Thanks for bearing with my handwriting!

Remember write reports as if a hydrologist that doesn't know about your site or MODFLOW is the reader <u>BTW If I get a paper with a cut and paste of MODFLOW output I will return it without grading --- and there will be NO "CHANCES" VIA Re-submission. If you cut and paste MODFLOW output in a report the grade will be ZERO</u>

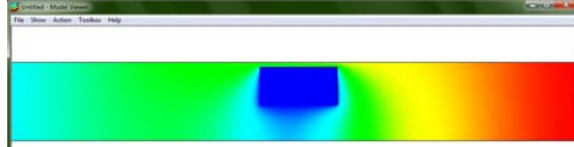**WOULD YOU LIKE TO SEE the HEAD DISTRIBUTION AS FOLLOWS?**

Figure 1: Heads in the aquifer

```
  1       2       3       4       5       6       7       8       9      10
..............................................................................
  1   19.27   19.27   19.26   19.19   18.97   19.68   20.11   20.52   21.89   21.89
  2   19.27   19.27   19.26   19.19   18.94   19.68   20.11   20.52   21.89   21.89
  3   19.27   19.27   19.26   19.19   18.97   19.68   20.11   20.52   21.89   21.89
```

Or would you prefer:
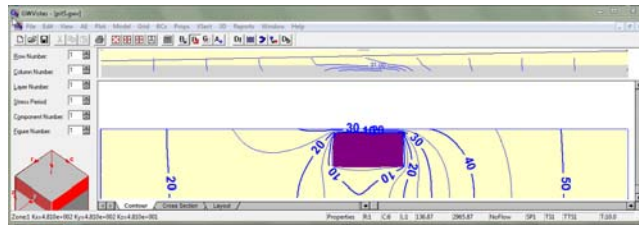
Or perhaps:


LET ME RE-STATE – VERY IMPORTANT!!! <u>If I get a paper with a cut and paste of MODFLOW output I will return it without grading --- and there will be NO "CHANCES" VIA Re-submission. If you do that the grade is a ZERO</u>

WOULD YOU LIKE TO SEE BUDGET AT ONE POINT IN TIME AS FOLLOWS?

Figure 2: You can clearly see the water is going into storage and the river is depleted

```
CUMULATIVE VOLUMES    L**3    RATES FOR THIS TIME STEP   L**3/T
------------------            ------------------------
      IN:                          IN:
      ---                          ---
   STORAGE =     267.2355        STORAGE =     6.9347E-02
CONSTANT HEAD =     0.0000   CONSTANT HEAD =       0.0000
     WELLS =       0.0000        WELLS =         0.0000
RIVER LEAKAGE =     0.0000   RIVER LEAKAGE =       0.0000
   RECHARGE =    3156.8997       RECHARGE =        3.4999

   TOTAL IN =    3424.1353       TOTAL IN =        3.5692

      OUT:                          OUT:
      ----                          ----
   STORAGE =       0.0000        STORAGE =         0.0000
CONSTANT HEAD =     0.0000   CONSTANT HEAD =       0.0000
     WELLS =    1800.0000        WELLS =           3.0000
RIVER LEAKAGE =  1624.1998   RIVER LEAKAGE =       0.5694
   RECHARGE =       0.0000       RECHARGE =        0.0000

   TOTAL OUT =   3424.1997       TOTAL OUT =       3.5694

   IN - OUT =   -6.4453E-02      IN - OUT =     -1.5736E-04
```

OR WOULD YOU PREFER SEEING THE BUDGET AS A FUNCTION OF TIME?
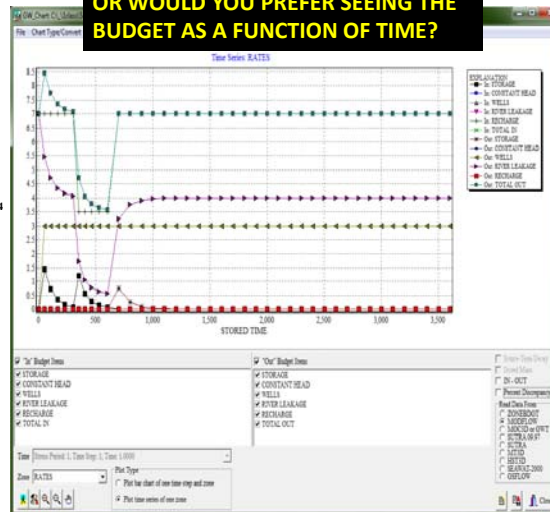
NOTE: **ModelMate does not simulate nor calibrate anything**
 MODFLOW simulates and
 UCODE calibrates

THERE IS <u>NO "TIME" IN STEADY STATE</u>

Transient Work Requires Storage Parameters
 S_s is specific storage
 Storativity or Storage Coefficient is   S = S_s * thickness
 Similar to K and Transmissivity
 What do you know about values of S?
 Generally "small" numbers e.g. typically 1×10^{-7} to 1×10^{-4}
 when it approaches 1×10^{-3} we call the formation a semi-confined aquifer
 Say you use an S_s of 8×10^{-3} ft^{-1} and the aquifer is 50 ft thick then S = 0.4 !!!!!

Recall assignment requires multiple transient stress periods (minimum 2)
 In your report, use a graph to show the stresses and their timing

Understanding Storage Term in the Budget (think of storage as an external reservoir):
 water OUT TO STORAGE occurs when <u>water levels rise</u>
 this may be confusing because you picture that water is going into the aquifer
 think of it in the way you had to think of it for water budgets in your basic hydro class
 VOL = Δh * area of cell * storage coefficient
 storage coefficient is SY or S depending on aquifer condition (unconfined/confined)
 water IN FROM STORAGE occurs when <u>water levels fall</u> (same formula)

USE CHARTS RATHER THAN TABLES – Take advantage of GWChart
 USE RATES rather than CUMULATIVE VOLUME
 USE hydrographs – show locations other than pumping wells
 must have data saved in output (via .oc file) to use GWChart

BUDGET – Generally USE RATES vs CUMULATIVE

HYDROGRAPHS – For heads, flows, and concentrations

What do we mean by Initial Conditions for a Transient run ?
    It is not the same as for your steady state model
    What are your options for setting these up?
      see notes and recall discussion on MAR 30
      Transient Modeling and GUIs   ASSGN #6 DUE
      PDF of class notes **Transient Modeling.pdf**

If the model results seem "odd" figure out the cause ... Usually it is an input error
  first submission is intended to get you feedback to improve learning and grades
  it was not intended to allow people to be late (although it can rescue you)
  it is highly unusual that you entirely understand your model results the first pass
  generally it takes at least 2 passes

WATCH MASS BALANCES FOR ALL TIMESTEPS!
  Often the biggest trouble is on the first time step of a stress period
  Why?
  How do we improve mass balance?
    Closure criteria / # iterations
      How do we control those?
      In solver package
    Time step size
      How do we control those?
      In dis package
      Period Length - # of steps - timestep multiplier
        typically multiplier > 1 (1.1-1.3)
    consider magnitude of stress change and size of last step in previous period