CEE203 Homework #1

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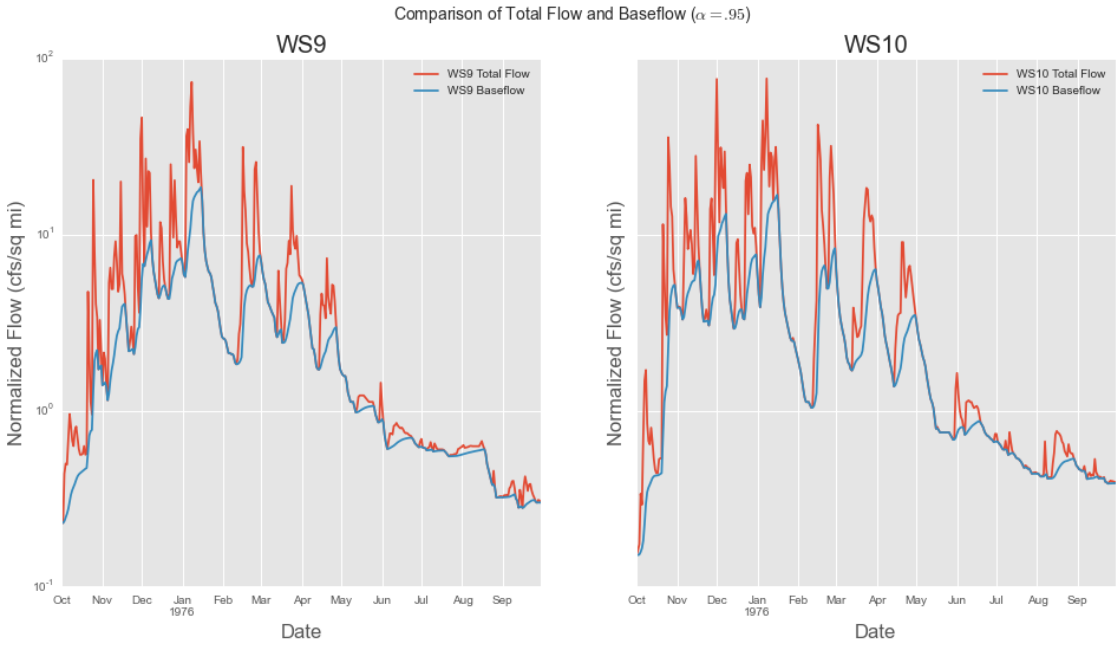
Part 1: Table Out[97]:

	WS9	WS10
Annual Runoff (mm)	1,665.31	1,939.85
Baseflow Index	0.55	0.49
Recession time constant (days)	3.36	3.75
Peak annual flow (cfs/sq mi)	73.66	77.10
Minimum annual flow (cfs/sq mi)	0.23	0.15

