Environmental Multiphase Flow – A New Frontier

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Environmental multiphase transport at the Earth's interfaces is an important but immature branch of environmental fluid mechanics. Examples include the BP Macondo oil well spill, rain and hurricane development, airborne pollutant and pollen dispersion, pathogen spread in the biosphere, coastline erosion, sediment source to sink, air-sea interaction, ocean mixing, and transport of water through soil. These areas embody dynamic and multiscale processes that can only be rigorously studied relatively recently, due to rapid advancements in scientific computation and fine-scale instrumentation. Traditional empirical and phenomenological approaches are gradually being replaced by first-principle based approaches, improving our ability to predict and model weather systems, climate changes, coastal/ocean waves and circulations, tsunami, changes in the water cycle, and environmental quality, livability, and sustainability. I envision that rapid knowledge advancement in environmental multiphase transport at Earth's interfaces will occur in the next decade. In this talk, I will illustrate research opportunities by a few examples, as well as the likely approaches that will be effective in moving this emerging field forward.