Foundational AI for Solving PDEs and Systems on the Sphere

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Abstract

Recent developments in AI are transforming a large number of fields and are now starting to make a major impact in computational physics. Here we describe some of these innovative AI techniques that have been recently developed and how they can work together. We will indicate how AI may be deployed for modelling of environmental flows. Recent advances have enabled AI software to solve, to within numerical tolerances, the discrete differential equations that govern the physics of fluids (AI4PDEs). Important also is the use of AI to solve particle systems (e.g. AI for Discrete Element Modelling (AI4DEM)) which are expressed by interparticle forces and Lagrangian particle motion. This approach can for example be used to: examine turbulent mixing or model concentration fields or sea ice. The presentation will provide a summary of these forward models and a view on how these new approaches can be used with trained foundational AI models to form even more powerful methods.

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