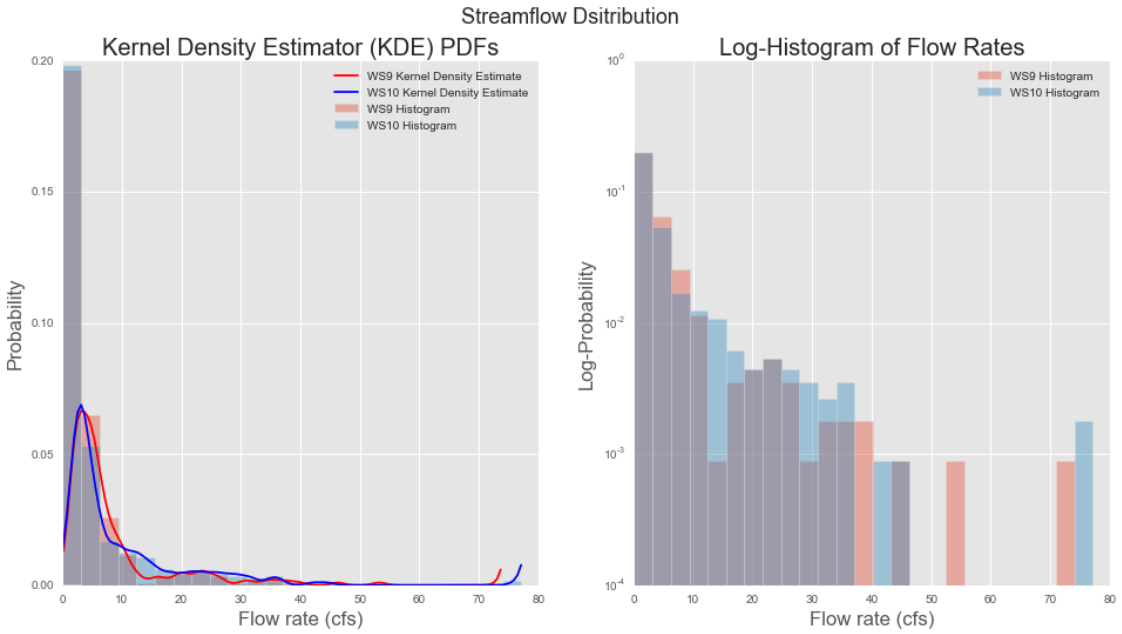
Explanation of methodology: An alpha of .95 was chosen for the baseflow calculation based on a subjective visual analysis of the representation of baseflow for several alpha choices between .9 and .99. The recession time constant τ_k is cacluated as the time for the hydrograph to recede to $1/e$ of a peak value. Based on a visual analysis, peaks with a $\tau_k > 7$ days were outliered due to the high prevalence of additional rain events confounding the recession of these peaks. In addition, peaks that had a magnitude less than $2x$ of the baseflow were simultaneously outliered.

Part 2: Plot

Out[99]: <matplotlib.text.Text at 0x1165ddf50>



Out[100]: <matplotlib.legend.Legend at 0x118f0eb50>



NOTE: The kernel density estimator does not do a great job fitting a non-parametric PDF to the data (and looks really funny if you try to plot it in log space), so the log-histogram is likely a better representation of the streamflow distributions.

Part 3: Interpretation These two watersheds display much more similar hydrograph behavior than the two we compared in class. However, there are a few notable differences:

- WS10 has about a 16% greater annual runoff. If they are located near enough, and thus experiencing similar precipitation, this would indicate that a greater percentage of the precip in WS9 is going to recharge and/or evapotranspiration. They certainly seem near enough to experience precipitation events at similar times. On the other hand, WS10 may simply be getting more rain than WS9 due to a variety of topographic/geographic factors.
- Both watersheds display a Baseflow Index of roughly .5 at the chosen alpha, though WS9's BI is slightly higher. This indicates that a greater percentage of WS10's annual flow comes from quickflow than WS9's. In the urban/non-urban comparison, we saw that the non-urban watershed had a much higher BI. Taken in concert with the observation of lower annual runoff in WS9, this may indicate that a greater portion of the flow in WS9 is coming from groundwater, rather than surface runoff. Or, it may corroborate the hypothesis that WS10 simply gets more rain during precipitation events.
- The recession time for WS10 is slightly longer than that of WS9. While the magnitude of this difference is sensitive to choice of recession threshold and outliers, these the sign of that difference is less so. This would tend to suggest that WS10 has a less "flashy" hydrograph than WS9, yet we observe a greater BI for WS9. This seems to further support the idea that WS10 is simply receiving greater rainfall during precip events than WS9. This would lead to the lower BI even though WS10 is slower to drain than WS9
- This hypothesis is supported by the higher peak flow in WS10, as well as the greater amplitude of local peaks in the hydrograph. The minimum flows are not different enough to significantly influence my interpretation, and the drier parts of the hydrograph look similar to me as well.
- The histograms/PDFs are also similar enough that I do not believe one can draw significant conclusions about the differences in the two watersheds from this figure

In summary, these observations lead me to believe that WS10 and WS9 are located near each other, but that WS10 receives greater rainfall with each rain event. Both hydrographs appear to exhibit rain-fed, rather than snow-fed behavior. WS10 appears to take longer to drain than WS9, which may be attributable simply to the greater rainfall or to some properties of the surrounding vegetation/soils.