Regional analysis of monthly runoff using regime curves

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The evaluation of monthly runoff in ungauged basins is necessary for water resources assessment and management, and can be achieved through regional analysis. A trivial approach toward this evaluation is to carry out a different statistical (regional) analysis for each of the twelve months. A major problem with this approach is that it can produce a different multi-regression model for each considered month, possibly involving a large number of geomorphic and climatic basin attributes. Moreover, this approach does not preserve the month to month correlation. The alternative proposed here involves the following steps: (i) deseasonalise the monthly runoff data by dividing them by their corresponding monthly averages; (ii) use a two-parameter distribution to represent the inter-annual variability; (iii) reproduce the series of the monthly averages (the regime curve) using a Fourier series, whose parameters are regionalized by multi-regression analysis; (iv) treat the series of the monthly variances in a similar manner. This procedure involves a limited number of regression models, built for the Fourier curve parameters, and requires a reasonable number of catchment descriptors. An application to a large alpine region in northern Italy demonstrates the robustness of the proposed procedure.