EGU21-16403
https://doi.org/10.5194/egusphere-egu21-16403
EGU General Assembly 2021

Ensemble Kalman Filter for non-conservative moving mesh solvers with a joint physics and mesh location update

Christian Sampson[1], Alberto Carrassi[2,3], Ali Aydogdu[4], and Chris Jones[1]
[1]University of North Carolina at Chapel Hill
[2]University of Reading
[3]University of Utrecht
[4]Centro Euro-Mediterraneo sui Cambiamenti Climatici

Numerical solvers using adaptive meshes can focus computational power on important regions of a model domain capturing important or unresolved physics. The adaptation can be informed by the model state, external information, or made to depend on the model physics.
In this latter case, one can think of the mesh configuration as part of the model state. If observational data is to be assimilated into the model, the question of updating the mesh configuration with the physical values arises. Adaptive meshes present significant challenges when using popular ensemble Data Assimilation (DA) methods. We develop a novel strategy for ensemble-based DA for which the adaptive mesh is updated along with the physical values. This involves including the node locations as a part of the model state itself allowing them to be updated automatically at the analysis step. This poses a number of challenges which we resolve to produce an effective approach that promises to apply with some generality. We evaluate our strategy with two testbed models in 1-d comparing to a strategy that we previously developed that does not update the mesh configuration. We find updating the mesh improves the fidelity and convergence of the filter. An extensive analysis on the performance of our scheme beyond just the RMSE error is also presented.