Representing grassed buffer strips hydrology in a regional scale model

Aurore Degre and C. Sohier
University of Liege, Agro-Bio Tech, Hydrology and Hydraulic Engineering, Belgium

In Walloon Region (Belgium), like in many other European countries, riparian buffer strips appear to become one of the most approved nutrient mitigation measures. Within the frame of the water framework directive, policy makers need nutrient mitigation forecasting at the scale of the surface water bodies (from 3 to 426 km² in Wallonia). It induces that the hydrological models have to deal with different designs of the buffers themselves and of their catchment areas.

Up to date, most of the studies focused on sediment deposition at field scale. They concluded that the grassed strips can be very effective; nevertheless, the measured effects are still very variable. More often, the way the runoff water passed through the buffer strip (diffused or concentrated flow) is not considered.

We adapted our regional hydrological model (physically based, spatially distributed over the 17.000 km² Walloon region (Sohier et al., 2009)) by developing a new "buffer strip subroutine" that identifies automatically the catchment area of all the buffer strips. This is done using a 10 m resolution DTM. The catchment area is then subdivided into an "area of flow concentration" that leads the water to pass through the buffer strip on a very small portion of it and into an "area of diffuse flow" that leads the water to pass through the buffer strip using its whole length. The daily fluxes of water, nutrient and sediments that pass through the buffer are calculated by the model using our dynamic geodatabases (soil, DTM, weather, land use, agricultural practices). Depending on whether the flow is diffused or concentrated the water depth can vary to a large extent; so does the deposition ratio (algorithm adapted from Deletic, 2001). The buffer itself is modelled as grassland without direct fertilisation. Water and nutrient coming from the watershed can be used by the grass, water can infiltrate, evaporate or runoff and denitrification can occur when the soil is saturated. The oral presentation will show our results at the water body level for different buffer strip scenarios considering sediments and nitrate reduction in surface water.

References

Deletic A., 2001. Modelling of water and sediment transport over grassed areas. Journal of Hydrology 248., 168-182

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