

CVEN 627 “Engineering Surface Water Hydrology”

MINI-PROJECT 1

Assigned 2/13/06

Due 2/27/06

In this mini-project, you will explore the role of spatial and temporal aggregation on hydrologic modeling in the form of the Palmer Drought Severity Index.

Using the same data files and VB codes as you used in Homework #1, do the following:

(1) Determine the time-series of PDSI values from January 1948 to December 2004 using a monthly time-step for:

- (a) Peoria County (stations 111627, 116711, and 117004); and
- (b) Illinois Climate Division 4 (stations 111475, 111627, 111743, 112193, 113940, 115079, 115712, 116711, and 117004)

For each of these larger spatial units you will need to spatially average temperature and precipitation values in each month. A Thiessen polygon analysis has already been done to produce the sets of spatial multipliers given in the accompanying file (downloadable from the course website). Note that whenever data is missing at a station in a given month, you will need to use the appropriately adjusted multipliers. Once you have spatially averaged meteorological values, all other calculations are done in the same way as in Homework #1.

(2) Determine the time-series of PDSI values from January 1948 to December 2004 for Illinois Climate Division 4 for the following 2 time-steps:

- (a) 0.5 months; and
- (b) 2 months

To determine data values for T and P at these time-steps, you'll may start with the daily spatially averaged values for CD4 that you determined in (1b) above. Then, compute sums or means as appropriate for half-month or two-month periods. Half-months should be defined based upon the actual number of days in the whole month. That is, 30-day months are composed of two 15-day half-months; 31-day months are composed of one 16-day and one 15-day half-month; etc. Two-month periods should be Jan+Feb, Mar+Apr, May+Jun, etc.

Thornthwaite PE values will need to be adjusted for the time-step length. Averaged values will be computed based on the time-step as well. For example, when using half-month time-steps, there will be 24 values of alpha; when using two-month steps, there will be 6 values of alpha.

(3) Also posted on the course website is soil moisture measured at a site in Peoria, IL, at irregular intervals from 1982 to 1999. Assess the results you've determined in Homework #1 and parts (1) and (2) above against this measured soil moisture data.

Answer the following questions:

- (a) Do the soil moisture values S'_s and S'_u computed in the PDSI model appear to be representative of the real soil moisture measured at Peoria?
- (b) At what levels of spatial and temporal aggregation do the modeled and measured soil moisture agree and disagree?
- (c) Looking back through the meteorological data measured at the Peoria Airport station (116711), do the measured soil moisture values appear to respond to the measured weather?
- (d) There is significant interest on the part of much of the hydrologic community (a really happenin' bunch of folks) in installing sensor networks for soil moisture that would operate alongside weather data networks. Based upon what you've seen in these assignments, what do you think of that idea? What issues should be considered in the design and implementation of such networks?