Hydrological behavior of a forested catena

Deborah Deraedt[1], François Ridremont[2], Hugues Claessens[2], Aurore Degré[1]

[1] Univ. Liège, Agro Bio-Tech, STE, Soil – Water Systems

[2] Univ. Liège, Gembloux Agro Bio-Tech, FNP, Forest and Nature Management

Corresponding E-mail : deborah.deraedt@ulg.ac.be

Introduction

At the time when the significance of water becomes more than obvious, we realize the utility of models that describe hydrological phenomena and that permit the optimization of water management. Soil properties as well as tree characteristics have a strong influence on hydrology and are really essential elements in these models. Although, both are spatially and temporally variable this heterogeneity is not totally taken into account in forest growth and hydrological models.

Objects

The aim of this study is to characterize, understand and conceptualize along a forested slope :

- the horizontal and vertical heterogeneity of soil characteristics.
- the water flow distribution within the soil horizons.
- the forest growth characteristics.

And finally, to include the forest, soil and water allocation variability in a physical hydrological model.

Site Location

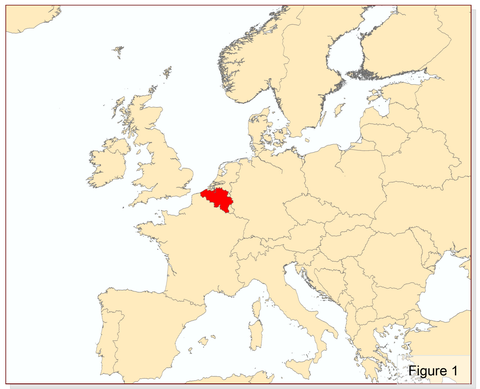

Figure 1

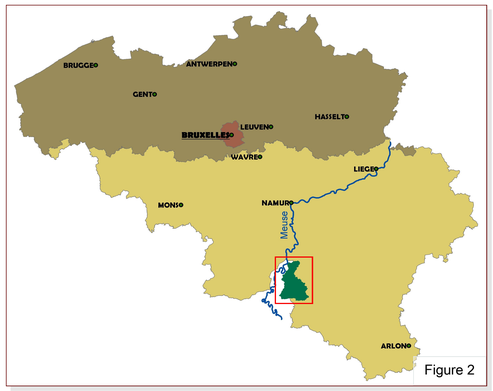

Figure 2

The selected catena is covered with Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco). The studied site is located in the Belgian Ardennes (Wallonia) in a Meuse subbassin (Figure 1, 2, 3 and 4)

The catena is about 170 meters long and the average slope is 25%. The soil is quite stony and shallow but rather homogeneous horizontally.

Figure 4

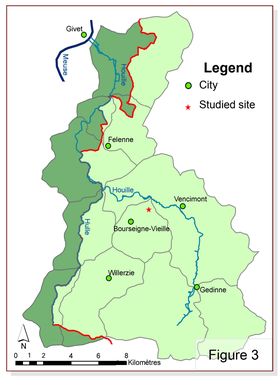

Figure 3

Material and Methods

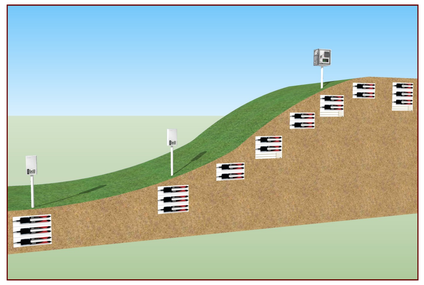

Figure 5 Instrumentation schema

To determine the slope effect on soil vertical and horizontal heterogeneity some samples will be collected along the slope for each soil layer. They will be analyzed in laboratory to measure structural and hydrodynamic properties (e.g. bulk density, water retention curve, granulometry). Other parameters like infiltration rate or soil layer depth will be measured *in situ*.

Nineteen capacitive sensors connected to three dataloggers will be placed along the slope, as shown in Figure 5, to record soil moisture. These sensors will be accompanied by three TDR sensors and a temperature captors.

The water flow repartition within the horizons down the slope will be characterized by a dye tracing test. The dye will be applied on the surface of the upper slope and will be collected with subsurface water from each soil layer using an experimental devices placed down the slope (Figure 6).

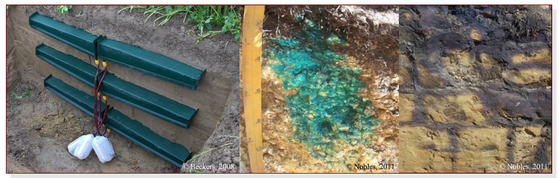

Figure 6 Dye tracing experimentation

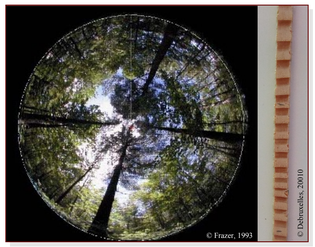

Figure 7 Hemispherical picture and stem core

To describe the variability of the forest cover along the slope some tree characteristics will be measured such as stem circumference and root distribution. Leaf Area Index (LAI) will be evaluated from hemispherical picture and basal area. At the end of the research, some stem samples will be collected for a dendrochronologic study. (Figure 7)

The relations between the slope and the soil, tree and hydrology will be introduced into a physical hydrological model in order to improve the consideration of the slope effect on the heterogeneity of these parameters.

Prosprects

Over and above the improvement of water resources modelling, such a model would help water management. From the point of view of the climate change, it would e.g. determine the best adapted species to each forest site.

EGU General Assembly 2012

Vienna, Austria

22-27 avril 2012