Drainage density and flood statistics: are they related?

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We investigate the links between the drainage density of a river basin and selected statistics of the river flows such as, for instance, mean, standard deviation, coefficient of variation and coefficient of skewness of annual maximum series of peak flows. The investigation is carried out through a three-stage analysis. First, a numerical simulation is performed by using a spatially distributed hydrological model in order to highlight how flood statistics change with varying drainage density. Second, a conceptual hydrological model is used in order to analytically derive the dependence of flood statistics on drainage density. Third, the dependence between flood statistics and drainage density is analysed for 44 watersheds located in northern Italy. The three-level analysis seems to suggest that a critical value of the drainage density exists for which a minimum is attained in both the coefficient of variation and the absolute value of the skewness coefficient. Such minima in the flood statistics correspond to a minimum of the flood quantile for a given exceedance probability (i.e., recurrence interval). Therefore, the results of this study may provide useful indications for flood risk assessment in ungauged basins.