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Hw 9

Stream Exercise -edit

Chart, histogram

Description automatically generated

Chart, diagram

Description automatically generated

1. The code is provided to produce the first set of 'correct' figures. Use these figures to describe the nature (direction/magnitude) of stream/aquifer exchange along the stream. In particular, explain why the leakage changes magnitude or direction where these values change.

**As we are using the STR module in this code, we are simplifying hydraulic parameters of stream and Manning’s formula for the computation of the surface water level. In the first figure, as we see the flow coming in, it matches with the flow coming out, which should be the case considering conservation of mass properties as the inflow minus outflow equals our leakage value. Flow in the adjacent reaches is the difference between the flow from the previous reach and the seepage/leakage (positive or negative) through the bottom sediment layer. Assuming that the discharge from the previous reach is consistent with the current reach, we can view the leakage/seepage of the system as the magnitude of the flow. The STR module also assumes that the flow from the previous reach is instantaneously available at the next reach in flow direction.**

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b) Use the head distribution to describe the movement of water across the boundaries and into/out of the stream.

**Looking at the head distribution within both figures 1 and 2, the head of the water decreases along the reach as we approach the stage of the river. Once we reach the stage of the river, the head of the cell remains constant with the stream. Once we go further into the stream, we see the continuous decreasing of head within the cell, however, it is at an exponential decay this time. Not sure why this is the case.**

**Looking at the head distribution within both figures 1 and 2, the head of the water decreases along the reach as we approach the stage of the river. There is a gradient across the stream bed sediments from the cell to the stream. Once we reach the stage of the river, the head of the cell remains constant with the stream. There is a small difference between the cell and the stream in the middle section of the head graph because as the streambed conductivity gets high, it cannot maintain the difference between the cell and the stream. Once we drop below the head of the stream, we see the continuous decreasing of head within the cell, however, it is at an exponential decay this time as we lose more energy.**

c) Choose two things to explore (e.g. impact of streambed K or inflow into the river or recharge rate). Produce a plot for each to compare to the base plots and use the plots to explain the impact of the hydrologic change.  
  
**Initial k = 1 f/d**

**Changed k = 5 f/d**

**Chart, histogram

Description automatically generated**

**Chart, diagram

Description automatically generated**

**For an increase in hydraulic k, we see an increase in stream head and therefore an increase in head within the cell all around, “squishing” the values towards the top. Additionally, the flow in and out look more symmetrical. The head distributions also look more vertical as there is more uniform change along the streambed with a higher k value. Higher k seems to have a large impact on the system.**

**For an increase in hydraulic k, we see an increase in stream head and therefore an increase in head within the cell all around, “squishing” the values towards the top. As the hydraulic K increases as noted before, we see that the system cannot maintain the difference between the cell and the stream. Therefore, we see a larger range of a very small change in head of the cell as we go along the stream stage head with increased hydraulic K values in the streambed. Additionally, the flow in and out look more symmetrical. Increased hydraulic K allows the flow to move uniformly throughout the system. The head distributions also look more vertical as there is more uniform change along the streambed with a higher k value. Higher k seems to have a large impact on the system.**

**Initial streambed roughness = 0.02377**

**Changed roughness = 0.2**

**Chart, histogram

Description automatically generated**

**Chart, diagram

Description automatically generated**

**For an increase value in the roughness, I did not see any change. This surprises me as the STR module we use uses Manning’s equation which is dividing n, the roughness value over the whole function.**