Climatic Change Implications for Hydrologic Systems in the Sierra Nevada

Part Three:

Sample Model Results by Region Generalized HRU's

Part 3 was created from the HSPF model by John Humphreys, PhD.

The following graphs were output from the HSPF model, using a generalized HRU approach.

The process was as follows.

189 HRU's were defined by:

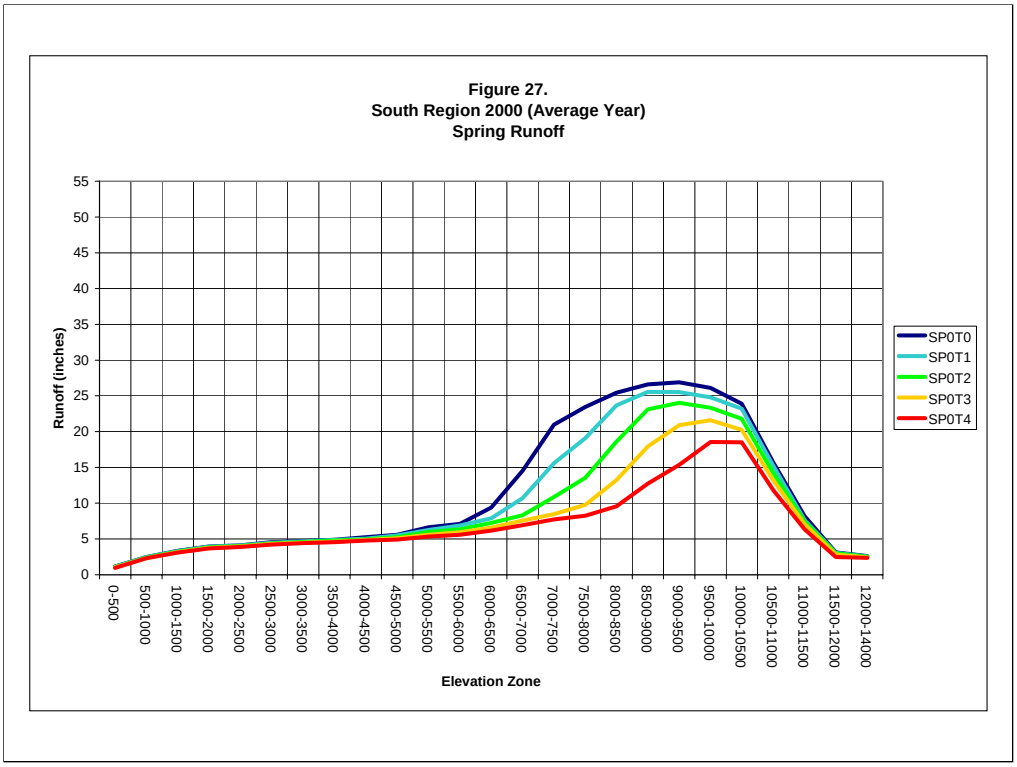
- 500 feet elevations increments
- 3 aspects--- north, south, east-west-flat
- 3 vegetation types--- forest, shrub, and bare

An initial test of the HSPF model using both soil type and vegetation cover compared to using just vegetation cover (as an indicator of both vegetation type and soil) showed that at the level of coarseness of this study, using soil type in addition to vegetation was not necessary. The number of variables in the output for the calculator would have been 567 HRU's rather than the 189 HRU's used. Very little difference was shown by the HSPF runs, so for this study, vegetation cover is used as a surrogate for soils. The vegetation types were defined by aerial photo interpretation.

The following graphs used a generalized HRU approach. Equal weight was given each HRU factor within the elevation increments, and elevation increments were likewise given equal weight. For example, the runoff in inches in the central study region would be that derived from an area equally proportioned into each of the nine HRU's within each elevation band and also equally proportioned between each and every elevation band.

These graphs are designed to show the elevation distribution of various significant hydrological processes that may be influenced by global warming.

Individual watersheds will have very specific characteristics defined by their specific HRU's, and variable watershed area by elevation. Section five will profile two individual watersheds as examples.



