Geophysical Research Abstracts
Vol. 12, EGU2010-3098, 2010
EGU General Assembly 2010


# Measurement of soil water erosion in Africa: the potential support provided by nuclear techniques

Lionel Mabit

IAEA/FAO, Soil Science Unit, FAO/IAEA Agriculture & Biotechnology Laboratory, IAEA Laboratories Seibersdorf, Austria (L.Mabit@iaea.org / +431-2600-28222)

Conservation of soil and water resources has become a major agronomic and environmental concern. Degradation phenomena, such as erosion, desertification and salinization affect 65% of soils worldwide. Soil degradation is currently affecting 1.9 billion hectares and is increasing at a rate of 5 to 7 million hectares each year. Almost 50% of 133 million ha degraded soils by overexploitation are located in Africa. The degradation of arable lands affects especially arid areas with poor vegetation cover and tropical areas with high intensity rainfall. Water erosion is by far the most common type of land degradation in Africa. Accelerated erosion decreases soil productivity, increases sedimentation and is related to environmental pollution problems in agro-ecosystems.
To control soil erosion there is a need to assess the impact of major land use and the effectiveness of specific soil conservation technologies using various approaches. Effective erosion control starts with the knowledge of soil erosion rates and mechanisms.

In Africa, various research projects on water erosion have been implemented involving different conventional techniques such as remote sensing, morphometric investigation, sediment transport models and sediment loading measurements, runoff plots and rainfall erosivity measurements. However, only limited quantitative data on erosion and sedimentation magnitude under African agroenvironmental condition are available.

Traditional monitoring and modeling techniques for soil water erosion require many parameters and years of measurements of (inter-annual and mid-term) climatic variability and cropping practices. Conventional erosion and sedimentation methods are limited to provide mid-term trends in soil erosion, however fallout radionuclides (FRN) – e.g. 137-Cs, 210-Pb and 7-Be – have proven to be very powerful tools to trace soil erosion and sedimentation within the landscape from plot to basin scale. FRN techniques allow the estimation of short and medium-term rates of soil redistribution integrating land use and climatic variability. FRN can be used to obtain average soil redistribution figures for time scales ranging from single events to many years of erosion processes, while direct erosion measurements are related to single rainfall events or rather short periods of time (e.g. erosion plots). FRN methodologies integrate all processes involving soil particle movements and allow quantification of soil loss and deposition associated with sheet erosion, which is difficult to assess using other conventional approaches. Sampling of individual points allows spatially distributed information on rates and patterns of soil redistribution. Also, one of the main advantages of the FRN is that time-consuming, costly maintenance, long-term monitoring programme and installations required by non isotopic and conventional methods can be avoided. Soil sampling can be completed in a short time and the site disturbance during sampling is minimal and does not interfere with seeding and cultivation operations. Since radionuclide-based measurements also provide information on the spatial distribution of erosion/sedimentation rates, they can be used to validate the results of distributed soil erosion models.

The main purpose of this contribution is to present a synthetic overview of the usefulness in using nuclear techniques in Africa to investigate medium and short term soil erosion and sedimentation processes. Also, the advantages and limitations in using the FRN (137-Cs, 210-Pb and 7-Be) as soil redistribution tracer will be compared to other conventional water erosion methods.

Keywords: Water erosion, conventional erosion assessment and measurement, nuclear techniques.