The Python script (slide38to40) performs a series of data manipulations and calculations on a dataset related to water quality and flow measurements, focusing mainly on Dissolved Reactive Phosphorus (DRP) concentrations and specific flow rates. Here’s an explanation of each part of the code:

1. Loading Data: The script begins by importing necessary libraries and loading the data from a CSV file into a DataFrame.
2. Date Parsing: It converts date strings in the data to datetime objects for easier manipulation.

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| Result  DatetimeWQ DatetimeF  ~~0 2011-04-18 09:08:00 2011-04-18 09:10:00~~  1 2011-04-20 09:15:00 2011-04-20 09:15:00  2 2011-04-26 09:26:00 2011-04-26 09:25:00  3 2011-04-27 12:38:00 2011-04-27 12:40:00  4 2011-05-12 10:16:00 2011-05-12 10:15:00 |

1. Unit Conversion: Converts DRP measurements from milligrams per liter (mg/L) to kilograms per cubic meter (kg/m³).
2. Interpolation and Averaging:
   1. Interpolates DRP concentrations to estimate values between measurements.
   2. Averages the flow rates (Flow[cumec]) to approximate the flow at intermediate times.

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| Result  DRP\_kgm3 c\_int q\_j  0 2.900000e-06 0.000114 0.3485  1 2.260000e-04 0.000116 0.3825  2 6.600000e-06 0.000010 0.2365  3 1.380000e-05 0.000007 0.1710  4 6.000000e-07 0.000055 0.2130  The DRP concentrations have been converted to kg/m³, and both interpolated concentrations (c\_int) and mean flows (q\_j) have been calculated. The interpolated concentration is the average between consecutive measurements, allowing for a smoother representation of concentration over time. The mean flow is similarly calculated to approximate flow rates at intermediate points between measurements. |

1. Time Differencing: Calculates the time difference between consecutive measurements in seconds.
2. Mass Load Calculation:
   1. Computes the mass load of DRP for each interval using interpolated concentrations, average flows, and the time difference.

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| Result  Time\_diff\_sec Mass\_Load\_kg Total\_Stream\_Volume\_L  ~~0 173220.0 6.909023 14030820.0~~  1 519060.0 23.090254 319740960.0  2 97920.0 0.236212 14590080.0  3 1287480.0 1.585145 417143520.0  4 266700.0 3.113029 4800600.0  Time differences between measurements in seconds, the mass loads of DRP contributed by each interval in kilograms, and the total stream flow volume for each interval in liters. |

1. Total Stream Volume Calculation: Computes the total volume of stream flow in liters for each interval.
2. Monthly Aggregation:
   1. Groups data by month.
   2. Sums up total mass loads and stream volumes for each month.
3. Flow-Weighted Mean Concentration (FWMC): Calculates the monthly flow-weighted mean concentration of DRP.
4. Mass Export per Hectare: Calculates the mass of DRP exported per hectare of watershed area for each month.

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| Result  Total\_Mass\_Load Total\_Stream\_Volume FWMC\_mg\_L Mass\_Export\_kg\_ha  ~~2011-04 31.820635 7.655054e+08 0.000042 0.022252~~  2011-05 483.742478 7.441268e+08 0.000650 0.338281  2011-06 175.512437 1.095968e+09 0.000160 0.122736  2011-07 3.408562 7.688592e+07 0.000044 0.002384  2011-08 29.513197 5.195074e+08 0.000057 0.0206  The calculations are now complete with monthly totals, including the total mass load of DRP, total stream volume, Flow-Weighted Mean Concentration (FWMC) in mg/L, and the mass export of DRP per hectare. These values are summarized for each month in the dataset from April 2011 through December 2021, with handling to ensure all months within the range are represented, even if they have no data (filled with zero. |

1. Handling Missing Data: Ensures that all months in the range of the dataset are represented, filling missing months with zeros.
2. Saving Results: Saves the monthly totals to a new CSV file.
3. Completion Notification: Prints a message indicating that the calculations are complete and where the results are saved.

Here is the final code

A screenshot of a computer

Description automatically generated