MAE 5010 | DATA ASSIMILATION

HOMEWORK ASSIGNMENT 4

(Due: March 5th class time)

Feel free to use any computer language you like and you can use available packages (i.e., you do not have to write standard tools from scratch, you can use built-in packages).

Please report your findings clearly and concisely, and return via hard copy (you can embed code snaps into your report if you wish, or preferably you can provide GitHub links for your codes if it is easier for you).

Consider a linear advection equation:

with Drichlet boundary conditions and initial condition

Verify that the exact solution can be found as

Perform 4DVAR for retrieval of the initial condition

* Use 2nd order central difference for space and 4th order Runge-Kutta for time (or 2nd order RK or Lax-Wendroff).
* Set time step , use , where
* Generate observations at 10 observation time
  + Experiment using two different measurement error standard deviation
* (i) Start from
* (ii) Start from
* You can use any minimizer (including packages).
* Once convergence, plot your initial guess and final solution at . Please compare assimilated results with the true (expected) solutions.