INTRODUCTION

More than 10 % of arable lands are drained in the world. Subsurface drainage increase water and sediment connectivity (Gay et al., 2016). The impact of subsurface drainage on the water regime is well understood (Skaggs et al., 1994 ; Gralmich et al., 2018) and numerous studies quantified erosion by subsurface drainage (Skaggs et al., 1994 ; Montagne et al., 2009). But the understanding of water and suspended solids dynamics from field to catchment outlet is a key to set efficient conservation measures to reduce erosion up. Here, we focus water and suspended solids dynamics from the soil profile scale to the field scale.

OBJECTIVES

- Determine the relative contributions between surface and subsurface sources for suspended solids
- Identify water pathways

STUDY SITE

Agricultural drained catchment
Area: 2500 ha
Altitude: 94 – 129 m
Mean slope: 0.4 %
Land use: 76 % crop field, 17 % forest, 7 % grassland
Drained fields: > 50 %
Outlet: Louroux pond

Agricultural drained field
Area: 5 ha
Tillage: conventional
Crop: wheat
Mean slope: 1 %
Drainage type: subsurface and surface
Subsurface drains depth: 120 cm
Spacing: 10 m
Age of the drains: > 30 years

Hydromorphic soil
LA : Silt-loam
S1 : Silt-loam
S2 : Silty-clay
Hydromorphic marks from 25 cm

MATERIALS AND METHODS

Sampling and monitoring at the catchment scale

Automatic sampler and data logger
Pressure sensor
Venturi channel

Sampling and monitoring at the field scale

Automatic sampler and data logger
Signon system connected to the drain for subsurface run-off flow measurement

Photography of one of the 5 sampling stations taken during a runoff event

Photography of the field monitoring station taken during the runoff event of the 1st February 2020

Photography of the field monitoring station taken during the runoff event of the 1st February 2020

Sampling and monitoring station set up for soil water sampling

Soil water sampling tube

Soil water sampling tube connected to tension meter

Soil water sampling tube

Sampling tubes setup

Sampling tubes: 5 18 cm long and 2 cm diameter per sampling point

Sampling stations

Sampling and monitoring stations

Field equipment

Subsurface drain system

Drainage network

Drainage type: surface, subsurface and surface

Drained fields:
- Mean slope: 10 %
- Area: 500 ha
- Age of the drains: > 20 years
- Spacing: 10 m

Drainage layout:
- Distance between the drains: 120 m
- Drainage type: surface, subsurface and surface

Drainage type:
- Surface:
  - Width: 30 cm
  - Depth: 60 cm
- Subsurface:
  - Diameter: 15 cm
  - Depth: 120 cm
- Surface:
  - Width: 30 cm
  - Depth: 60 cm

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RESULTS

Case study of the runoff events occurred between the 30th January 2020 and the 3rd February 2020

- Three rainfall events:
  - 3.2 mm the 30th of January from 7:35 to 10:15 A.M. This event generated no runoff.
  - 7.4 mm the 1st of February from 4:20 to 7:50 A.M.
  - 9.2 mm the 2nd of February from 1:15 to 11:00 A.M.

- Two subsurface and surface runoff events:

- Runoff type
  - Volume (m³)
  - Max flow (L/s)
  - Lag time

Runoff event of the 1st of February

<table>
<thead>
<tr>
<th>Runoff type</th>
<th>Volume (m³)</th>
<th>Max flow (L/s)</th>
<th>Lag time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsurface</td>
<td>42,4</td>
<td>1,62</td>
<td>2h3</td>
</tr>
<tr>
<td>Surface</td>
<td>84,9</td>
<td>13,15</td>
<td>1h49</td>
</tr>
</tbody>
</table>

Anion concentrations:
- Rainfall samplings present an anion concentrations under quantification limit.
- Soil is the only anion source so anion concentration of the water increase with the time of residence in the soil.

Soil water anion concentrations evolutions as function of depth of sample along the 5 days of monitoring:
- (b) chloride, (b) nitrate, (c) sulfate.

CONCLUSIONS AND PERSPECTIVES

Time of residence in the soil of the water
- The low anion concentrations of surface runoff show that water of surface runoff directly come from the rainfall or its time of residence in soil is shorter than the time needed to get the chemical balance between water and soil.
- The decrease of anion concentration in the subsurface water during the two runoff events should be explain by a mixing process between soil water and more recent – from rainfall – water or by a piston effect which transfers old water volume – chemically balanced with the soil – first, follows by the recent water volume. This will be specified using stables isotopes results.
- Hydrodynamic of the soil will be compared to results of grain size and mineralogy to understand the sediment dynamic.

REFERENCES