Problem

Data was obtained from the Rio Grande at Bernalillo (Geological Survey Professional Paper 462-B and 462-F) on June 4th 1953. The total flow depth is 3.5 ft, the channel top width is 270 ft, energy grade line \( (S_f) \) is 0.000083 ft/ft, mean particle size approximately 0.069 mm and temperature is 62°F. The velocity and concentration profiles are provided in the following table.

<table>
<thead>
<tr>
<th>( y ) (ft)</th>
<th>( V ) (ft/s)</th>
<th>( C ) (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>3.72</td>
<td>2359</td>
</tr>
<tr>
<td>0.8</td>
<td>4.09</td>
<td>1809</td>
</tr>
<tr>
<td>1.3</td>
<td>4.36</td>
<td>1540</td>
</tr>
<tr>
<td>1.7</td>
<td>4.36</td>
<td>1240</td>
</tr>
<tr>
<td>2.2</td>
<td>4.25</td>
<td>1151</td>
</tr>
</tbody>
</table>

1) Plot the velocity and concentration profiles;  
2) Determine kappa from the velocity profile;  
3) Plot the concentration data on the log log plot and determine the Rouse parameter;  
4) Calculate the Concentration \( C_a \);

Optional  
5) Numerically integrate the velocity profile to find the unit discharge;  
6) Numerically integrate the product of velocity and concentration to determine the unit sediment discharge;  
7) Assuming uniform flow conditions over the entire channel width, estimate the total discharge of the river in m³/s; and  
8) Estimate the daily sediment load in metric tons per day.

\[
\frac{U}{U_x} = \frac{1}{K} \log (\ )
\]

\[
\text{depth} = 8.9563 \log V - 1.21
\]
2) Using Excel to determine log. regression

\[ V = 0.3144 \ln (y) + 4.1463 \]

\[ U_x = \sqrt{ghS} = \sqrt{132.2 \text{ ft} \times 3.5 \text{ ft} \times 0.000083} \]

\[ U_x = 0.0967 \text{ ft/s} \]

\[ V = \frac{U_x}{K} \ln \left( \frac{y}{y_0} \right) = \frac{U_x}{K} \left[ \ln y - \ln y_0 \right] \]

\[ -\ln y_0 = \frac{4.1463}{0.3144} \]

\[ y_0 = 1.87 \times 10^{-6} \]

\[ \frac{U_x}{K} = 0.3144 \]

\[ \theta \frac{K}{a^3.144} = \frac{0.0967}{0.3144} = 0.31 \]
3) Plot using Excell

\[ C = Ca \left( \frac{h - y}{Y} \cdot \frac{a}{h - a} \right)^{R_0} \]

Plot \rightarrow Concentration (Y-axis)

\[ \frac{h - y}{Y} \cdot \frac{a}{h - a} \] (x-axis)

\[ a = 2ds \rightarrow 2 \times 0.069\text{mm} \times \frac{1\text{m}}{1000\text{mm}} = 1.38 \times 10^{-4}\text{m} \]
\[ h = 3.5\text{m} \]

\[ y = 17781 \times 0.2582 \]

\[ R_0 = 0.26 \]

If \[ a = 0.3\text{m} \]
\[ y = 2389 \times 0.2582 \]

\[ R_0 = Ca = 2389 \text{ if } a = 0.3\text{m} \]
\[ Ca = 17,781 \text{ if } a = 0.000138 \]