The formula for quantile map contains bias correction. This is similar to Noel A.C.Cressie, “Statistics for Spatial Data”, 1993, p. 137. See formulas below. Using this formula the integral of quantile predictions by q will produce unbiased prediction.

Universal Kriging formulas:

$$\Sigma\lambda + \mathrm{X}\mu = \mathrm{b}$$

$$\mathrm{X}^T\lambda = \mathrm{x}$$

Kriging prediction:

$$\hat{Y} = \lambda^T Y$$

$$var\{Y - \hat{Y}\} = \sigma^2 - \lambda^T b - \mathrm{x}^T\mu$$

Formula for quantile map (the formula contains bias correction):

$$\widehat{Z_q} = t^{-1}(\hat{Y} + N^{-1}(q) * \sqrt{\sigma^2 - \lambda^T b + \mathrm{x}^T\mu})$$

where

t^{-1} – inverse of transformation function,

q – quantile value,

N^{-1} – inverse of cumulative normal distribution function.

Notes:

1) Only Simple Kriging uses proper conditional distribution and is capable of properly reconstructing quantiles.

2) Accurate quantile map estimation in Ordinary Kriging requires Gaussian data distribution. Therefore, misspecification of transformation may lead to poor quality of quantile map.

3) The uncertainty of the model parameters estimation is not taken into account. Usually it will lead to most quantiles biased towards the mean value.

4) Most of these limitations are overcome in Empirical Bayesian Kriging.