Homework 4: Baseflow Index and Recharge
GEOS 4430 - Fall '11

Due: Nov. 1st
(but may be handy for the midterm...)

An automated program BFI for hydrograph separation is available and has been used for a variety of hydrological purposes (e.g. US map of BFI). The program uses daily streamflow files from the USGS (e.g. E. Fk. Trinity at McKinney), allowing BFI computation for any real-time streamgauge in the U.S.

We will study hydrological differences between North Texas' surface water supply and Central Texas' (Austin-San Marcos-San Antonio), using the BFI program results (see BFI homework output files).

1. Compare the baseflow characteristics of the E. Fk. Trinity at McKinney with the Comal River

   (a) Examine the full-record mean Baseflow Index (BFI, or computed fraction of baseflow to stormflow at that gauge) for both rivers. This is recorded in the last lines of the BFI output files *eFkTrinityMcKinneyDailyQ.bfi* and *comalRiverTX.bfi*

   (b) what is the primary source of streamflow for each river?

   (c) how is each likely to respond to short term climate changes (e.g. drought)? You might try to plot total discharge for both vs time to support your answer.

   (d) compare two dry years, e.g. 2006 for the Upper Trinity River, 2002 for Comal River. How does BFI correlate with total discharge (a plot of Q and BFI vs. year might help here...)

   (e) how should water resources management differ for the two rivers during periods of extended drought?

2. Examine the discharge record for calendar year 2009 for both rivers (files *comalRiverTX.q* and *eFkTrinityMcKinneyDailyQ.q*):

   (a) how did baseflow and total discharge vary over the year for both rivers?

   (b) examine baseflow and total discharge for a single storm event for each river (e.g. late August has a nice one, or you can choose something earlier than 2009 for Comal River to avoid drought effects in the record)

i. of the three single-storm baseflow separation methods discussed in class (e.g. concave, ...) which most closely approximates the BFI program results

ii. for the storm event in each river, do you agree with the program's choice of inflection point (time after which all discharge is assumed to be baseflow)? Why or why not?

iii. the parameter N in the BFI input dialog (file *bfi_comalRiver.log*) allows you to adjust the placement of that inflection point. A USBR study indicated $N = 2$ days is best for Comal River at this location.

3. To run BFI on your own:

   (a) download and install the BFI software (requires Fortran compiler ?)

   (b) download a daily discharge record from USGS (e.g. any of the real-time gauges, pick *Time series: Daily data* in *Tab separated* format

   (c) replace the line "# Data for the following site(s) are contained in this file" with "# Sites in this file include:"

   (d) give the file an extension of **.rdb* (optional??)

   (e) see Wahl & Wahl 2004 for an example application of this software