Advection problem in 3D

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The code in Tutorials/Amr/Advection_F is modified to do a 3d case. The Fortran routines contained in the Src_3d directory from Tutorials/Amr/Advection_AmrCore/Source is used and routines from Tutorials/Amr/Advection_AmrCore/Exec/SingleVortex is used. The detailed documentation is given in the AMReX website (https://amrex-codes.github.io/amrex/docs_html/AmrCore.html), and the changes in 3d are self explanatory.

1   Run the code

This example builds the code as a third party by just linking to the amrex library in tmp_install_dir/lib. It is done using an automated makefile generation procedure using mkmf (https://github.com/NOAA-GFDL/mkmf) which contains a perl script that creates a makefile taking care of all dependencies (see the git repo for more details). Currently the makefile is already built. If changes are made, then do the following in the Source directory.

1. ls ../Exec/SingleVortex/*.f90 Src_3d/*.f90 > path_names

2. Change the path to tmp_install_dir in template.mk (tmp_install_dir is located in amrex)

3. ./mkmf/bin/mkmf -t template.mk -p main3d.MPI.gnu.ex path_names

4. In the source code directory execute – ./mkmf/bin/mkmf -t template.mk -p main3d.MPI.gnu.ex path_names – this will build the makefile

5. make – will build the executable main3d.gnu.MPI.ex

6. mpirun -np 4 ./main3d.MPI.gnu.ex ../Exec/SingleVortex/inputs

Currently run_Advection3d.sh has all the commands required to compile and execute the code – just do sh run_Advection3d.sh.

Note: The last line in template.mk contains flags from the verbose result of make using AMReX GNUMakefile. There could be more of these flags. These maybe important for optimization.

The GNUMakefile is also retained in the SingleVortex directory. To build just do make. Make sure to change the path in Exec/Make.Adv, and also do make clean in the Source directory to remove all .o and .mod files.

See the visualization section in the AMReX website (https://amrex-codes.github.io/amrex/docs_html/Chapter11.html) for more details on visualization. Fig. 1 shows the result at an instant in time.
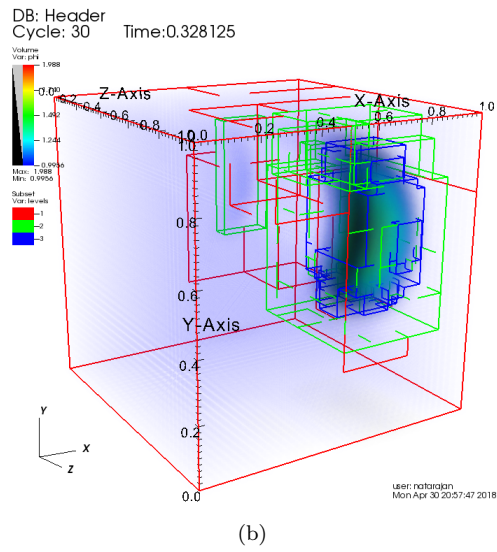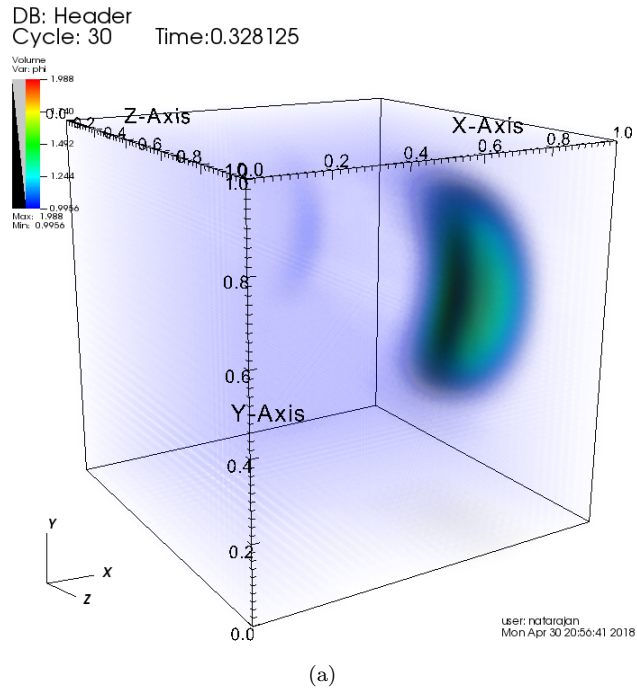
(a)

(b)

Figure 1: (a) ϕ at $t = 0.328$ and (b) AMR grid levels.