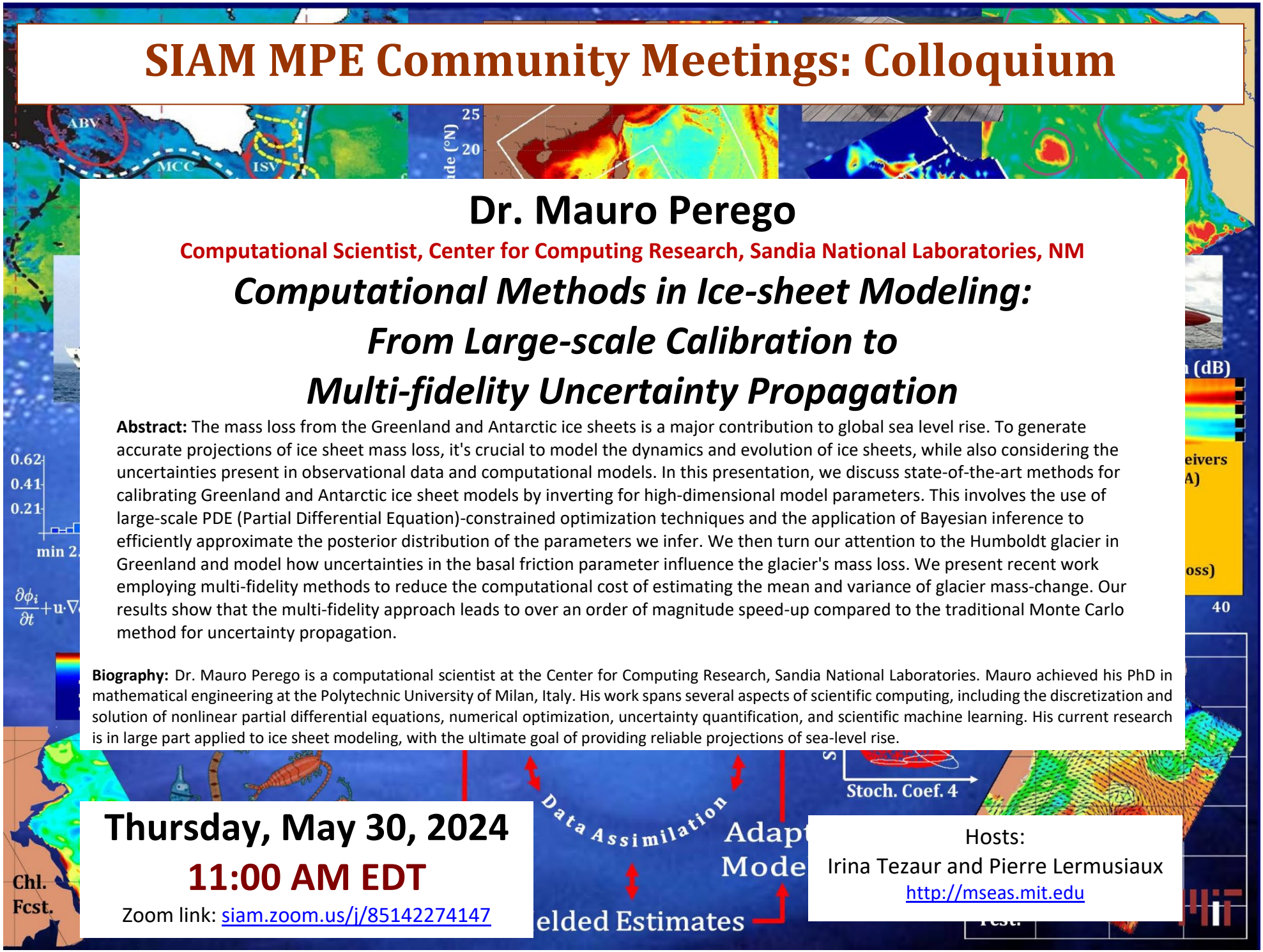
SIAM MPE Community Meetings: Colloquium



Dr. Mauro Perego

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Computational Methods in Ice-sheet Modeling: From Large-scale Calibration to Multi-fidelity Uncertainty Propagation

Abstract: The mass loss from the Greenland and Antarctic ice sheets is a major contribution to global sea level rise. To generate accurate projections of ice sheet mass loss, it's crucial to model the dynamics and evolution of ice sheets, while also considering the uncertainties present in observational data and computational models. In this presentation, we discuss state-of-the-art methods for calibrating Greenland and Antarctic ice sheet models by inverting for high-dimensional model parameters. This involves the use of large-scale PDE (Partial Differential Equation)-constrained optimization techniques and the application of Bayesian inference to efficiently approximate the posterior distribution of the parameters we infer. We then turn our attention to the Humboldt glacier in Greenland and model how uncertainties in the basal friction parameter influence the glacier's mass loss. We present recent work employing multi-fidelity methods to reduce the computational cost of estimating the mean and variance of glacier mass-change. Our results show that the multi-fidelity approach leads to over an order of magnitude speed-up compared to the traditional Monte Carlo method for uncertainty propagation.

Biography: Dr. Mauro Perego is a computational scientist at the Center for Computing Research, Sandia National Laboratories. Mauro achieved his PhD in mathematical engineering at the Polytechnic University of Milan, Italy. His work spans several aspects of scientific computing, including the discretization and solution of nonlinear partial differential equations, numerical optimization, uncertainty quantification, and scientific machine learning. His current research is in large part applied to ice sheet modeling, with the ultimate goal of providing reliable projections of sea-level rise.

Thursday, May 30, 2024

11:00 AM EDT

Zoom link: siam.zoom.us/j/85142274147

Hosts:
Irina Tezaur and Pierre Lermusiaux
http://mseas.mit.edu