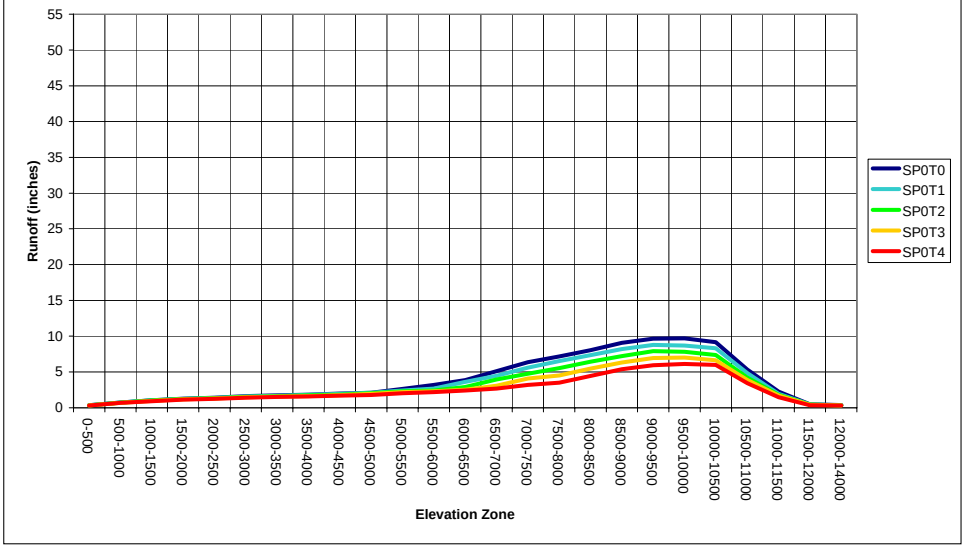
This series of three slides shows Spring runoff for the three water year types. HRU's are generalized.

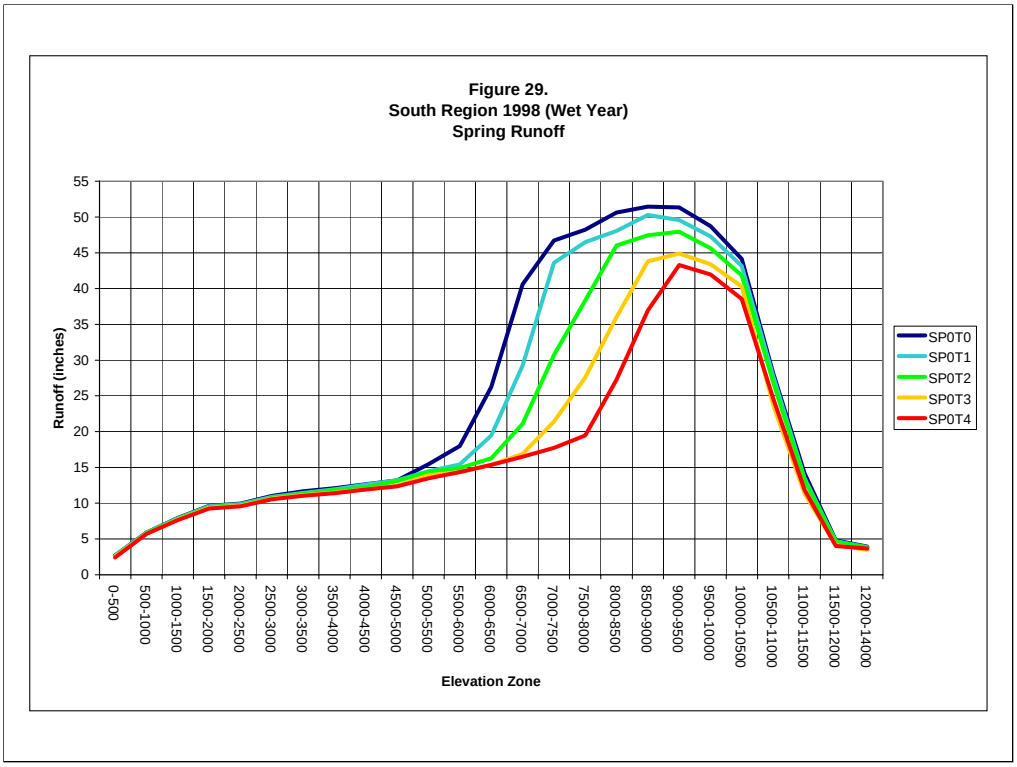
Observations:

With increasing temperature, winter rainfall precipitation extends to higher elevations, and snowpack melts earlier in the season, resulting in winter runoff occurring in higher elevations in greater magnitude due to global warming. Spring runoff is decreases in magnitude and is limited to the higher elevations. The most significant impacts are between 6000 and 11,000 feet elevation.

Impacts are more significant in wet water years.

