

**Karthik Kashinath** leads various climate informatics projects at the Big Data Center @ NERSC (Lawrence Berkeley Lab). He received his Bachelors from the Indian Institute of Technology, Madras, Masters from Stanford University and PhD from the University of Cambridge, U. K. His background is in engineering and applied physics. He has worked on various projects spanning a wide range of disciplines from supersonic aircraft engines to battery technologies to complex chaotic systems and turbulence. His current research interests lie in physics-informed machine learning and novel data analytics and pattern discovery methods for large complex systems such as Earth’s climate. When he is not in front of the computer he runs up mountains, swims in lakes and cooks exotic global cuisines.

**Physics-informed Machine learning for weather and climate science.**

**Abstract:**

Machine learning (ML) provides novel and powerful ways of accurately and efficiently recognizing complex patterns, emulating nonlinear dynamics, and predicting the spatio-temporal evolution of weather and climate processes. ML and DL have had some remarkable successes in challenging problems in complex physical systems such as turbulent flows and weather and climate systems.

However, off-the-shelf ML and DL models do not always obey the fundamental governing laws of physical systems, nor do they generalize well to scenarios on which they have not been trained. We discuss briefly approaches to incorporating physics and domain knowledge into ML models towards achieving greater physical consistency, reduced training time, improved data efficiency, and better generalization. Finally, we synthesize the lessons learned and identify scientific, diagnostic, computational, and resource challenges for developing truly robust and reliable physics-informed ML models for turbulence, weather and climate processes.