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Short and long memory unobserved components in hydrological time series

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In this work we discuss the problem of estimating unobserved components in short and long memory hydrological time series. In particular, we focus our attention on *Decomel* (Piccolo, 1979, 1982). This is a statistical method to decompose a stochastic process $Z_t \sim ARMA(p,q)$ into the sum of two independent processes $X_t \sim ARMA(p_x,q_x)$ and $Y_t \sim ARMA(p_y,q_y)$. The method relies on four main steps:

i) to identify the conditions for the decomposition and the orders $(p_x,q_x;p_y,q_y)$;

ii) to search for the parameter vector $\beta = (\beta_x,\beta_y)'$ characterizing the AR and MA operators of the component processes such that:

$$G(\beta) = \int_{-\pi}^{\pi} \left(f_z(\omega) - f_x(\omega;\beta_x) - f_y(\omega;\beta_y)\right)^2 d\omega = min!$$

where $f_z(\omega),\ f_x(\omega;\beta_x),\ f_y(\omega;\beta_y)$ are the spectra of the Z_t, X_t, Y_t, respectively;

iii) to check for the admissibility conditions, that is, the strict positiveness of the estimated spectra of the components;

iv) to evaluate the filter weights needed to extract the components from the series by standard Wiener-Kolmogorov theory.

The integral is computed over a grid of discrete points. This results in a non-linear regression problem.

In this article we discuss how the procedure can be fruitfully applied to analyse hydrological time series. Firstly, we modify *Decomel* to make it a semiparametric method.

Secondly, we discuss an extension of the decomposition procedure to long memory time series. An application to some river flow time series conclude the work.

Essential References

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