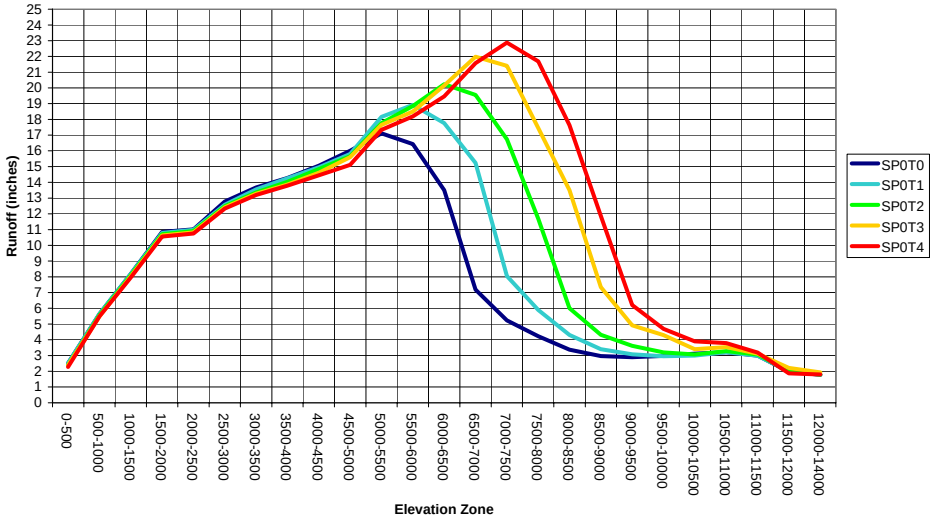
Figure 28.
South Region 1992 (Dry Year)
Spring Runoff

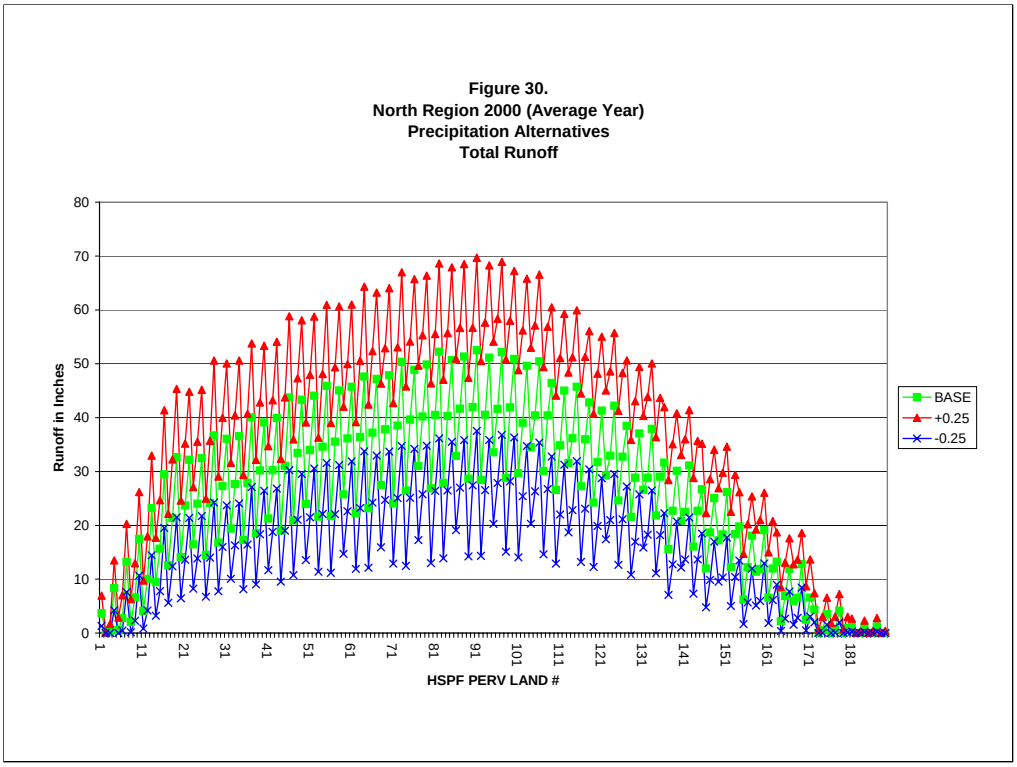




Spring runoff declines in magnitude and occurs at higher elevations with increasing temperatures.

Figure 26.
South Region 1998 (Wet Year)
Winter Runoff





189 different Hydrologic Response Units (HRU's) are graphed here for each of the three water year types.

Tremendous amount of data was used in the HSPF model.

189 HRU's comes from:

Aspect (3)

Veg type (3)

Elevation intervals (500 ft bands; 25 variables)

Aspect and vegetation types are combined below 3000 feet elevation, producing 189 HRU's.

There is an imbedded limit of HRU's in the HSPF model. HSPF will not support more than 200 HRU types.

The other major hydrologic model, PRMS, would accept only 40 variables, which is why HSPF was selected as the modeling program for this study.