# A Review on the Applications of Fractional Order Partial Differential Equations in Environmental and Geophysical Modeling

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**Abstract:** *Fractional order partial differential equations (FPDEs) have emerged as powerful tools in modeling complex natural and environmental processes that cannot be adequately described by classical integer-order models. Their ability to incorporate memory, hereditary properties, and nonlocal behavior makes them particularly useful in geophysical and environmental contexts. This review highlights recent advancements in the applications of FPDEs to groundwater hydrology, contaminant transport, atmospheric and oceanic dynamics, and environmental risk assessment. The mathematical formulations, advantages, and limitations of FPDE-based models are discussed, along with their implications for sustainable environmental management and geophysical prediction*