



## **Modeling Soil Erosion and sediment delivery to rivers in a mountainous tropical basin in the Peruvian Andes**

Yessica Martinez (1), Sergio Morera (1), Gerd Dercon (2), and Ana Navas (3)

(1) Instituto Geofísico del Perú, Calle Badajoz # 169 – Ate Vitarte, Lima 3, Peru, (2) Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Department of Nuclear Sciences and Applications, International Atomic Energy Agency, IAEA, Wagramerstrasse 5, 1400 Vienna, Austria, (3) Estación Experimental de Aula Dei (EEAD-CSIC). Consejo Superior de Investigaciones Científicas. Zaragoza. Spain

Soil erosion and sediment delivery to rivers are important drivers for land degradation and environmental change in high-altitude mountainous ecosystems. In the tropical Peruvian Andes soil erosion negatively affects agricultural yield by reducing soil fertility and water availability to crops. Sediment delivery affects river morphology and water quality, and contributes to the sedimentation in reservoirs and ponds. The Santa river watershed contains the most glaciated tropical mountain range in the world, the Cordillera Blanca, and its water is an important source of hydropower production (providing 60% of the total energy needed), used for human consumption and ensures large-scale agriculture projects along the Peruvian coast. The Santa river basin comprises two main tributaries, i.e. the Santa and Tablachaca rivers. The Santa basin covers an area of 7,000 Km<sup>2</sup> and drains the west side of the majority of the glacierized valleys of the Cordillera Blanca. At the other hand, the Tablachaca River is characterized by a very steep geography with almost 93.4 Km of vertical relief within a 3,000 Km<sup>2</sup> catchment area, but with only a few smaller glaciers. The aim of this study was to estimate soil loss and suspended sediment yield (SSY) from the Santa River Basin using a spatially distributed soil erosion and sediment delivery model (WATEM/SEDEM). It also sought to investigate the drivers for main differences in the Suspended Sediment Yield (SSY) of two glacierized sub-watersheds within the Santa river basin. The model calibration and validation were carried out using suspended sediment concentration data (September 2002-August 2009) from two river gauging stations located at the outlets of the Santa and Tablachaca Basins. The calculated mean annual soil loss for the Tablachaca River Basin was 20.9 t/ha/year, whilst for the Santa River Basin was 6.9 t/ha/year. Bare land located on steep slopes with limited crop or natural cover contributed to more than 80% of the sediment yield in both sub-basins. The Santa and Tablachaca River Basins show similar characteristics in mean precipitation and water discharge; however the Tablachaca's specific sediment yield is three times higher than the Santa SSY. Several River Basin features could be identified to explain these large differences. For instance, mining tailing and exploitation in the upstream part of the Tablachaca River could increase the sediment load downstream, however the magnitude of the mineral processing activities are unknown for confirming that mining leads to a much higher specific sediment yield. In the Santa River Basin, the accelerated shrinking of glaciers originates a large amount of proglacial lakes dammed by bedrock or moraines. These lakes could store glacier melt water and great part of the sediment that comes from hillslopes decreasing the SSC in the Santa river sub-basin. Furthermore, the predominant less erosive igneous rocks at the headwaters of this sub-watershed are likely contributing with fewer amounts of sediments.