Geophysical Research Abstracts
Vol. 19, EGU2017-14571, 2017
EGU General Assembly 2017

Partitioning washoff of manure-borne fecal indicators (Escherichia coli and stanols) into splash and hydraulic components: field rainfall simulations in a tropical agro-ecosystem.

Olivier Ribolzi (1), Emma J. Rochelle-Newall (2), Jean-Louis Janeau (2), Marion Viguier (3), Emilie Jardé (4), Keooudone Latsachack (3), Thierry Henri-Des-Tureaux (3), Chanthamousone Thammahacksac (3), Claude Mugler (5), Christian Valentin (2), and Oloth Sengtaheuanghoung (6)

(1) Géosciences Environnement Toulouse (GET), UMR 5563 (CNRS-UPS-IRD), 14 avenue Edouard Belin, 31400 Toulouse, France (olivier.ribolzi@ird.fr), (2) iEES-Paris (IRD, Sorbonne Universités, UPMC Univ Paris 06, CNRS, INRA, UPEC, Université Paris Diderot), CC237, 4 place Jussieu, 75005, Paris, France, (3) IRD-iEES-Paris, Department of Agricultural Land Management (DALaM), P.O. Box 4199, Ban Nongviengkham, Xaythany District, Vientiane, Lao PDR, (4) UMR Géosciences, Université de Rennes 1, Campus de Beaulieu, 35042 Rennes cedex, France, (5) Laboratoire des Sciences du Climat et de l'Environnement (LSCE) Centre de Saclay, Orme des Merisiers, Bât. 701 91 191 Gif-sur-Yvette Cedex, France, (6) Agriculture Land-Use Planning Center (ALUPC), Ministry of Agriculture and Forestry, Vientiane, Lao PDR

Overland flow from manured fields and pastures is known to be an important mechanism by which organisms of faecal origin are transferred to streams in rural watersheds. In the tropical montane areas of South-East Asia, recent changes in land use have induced increased runoff, soil erosion, in-stream suspended sediment loads resulting in increased microbial pathogen dissemination and contamination of stream waters. The majority of enteric and environmental bacteria in aquatic systems are associated with particles such as sediments which can strongly influence their survival and transport characteristics. Escherichia coli (E. coli) has emerged as one of the most appropriate microbial indicators of faecal contamination of natural waters, with the presence of E. coli indicating that faecal contamination is present. In association with E. coli, faecal stanols can also be used as microbial source tracking tool for the identification of the origin of the faecal contamination (e.g. livestock, human, etc).
Field rain simulations were used to examine how E.coli and stanols are exported from the surface of upland, agricultural soils during overland flow events. The objectives were to characterize the loss dynamics of these indicators from agricultural soils contaminated with livestock waste, and to partition total detachment into the splash and hydraulic components. Nine 1m2 microplots were divided in triplicated treatment groups: (a) controls with no amendments, (b) amended with pig manure or (c) poultry manure. Each plot was divided into two 0.5m2 rectangular subplots. For each simulation, one subplot was designated as a rain splash treatment; the other was covered with 2-mm grid size wire screen 10 cm above the soil surface to break the raindrops into fine droplets, thus drastically reducing their kinetic energy. E. coli concentrations in overland flow were estimated for both the attached and free living fractions and stanols were measured on the particulate matter washed off each sub-plot.
Rain splash reduced infiltration rate, enhanced overland flow generation and contributed greatly to sediment detachment and entrainment. It had a strong impact on the export of E. coli and stanols from the soil surface and particle bound, rather than free E. coli dominated, although some differences were observed between treatment. High stanol concentrations were measured in overland flow waters from amended plots and specific stanol fingerprints were found between plots amended with pig or poultry manure, suggesting that stanols can be used to determine the origin of the faecal matter at the catchment scale in tropical rural environments.
This work underlines the importance of rain drop impacts on the washoff of manure-borne fecal indicator organisms and biomarkers; it also opens the door for the improvement of focused models on faecal bacteria and stanol export that take into account both hydraulic and splash effects of rain induced erosion.