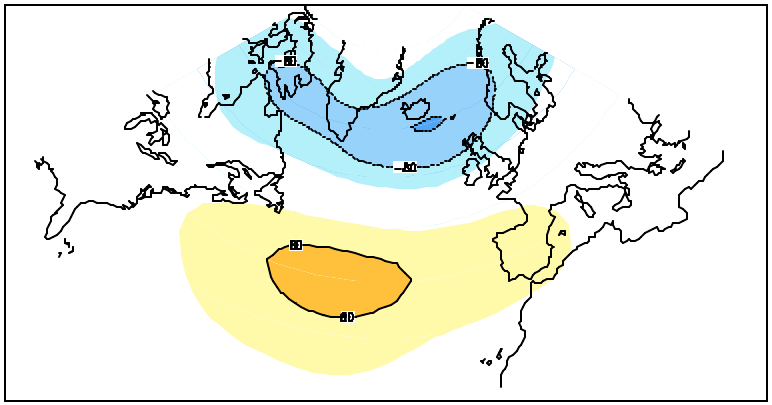
119 maps

Regime: 2 (NA:60W−0,25−75N)



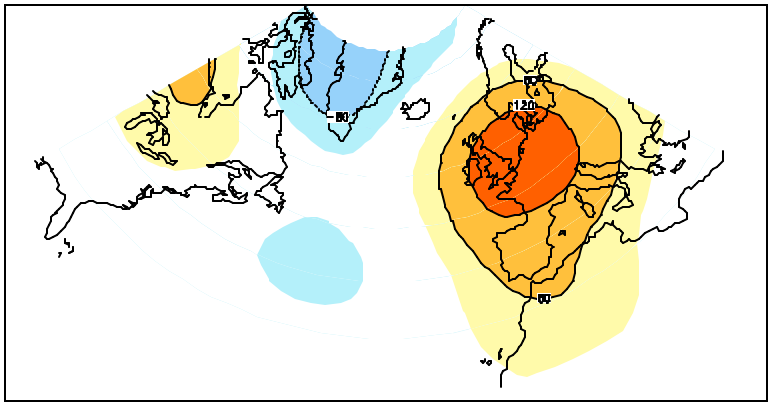
107 maps

Regime: 3 (NA:60W−0,25−75N)



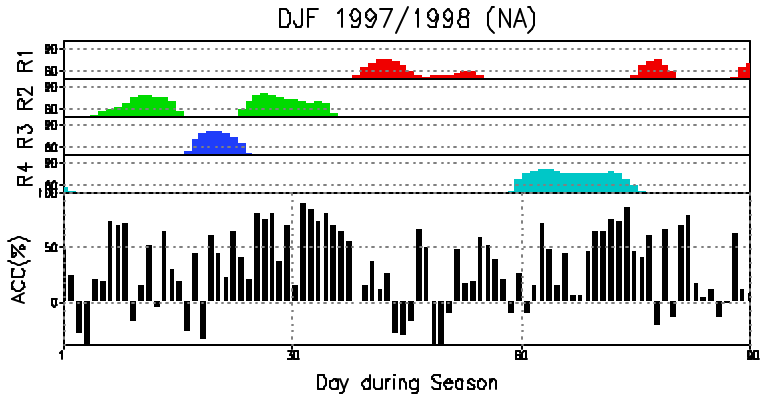
77 maps

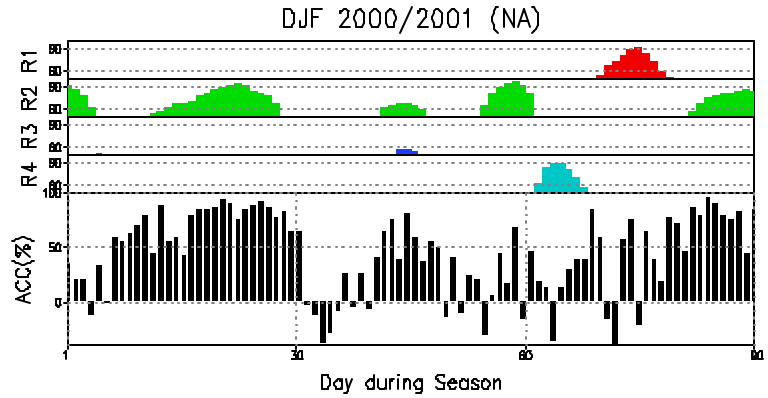
Regime: 4 (NA:60W−0,25−75N)

