NET RAINFALL ESTIMATION BY INVERSED GEOMORPHOLOGY-BASED UNIT HYDROGRAPH –A TUNISIAN STUDY CASE

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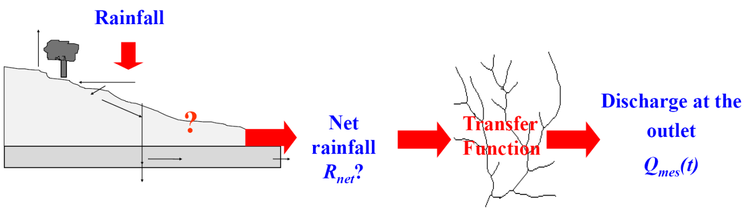
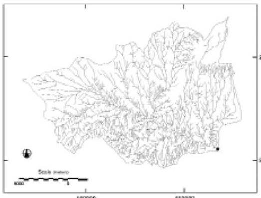
The use of a geomorphology-based unit hydrograph in a semiarid basin

The geomorphological basis can be observed for any considered outlet, from information about the relief and the watercourses. It can be translated into basin-level transfer functions, through more or less complex conceptualisations, according to the available data and knowledge.





Skhira Basin (192 km²) part of the Merguellil, Central Tunisia.

River network observed from 1:50000 topographic maps.

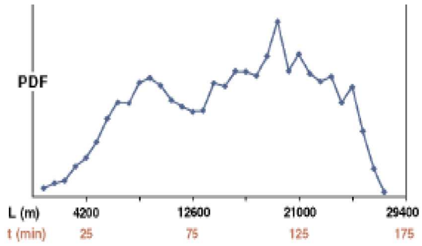
u(t) = *pdf* (L,v)

pdf: probability density function

L: length of stream course

v: average velocity

$$Q(t)=\frac{S}{\Delta t}\times\sum_{\tau=1}^{\min(t,\theta)}\overline{R_{eff}}(t-\tau+1)\times u(\tau)$$

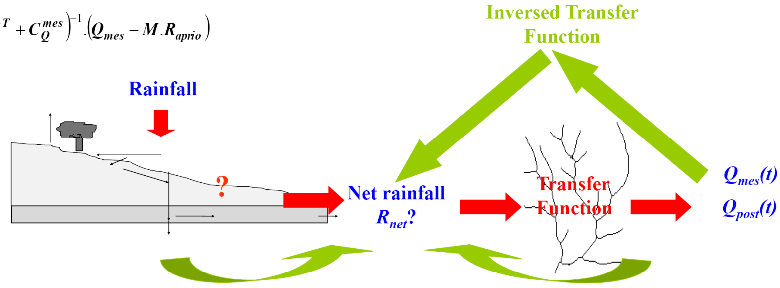


Inverse modelling of the basin level transfer function

$$R_{net}=R_{aprio}+C^{aprio}_{Rnet}.M^{T}.\left(M.C^{aprio}_{Rnet}.M^{T}+C^{mes}_{Q}\right)^{-1}.\left(Q_{mes}-M.R_{aprio}\right)$$

$M=\left(\frac{\partial m_i}{\partial R_i}\right)$: Matrix of partial differential of the model / R_{net}

C^{aprio}_{Pn}, C^{mes}_{Q} : Covariance matrices



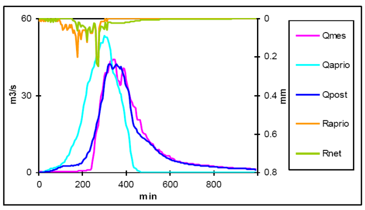
Simulation with *apriori* 1 : $R_{net}(t)$ = Kr.Rainfall(t)

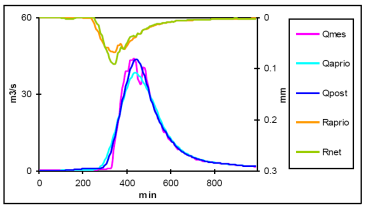
Simulation with *apriori* 2 : $R_{net}(t)$ = Specific discharge (t – Lag-time)

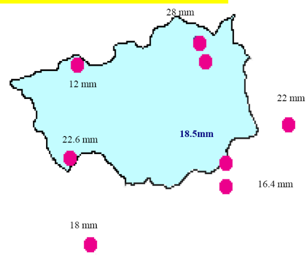
14/03/1996 event

Nash1 = 0.96

Nash2 = 0.98



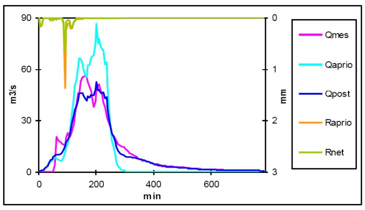


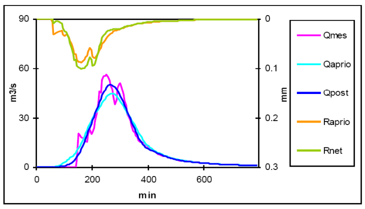


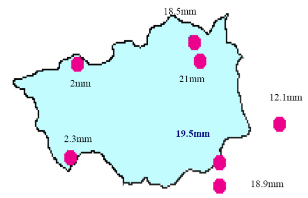
04/11/1997 event

Nash1 = 0.94

Nash2 = 0.97







Conclusions

- Low-instrumented and ungauged basins.
- No prerequisite production function.
- Effects of rainfall variability and of the apriori choice.
- Underlying robustness of the geomorphological basis.

Ref: Boudhraâ H., Cudennec C., Slimani M., Andrieu H., 2006. In Predictions in Ungauged Basins: Promises and Progress (Proceedings of symposium S7 held during the Seventh IAHS Scientific Assembly at Foz do Iguaçu, Brazil, April 2005). IAHS Publ. 303, 2006.

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Perspectives