ADH
Rules of Thumb

Refinement Levels

- **Refinement Levels (ML mat# lev#)** – allows an element to be divided into a maximum of 2lev# of elements, you may not use all of them depending on the flow conditions and the SRT

Method for determining refinement tolerances

- **Method for determining refinement tolerances (SRT mat# tol#)** – run a short simulation with ML = 0 and SRT = 1, view the *err.dat output file to determine the magnitude of the residual error values, use the SMS contour options to determine which elements may be refined for a given tolerance value.
- The values in the *err.dat file are ratios of residual error to tolerance value. When this ratio is greater than 1, an element can be refined.
- Once an appropriate SRT value is determined for each material from the initial run, set the SRT values and run again. This time the *err.dat file should contain much lower values.
- Locations where the values remain greater than 1 usually require more refinement levels.
- A standard rule of thumb is to not refine more than about 20% of your mesh at a given time, so select the appropriate SRT with this in mind. Watch the run and check the amount of resolution that is being added to make sure that you are getting the expected results.

Mesh Quality

- **Mesh quality** is always a concern for numerical modeling.
- Meshes used with other tools may not easily convert to linear triangles with good aspect ratios simply by splitting quadrilaterals.
- Always check your mesh quality for thin triangles and rapid variation in element size.

Wetting/Drying Tolerances

- **Wetting/Drying Tolerances (DTL tol# tol#)** – The wetting/drying tolerances default to 0 if the card is not included and it is not needed when the domain remains wet. However, once drying begins to occur, the model can become unstable unless these values are set greater than 0.

- Although 2 parameters are available, setting both to the same value is most successful at this time. This value has a unit of length.

- Once the depth becomes equal to or less than the tolerance depth a stability factor is applied to prevent large velocity results and instabilities (essentially placing mass balance as the priority and not worrying with the physics).

- It is best to keep this value as low as possible…starting around 0.001*max depth in the model and then adjusting to improve model performance is a good method.

Steady State Initial Timestep

- **Steady State Initial Timestep (STD #)** – The steady state option doesn’t care about time but ADH still computes through a timestepping method.
- When using this option, an initial timestep is requested. This value should be fairly small, on the order of 5 or 10 in most cases.
- The code will increase or decrease this value as is runs in an effort to reach convergence to the NTL value.
- Since the product of the initial residual and the initial timestep size is kept constant to determine how to vary the timesteps as the residual changes throughout the run, the initial timestep size can have a large effect on the solution.
- If the run fails, drop the initial timestep by about half and try again.

Eddy Viscosity

- **Eddy Viscosity (EEV and EVS)** – Eddy viscosity is a parameter that helps numerical solutions match reality.
- Higher values indicate more viscous flow and vice versa.
- It is often difficult to determine how to set the various EVS values so the Estimated Eddy Viscosity (EEV) can help.
- This parameter computes the appropriate viscosity term depending on the depth and velocity magnitude at each location and time. This option requires the user to input a coefficient between 0 and 1.
- Typically 0.5 is a good place to start and sensitivity checks can be performed to determine if this coefficient should be adjusted.
- If using EVS, an initial estimate can be calculated as 1/40*h*u, where u is a representative depth in the model and u is a representative velocity magnitude.

Sediment Time Steps

- **Sediment Initial Timestep Estimate (TC SDI #)**
- **Sediment *dt* init. est. =** $.693\frac{h}{w_s}$

w_s **= settling velocity of suspended grains**

$$w_s = u^* = \frac{\sqrt{\tau}}{\rho\omega}$$

For all of these cards, more information can be found in the Adaptive Hydraulics 2-Dimensional Shallow Water Manual as well as the ADH Quick Reference.

Common Error Messages

- *2D elements do not exist to match 1D elements*

  Check node numbers in edge strings, there is likely a wrong node number or a gap

- *Overland flow does not match available types*

  Either the hotstart file does not contain correct initial depths (the mesh is dry) or there is a string that does not have an associated boundary condition