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How nanoscale processes affect soils systems on local, regional, and global levels

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Abstract

The behavior of natural and anthropogenic nanomaterials in Earth systems is dependent on their interactions under a broad range of physicochemical conditions. The binary interactions of nanomaterials and chemical species (e.g., nutrients or contaminants in soils) affect nanomaterial growth, stability, phase transformation, aggregation, and aging. All of these processes are a function of nanomaterial size, shape, composition, and concentration. While the influence of anthropogenic nanomaterial fluxes on Earth systems are currently unknown, it is clear that there are many Earth systems that are affected by the presence of natural nanomaterials due to their reactivity and their potential to alter contaminant and nutrient mobility. Examples include: 1) Climate effects on terrestrial systems, and more specifically, the impacts of changing climate on soils and the many nanomaterials within them. These affect agriculture and food production, forest ecosystems, as well as surface and ground water quality. 2) Climate change will induce accelerated weathering of rocks and minerals and the subsequent formation and/or release of nanomaterials that will dynamically affect processes and reactions initially within terrestrial systems, but ultimately in riverine, and oceanic environments. 3) Climate change induced glacier retreat is another world-wide phenomenon that has local, regional and global impacts on natural nanomaterial loading. The increase in melted water volume will transport significant amounts of organic and inorganic nanoparticles from riparian sediments to nearby rivers and oceans.

Bionote

Dr. Qafoku is a nationally and internationally recognized expert in the area of environmental soil chemistry. He is currently Chief Scientist and Lead of the Interfacial Geochemistry Team of the Pacific Northwest National Laboratory. He has covered a wide range of research topics including elemental cycling in soils, transport-controlled fate of contaminants in waste-affected environments, environmentally sustainable energy development via geologic sequestration of carbon dioxide, mineral getters and waste form performance, and nanoparticles and nano-scale phenomena in soils. Dr. Qafoku has given many presentations at national and international conferences and has published peer-reviewed articles and book chapters in the world's top research outlets (e.g. Science, Nature Communications, Encyclopedia of Soil Science, Handbook of Soil Science). He is the recipient of internationally recognized and prestigious honors and awards (e.g., he has been a Fulbright Scholar, is a recipient of an R&D 100 Award as well as the Jackson Award for Soil Chemistry and Mineralogy from the Soil Science Society of America).