



A physical model to test hydro-geo-ecological organisation and process interaction.

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From the second law of thermodynamics we can formulate the hypothesis that hydro-geo-ecosystems evolve to a state of maximum free energy dissipation. As such they expose structures which facilitate large fluxes in mass/rainfall driven conditions and a storage to feed large dissipation in energy/radiation driven conditions. While this general concept may be trivial it has proven rather challenging to find experimental, observational and modelling tools to test and develop specific hypotheses for such organisation processes.

We developed a new modelling approach representing water itself as particles with the echoRD model (eco-hydrological particle model based on representative structured domains) at the plot scale. While this is yet far from catchment scale organisation it however has proven an insightful tool to approach the interactive processes without non-testable conceptual assumptions or parameters. Moreover, it also can test the information gain from different observational and experimental data. As we combine stochastic and physical descriptions bridging scales, the model may be highly relevant for analyses at larger scale.

We will present the model and highlight its main ideas, features and opportunities. Special emphasis will lie on 1) the representative structured domain formulation, 2) the interaction between structure and matrix and 3) the physical and stochastic representations of the processes.

We will then present examples of hypothesis testing for catchment organisation from experimental and virtual insights.