Geophysical Research Abstracts
Vol. 18, EGU2016-2871, 2016
EGU General Assembly 2016

Efficiency of thermography in the study of hydrological connectivity

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Hydrologic connectivity is an emerging concept which permits deeper understanding of catchments behavior. However, the measurements of functional connectivity is complex and still needs new developments in order to approach the « dynamic » part of the story.
This study aims at assessing the efficiency of thermography to analyze hydrologic connectivity in an agricultural catchment in Belgium (loamy soils). Tests have been performed on experimental tubs at first and on field at second.
Under controlled conditions, hot milk was spread on an experimental tub with bare soil and grass. The hot milk permits to compare color tracer with thermic one. The results are quite good. The binarization of pictures from usual camera and from thermic one gives similar percentage of runoff coverage at same locations. The mean difference is about 8% for bare soils and 10% for planted grass. There is a slight overestimation with thermic camera because of time delay of soil cooling after milk passing. In the same time in the planted grass, there are some runoff pixels which are hidden by vegetation.
On field, blue colored water was used to simulate a rainfall on a field covered with mustard and on the same field without any coverage. Where runoff flows, the soil appears warmer because of heat extracted by water in the soil. The results comparing visual and thermic pictures are more nuanced. The mean difference reaches 30% on bare soil. Indeed, (i) the rainfall drops seem to hide the runoff during the rain; (ii) the vegetation density (mustard) is quite a problem for runoff detection. However, the difference between successive time pictures permits to distinguish flow paths easily.
In conclusion, thermography stands as a good alternative for connectivity study. It's obviously a preliminary study which gives some indications of the possible use of thermography. At present, we are testing real rainfalls (different types) with different camera's positions and different land use (different vegetation density).

Key-words: functional connectivity, thermography, binarization, path flows