Geophysical Research Abstracts
Vol. 17, EGU2015-14793-2, 2015
EGU General Assembly 2015


# Combined use of fallout radionuclides and stable isotopes for investigating soil erosion processes in a Moroccan watershed

Moncef Benmansour (1), Lionel Mabit (2), Anis Zouagui (1), Nouredinne Amenzou (1), Mohamed Sabir (3), Asmae Nouira (1), Christian Brandt (4), Frank Rasche (4), Mustapha Naimi (5), Mohamed Chikhaoui (5), Hamid Marah (1), Azzouz Benkdad (1), and Fouad Taous (1)

(1) Centre National de l'Énergie, des Sciences et des Techniques Nucléaires (CNESTEN), Rabat, Morocco, (2) IAEA Joint FAO/IAEA Division, Soil and Water Management and Crop Nutrition Laboratory - Joint FAO/IAEA Division, Seibersdorf, Austria (L.Mabit@iaea.org), (3) Ecole Nationale Forestière d'ingénieurs, Salé, Morocco, (4) University of Hohenheim, Stuttgart, Germany, (5) Institut Agronomique et Vétérinaire Hassan II, Rabat, Morocco

On-site and off-site impacts associated with land degradation by soil erosion are a major concern in Morocco. This study aimed to use fallout radionuclides (FRNs): Caesium-137 ($^{137}$Cs), excess Lead-210 ($^{210}$Pb$_{ex}$) and Beryllium-7 ($^{7}$Be) in combination with carbon and nitrogen stable isotopes (i.e. Carbon-13 ($^{13}$C) and Nitrogen-15 ($^{15}$N)) in estimating soil loss in the "My Bouchta" watershed and the origin of sediment deposits in a downstream water reservoir (i.e. "Talembout"). Using $^{137}$Cs, the net soil erosion rate, for the "My Bouchta" watershed over a period of 50 years, was estimated at 23 t/ha/yr with a main sediment contribution (> 90%) from the agricultural fields, the forest and shrub fields contributing to less than 10% of the overall sediment production.

This result indicates clearly the role and the effectiveness of the forest plantations and vegetation cover to protect soil resource against erosion processes. The use of the $^{210}$Pb$^{ex}$ technique in three different fields further highlighted that soil erosion rates over a period of 100 years were lower than those obtained by $^{137}$Cs reflecting the increase of soil loss during the last decades. Tests of fallout $^{7}$Be associated with short rainfall events in four fields confirmed the results obtained with $^{137}$Cs, that areas under natural vegetation were protected against erosion.

Sedimentation rates were assessed for the "Talembout" water reservoir and the mean values obtained for two sediment cores using $^{210}$Pb$_{ex}$ and the Constant Rate of Supply (CRS) model were about 0.51-0.58 g/cm$^2$/yr. The obtained results showed also a significant yearly increase of the sedimentation rate.

The results derived from the stable isotopes depth profiles indicated similar behavior for forest and shrub fields. Furthermore, strong correlation between $\delta^{13}$C and total C was observed for this type of land use while for the agricultural fields, the correlation was not significant. In addition, the sediment profile of N-15 indicated an increased use of synthetic fertilizers during the last 15 years.

In addition, the compound-specific stable isotope (CSSI) techniques have been tested in the study area using C-13 signatures in fatty acids extracted from soil sources and sediment materials. The preliminary results highlight that more than 80% of the sediment deposits are originating from agricultural areas. Additional measurements are needed for reinforcing the final interpretation.