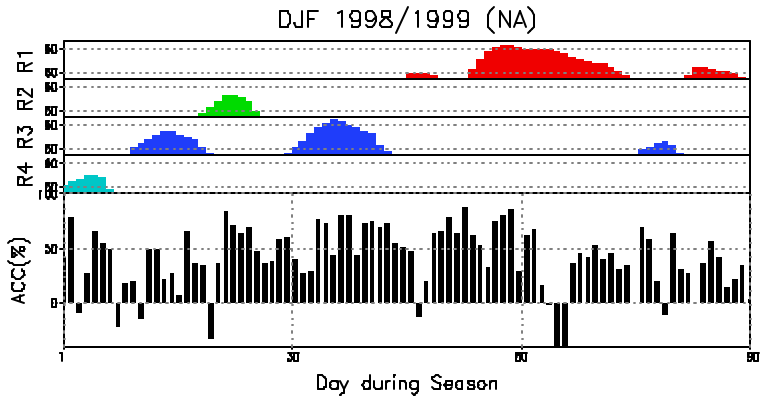


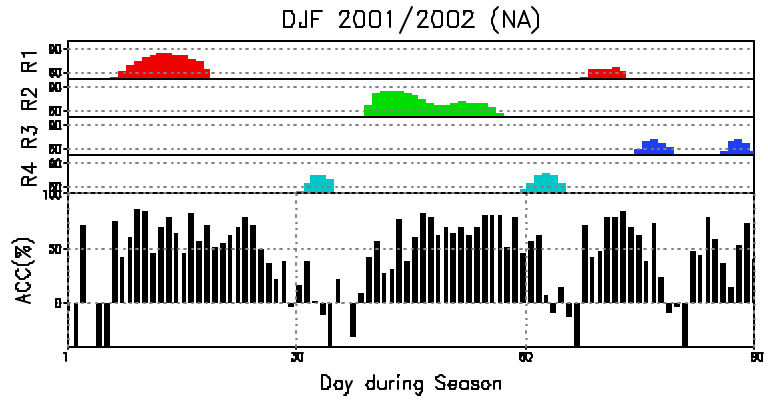
43 maps

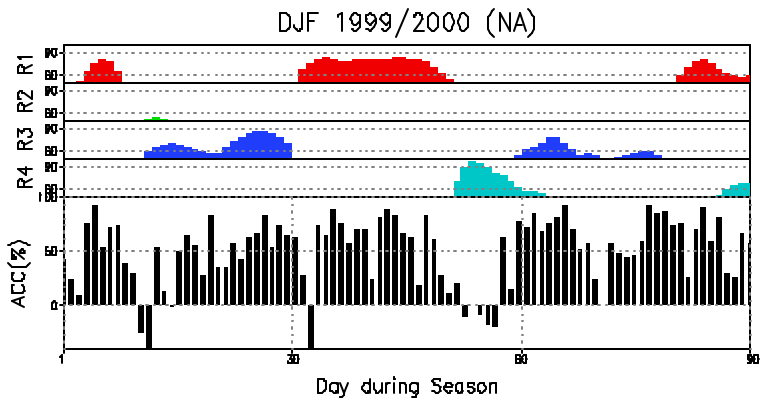
Fig. 5
Week2 Forecast Skill for the Flow Regimes in NA











Average skill score (ACC) of regimes:

- R1~45
- R2~54
- R3~43
- R4~30