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Human geomorphic footprint and global geomorphic change: implications for hydrogeomorphic hazards

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The human geomorphic footprint (HGF), expressed as the area affected by the construction of new "anthropogeoforms" or the volume of geologic materials directly or indirectly displaced by human action has grown considerably in the last decades. Available data suggest that the present HGF is roughly 50,000 km^2 a^{-1} of new anthropogeoforms and 300 $x10^9$ t a^{-1} of solid materials transferred from one part of the earth's surface to another. The latter represents a "technological denudation" that could be 1-2 orders of magnitude greater than denudation by natural agents or sediment transport by the world's rivers. This implies a profound modification of geomorphic processes that produces a series of often disregarded environmental consequences. Some of those can by directly linked to excavation/accumulation activities and are essentially local, but in other cases the possible relationship appears to be more indirect and could have a widespread character.

The transformation of land surface by human action is shown not only by landform construction and transfer of geologic materials, but also by land-use change in general and modification of the characteristics of the surface layer. This seems to affect both the hydrologic response and the sensitivity of that surface layer to different geomorphic agents. The magnitude of the above mentioned modification is logically related to the intensity of human activities, themselves related to the number of people on the planet and their economic and technological capabilities, which grow practically in all regions of the planet. It is thus reasonable to expect that the HGF and its effects should grow with time. If this were so, we should expect to find evidences of a general acceleration of geomorphic processes in the world that could represent a "global geomorphic change".

The final expression of geomorphic processes, which could be used to test that hypothesis, is sediment generation and deposition. Data are presented on sedimentation rates in different areas showing that in most of them sedimentation has increased significantly during the last century (by about one order of magnitude in most cases) and that such increase does not seem to be related to climate but rather to human activity.

If a global geomorphic change is indeed taking place, an increase in the frequency/intensity of related hazards, such as landslides or floods, should be expected. Data are presented indicating that it could be so. If what the data presented suggest is confirmed by further and deeper analyses, existing hazard and risk assessments for those processes should be reconsidered, because they would likely represent underestimates.

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