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Subtropical regions of the world are affected by intense soil erosion associated with deforestation, overgrazing and cropping intensification. This land degradation leads to important on-site (e.g. decrease in soil fertility) and off-site impacts (e.g. reservoir sedimentation, water pollution). This study determined the mean sediment residence times in soils and rivers of three catchments (3 – 12 km^2) with contrasted land uses (i.e. cropland, forests, rangelands, extended gully networks) located in highlands of the transvolcanic belt of central Mexico. Calculations were based on rainfall and river gauging as well as on fallout radionuclide measurements (Be-7, Cs-137, Pb-210). Atmospheric deposition of Be-7 and Pb-210 was estimated based on the analysis of rainfall precipitated samples. Rainfall samples were collected all throughout the rainy season in order to take account of the temporal variations of the radionuclide fluxes. Furthermore, sampling of suspended sediment was conducted at the outlet of each catchment during most of the storms that occurred throughout the 2009 rainy season. Be-7, Cs-137 and Pb-210 concentrations of this sediment were determined by gamma-spectrometry. A two-box balance model was then used to estimate the sediment residence time and the inventory of radionuclides in the three selected catchments. This model subdivided each catchment into two boxes: (i) a "soil-box" characterised by low transport velocities and hence long radionuclide residence times and (ii) a "river-box" covering the river surface and its surroundings characterised by quicker exchanges and shorter radionuclide residence times. Input and output fluxes of sediment and radionuclides were taken into account in each box. Radioactive decay during the residence time of sediment was also considered.

The mean residence time of sediment in soils ranged between 13,300 – 28,500 years. In contrast, sediment residence time in rivers was much shorter, fluctuating between 28 and 393 days. The shortest residence time ($\sim$ 3 months) was measured in a catchment dominated by rangelands, whereas it was the longest ($\sim$ 13 months) in a catchment dominated by cropland and extensive networks of 'historical' gullies. Our results support the hypothesis of a sediment transfer through a succession of deposition and resuspension steps. They also show the priority of stabilising old gully systems and to implement on-site erosion control measures in subtropical regions.